

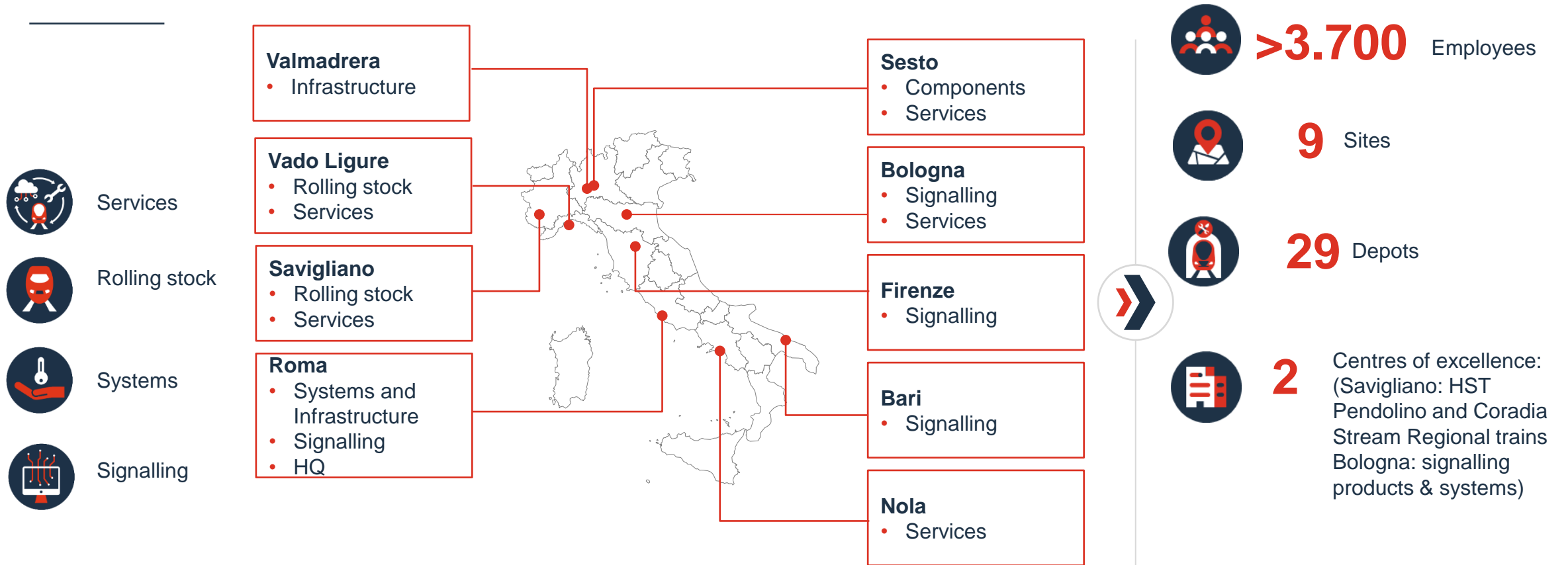


Digital Warehouse and 3D Printing – Alstom Approach

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Alstom in Italy

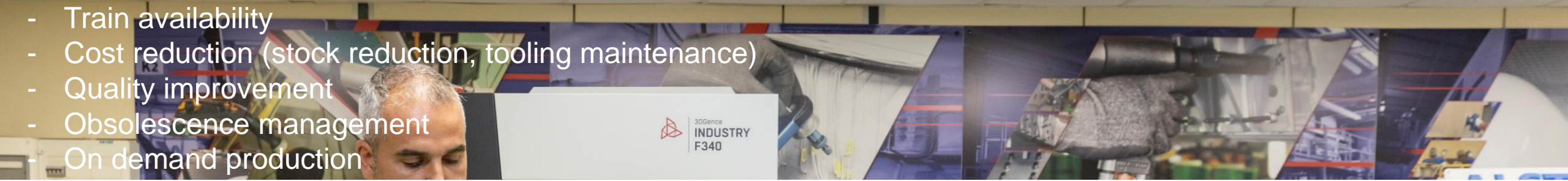


Manufacturing trains for 160 years, signalling systems and electrification infrastructure for 90 years and traction systems for 60 years

The Alstom Digital Warehouse

In the Services field the spare parts availability is a key performance indicator to be competitive on the market:

