PROJECT

IPROMES

Using Image Processing as a Metrological Solution

**Funding:** European (6th RTD Framework Programme)

**Duration:** Jan 2004 - Jun 2007

**Status:** Complete with results

**Total project cost:** €3,214,684

**EU contribution:** €1,809,104

Call for proposal: FP6-2002-AERO-1

CORDIS RCN: 72820

Background & policy context:

The importance of metrological controls is increasing in the engineering industry, and particularly in aeronautics, due to the high measurement precision and quality requirements. This important operation varies from an average of 1% to 15% of the aeronautics total production time, depending on the type of produced parts or assembly. This is considerable for a sector where the production time is very high. Unfortunately, in order to reach the high level of quality, performance and safety needs, European aircraft industries have been obliged to invest in expensive and specific solutions as the dimensional precision and the positioning issues are critical.

Objectives:

This project aimed to use photogrammetry and image processing techniques to perform the 'in-process' positioning during the assembly phase and to complete the final measurement control (quality control, maintenance) of aircraft parts afterwards. This project used optical sensors (cameras) instead of the traditional gauges in order to automatically access geometrical data of parts and structures to be controlled, and then to proceed with three-dimensional measurements. With this optical solution, the manufacturing of the frame will be simplified. Thanks to the photogrammetry technique, the measurements will be calculated in real time with instant feedback from the cameras. Implementing a non-contact measurement system will allow drastic reduction of the control duration and standardisation of the control tools.

This project was expected to lead to the following results:

- New image processing algorithms,
- new optical sensors meeting the requirements of the aeronautical sector,
- a 'steps and gaps' optical measurement system for aeronautics, a flexible frame prototype equipped with optical sensors, and
- new assembly concepts.

Methodology:

The innovative solution was based on photogrammetric and image processing techniques. Simultaneously, it offers a high precision, resulting from the use of photogrammetric techniques, and rapidity and ease-of-use, resulting from the use of automatic image processing. With an image processing-based technology, the images can be stored and thus it remains possible, months or years later, to proceed with a complementary measurement of specific characteristics of the part under scrutiny. This is very useful in terms of traceability. Secondly, a simultaneous measurement system can be used to assist the operator in positioning parts during the assembly process.

The measurement system is thus not only useful in control operation but effectively becomes an assembly process tool. Thanks to the optical solution, an innovative framing concept will be set up, so no positioning issue will be required. As the frame will only support the sensors, it will be simplified compared to the current ones. This improvement will lead to proposals for adoption of a 'universal
frame’. Indeed, with such a measurement system it becomes possible to create multi-purpose and versatile frames, which can be used for different types of aircraft (for example Airbus A320/A340).

**Parent Programmes:**
**FP6-AERO-1.1 - Strengthening competitiveness**

**Institute type:** Public institution  
**Institute name:** European Commission  
**Funding type:** Public (EU)

**Lead Organisation:**

| Alma Consulting Group  
| **Address:** Domaine des Bois d'Houlbec  
| 27120 HOULBEC COCHEREL  
| France  
| **Organisation Website:** [http://www.almacg.com](http://www.almacg.com)  
| **EU Contribution:** €0  

**Partner Organisations:**

| Metrostaff Srl  
| **Address:** Corso Susa 242  
| RIVOLI (TORINO)  
| Italy  
| **EU Contribution:** €0  

**Key Results:**

**Result No 1: New Image Processing Algorithms**

The image-based measurement processes of R1, extend the state of the art in the field of optical 3D measurement with innovative algorithms that target at measurements of highly reflecting surfaces, of curved edges, of chamfered edges, taking into account the required level of automation, accuracy and robustness.

**Result No 2: New optical sensors answering the requirements of the aeronautical sector**

In R2 ActiCM developed a sensor that extends the state of the art in the field of optical 3D measurements using innovative algorithms specially tailored for the requirements of the aeronautic end user in terms of accuracy and illumination robustness. ActiCM’s AdventCR system with this new sensor measures geometrical feature coordinates using images taken from parts and estimates point coordinates on parametric surfaces using structured light patterns projected onto aeronautic part. This sensor is particularly tailored to perform following medium-range measurement of geometrical features (circular holes, square holes, slot holes) and medium-range measurement of surface points and edges.

**Result No 3: Step and Gaps measurement system for aeronautics**

Aeronautics has high accuracy requirements on the step and gap measurements. Coord3 and Metrostaff optimized the MAGAM sensor by a software solution that increases the accuracy of the sensor. The patent of the MAGAM sensor is owned by COORD3/ESIC-SN/LOGITEST WESTINGHOUSE.

**Result No 4: Flexible frame prototype equipped with optical sensors**

The flexible frame is an innovative concept in the field of the inspection and assembly tools. It makes possible to use the main structure of the tool for a quantity of application and to add the tool with 'inspection capacity'. While the standard tools can measure only a limited number of features (mainly points), the flexible frame can be re-configured upon the need and the optical sensor can be programmed for different measuring tasks.
The innovation consists in at least two aspects:

- a single tool is used for inspection of different parts and
- reconfiguration of the sensors is easily possible when the measuring strategy must be changed.

Applications are a large range of inspection tools for aeronautical industries. The new flexible frame could be purchased or rent by the user companies. Besides, Axist can promote his activity in term of inspection activity

Documents:
Final Act Report IPROMES.pdf (Final report)

STRIA Roadmaps: Vehicle design and manufacturing
Transport mode: Air transport
Transport sectors: Passenger transport, Freight transport
Geo-spatial type: Network corridors