

# North East Maintenance Forum



Thursday 20th October 2016



www.northeastmaintenanceforum.org.uk







# Introductions and Welcome Roger O'Brien Director of AMAP University of Sunderland









# #NEMFOct16

@AMAP\_Sunderland

www.northeastmaintenanceforum.org.uk





# **Agenda**



9:00am Introductions and Welcome, Roger O'Brien, Director of AMAP & NEMF

**9:10am** Case Study Presentation, Maintenance Practices, Sean Scott, Bridon-Bekaert

**9:30am** Case Study Presentation, Industry 4.0 and the impact on Maintenance, Richard

Chamberlain and Michael Lomax, Bosch Rexroth

**9:50am** Policy Related Presentation, Risk assessment and testing legislation impacts on

maintenance professionals, Trevor Hall, Hall and Angus

**10:10am** Questions for Speakers and Discussions, facilitated by Roger O'Brien

**10:30am** Updates from the Forum and member news, Roger O'Brien

**10:45am** University Engagement – New Manufacturing MSc and Opportunity for Student Projects,

Dr Michael Knowles, University of Sunderland

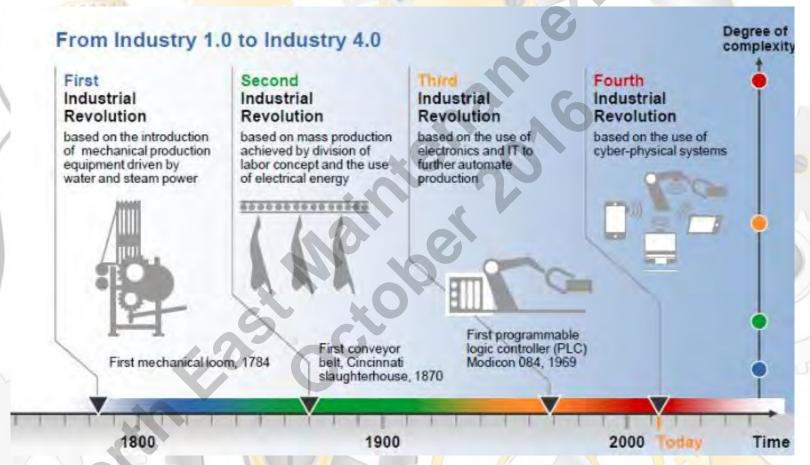
**10:55am** A word from our Breakfast Sponsor – The EY Manufacturers League, David Baggaley, EY

**11:00am** Closing remarks and Networking at Oktoberfest











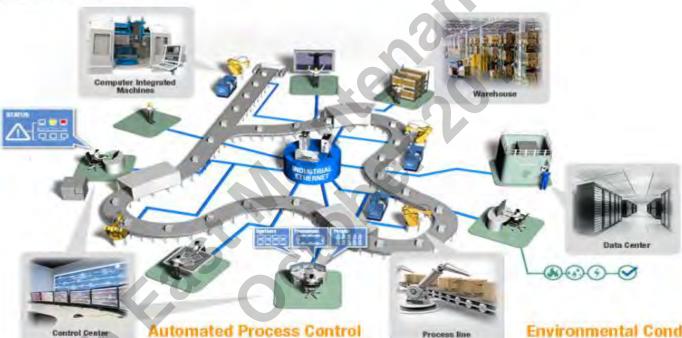


#### Computer-Integrated Manufacturing

Real-time and accurate collection of production line data

#### **Real-time Production Monitoring**

Greater control over the production process



Reduce the need for manual intervention

in the production line

#### Environmental Conditioning and Monitoring

Monitor and control environmental conditions to optimize efficiency

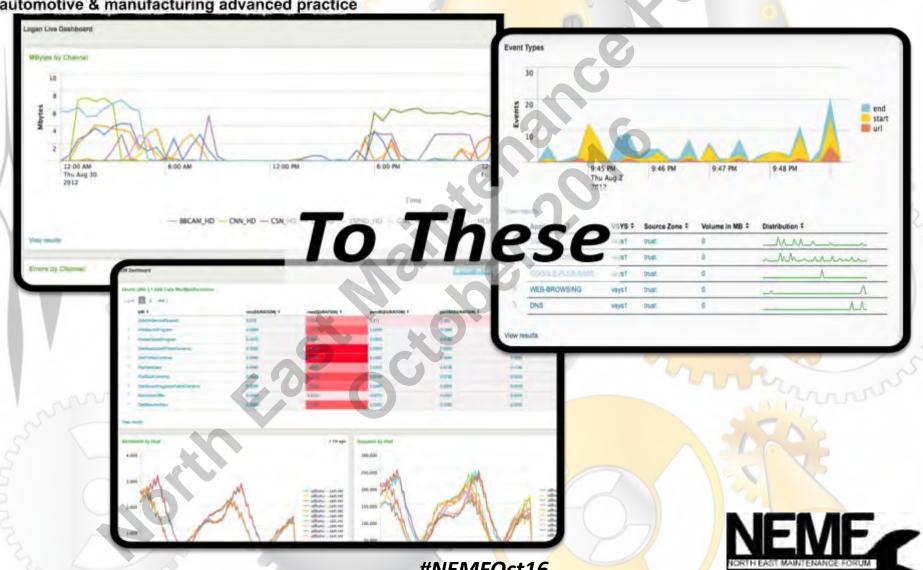




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#NEMFOct16



# "Big data is like teenage sex:

Everyone talks about it, nobody really knows how to do it, everyone thinks everyone else is doing it, so everyone claims they are doing it.

Professor Dan Ariely Duke University





# 14.0 - Impact on Skills?

- Flexible and Responsive maintenance engineers
  - STEM subjects
  - Mobile Application Developer
  - Software Engineer
  - Understand data analytics
  - Might help if they understood CBM, RCM, TPM etc.

No longer about wielding a spanner!





# Industry 4.0

- Cyber Physical Systems
- Connected Factory
- IoT Internet of Things
- Autonomous Systems
  - (and even supply chains)
- Sensors
- Big Data



We are **at** the tipping point of reality not talk!

We are actively involved and this network is here to help





Case Study Presentation

Maintenance Practices

Sean Scott

Bridon-Bekaert



# Delivering Maintenance at Bridon-Bekaert.



# Brief history of rope making in Newcastle.

Bridon-Bekaert as we are now, started life back in 1789 making hemp and coir ropes, in 1885 due to the demand for higher breaking loads the first wire ropes were produced. Much like metal forging the principles of rope making have not changed that much. What has changed are the materials, and of course the technical nature of the applications.

In June 2016 Bridon International merged with Bekaert Wire to form the company we are today. We continue to manufacture wire ropes of all sizes and have the capability to manufacture the largest by diameter ropes in the world but on slight newer machines, when I say newer, we are still using tubular machines that were originally built in 1950 though we do now have several that were purpose built for us in 2012.







