



Adaptive Edge Grinding System

Blade dimension: Length: minimum 40 mm, maximum 250 mm.
Width: minimum 20 mm, maximum 120 mm.

November 2019





Benefits: Scan blade less than 7 sec,
Repeatability up to 0.01 mm, Measurement
accuracy up to 0.02 mm.

No blade shape restrictions.

November 2019





Benefits: Setup time for new blade no more than 10 min.

Compactness. Installation Dimensions
2,2x1.4m

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Automatic Edge Grinding system

General

Manufacturing parts for today's modern jet engines requires working to very tight tolerances, and while manual grinding and hand finishing operations were accepted practices in the past, the introduction of more technical designs to improve fuel efficiency in the engines is demanding more precise computer-controlled, automated and repeatable finishing solutions.

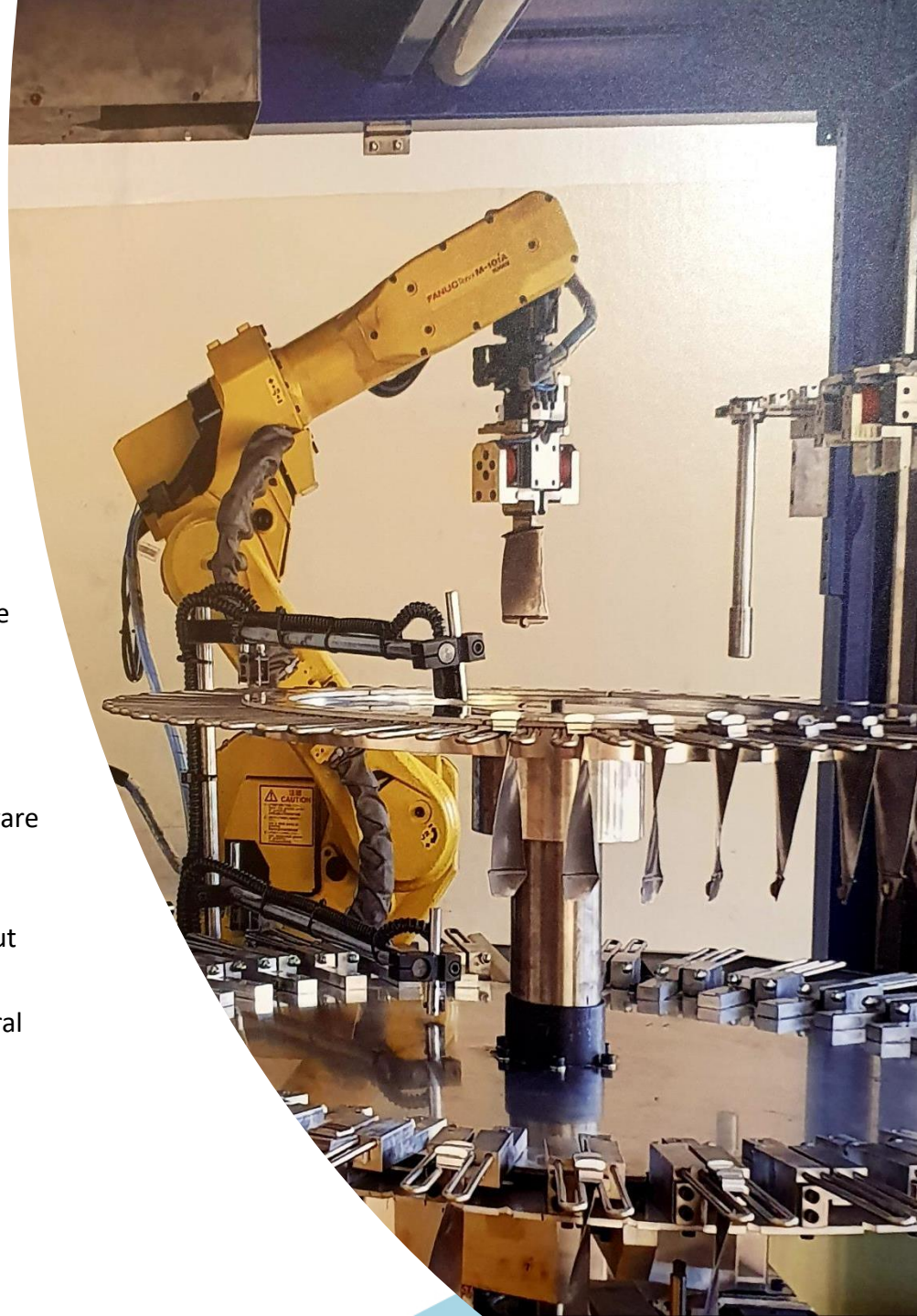
The AEG system is designed, developed and manufactured in cooperation of BAOR and MTL 3D companies in accordance with customer requirements and definitions.