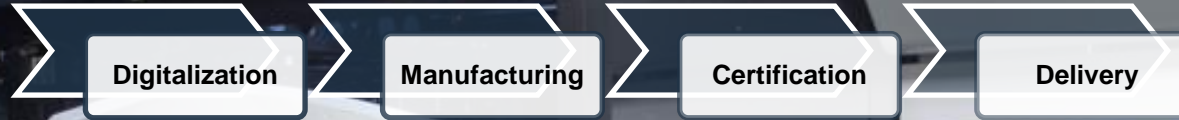
- Train availability
- Cost reduction (stock reduction, tooling maintenance)
- Quality improvement
- Obsolescence management
- On demand production



Alstom's Strategy

3D Printing Hub network to support Customers needs and Business growth

- Alstom Hubs capable to support region (special process, validation and certification)
- Manage local suppliers network
- R&D and innovation



Focus on certified materials and validation

- Fire and Smoke behavior for polymers
- Certification of metal parts



What an Alstom 3D Printing Hub do

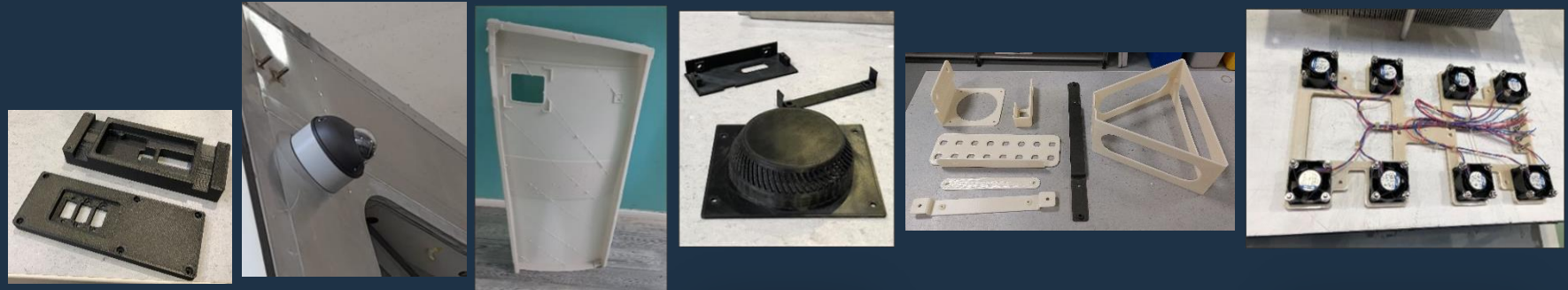
Jigs & Tools

- Design optimization (resistance, weight)
- Lead Time reduction
- Customised tooling
- EHS Lock Out Tag Out tools



Prototyping

- Lead time reduced
- Metals/ polymers /elastomeric
- Ready to test, no molds
- Big dimensions



Spare Parts & Obsolescence

- Lead time reduced – no MOQ – no Molds
- Metals/ polymers /elastomeric
- Materials EN45545 certified
- Reverse engineering with 3d scan



Some Examples

- **Problem:** to produce hundreds of footrests that were in need of replacements after 10 years train services. Original supplier didn't have the original mold anymore. Parts need to have same aesthetical finish and be rapidly available to reduce train stops without compromising the original requirements



- **Solution:** use 3d printing to avoid new mold cost, mold maintenance, avoid MOQ and reduce lead time

Some Examples

- Overall Statistics:



11h to produce up to 30 footrests



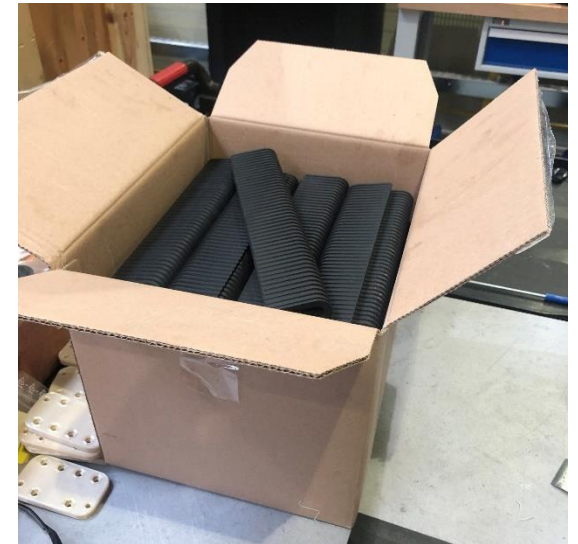
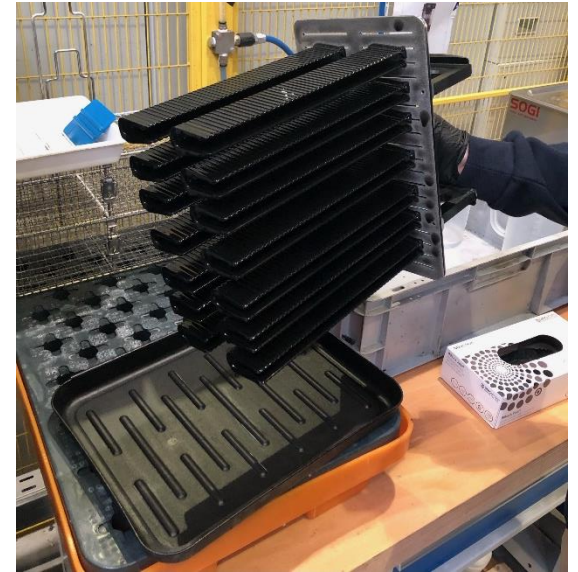
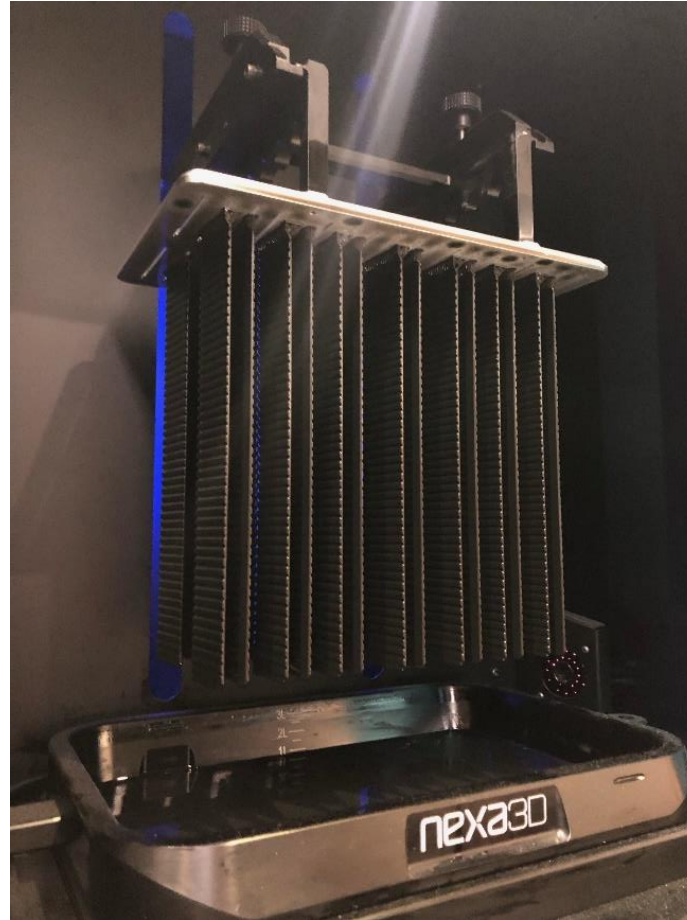
25% cost reduction compared to injection molded part



Lead time reduced by more than 90%



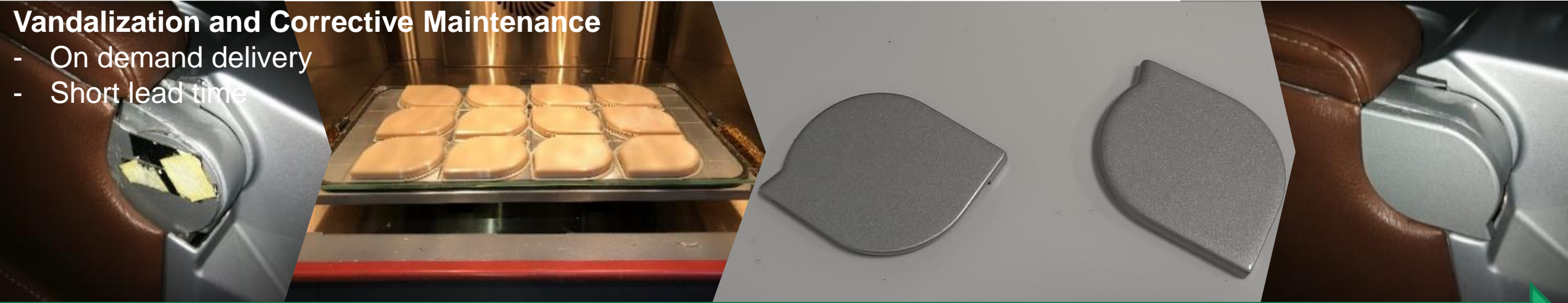
No Minimum Order Quantity and flexibility to produce only what & when needed



