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Original Citation

Wright, Daniel, Murgatroyd, S., Longstaff, Andrew P., Myers, Alan and Fletcher, Simon (2010) Process control within an SME to increase output and achieve consistent manufacture of components. In: *Future Technologies in Computing and Engineering: Proceedings of Computing and Engineering Annual Researchers' Conference 2010: CEARC'10*. University of Huddersfield, Huddersfield. ISBN 9781862180932

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Process control within an SME to increase output and achieve consistent manufacture of components

D. Wright, S. Murgatroyd, A. P. Longstaff, A. Myers, S. Fletcher



University of HUDDERSFIELD

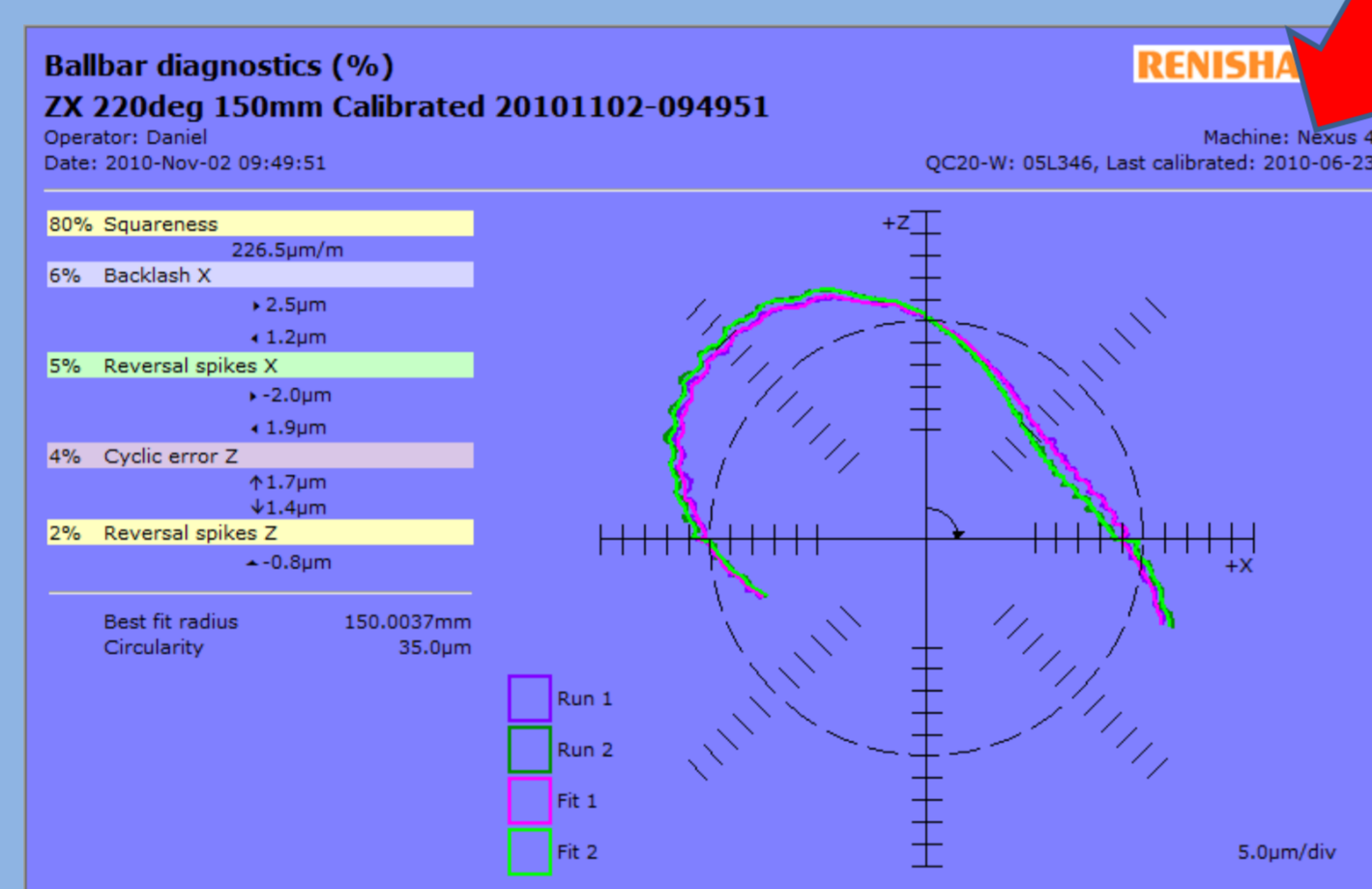
Introduction - Process control is a key aspect to any company looking to increase machining output and availability, and also those who strive to achieve automation. The dangers associated with this philosophy can be seen when producing batch's automatically. With no operator intervention, any weakness in the process control chain can result in high levels of scrap being produced.

To achieve consistent manufacturing it is necessary to look at the processes which make up the whole operation. The majority of the components manufactured within the case-study SME can be single or batches of very few parts.

