PROJECT PROPOSAL – RE BLADE

Title:	Advanced Support System for Aircraft Turbine Blades Design
Acronym:	REBLADE

Challenge:

Metrology is essential to product and process quality. Coordinate Measurement Machines (CMM) are machine tools commonly used in controlled environments for measuring the physical and geometrical characteristics of a manufactured part. Dimensional inspection with a CMM not only enables one to certify a part, but also makes it possible to fine tune the manufacturing process, to determine the quality output of the process itself.

The metrology sector encompasses **the global manufacturers of precision components for the aeronautical and aerospace,** automotive and general engineering industries. Companies within these industries are experiencing a continuously increasing demand to guarantee that their manufacturing and assembly processes are working with ever tightening specifications.

If the **rapidly increasing demands for improved product quality, predictability and more cost efficient manufacturing processes**, are to be met, it is essential that metrological technologies improve and advance in line with the needs of industry, if not beyond. Failure to stay apace with these needs will ultimately jeopardise the growth and sustainability of European manufacturing.

State of the art metrology is traditionally executed offline in a laboratory environment. Manufactured parts must be moved from the shop floor to this alternate environment for quality control. The **laboratory environment**, by its very nature, **is inherently limited**: (1) it is not possible to measure the quality of every part produced; (2) offline metrology has a **negative time and cost impact on the production process**; and (3) maintaining a separate quality control environment is costly. This reality is incapable of meeting the increasing quality control requirements of today's manufacturing industries, which demand the use of high performance, reliable and adaptive manufacturing control tools that also reduce production costs. This approach leads to a paradox whereby metrology is needed for quality assurance but the current status quo creates excessive delays in the manufacturing process. Hence, a dichotomy exists placing current dimensional metrology approaches in the spot, both as enablers and manufacturing process bottlenecks.

A new solution should be provided from the machine tool sector capable of producing new metrology solutions capable of handling new large piece materials, with particular micro-features that heavily impact performance of the manufactured part in an increasingly shorter production cycle times.

Project Idea:

This project has a vision that will address the needs of today's and tomorrow's manufacturers – the development of **high accuracy, high precision, fast, reliable and adaptable inspection systems** that are **designed for the shop floor environment**, to be fully integrated in the production line to perform advanced **in-line inspection** of every manufactured part. This cannot be achieved by mere hardware mechanical evolution. Advanced high-precision metrology solutions should be coupled with the introduction of two new concepts for advanced quality control, namely **Virtual Parts** and **Virtual Metrology**.

The project main objectives are:

1. Drive the movement of CMMs from the laboratory environment to the real environment of the industrial shop-floor.
2. Develop a new generation of CMMs, based on the concept of Virtual Metrology, to improve in 20% the quality, predictability and cost efficiency of design and industrial manufacturing processes.
3. Develop a virtual metrology environment to remove the time and cost constraints posed by current metrology practices, by moving them into a flexible, self-learning, self-configuring and self-optimizing virtual environment.
4. Implement virtual metrology tools into inspection systems to provide valuable and accurate information and data concerning the object scanned, namely information on the object's dimension, shapes, geometrical and surface characteristics. The information gathered can then be stored and used at any time during the product lifecycle, from the initial design phase right through to the production phase. This will further enhance the manufacturers ability to capture knowledge and implement it in product development and design tools, thereby improving product quality, predictability and cost efficiency.

The next generation of CMM machines to be developed in the scope of this project will have a **direct application to the manufacturing sector of aeronautical components**, namely, with application in **in-line dimensional inspection of aircraft turbine blades**, with potential utilization in other metallic and/or composite components.