# Oil & Gas sector









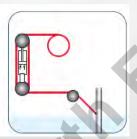


Riser Tensioner Lines

**Drilling Lines** 



**Crane Ropes** 







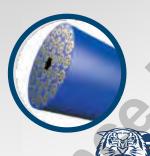




# **Mining sector**



## Surface and underground extraction

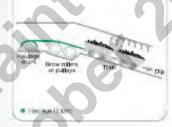






## **Hoist and Balance**





**Under Ground** 

Haulage

Conveyor



**Dragline** 



**Surface**Boom Line



**Hoist Rope** 





# **Industrial sector**

# **Port and Crane Equipment**







Constructex\*

# Endurance Endurance

# Mobile Lattice and Boom Crane



Boom Hoist Rope
 Main Hoist Rope

# Telescopic Mobile Crane



#### **Dockside Crane**



Boom Hoist Rope
 Main Hoist Rope

## **Container Crane**



Trolley Rope
Boom Hoist Rope
Main Heist Rope





# **Other market sectors**

#### **Structures**





#### **Services**



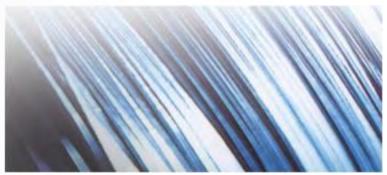
❖ Repair and maintenance, Installation and replacement services, Inspection and testing, Non-destructive examination (NDE), Splicing

# Marine



Trawl Warps and Purse WiresHarbor, Escort & Ocean Towing

#### Wires



❖Wire rope, Armouring, General Engineering





# The way we used to be.

Historically due to the demands made by the Production staff the maintenance regime had been a *repair when broken attitude*.

The machines were driven hard and abused with few concerns for both maintenance and the H&S of staff.





BRIDON · BEKAERT
THE ROPES GROUP







# Maintenance challenges.



# **Dust**

During the manufacturing process of wire ropes we use individual wires lubricated with soap dust, this is to reduce the friction on the wires as they pass through the machines. Due to the machine run speeds this dust is ejected and either settles on or coats all surfaces both inside and outside of the machinery, this can quickly build up and cause many issues as well as disguise others.







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# Grease

During the stranding and closing process most ropes will have grease injected into them for lubrication defined by the end user, this grease is heated to 100'C and pumped onto the strands as they enter the forming point, due to the nature of the process this grease will also migrate to other parts of the machinery, this can develop into breakdowns if it is not captured swiftly.





ROPES GROUP





THE ROPES GROUP

The way forward.



#### **Implementing Planned Preventative Maintenance.**

The poor maintenance regime continued until the positives of planned maintenance started to become more apparent when the old machinery failed on a regular basis and spare parts became more difficult to source.

In 2011 we instigated a simple PPM system that scheduled simple checks to the machinery, this is currently still in a MS Excel format but will soon be migrated onto the CMMS software we have installed, we are also developing more in-depth checks and are improving the maintenance toolbox with predictive methods such as vibration, thermal, oil sampling analysis technologies and die pen crack testing to name a few.





# VA Predictive Maintenance Using IPAD and Vibepro APP

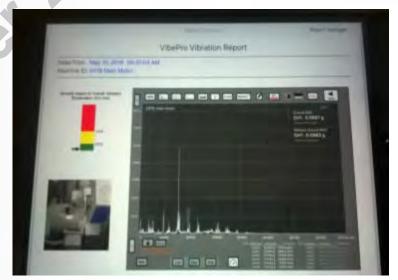
We carry out monthly checks on various critical bits of equipment using IPAD with and wireless accelerometer.

- Tube bearings
- Motors
- Gearboxes



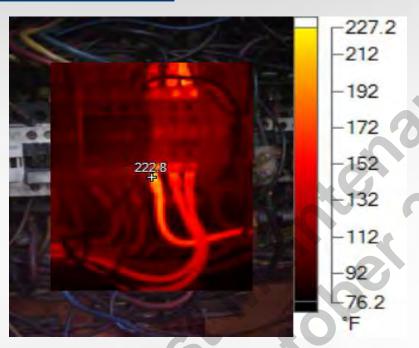
#### **Vibration report**

A report is then generated and this can be put into trending report and saved electronically.



BRIDON · BEKAERT

#### **Grease tank contactor**

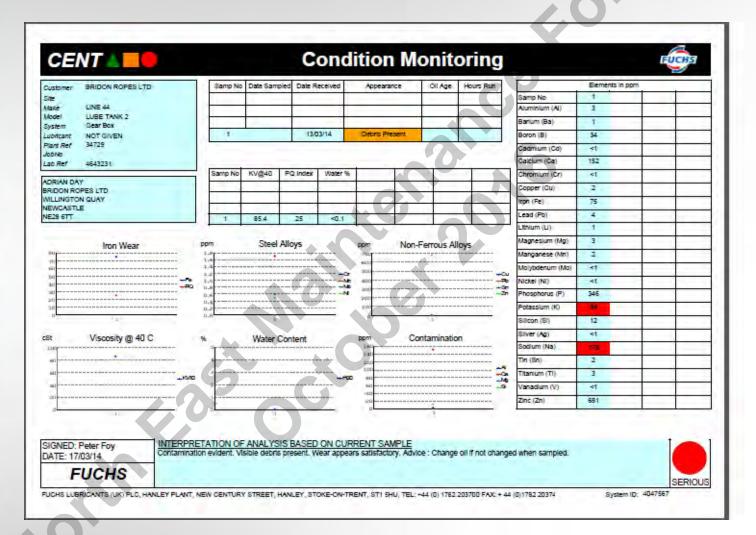


Grease tank contactor reading 106 degrees/222.8 F on TI camera . Contactor requires checking over and wires reterminated ,Possible slack connections.

# Fluke Ti 110 thermal image camera







# Thank you for listening, are there any questions?





Case Study Presentation
Industry 4.0 and the impact on Maintenance
Richard Chamberlain and Michael Lomax
Bosch Rexroth



#### Engineering skills are changing...

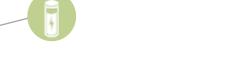






CONNECTED MOBILITY

# IoT@Bosch CONNECTED INDUSTRY **CONNECTED BUILDINGS** (((¶)))



**CONNECTED ENERGY** 



Mechanization, water power, steam power

Mass production, assembly line, electricity

Computer and automation







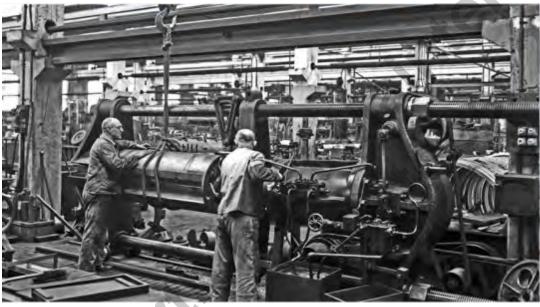


Industry 1.0

Industry 2.0

**Industry 3.0** 

Industry 4.0







#### **Dual strategy for Connected Industry**



#### Lead Operator

Product manufacturer/ Product view



#### 250 Bosch plants world wide

- Manufacturer of products
- Machine operator
- Plant operator
- Interface to customers/suppliers