Some Examples

Vandalization and Corrective Maintenance

- On demand delivery
- Short lead time

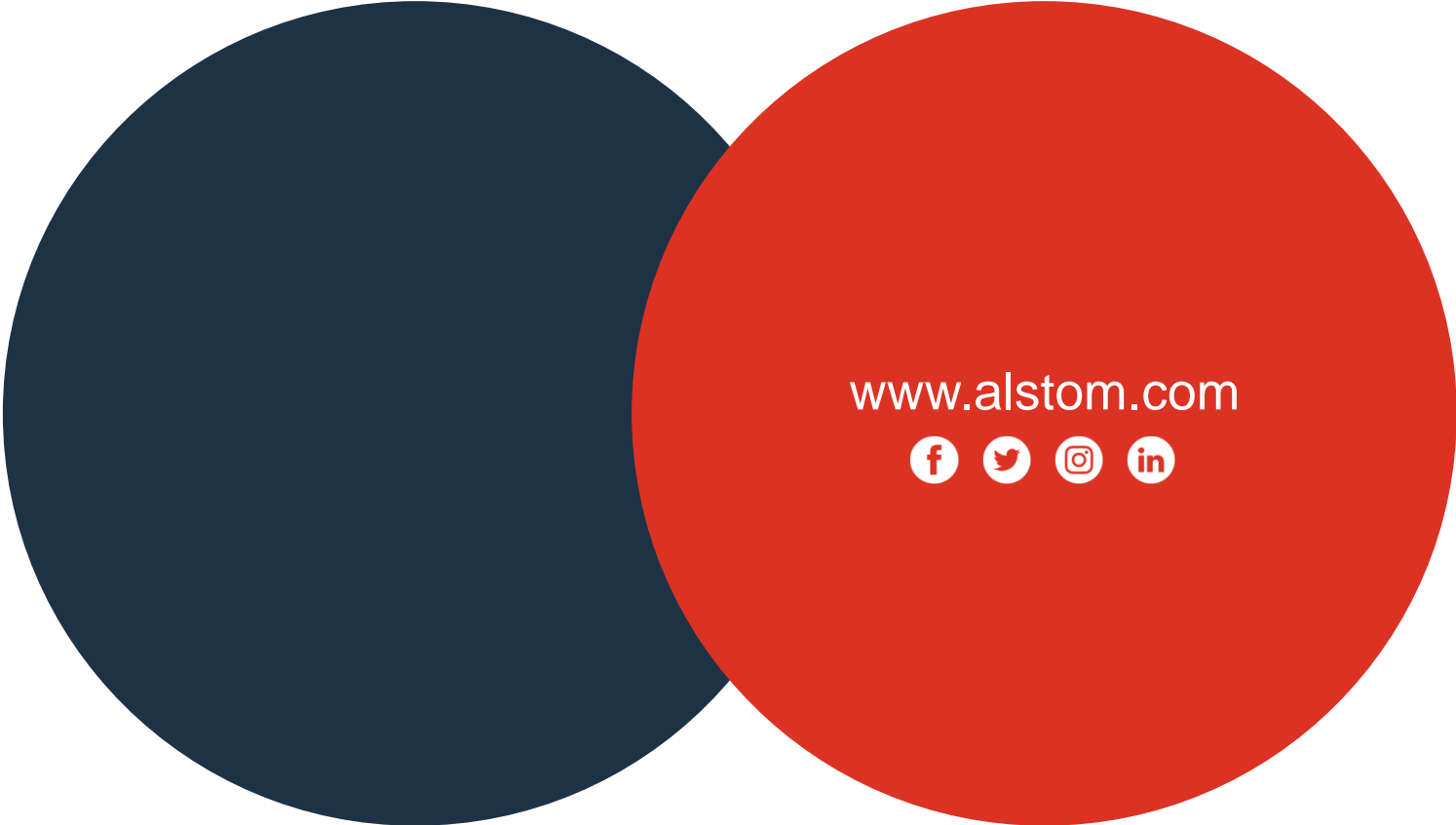


Spare parts ready in 2 weeks max.

Obsolescence resolution

- Competitive solution
- Extend train lifetime





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