



## **HORIZON-CL4-2021-TWIN-TRANSITION-01-02: Zero-defect manufacturing towards zero-waste (IA)**

### **Ideas for the project:**

A reliable monitoring system is crucial in the machining process of aeronautic components made of materials which are hard and/or difficult-to-cut, to eliminate the scrap production. Component failure during the machining process does not directly affect the end user, as strict quality control rules implemented on all the production runs ensure the necessary product quality. However, the faulty components proportionally increase the production costs and are included in the final price of the product.

### **Our ideas for the project:**

Efficient methodologies and procedures are required to acquire the appropriate signals directly from the machine tool control unit and effectively process them in real-time to considerably reduce scrap production. Artificial intelligence tools are required for signal processing to help identify the conditions of the **cutting tool** corresponding to the surface anomalies on the machined component. The proposed Advanced Monitoring System "AMOS" meets all the prerequisites to significantly reduce the production time and the amount of scrap in the production process, thus drastically reducing the price of the finished products. The AMOS can be utilised by component manufacturers to obtain the information about the integrity parameters of the machined surface and the sub-surface layer, as well as the condition of the cutting tool and its real-time optimal usage, significantly increasing the economic competitiveness in the global market.

### **Experience and infrastructure offered:**

1. Up to date infrastructure for manufacturing and testing of processes and prototypes (see technology at <http://www.sjf.tuke.sk/paic/en/> and <http://www.sjf.tuke.sk/kstam/>).
2. Test bed with digital twins for optimisation of machining process parameters in real time
3. Manufacturing data collection and its evaluation
4. Advanced monitoring techniques for tool condition as well as surface integrity identification

### **Projects solved, related to the issue:**

1. Development of intelligent monitoring system for zero-defect production of irreplaceable parts (national research grant – Mankova, Vrabel, Vargovcik), see Mankova, I. - Vrabel, M. – Vargovcik, L.- Eckstein, M.: Intelligent Monitoring System for Zero-defect Production of Irreplaceable Parts. Lecture Notes in Mechanical Engineering, Springer Nature s. 147-156. - ISBN 978-3-030-31342-5
2. Utilization of artificial intelligence during machining of difficult to cut materials like titanium and/or nickel based superalloys for process monitoring (PhD thesis - Vrabel)
3. Development of Advanced Monitoring System for Machining Process of Hard and Difficult-to-cut Materials of Aeronautic Components (ESA proposal under revision process - Vrabel)
4. Adaptive Control of Manufacturing Processes for a New Generation of Jet Engine Components (7<sup>th</sup> FP)

### **Partners in previous research projects:**

Universita Degli Studi Di Napoli Federico II, RWTH Aachen University, Mondragon University, Otto von Guericke University Magdeburg, University of Miscolc, Óbuda University, University of Novi Sad, Cracow University of Technology, Częstochowa University of Technology, Tomas Bata University

### **Contacts to industrial partners:**

**CERN, Oerlikon, Minebea, Eli Beamlines, Schunk, Latécoère, SWEP, AIRBUS, Magna P, Sonaca, MASAM**

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