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Industrial metrology applications

Paul Maxted – Director of Industrial Metrology Applications

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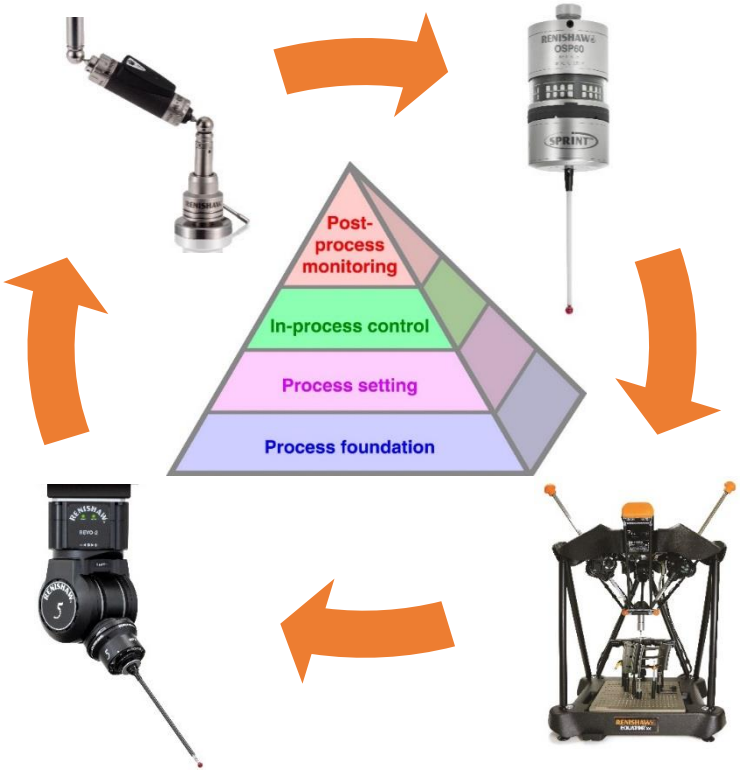
Industrial Metrology Applications…

- CNC machine calibration and performance assessment
- Consistent process output - accommodate variation
- Compensate for changes or drift during machining
- Verification of parts to meet design intent



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Renishaw technology enables…

- Highly productive precision machining
- Reduced skill requirements
- Reduced quality costs
- Factory automation

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Applications relevant to many industries

Aerospace

Precision manufacturing

Process Input / source of variability					
Machine dynamic performance – accuracy of interpolated features	✓				
Cosmetic surface finish on circular interpolation	✓				
Machine set up – critical alignments and positions			✓		
Tool length and diameter offset measurement		✓			
Confirmation of expected tool assembly		✓			
Work piece set up – position and alignment			✓		
Compensation for input material variation			✓		
Machine and part thermal growth compensation			✓	✓	
Tool breakage detection		✓			
Process control of tool offsets			✓	✓	
Point of manufacture QA				✓	
Final certification and pass off prior to assembly					✓

Automotive

Heavy industry

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Applications relevant to many industries

Aerospace

Precision manufacturing

Proces				
Machine dynar features				
Cosmetic surfa				
Machine set up	✓			
Tool length an				
Confirmation o				
Work piece set	✓			
Compensation	✓			
Machine and p	✓	✓		
Tool breakage				
Process contro	✓	✓		
Point of manuf		✓		
Final certificati			✓	

Automotive

Heavy industry

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Precision manufacturing

Process Inp			
Machine dynamic pe features			
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Machine set up – cri			
Tool length and dian			
Confirmation of expe			
Work piece set up –			
Compensation for in			
Machine and part th		✓	
Tool breakage detec			
Process control of to		✓	
Point of manufacture		✓	
Final certification an			✓

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Heavy industry

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Process Inpu			
Machine dynamic perf features			
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Confirmation of expec			
Work piece set up – p	✓		
Compensation for inpu	✓		
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Tool breakage detecti			
Process control of too	✓	✓	
Point of manufacture (		✓	
Final certification and			✓

