

18/02/2016 – Maintenance & support cluster update

The maintenance & support cluster consists of eight Factory of the Future (FoF) projects: iMAIN, Power-OM, SUPREME, EASE-R, T-REX, SelSus, ReBorn and white-R. Of these, iMain, iMAIN, Power-OM, SUPREME, form the core of the cluster, involving 25 partners from eight European countries.

Through these projects, the cluster will deliver the basis of an advanced modular condition monitoring and maintenance system for forming machines and other highly stressed systems. These new smart and agile maintenance approaches should increase the lifetime and energy efficiency of production equipment while reducing maintenance costs.

The projects

Ultimately, the cluster's projects are creating new tools and methodologies for the sustainable maintenance of production equipment in order to improve energy management and optimization tools. This, in turn, will help to reduce energy costs, maintenance costs and environmental pollution of European factories. Moreover, the results of research projects in this field should contribute to increasing global competitiveness and job creation.

Each project is working on condition-based and predictive maintenance systems to extend the system lifetime of machine tools while improving their effectiveness, energy consumption and reliability. The aim of the cluster is to connect these projects, thereby stimulating a dialogue and technology exchange and facilitating the industrial exploitation of results. It is also believed that clustering will help to increase dissemination and thereby the visibility and perception of the projects.

The research areas being undertaken by the projects within the maintenance & support cluster will have an impact in the following areas:

- Increasing the availability of production systems & overall equipment effectiveness
- Reducing energy consumption
- Reducing renovation and repair costs
- At the end-of-life stage, promoting the the reuse of production system components in new life cycles
- Achieving cost reductions – by reusing existing modular equipment when setting up production systems for new product variants
- Renovating outdated plants and structures and creating safe production sites

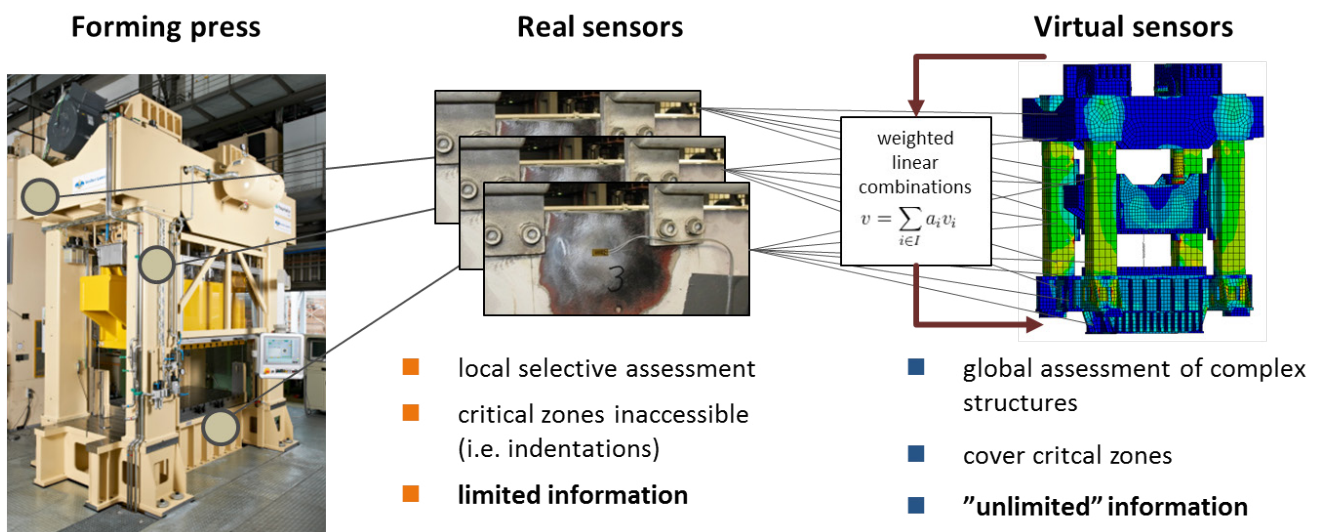


Figure 1: Strain measurement in forming machines with virtual sensors



Customers and targets

Broadly speaking, the maintenance & support projects address manufacturing and production markets. However, the projects are also focusing on maintenance-relevant markets, such as converting machines, the mining industry and transportation. Table 1 highlights the target markets and potential customers for the solutions under development.