Experience out of more than 100 pilot projects for connected industry









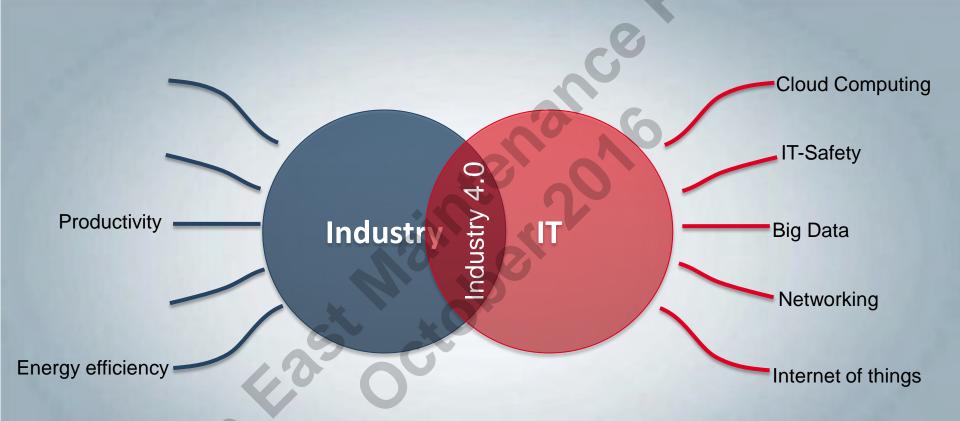


Important changes in recent years





### Industry meets IT - he merging



Existing industrial techniques are better combined and with IT techniques enriched in order to achieve added value in the production!











#### People as key players

Digital assistance functions and intelligent workplace layouts support people with contextual information, improved ergonomics, and in this way elevate the degree of customization of the work environment.















#### **ActiveAssist**











#### <u>Distributed intelligence</u>

Decentralized intelligent automation components carry out their tasks independently and make autonomous decisions using integrated software following the specifications of higher-level systems.



















# <u>Fast integration and flexible</u> <u>configuration</u>

With Plug and Produce, people, machines, processes, and commodity streams are integrated ad-hoc with one another.

Software tools simplify the startup, integration, and (re-)configuration as well as the diagnosis and maintenance of all components, modules and machines.















#### Open standards

Standards across manufacturers and independent of platforms form the basis of horizontal and vertical integration and thus the smooth exchange of information within value creation networks.































Efficient monitoring and display of the process conditions, key data (KPIs) and quality data

A Great First Step to i4.0

#### **Current solution**



- High data maintenance effort
- High need for space
- Restricted support for interactive solution rounds

#### i4.0 solution



- Can be connected to MES, ERP, DB
- Paperless communication
- Moderation-, escalation-, whiteboardfunctions
- Open system via

https://www.boschrexrotin.com/en/xc/products/products-groups/assembly-technology/manual-production-systems/activecockpit/activecockpit











#### Digital lifecycle management



















# Secure value creation networks











# BOSCH APAS Assistant: Collaborative Robot



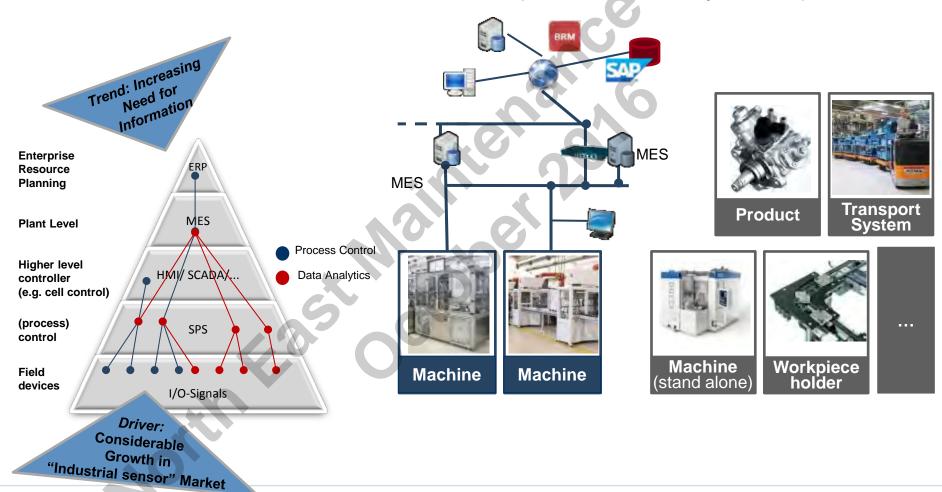


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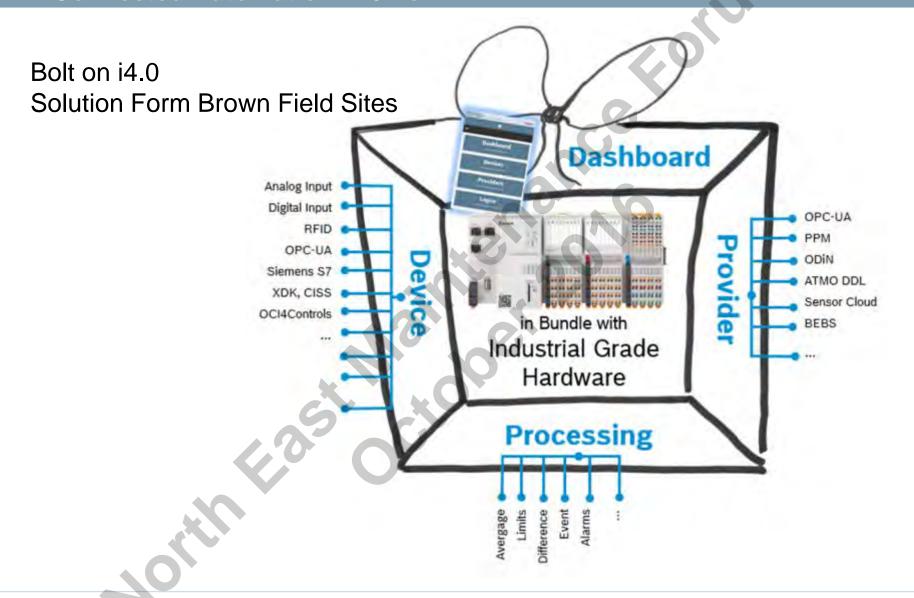


# Today's typical production scenario

Hierarchical IT and control structure ("Automation Pyramid")