Automotive

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Precision manufacturing

Process Inp				
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Work piece set up – pc	✓		
Compensation for inpu	✓		
Machine and part therr	✓	✓	
Tool breakage detectio			
Process control of tool	✓	✓	
Point of manufacture Q		✓	
Final certification and p			✓

Automotive

Heavy industry

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Traditional Industrial Metrology customers…

- Sensors and metrology systems to OEMs
  - CMM manufacturers / CNC Machine tool builders
- High-value manufacturers

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Case study - Beijing Jingdiao

"We chose Renishaw products when our company was first founded because we admired their brand values and product performance. We compared precision calibration equipment, including laser interferometers and ballbars from a number of brands on the market, and found that of all the comparable products, Renishaw offered the most consistent performance and the most widely recognised measurement results."

Beijing Jingdiao Company Ltd (China)

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Working more closely with end users…

- Advanced technology requires direct involvement
- Supplying systems rather than accessories
- Adding value – technical partners

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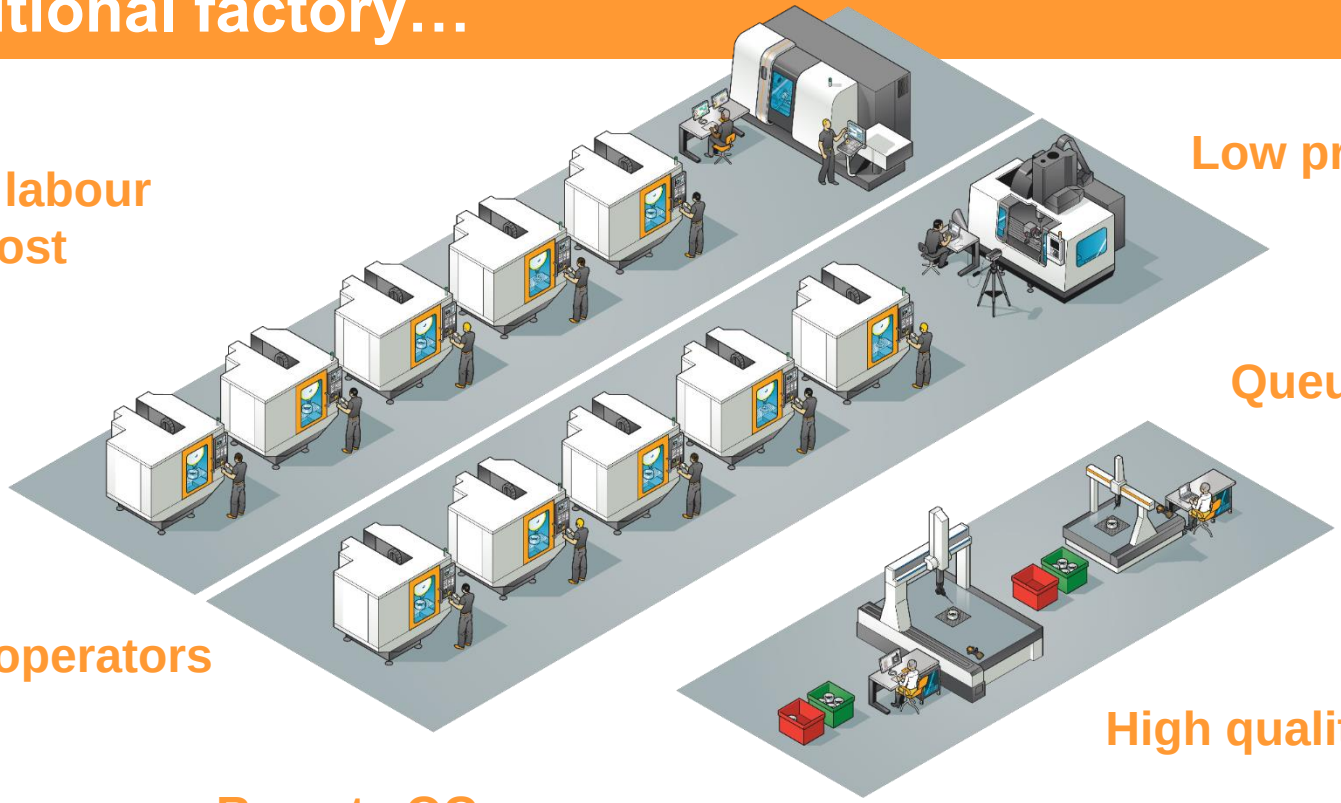
Traditional factory…



