

**Self-learning control system for freeform milling with high energy fluid jets  
(CONFORM-JET)**

<http://www.conformjet.eu/>

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**Research area:** NMP-2008-3.2-2 Self-learning production systems

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**Project description**

Innovative control philosophies that enhance the capabilities of niche processing methods are of critical importance for EU manufacturers of high value added products made of advanced engineered materials. High Energy Fluid Jets (HEFJet) processing is a niche technology with outstanding capabilities: cuts any material at negligible cutting forces; generates virtual zero heat; uses the abrasive jet plume as a universal tool.

Nevertheless, freeform machining by High Energy Fluid Jets Milling (HEFJet\_Mill) is still at infancy level. This is because no control solution for HEFJet\_Mill exists. ConforM-Jet will develop and demonstrate, for the first time, a self-learning control system for HEFJet\_Mill to generate freeform parts. This will be done by integrating models of HEFJet\_Mill with patterns of multi-sensory signals to control the outcomes of jet plume workpiece interaction, i.e. magnitude and shape of abraded footprint; these are key issues in controlling the generation of freeforms via HEFJet\_Mill.

This will be done via the following research steps:

- Develop a novel integrative energy-based model of HEFJet\_Mill.
- Develop an innovative energy-based multi-sensing monitoring system for HEFJet\_Mill.
- Develop a radically new control system for HEFJet\_Mill of freeforms that is equipped with novel abilities:

Self-learning ability: Self-gauging of the energetic models of HEFJet\_Mill vs. key energy-based sensory signals. Thus, whenever new working scenario occurs, updated models are employed by the model predictive controller.

Self-adaptive ability: The energy-based sensory signals, trained with the data available in the process database, will be taught to respond to process variations by feeding back the correct combination of process parameters.

– Demonstrate ConforM-Jet control strategy on multi-axis HEFJet\_Mill systems to generate aerospace, medical, and optical freeform components made of difficult-to-cut materials (Ni/Ti alloys, optical glass).

### **Project details**

**Project Acronym:** CONFORM-JET

**Project Reference:** 229155

**Start Date:** 2009-11-01

**Duration:** 48 months

**Project Cost:** 5.1 million euro

**Contract Type:** Small or medium-scale focused research project

**End Date:** 2013-10-31

**Project Status:** Execution

**Project Funding:** 3.76 million euro

### **Participants**

ELLA-CS SRO	CZECH REPUBLIC
BAE SYSTEMS (OPERATIONS) LTD	UNITED KINGDOM
FUNDACION TEKNIKER	SPAIN
KUNGLIGA TEKNISKA HOEGSKOLAN	SWEDEN
FACHHOCHSCHULE NORDWESTSCHWEIZ	SWITZERLAND
WATERJET AG	SWITZERLAND
ZEEKO LIMITED	UNITED KINGDOM
FINECUT AB	SWEDEN