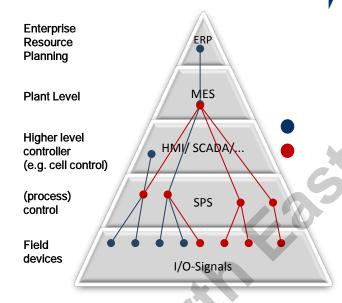


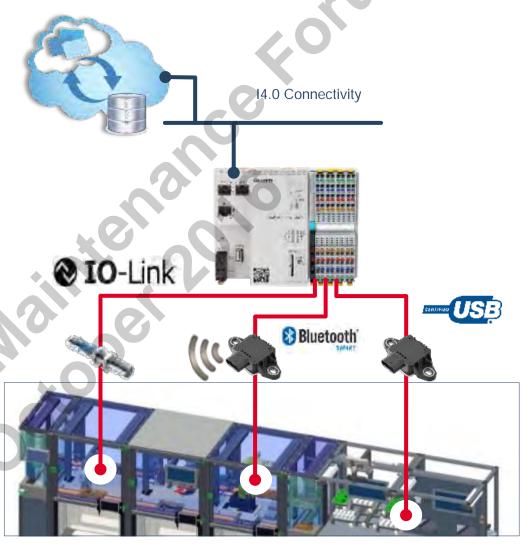


# i4.0 Upgrade Kit

#### 14.0 Upgrade Kit

- Enabler for Integrated Solutions
- From objects to applications





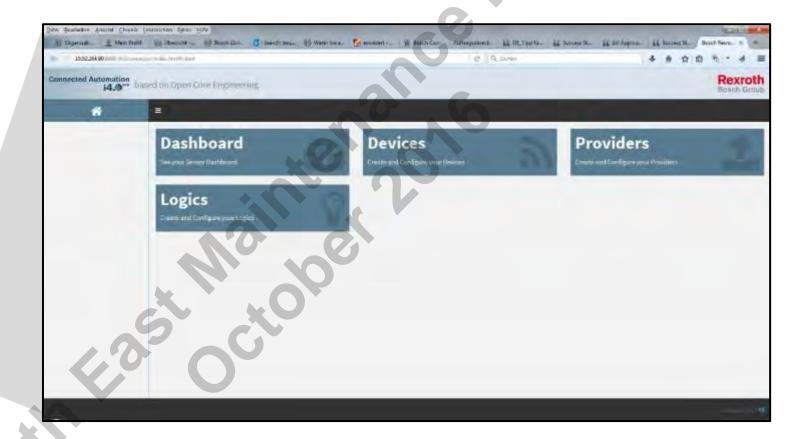
https://www.boschrexroth.com/en/xc/industries/factory-automation/showcase-i4-0/i40-connector



# Web based configuration







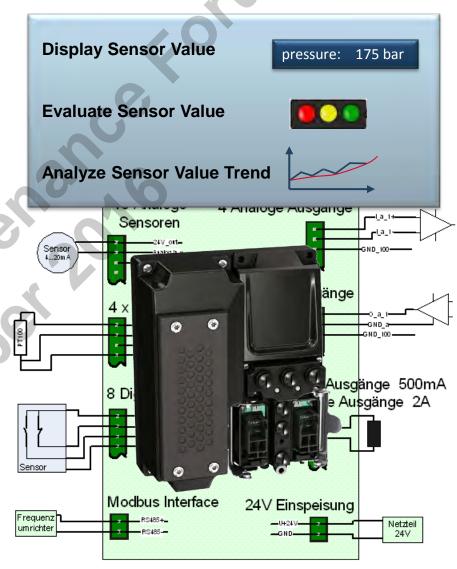




#### ABPAC - Connected Product

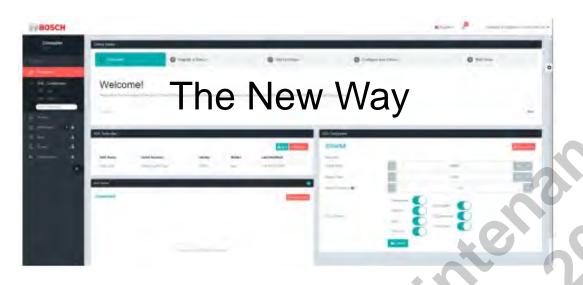






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14.0 Upgrade Kit



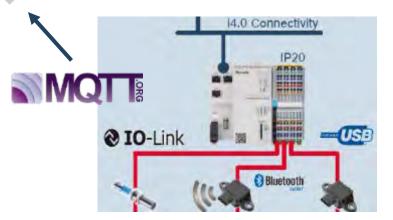




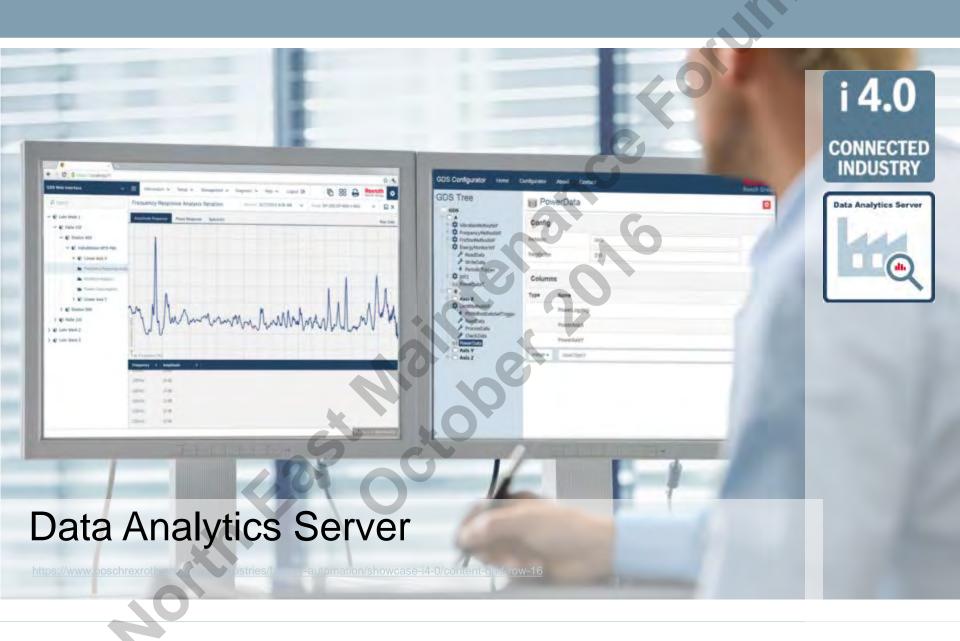
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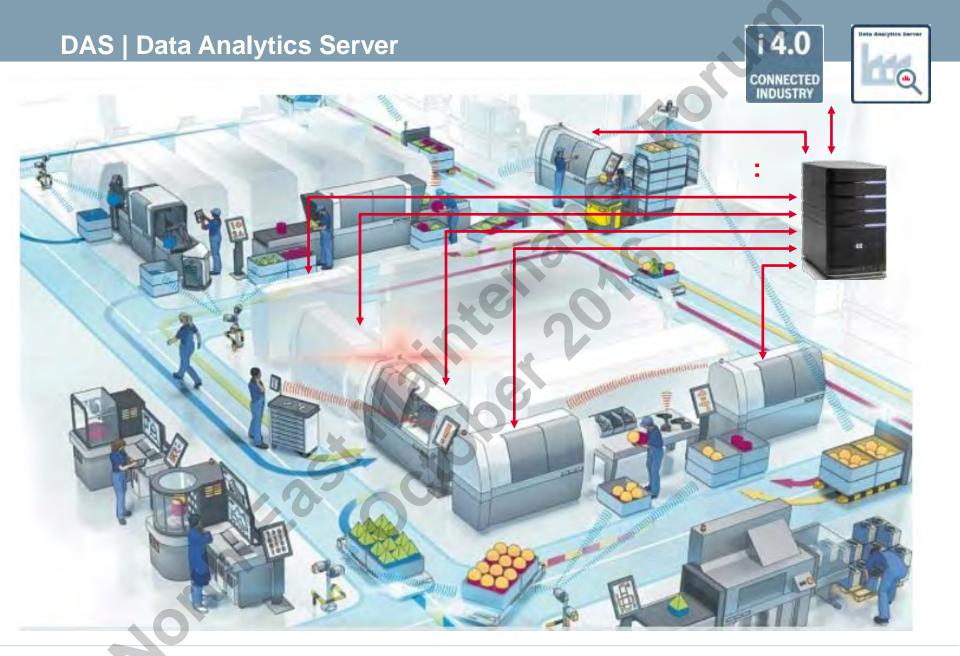
- Low cost
- Learning
- Portable