High labour cost

Low productivity

Queuing

Skilled operators

High quality costs

Remote QC area

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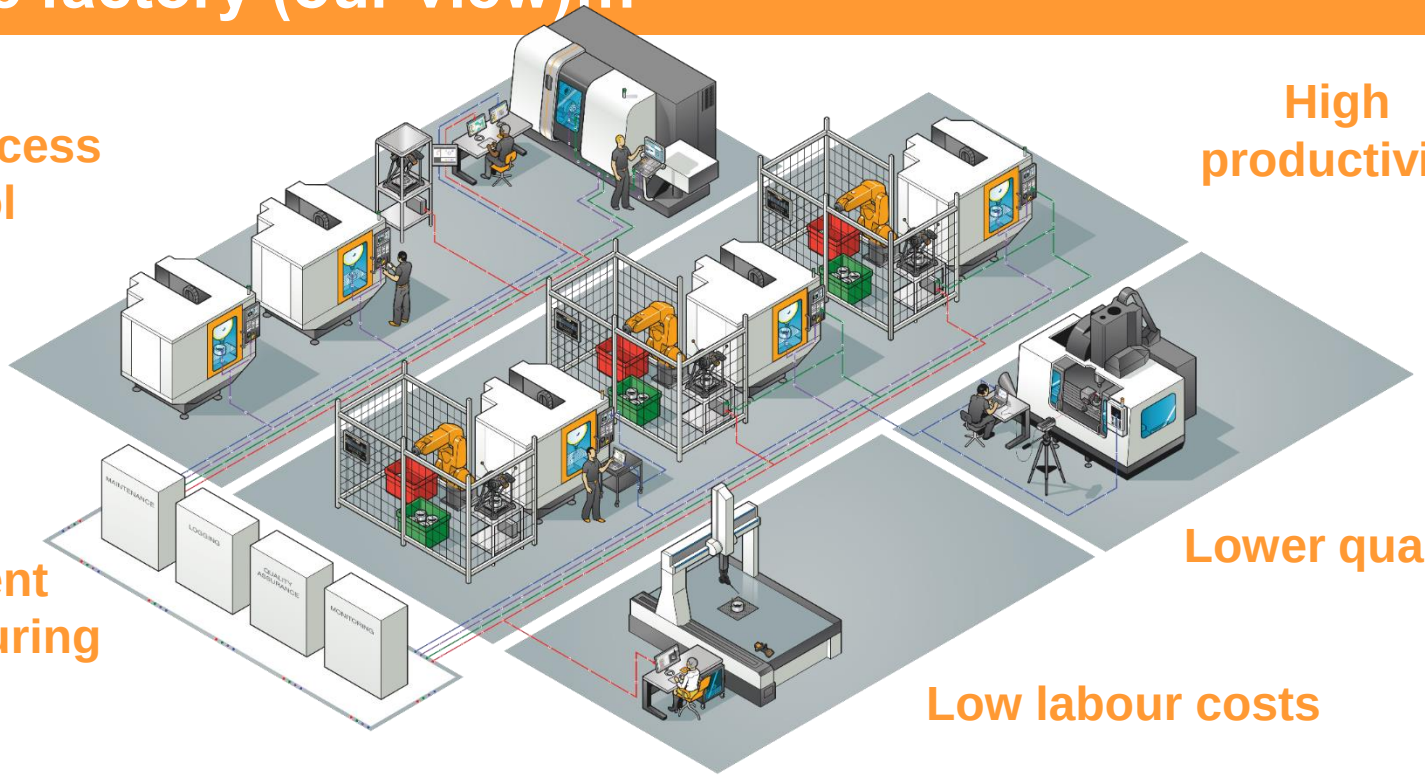
Future factory (our view)…