Project	Target market	Customers
	Machine tools (forming presses), mining industries and all other highly loaded mechanical systems	OEMs, machine tool builders, part manufacturers, plant manufacturers and operators, and maintenance providers
	Machine tools (milling)	OEM (machine tool manufacturers)
	Paper industry	OEM / users
	Machine tool manufacturers	OEM
	Machine tools, spindles, robotics, transport systems (lift trucks) and batteries	OEM
	Manufacturing devices, assembly lines, fixtures	OEM (maintenance)/users (operators)
	Machinery, robotics, in-line manufacturing	OEM/system integrators and component suppliers
	White rooms: robots, effectors, transportation, DNA fixturing systems	Component manufacturer for laser machines, manufacturer of solar cells) / OEM

Table 1: Target markets and customers for service & maintenance solutions



Current state-of-the-art

The state-of-the-art is characterized by limitations in implementing maintenance strategies. Currently, high maintenance costs, long downtimes, lower effectiveness and high energy consumption of machine tools strongly affect machine tool users:

- There is a lack of preventative maintenance
- There is no condition monitoring in the forming technology sector
- Conventional remote desktop systems lack complex forward planning capabilities
- Sensors do not measure enough physical parameters of machine tools
- High repair costs, long downtimes, high energy consumption, low energy efficiency
- Short lifetime, high maintenance costs, lower effectiveness

Cluster advances beyond the state-of-the-art

The maintenance & support cluster aims to improve the state-of-the-art, which is characterized by the high costs and long downtimes that result from a lack of predictive maintenance strategies. The cluster's projects are creating new predictive maintenance technologies to improve the overall capabilities of machine tools and their value to stakeholders. These challenges and advances are outlined in table 2.