#### **DAS | Data Analytics Server**



What do we want to do with the data?



Today many of us simply don't know!



We have to provide some ideas and develop additional data mining functions!



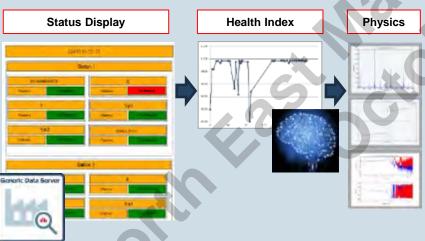
In the end, we are looking for a higher productivity, less energy consumption, quality improvement, ROI, etc.



#### **Data Analytics Server | DAS**

#### **Condition Monitoring**





#### Advantage

- Reduce unplanned downtime
- Planning of maintenance and repairs
- Reducing maintenance and repair costs
- Increasing machine availability
- Timely ordering of spare parts and planning the necessary resources

#### Solution – Condition Monitoring

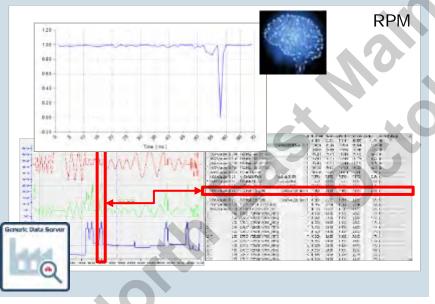
- Assessment of machine condition by detecting and processing internal and external data of critical machine components
- Status display for all relevant components
  - Overview on the status display
  - Health Index for individual components
  - Underlying physical effects



#### Data Analytics Server | DAS

# **Process Monitoring**





#### Advantage

- Reduction of process time and costs
- Ensuring the cycle time
- Ensuring process quality
- Reduction of energy and media consumption

#### Solution - Process Monitoring

- Increased productivity through cycle time optimization via MTX ewb
- Ensuring cycle times in production processes through data provision in ms cycle (consistency between NC block data and signals from the NC, PLC and Drives)
- Early warning of critical deviations by machine learning algorithms





# Use Case: Machine Health Index

# **Compact Machine Overview**





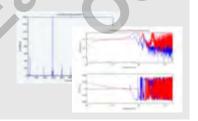
#### **Accuracy**

- Web Tension
- Register Error



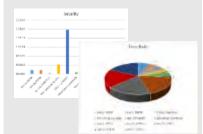
#### **Predictive Maintenance**

- Operating Hours
- Belt Tension
- ResonanceFrequency



#### **Failures**

- Failure Rate Overview
- Severity Overview



#### Load

- CPU Load
- Working Points of the drives



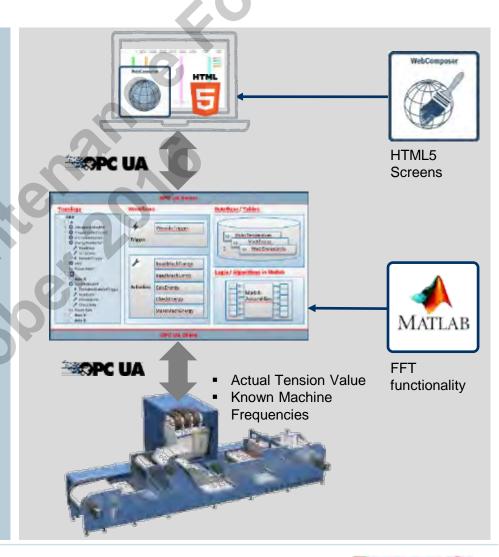




# Web Tension Quality

The goal was to evaluate the quality of the web tension

- Actual web tension was logged by the DAS
- A FFT shows the frequencies and amplitudes of the most domination disturbances
- Comparison with known machine frequencies

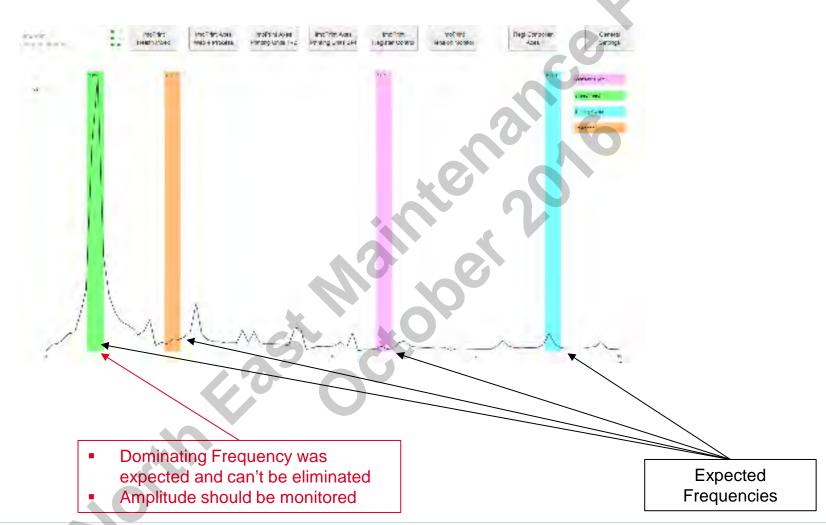




#### **DAS | Data Analytics Server**



# Web Tension Quality

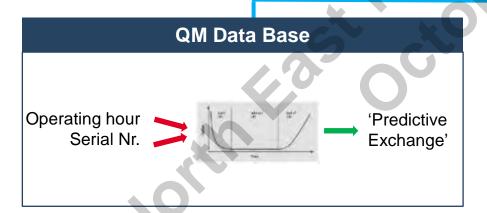




## Possible new business models



This could be offered by OEM in conjunction with a mchine warranty.