Direct process control

High productivity



Intelligent manufacturing

Lower quality costs

Low labour costs

Highly automated

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Our experience is relevant…

Highly automated

Low costs

Direct process control

Intelligent manufacturing

High productivity

Data generation

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Case study – FGP Precision Engineering

- Aerospace subcontractor
- Unacceptable quality costs
- Application of Renishaw technology to improve capability

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Case study – FGP Precision Engineering

- Periodic machine checking
- Preventative maintenance
- High confidence of part quality

"The ballbar has really helped us with the specifics on every one of our 5-axis machine tools. We're able to make a part better because our machines are more accurate and more predictable."

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Case study – FGP Precision Engineering

- Moving measurement to the shop floor
- Process control
- Inter-operation validation

> Since we have started using the Equator, we have not made a single bad part. The Equator is allowing the operators to operate complete process control.

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Our Sales teams are evolving…

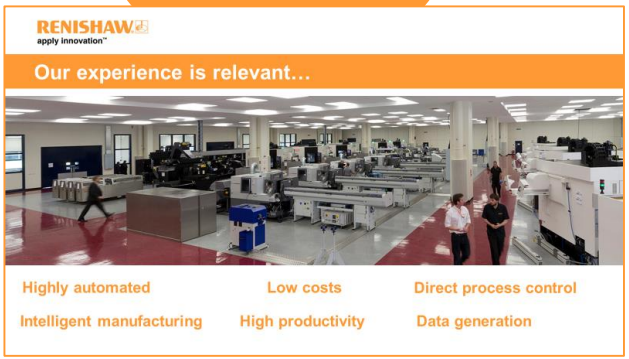
More end user focus

+

Increased application of products

=

Increased number of Applications Engineers globally



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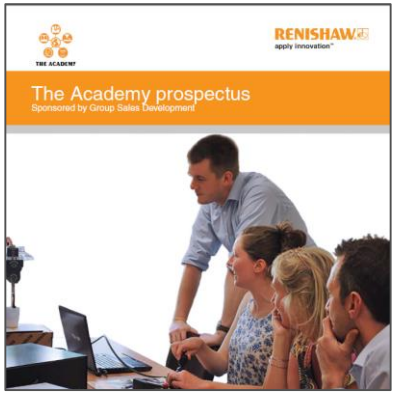
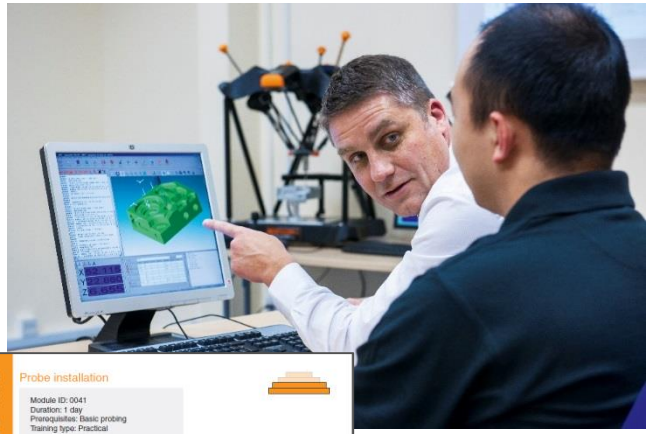
People development…