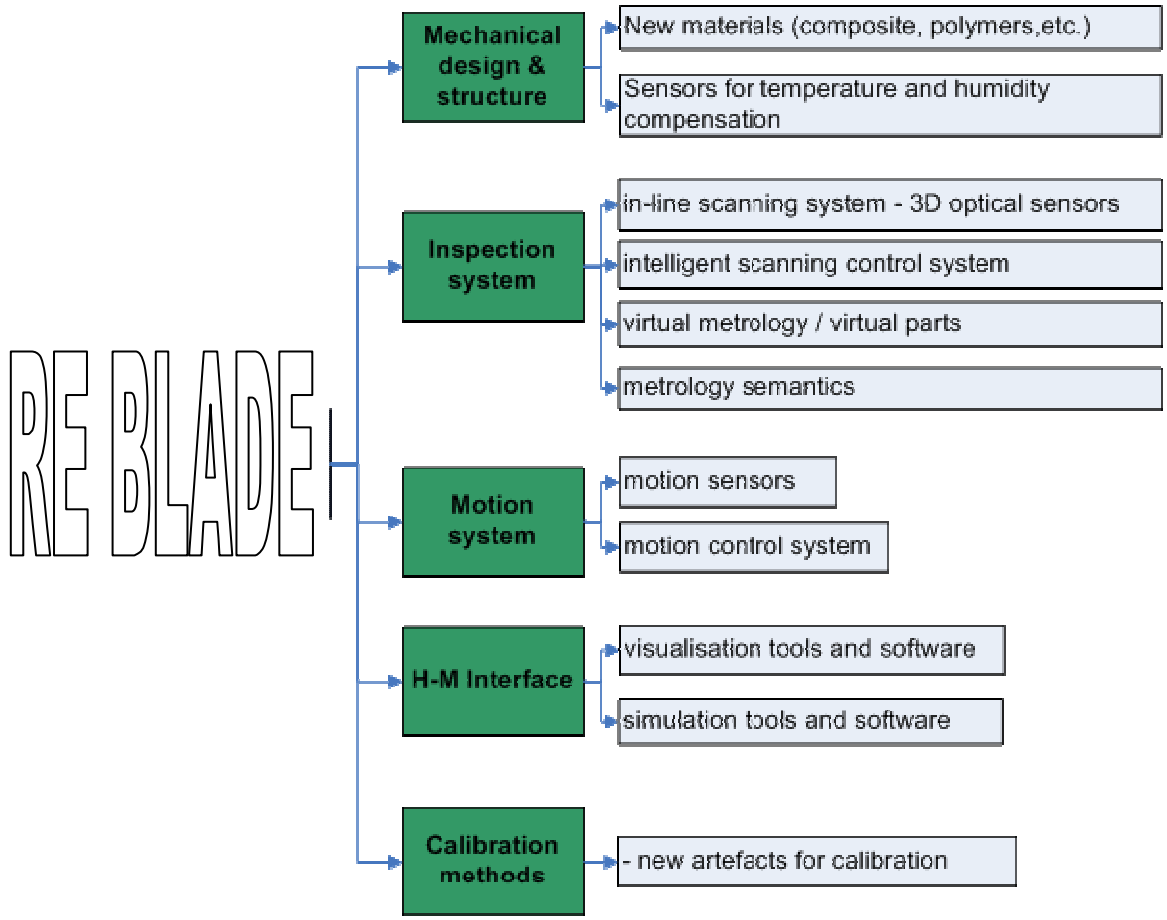

Figure 1. RE BLADE main components.

Partners (expertise and role):

Partner	Expertise / Role	Organization type	Country
TRIMEK (Coordinator)	CMM manufacturer Development of next generation of CMMs Mechanical design and structure of RE BLADE	SME	Spain
UNIMETRIK	Development of new calibration methods, standards and artefacts	SME	Spain
Innovalia Association	Development of virtual metrology tools and concepts Advanced CMM control system	RTD	Spain
Partners (to be defined)	Expertise in vision engineering Expertise in in-line sensors (3D optical sensors) Expertise in machine vision Expertise in machine sensors (temperature and humidity compensation) Expertise H-M interfaces Expertise in visualisation and simulation tools Expertise in motion sensors and control		To be defined
End User (to be defined)	Aeronautics parts manufacturer (blades manufacturer) End User Technology demonstrator		To be defined

Project Duration: 24 months

Project Budget: to be defined – total project budget no up than 1.5 M€.

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