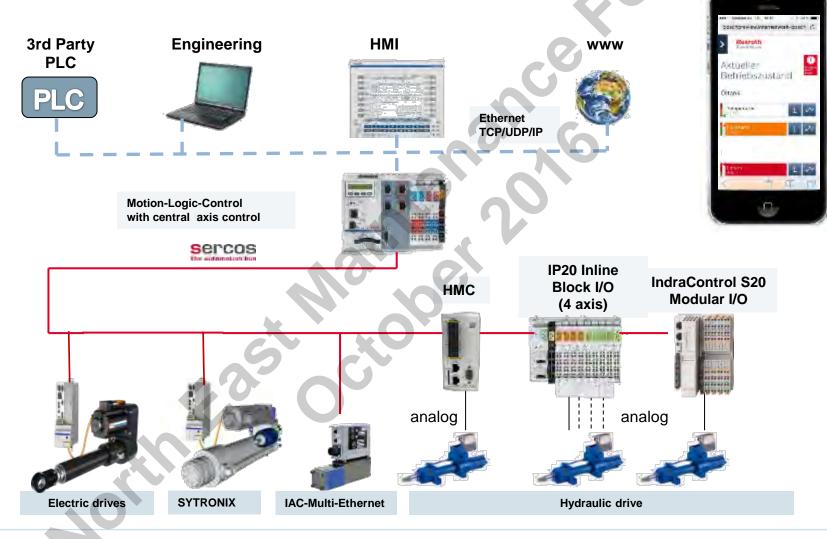






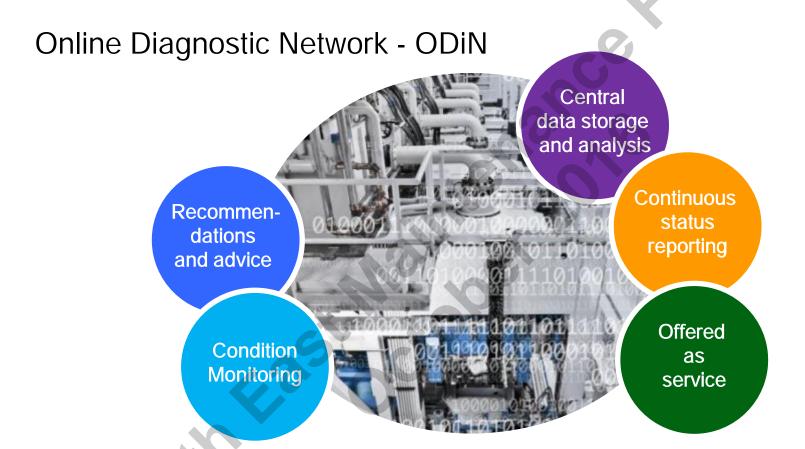


# Motion-Logic-Control for all drives

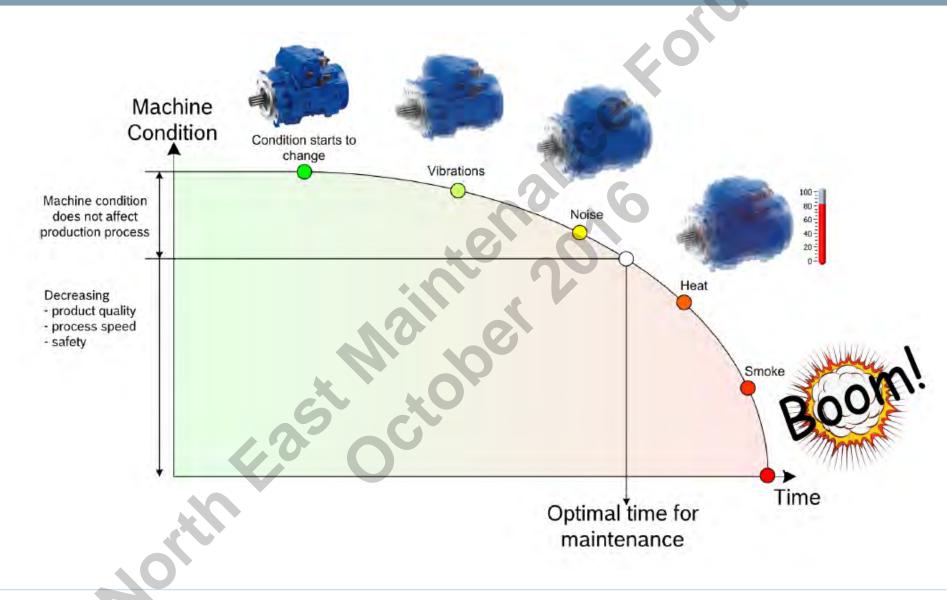




#### Dual strategy at Bosch / BoschRexroth



#### Connected Automation 14.0 now





#### Connected Automation 14.0 now



#### **Our Services**

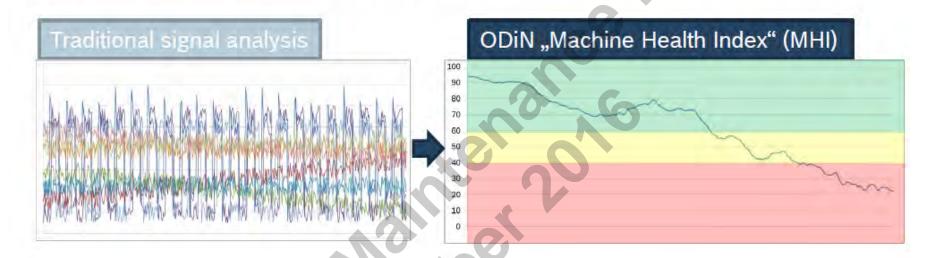
- Continuous reporting on the status of the machine and variations which could lead to failure
- Recommendations and advice about necessary maintenance actions

#### **Customer Benefits**

- Risk reduction: Issues identified before they become a big problem
- Cost reduction: Service only performed when needed



