

Belcan Corporation



Advanced
Engineering &
Technology
Division

ISO 9001 Registered

HPT Blade Shaped Hole Inspection

Belcan Engineering Automated Inspection System Development

Jack Gasper, Manager, Technical Programs

Belcan

Turning Resources Into Results

Belcan/GEAE Company-Sensitive Information

Shaped Hole Diffusers

- **Diffusers aid in dispersing airfoil cooling air more uniformly over airfoil**
- **Diffusers improve thermal balance of cooling air**
- **Control of diffuser size and location effect component performance & life**
- **Controlling the shaped hole drilling process improves component quality**

Machine Vision Applied To Turbine Blade Shaped Hole Diffuser Inspection

- **Present inspection method – Operator visually gauges hole entrance diffusers using templates**
- **Random offline inspection – inspection cycle requires 15mins with data recorded manually**
- **Drill machine operator receives delayed or no feedback needed for process control of diffuser footprint dimension**

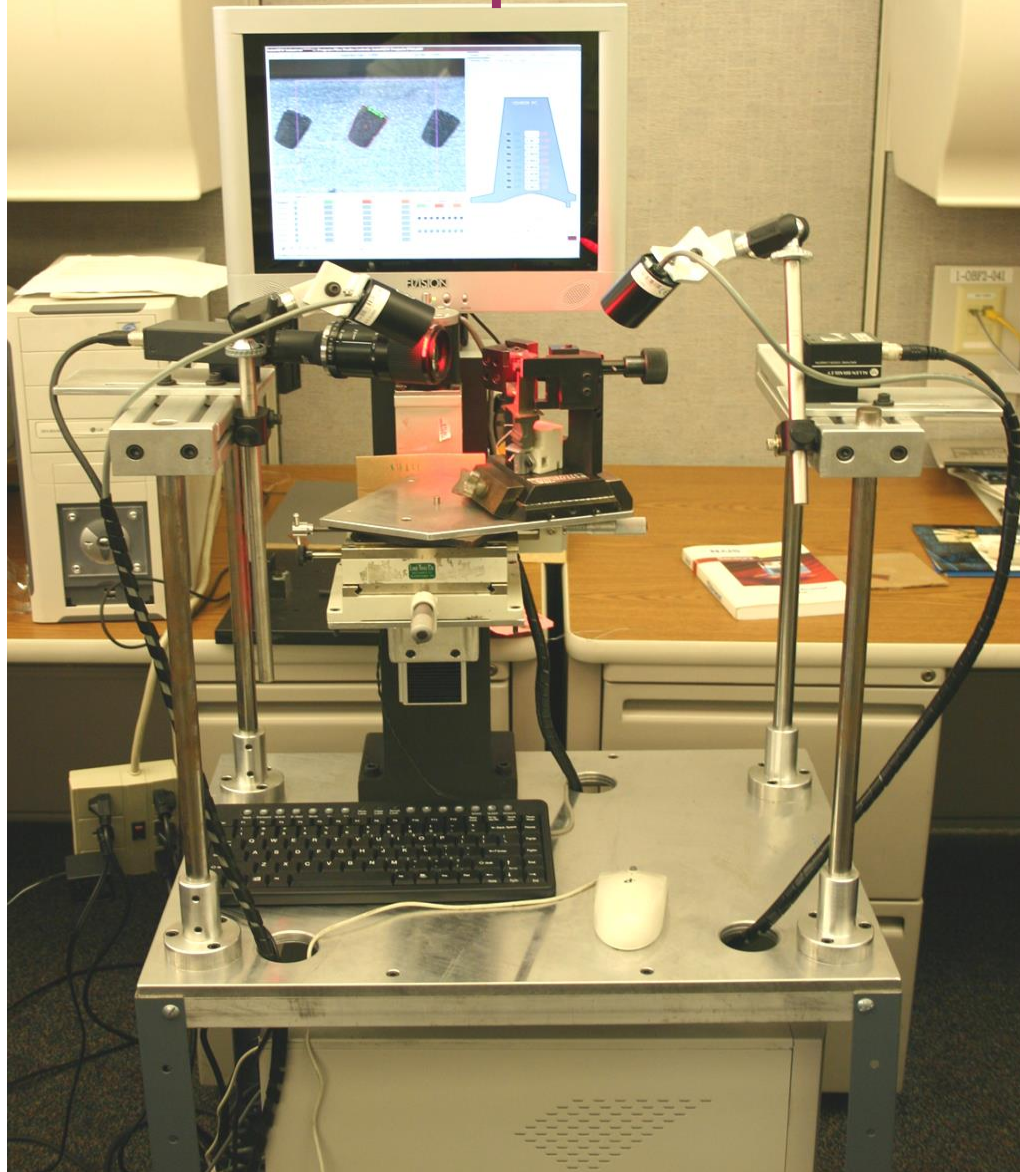
Advantages Of Automated Inspection Applied To Gauging Diffuser Footprints

- **Increased throughput - reduced operator inspection time and improved accuracy**
- **Cost savings - metal template gages currently being used will no longer be required**
- **Controlling diffuser quality satisfies component design intent**

Advantages Of Automated Inspection Applied To Gauging Diffuser Footprints

- **Improved part quality - close process monitoring will indicate process drift and identify when process re-targeting is needed**
- **100% Inspection - eliminates manufacturing escapes & reduces scrap**
- **Inspection data collected electronically – inspection results statistically compiled and displayed in an Excel format indicating process performance (i.e., gauge R&R, standard deviation, CP_k , etc.).**
- **Satisfies Process Certification requirements**

Automated Inspection System Development



Sample Display of Results

AutoVIEW Industrial **** C:\Program Files\Roslon Controls\AutoVIEW\Projects\PW3.AVP

S 1 Inspection Time: 0.1582 Parts/Min: 379.2575

Design Objects Gauge Records Stats Tracking

Operator View Setup Mode Rejects

2A8321 PC

97	0.02	0.0261	0.06
96	0.06	0.0721	0.109
95	0.057	0.0652	0.097
94	0.051	0.0575	0.091
93	0.047	0.0579	0.087
92	0.067	0.0874	0.116
91	0.062	0.0000	0.103
90	0.056	0.0733	0.096
89	0.05	0.0000	0.09

Track Mode	tmNone	X	N/A	Y	N/A	Angle	N/A	Result	N/A	UPDATED	*TEMPL	1
Channel 1	<input checked="" type="checkbox"/>	PASS	7	FAIL	14	INVALID	0	Vision Engine Totals				
Channel 2	<input type="checkbox"/>	PASS	0	FAIL	0	INVALID	0	7	14	0		
Channel 3	<input type="checkbox"/>	PASS	0	FAIL	0	INVALID	0	PASS	FAIL	INVALID		
Channel 4	<input type="checkbox"/>	PASS	0	FAIL	0	INVALID	0					
Channel 5	<input type="checkbox"/>	PASS	0	FAIL	0	INVALID	0					
Channel 6	<input type="checkbox"/>	PASS	0	FAIL	0	INVALID	0					
Channel 7	<input type="checkbox"/>	PASS	0	FAIL	0	INVALID	0					
Channel 8	<input type="checkbox"/>	PASS	0	FAIL	0	INVALID	0					

PC Row No.

Serial Number Cycle Post Report

Current Diffuser 97 Current Row PC Rejects

Setting RunMode to Running Running C:\Program Files\Roslon Controls\AutoVIEW\Pri Fixture 1 Encounter 1