Tooling file created for standardisation across machining centres. Standard tools are kept within the machine for common jobs and includes the Touch Probe. Pockets are left blank for job specific tooling and are changed as necessary. All tool information is recorded including grades, speeds, feeds lengths and manufacturer

On machine collision causes crash within machine damaging work piece, smashing probe and possibly causing machine error

Ballbar graph showing the machine error relating to the large crash of probe body into the side of the work piece



Machine checked using ballbar test equipment to evaluate machine alignment post incident

Component re-checked after machine alignment and showing a realistic dimension report which is comparable to manual inspection

CRAFTSMAN TOOLS
Inspector Name:
Inspector sign off:
Printed on: 10/32/26
SERIAL NUMBER: ABC123
PART NUMBER: G6537.MHI
REPORT

Point No.	Position			Tolerance			Position measured			Error in Position			Vector	Standard L. Actual Distance/Angle (°)	Error	
	X	Y	Z	min	max	X	Y	Z	X	Y	Z					
38	0.000	0.000	0.000	-0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	40.000	39.861	-0.139
39	0.000	0.000	0.000	-0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	54.249	54.249	0.000
40	0.000	0.000	0.000	-0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
41	0.000	0.000	0.000	-0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
42	0.000	0.000	0.000	-0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

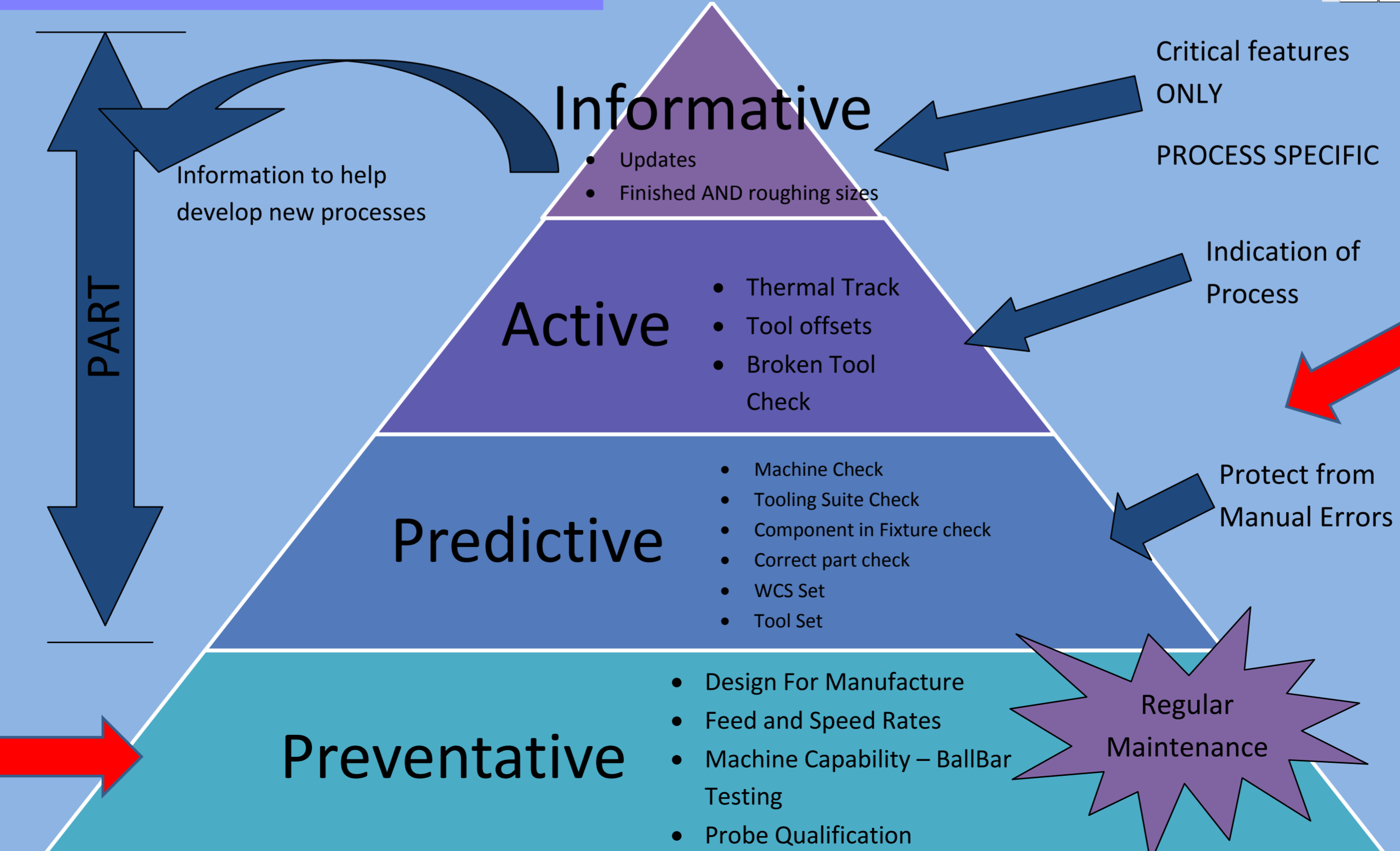
Component measured on the machine tool highlighting large errors. First checks are made with a quick ballbar test

CRAFTSMAN TOOLS
Inspector Name:
Inspector sign off:
Printed on: 10/30/26
SERIAL NUMBER: ABC123
PART NUMBER: G6537.MHI
REPORT

Point No.	Position			Tolerance			Position measured			Error in Position			Vector	Standard L. Actual Distance/Angle (°)	Error	
	X	Y	Z	min	max	X	Y	Z	X	Y	Z					
38	0.000	0.000	0.000	-0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	40.000	40.014	0.014
39	0.000	0.000	0.000	-0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	54.249	54.249	0.000
40	0.000	0.000	0.000	-0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
41	0.000	0.000	0.000	-0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
42	0.000	0.000	0.000	-0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Outcomes - On-machine probing of a component has been used as a first-line diagnostic tool when comparison with manual inspection identified errors in the production machine. Collisions on the machine tool give need for testing with the ballbar as a damage indicator and allow for maintenance to take place if necessary. Processes within manufacture have been standardised and allow for greater control of the components produced across a number of Machine Tools.

Component correctly secured to correct fixture check. Modification taken place within this example to allow for measurement to occur using touch probe



Tooling file table with columns for Tool No, Tool Description, Tooling Suite, Tool Length, Tool ID, Tool Grade, and Tool Name.