The AEG system is designed to carry out the automatic grinding of blade edge profiles, based on pre- and post-grinding inspection and analysis with automatic loading and unloading of blades at all process stages. The AEG system is replacing the current manual grinding process, while significantly improving the accuracy and efficiency of the grinding. The AEG system was tested and qualified at production floor and at laboratory conditions.



System structure

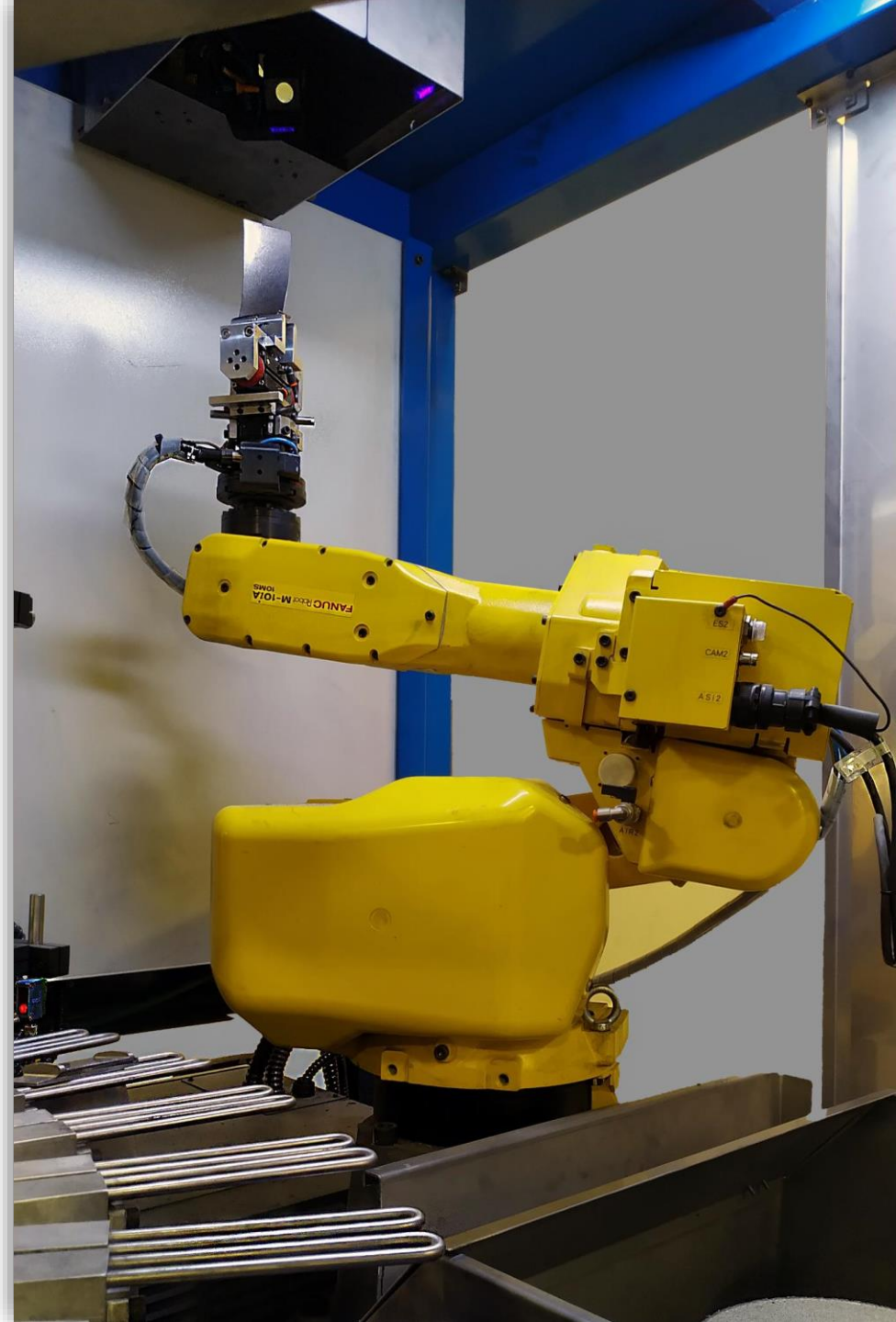
- Robot: 6 axis multi-articulated arm from one of the best world brands
- Measuring system: non-contact measuring providing fast edge inspection and analysis of actual edge shape, comparison to the theoretical model, making conclusions and correcting grinding paths with accordance to obtained results – all completely automatic
- Grinding system – contains of several rotating abrasive disks
- Main controller, terminal and PC – running UI, measuring software and communication with robot
- Input and Output carousel buffers – capable to hold several dozens of blades. System is adapted to dove-tail root blades, but can be tuned for other root type blades as well
- Gripper stock – may contain several grippers (each suit to several blade types)
- Dust removing system