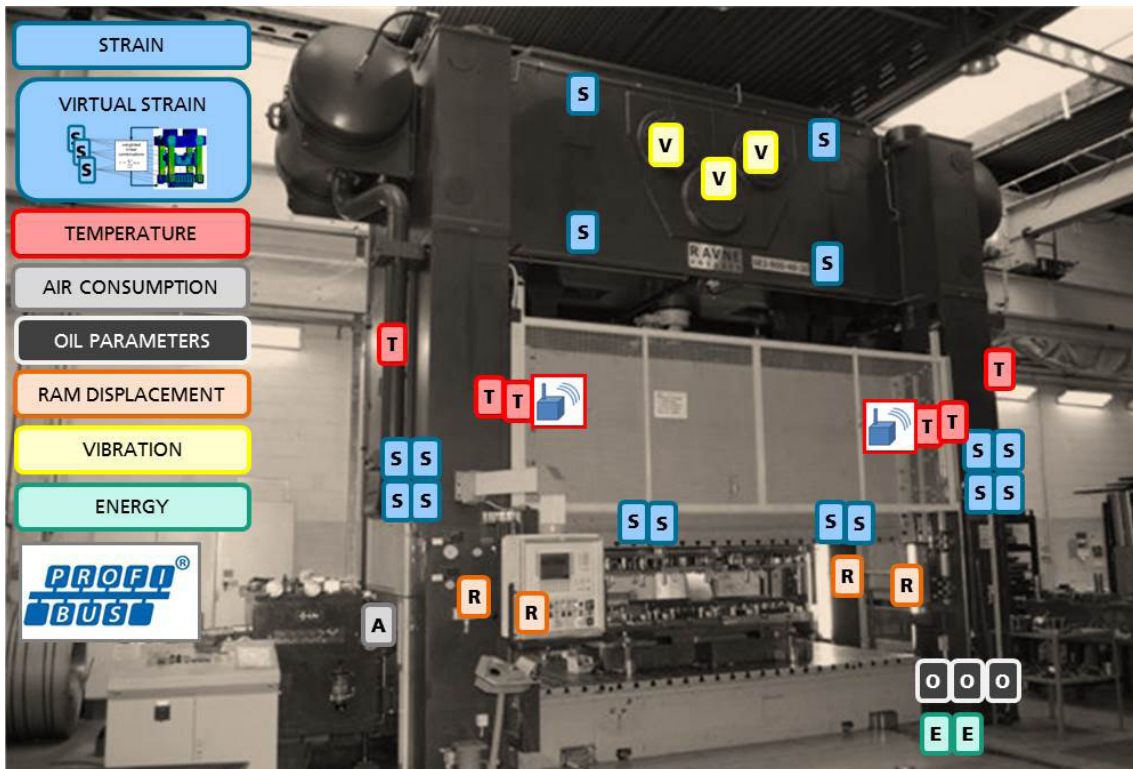


Figure 2: The iMAIN project is developing novel solution for information-based predictive maintenance systems



State-of-the-art and challenges

- Existing technology has limitations in the implementation of predictive maintenance strategies
- No condition monitoring in the forming technology sector
- Maintenance is often reactive rather than preventative
- Conventional remote desktop systems lack complex forward planning capability
- Broken and inefficient machines lead to high repair costs, long downtimes, high energy consumption and shorter lifetimes
- Sensors do not measure enough physical parameters of machine tools

Cluster advances

- Novel decision support system for predictive maintenance
- Multi-layer solution integrating embedded information devices and artificial intelligence techniques
- Energy consumption monitoring and profiling utilized as condition-based maintenance (CBM) technique
- A cloud solution for sharing monitored data
- Integrated approach for optimal energy consumption
- New methods for condition and risk-based maintenance, new deterioration models for residual life prediction, new signal processing methods integrated in embedded condition monitoring, and real time failure prediction and operation optimization
- Two new sensors: MEMS sensor for vibration, WIRELESS sensor for temperature measurement
- Extended capabilities
- Lifetime of production equipment increased by at least 30%
- Energy efficiency increased by at least 20%
- Availability of whole process increased by at least 30%
- Maintenance costs decreased by at least 40%
- Overall business effectiveness increased in terms of maintenance, operation and product reliability
- Repairs and replacements can be executed before actual breakdowns occur or cause other more expensive problems

Table 2: Summarising the current state-of-the-art and advances from the maintenance & support cluster





Frequent occurrences of fatigue fractures and the failures of forming machines have triggered the development of a novel strategy for stress monitoring and predictive maintenance of high-loaded mechanical components. The smart combination of advanced monitoring and knowledge-generation approaches, (i.e. virtual sensor technology, lifecycle histories or the merging of location-independent information sources) requires the development of new IT infrastructures.

Further information about the three completed projects can be accessed on the EFFRA website. Links are provided in table 3.

Project	Documentation	Project end date
iMAIN	Click here to access project-specific documentation	2015-08-31
Power-OM	Click here to access project-specific documentation	2015-08-31
SUPREME	Click here to access project-specific documentation	2015-07-31

Table 3: Links to the results of completed projects

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Editors’ notes:

FOCUS

The FOCUS project brings together 11 partners from 7 European countries to combine their expertise and knowledge to determine the state of the art within the given clusters. The clusters within FOCUS are: zero defect manufacturing (4ZDM), clean factories, robotics, high precision manufacturing (high micro), and maintenance and support. The FOCUS partners share their experiences to identify common ground and formulate methodologies for effective cluster creation and industrial exploitation of project results. The FOCUS partners are also pro-active in disseminating tangible outcomes from their activities.

This project has received funding from the European Union Horizon 2020 Programme (H2020) under grant agreement n° 637090. For further information please visit ec.europa.eu/research/index.cfm?lg=en

Factories of the Future

Factories of the Future is a EUR 1.2 billion program in which the European Commission and industry are collaborating in research to support the development and innovation of new enabling technologies for the EU manufacturing sector. For further information please visit: ec.europa.eu/research/industrial_technologies/factories-of-the-future_en.html

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