# **ODIN Condition Monitoring**



#### ODiN Advantages:

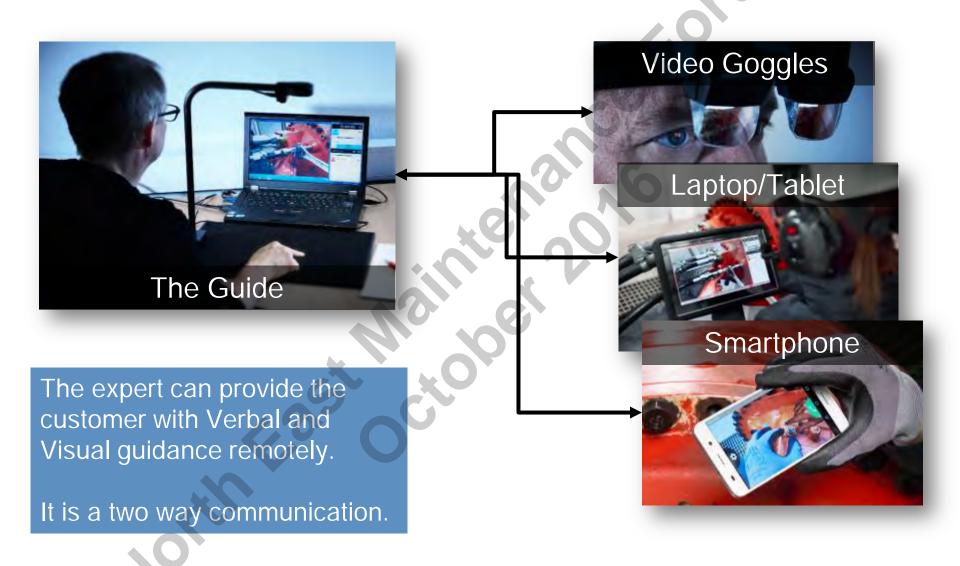
- Data Mining (ODiN) approach improves quality of predictive forecasting significantly
- · Complex machine behaviour represented in a single graph
- No need for manual threshold setting
- Significantly reduced number of false alarms
- One engineer can monitor a larger number of applications



# Connected Albonson Rexooth Original Service

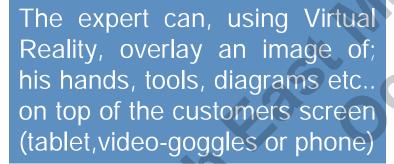


# Connected All Inaibis 4 long by 14.0?



# Connected Automation Insight Live?









#### Open Core Engineering - die Brücke zur Industrie 4.0

"In building the Connected World of the future, we believe no <u>single</u> company will be able to do this alone.

We believe in **Open Platforms**, in **Open Standards**, in **Open Source** and in **Strategic Alliances**."





Dr. Volkmar Denner CEO, Bosch



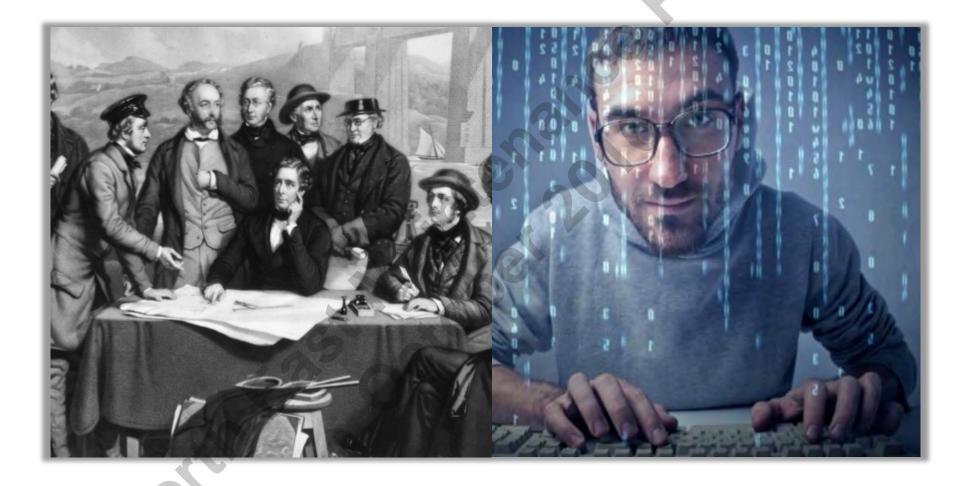
# DASSAULT | The **3DEXPERIENCE** Company





#### Connected Automation i4.0 now

### Engineering skills are changing...





#### **Connected Automation 14.0 now**



#### **Connected Automation 14.0 now**







Policy Related Presentation
Risk assessment and testing legislation impacts on maintenance professionals
Trevor Hall
Hall and Angus





The recent upgrade to the Insurance Act as of the 12<sup>th</sup> August 2016 places greater emphasis on the insured to give a fair presentation of their business to insurers by disclosing:

- All material circumstances via a reasonable search of the company
- To include senior staff where necessary, especially if the person dealing with the insurances does not know this information

To give a fair presentation now requires the client to give a fuller disclosure and to fail to disclose this to insurers whether deliberate, can:

- Result in a policy being cancelled
- Premiums paid not returned
- If the misrepresentation is non-deliberate the options are proportionate, insurers can:
  - Decline your risk but must return the premiums paid.

or

• Insurers can apply new terms in light of the new information.

It is the opinion of Hall & Angus that substance & alcohol misuse in the workplace or while on duty away from the workplace is part of a full disclosure to ensure the safety of the business, its employees and where appropriate contractors, visitors and the public.









# **Questions for Speakers and Discussions**









# Updates from the Forums and member news Roger O'Brien





#### **UK Maintenance Forum**

· Sunderland - NEMF

#### Confirmed

- Huddersfield
- Manchester
- Cambridge
- Strathclyde
- Coventry
- London

#### Planned

- Aberdeen
- Swansea
- Southampton







#### **Upcoming UK Maintenance Forum Events**

London: 17th Nov 2016 HSSMI, Olympic Park

Coventry: 23rd Nov 2016

Manufacturing Management Show, Ricoh Arena
Press Launch, Midlands MF with Coventry University

Scotland: 27th Jan 2017: IET Glasgow Remanufacturing Institute, Strathclyde University

Yorkshire: Feb 2016,
Yorkshire MF, University of Huddersfield

NEMF: 8th Feb 2016





# **EPSRC Proposal in Development**

Create a small 'prototype' factory cell comprising:

- Digital Manufacturing
- Big Data
- Internet of Things

Any interested parties contact:

Dr David Baglee

- david.baglee@sunderland.ac.uk
- Or via NEMF





# **Marie Curie Research Actions**

- Leading Finnish Research for 2 years arriving April 2017 to work with AMAP/NEMF
- Companies are being sought to engage with this
  - 2 large companies were part of bid
    - Opportunity for others
- Expert in Financial Aspects of Maintenance
  - ROI, ROCE, etc
- Interested Contact us via RO'B or DaveB





# **Training Courses now available via AMAP:**

# **Condition Based Maintenance**

# **Design and Process Failure Modes Effect Analysis**

See us on Stand H077 for more details (book via UoS online store or 0191 515 3888)





#### **Condition Based Maintenance**

This new two day course, suitable for managers, engineers and technicians, can significantly help maintenance and operations professionals begin to understand and apply the latest techniques, tools and strategies for condition based maintenance, as well as learning what needs to be put in place to succeed with these, and also start to consider future technologies.

This course sets out the fundamentals of Maintenance management and condition based maintenance and will provide practical steps, backed up with real world examples and equipment demonstrations of how to deploy and improve CB maintenance operations in those areas and reduce costs.