System overview

Advantages and know-how

- AEG - completely automatic, edge-grinding system
- Turnkey industrial solution for blade grinding
- High precision and repeatability
- Short cycle time and extremely high performance
- Wide range of blade geometries and shapes can be applied
- Fully compatible for steel, nickel and titanium alloy materials
- Close loop inspection-grinding process sequence



MTL

Non-contact 3D inspection solutions

System overview

Advantages and know-how

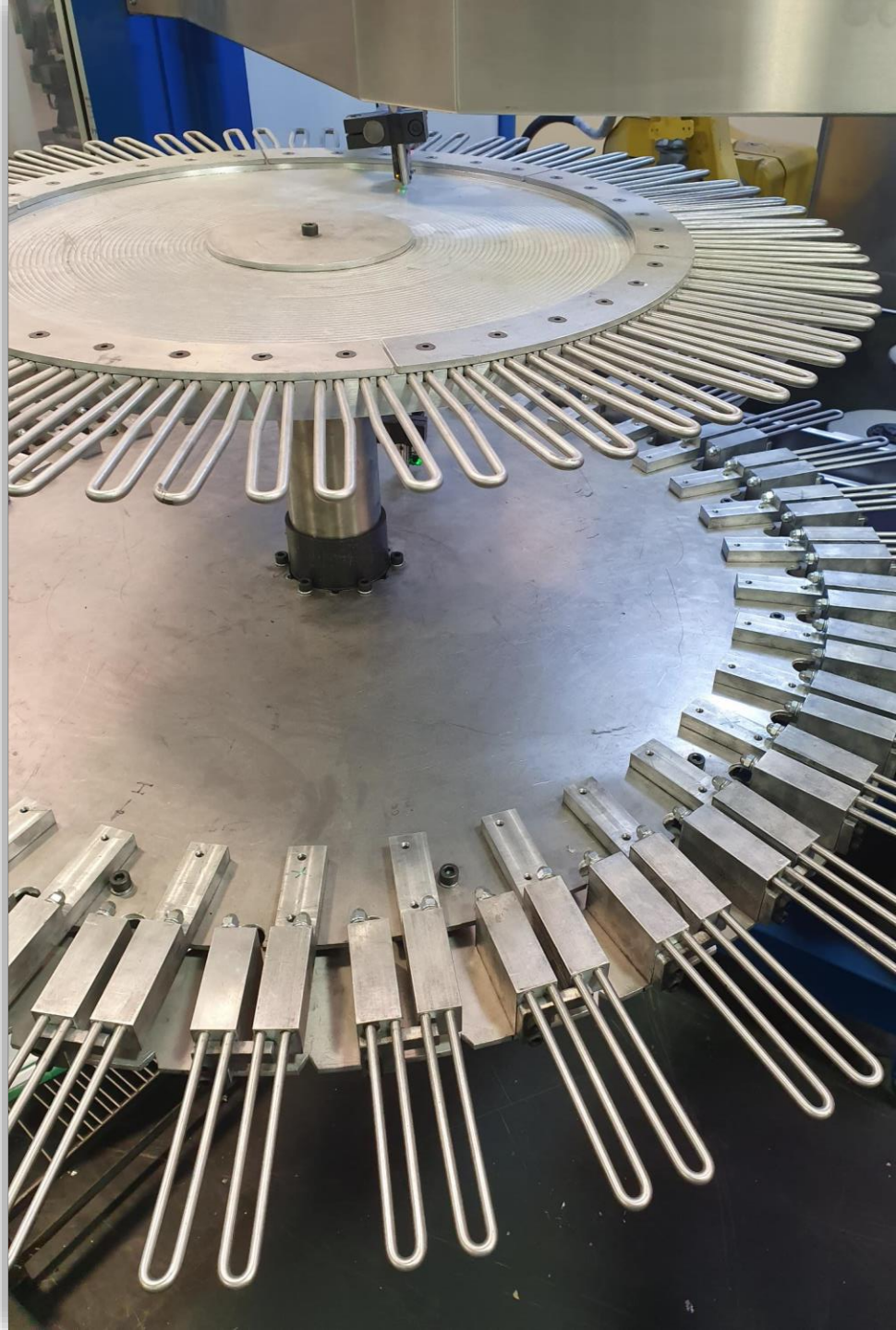
- Automatic analysis and report
- Non-contact 3D inspection module fully synchronized with robotic and grinding modules
- Quick and automated new blade setup and tuning process
- Very flexible adjustment system
- High producibility and low maintenance requirements
- Compact size system
- Minimized scrap ratio
- High buffer capacity