Developing world-class solution providers™

THE ACADEMY





Examples - our people…

Tom Silvey

Renishaw Apprentice now Applications Engineer

Ian Stroud

Renishaw Manufacturing now Applications Manager

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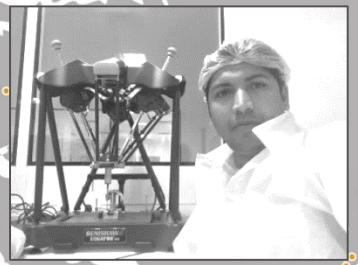
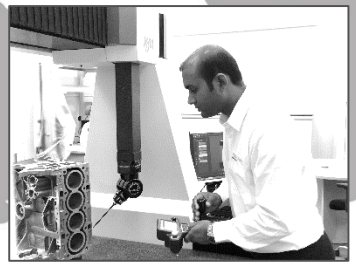
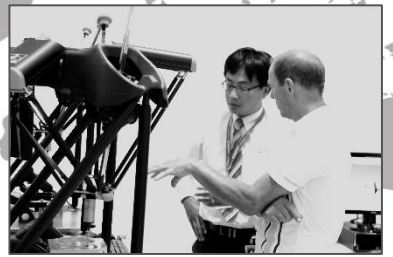
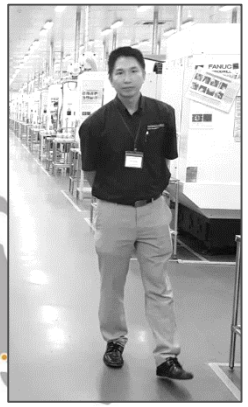
A global team…









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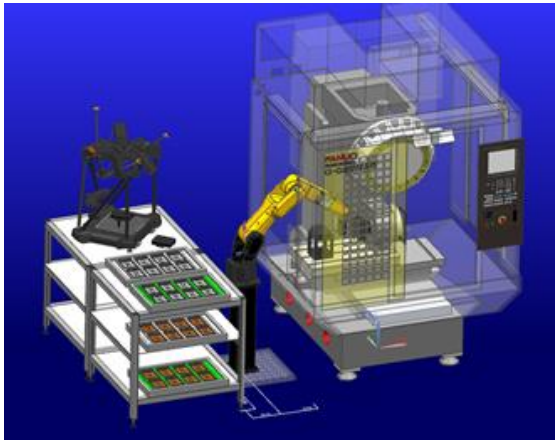
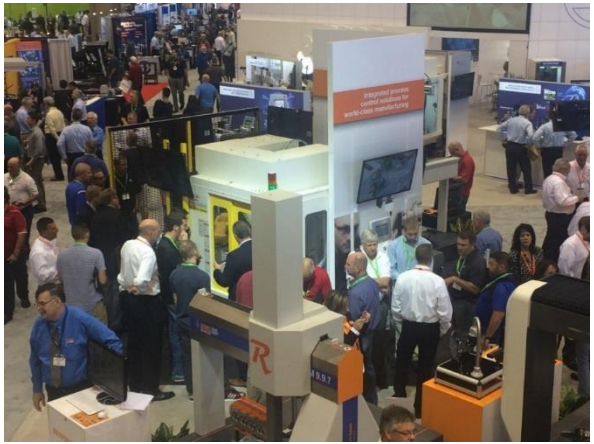
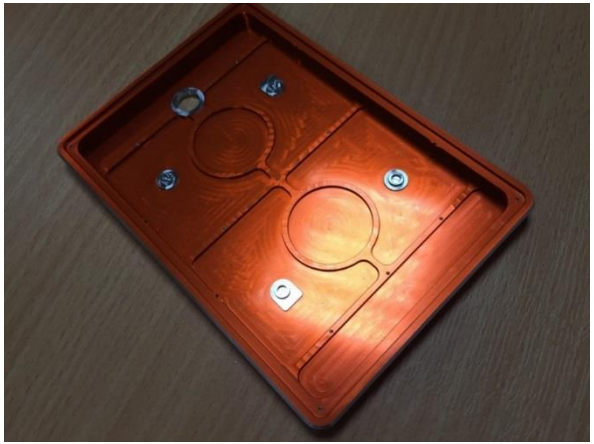
Industrial Metrology applications – in action







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Application of Renishaw technology…

- ❑ Accuracy of interpolated features
- ❑ Cosmetic appearance

- ❑ Baseline tool setting for milling cutters
- ❑ Accurate process setting for other tools

- ❑ Part Setting and work offsets
- ❑ Part loading error detection

- ❑ Final Process control of machined features
- ❑ Point of manufacture QA

- ❑ Final verification & certification to design intent