#### Next dates:

Condition Based Maintenance - 28th and 29th November 2016 - 2 day course





#### Failure Modes Effect Analysis

FMEA (Failure Mode and Effects Analysis) is a powerful technique that enables companies to improve customer satisfaction and reduce product liability risk by anticipating and preventing defects in design and manufacture. FMEA techniques are applicable to all industry sectors, though companies supplying the automotive industry or seeking compliance and registration to ISO/TS 16949 are required to use FMEA techniques to achieve product assurance.

These two 1 day practical FMEA training courses introduce the principles behind the FMEA techniques and explains how they can be applied at each stage of product and process development. They will provide delegates with a basic knowledge of the FMEA methodology, how to apply it to product and process design, and demonstrate how the results of the FMEA are used to define the requirements for effective product validation plans and effective control plan for the manufacturing process.

#### Next dates:

Design Failure Modes Effect Analysis (DFMEA) – 22nd November 2016 – 1 day course Process Failure Modes Effect Analysis (PFMEA) – 23rd November 2016 – 1 day course







# Transform your business with Degree Apprenticeships at the University of Sunderland.

Degree Apprenticeships are full-time paid employment incorporating at least 20% on and off the job training to level 6 or above. In April 2017 the government will introduce an Apprenticeship Levy to be paid by all employers with a pay bill in excess of £3 million. Levy payments may be used by the employer within 18 months to off-set apprenticeship costs. SMEs who don't pay the levy, will be eligible for government funding of up to 90% towards the costs of apprenticeship training.





# Agenda



# University Engagement Dr Michael Knowles University of Sunderland





# Opportunities for Engagement with the University of Sunderland

Dr Mike Knowles



## Contents

- MSc Manufacturing Engineering
- Degree Apprenticeships
- Student Placements
- Student Projects



# MSc Manufacturing Engineering

- In early 2016 we secured funds to develop a new MSc 'Conversion' programme to retrain graduates from non-engineering backgrounds to work in Manufacturing
  - Many thanks to all those who provided feedback during our consultation
- This received University Sign-Off over the summer and we are looking to recruit to intakes for January 2017 and September 2017



# MSc Manufacturing Engineering

- Topics to include:
  - Engineering Fundamentals
  - Automation
  - Design for Manufacturing,
  - Engineering Operations Management,
  - Advanced Maintenance
  - Quality Management
  - Project Management





## Part Time MSc Provision

- Part of the funding we secured was to develop a part-time or workbased route – for persons in the industry without technical qualifications.
- We will be consulting in the coming months but would welcome any feedback/suggestions/comments in how this can best suit the needs of industry:
  - Delivery Patterns Day/Block release?
  - Delivery Methods Negotiated Learning in the Workplace, "Blended Learning"
  - Short Courses that combine to larger award?



## Degree Apprenticeships

We are now looking to develop "Degree Apprenticeships"

Academic and vocational training programmes for employed students with attractive funding opportunities leveraging the apprenticeship levy

 We will be launching a full consultation in the coming weeks but in the meantime, please contact us if you have any suggestions or areas of interest.



### Student Placements

- Each year students from all four of our Bachelor of Engineering Programmes undertake placements between the second and third year of their study:
  - Automotive Engineering
  - Electronic and Electrical Engineering
  - Mechanical Engineering
  - Manufacturing Engineering
- Employers praise the quality of work from our students and often wish to take them on after they return or take further students in future years.



### Student Placements

- Students on placement are:
  - Employed by the Company
  - Selected by the Company
  - Working solely for the Company

BUT with support from the University

 During the placement process the student will collect evidence of their learning and will earn credit towards their final degree classification.



### Student Placements

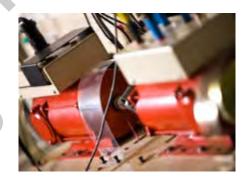
 All placements are fully supported by the University and each student has an 'academic supervisor' who ensures the academic requirements are met

 For more information please contact Dave Knapton (dave.knapton@sunderland.ac.uk)



## Student Projects

 Each year students at all levels engage in project work – either in project modules OR as part of taught 'technical' modules



 We are always keen collaborate with industry to ensure our students develop a firm understanding of "real-world" Engineering



 If you have a project or an area where you would like to work with our students please let us know



## Types of Project

- Undergraduate Engineering projects
  - Electronic and Electrical, Automotive, Manufacturing and Mechanical Engineering.
  - These will start in October and submit approx end of April.
  - Typically this would amount to about 400 hours of work to include the necessary background research and producing the final report.
  - Project may or may not include practical work but must address an Engineering Problem - no "big literature reviews"!



# Types of Project

- MSc Engineering Management
  - these are shorter but amount to more effort for the student
  - they run for 15 weeks starting September and February.
  - The student would be expected to do approximately 600 hours of work.
  - The projects can involve technical work but needs to tie back to a management related topic such as reliability, productivity etc.
  - These projects require the student to have a named 'client'



# Types of Project

- MSc Manufacturing Engineering
  - The students will do a 600 hour project which will require technical development work.
  - Subject to intakes this will run in January and May (approx.) each year.
  - Topics to include:
    - Automation
    - Design for Manufacturing,
    - Engineering Operations Management,
    - Advanced Maintenance
    - Quality Management
    - Project Management







### For more information....

- ME! Dr Mike Knowles
   michael.knowles@sunderland.ac.uk
- Dave Knapton Engineering Team Leader dave.knapton@sundeland.ac.uk
- Or get in touch via AMAP
- Many thanks for attention and support...







# The EY Manufacturers League David Baggaley

EY







# Closing remarks





# **Thanks**

Venue Sponsor:



Engineering & Manufacturing Network

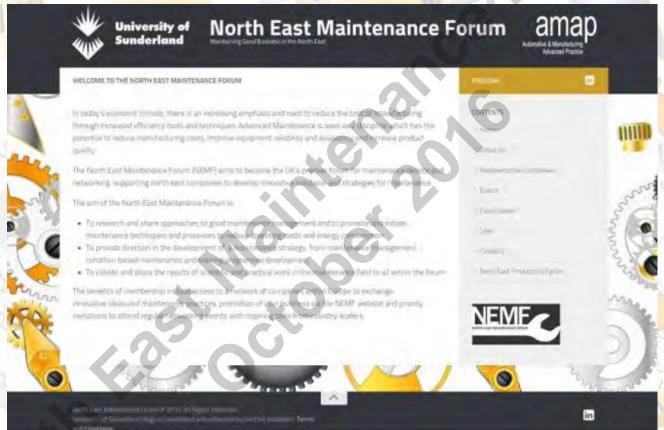
Breakfast Sponsor:



The EY Manufacturers League







www.northeastmaintenanceforum.org.uk

Also: LinkedIn Group and Facebook

#NEMFOct16





# Next meeting: 8<sup>th</sup> February 2017

Venue: TBC (Possibly Sunderland)

North East Maintenance Forum

www.northeastmaintenanceforum.org.uk





Thanks for your time and attention

North East Maintenance Forum



www.northeastmaintenanceforum.org.uk