System performance characteristics

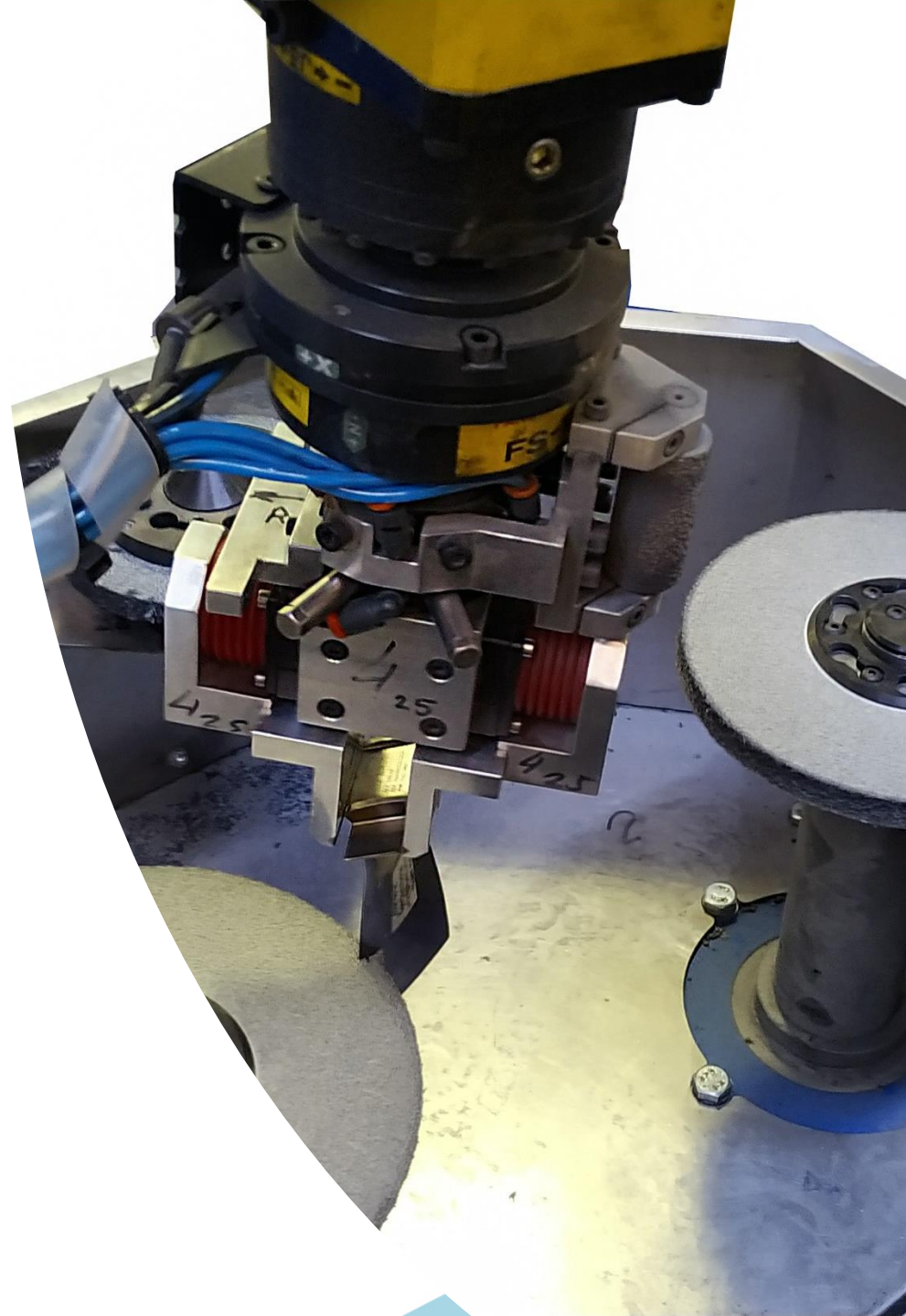
- Typical ready rate after the first grinding iteration > 95%
- Typical scrap rate < 0.5%
- Typical full process cycle time (from retrieving the blade from the input buffer to placing it to the output one) - 75 sec
- Typical batch time (40 blades) < 1 hour
- Typical blade type changeover time < 5 min
- Measuring accuracy within 0.01 mm
- Airfoil length – up to 250 mm



Working principle

Sequence

1. Operator selects blade type from the registered list
2. The system automatically adapts input and output carousel buffers to the chosen type
3. Operator loads the blades in the input carousel buffer and starts the process
4. The robot retrieves the first (or the next sequential) blade from the input carousel buffer holding it stiffly by the root
5. The robot brings the blade to the measuring system
6. The system performs measuring, the actual profile is compared numerically to the CAD model and the required grinding parameters are calculated and communicated to the robot
7. The grinding program is adapted to the measuring results



Working principle

Sequence

8. If the part is ready (within tolerance) or not repairable (lack of material) go to step 11
9. The robot takes the inspected blade to the grinding station and performs grinding process, according to the parameters received from the measurement system ,moving the part along rotating abrasive disks. Dust removal system is activated during the grinding
10. Go to step 5 (each blade is measured after grinding)
11. If the blade is ready robot will place it to the output buffer, otherwise – to the scrap box
12. If the input buffer is not empty, go to step 4
13. Operator unloads blade from the output buffer
14. The system has a special “grinding adjustment” mode which updates the grinding parameters in real-time based on gathered statistics from previous cycles. This mode will adjust the grinding parameters to the most optimal ones within several cycles of blades grinding



BAOR / MTL 3D

Adaptive Edge Grinding Solution

November 2019

