



“Development of a flexible manufacturing process for the low series production of metal parts for custom and special vehicles”

FP6 Collective Research, coordinated by **ASEM**

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**PUBLISHABLE EXECUTIVE SUMMARY  
M1-M12**

Due on 15<sup>th</sup> October 2007  
Delivered on 15<sup>th</sup> October 2007

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## **Publishable executive summary**

### *Summary description of project objectives*

The special vehicle sector requires unique production processes due to its specific technical challenges that cannot be dealt with using mainstream manufacturing methods. Special vehicles are mainly hand-made on a small-scale production based on craft skills, but the Flexform project aims at encouraging a shift towards a less resource-dependent manufacturing process. To support the move towards a more efficient, reliable and profitable technique, the project team aims to improve the knowledge of an emerging technology for sheet metal shaping: Incremental Sheet Forming.

Flexform is a consortium pooling the competence and experience of 19 participants, among which are SMEs, IAGs and RTD performers in the fields of special vehicle production and metal technologies. The participants will encourage the adoption of “dieless” Incremental Sheet Forming by the industry and develop software tools to facilitate the change in production methods, which is reflected in the project’s objectives.

- Objective 1: Development and implementation of an emerging technology “**Incremental Sheet Forming**”, in an **industrial environment** (requirements, definition of design rules, forming strategies, tools, procedures)
- Objective 2: Adaptation of simulation algorithms to ISF and development of a specific **CAEM** software interface, allowing for **easy decision-making of optimal part design**, linked to the definition of forming strategies, process parameters, and tool designs for Incremental Sheet Forming.

These scientific and technological objectives can be monitored by the achievement of the following:

- Availability of a specific simulation software (Month 21)
- Development of specific forming tools (Month 24)
- Improved process thanks to the combination and addition of new steps /technologies within the process flow (Month 24)
- Development of forming strategies to improve geometric limitations and accuracy (Month 26)
- Improved knowledge on part and process design (Month 26)
- Manufacturing of real industrial parts (Month 30)
- Benchmarking against other technologies (Month 35)

Moving away from a manual manufacturing process towards an automated and computer assisted process will be the key for the continued success of special vehicle producers. The competitiveness of these producers will be reinforced, with the more effective production of vehicles corresponding to the diverse demands of customers.

### *Contractors involved*

- 1 ASERM — Asociación Española de Rapid Manufacturing (ES)
- 2 SERNAUTO — Asociación Española de Fabricantes de Equipos y Componentes para Automoción (ES)
- 3 GTMA — Gauge and Toolmakers Association (UK)



- 4 FOSTA — Forschungsvereinigung Stahlanwendung e.V. (DE)
- 5 TECOS — Slovenian tool and die development centre (SI)
- 6 AIMME — Asociación de Investigación de la Industria Metalmeccánica, afines y conexas (ES)
- 7 CETIM — Centre Technique des Industries Mécaniques (FR)
- 8 Planchisteria Bergadana, S.L. (ES)
- 9 Ecoroll AG Werkzeugtechnik (DE)
- 10 Société de Recherches et Réalisations Automóviles (FR)
- 11 EDEATECH — Engenharia e Tecnologia, S.A. (PT)
- 12 Quantech ATZ (ES)
- 13 FormTech GmbH (DE)
- 14 Industrias Puigjaner S.A. (ES)
- 15 Drescher Karosseriebau GMBH (DE)
- 16 Fundació ASCAMM (ES)
- 17 RWTH-IBF — Institut für Bildsame Formgebung, Rheinisch-Westfälische Technische Hochschule Aachen (DE)
- 18 CIMNE — Centre Internacional de Métodos Numéricos en Enginyeria (ES)
- 19 GIP Institut Supérieur d'Ingénierie de la Conception (FR)

Project's logo



Project website:

<http://www.flexform.org/>

*Co-ordinator's contact detail*

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*Work performed*

During the first year, the work achieved within the work-package 1 includes:

- The study of SME requirements within and outside the consortium. This extensive task in which all the partners have collaborated gives a picture of the practices and

needs of SMEs in terms of sheet metal forming in small batches. The results of the study have been gathered within the deliverable D1.1

- The characterization of products made by incremental sheet forming and their comparison with the same parts made by conventional technologies is on-going.
- New incremental sheet forming strategies to improve geometric accuracy as well as to overcome geometric limitations are being developed. In the first case, two benchmark parts have been designed, and 5 advanced forming strategies are being applied for their manufacture. Then all the parts are compared in terms of accuracy. These advanced forming strategies consist in processes in which un-usual preform or intermediate steps are first manufactured before forming the final shape of the part. In the second case, some strategies have been developed successfully to form a cylindrical cup with vertical walls, which was not possible with conventional state



Cylindrical cup formed within Flexform

of the art strategies

- Finally, today's FE softwares for the simulation of incremental sheet forming have been assessed, and benchmark simulations have been performed

During the first year, the work achieved within the work-package 2 includes:

- The investigation on influence of process parameters. The consortium has decided to orientate the work within this task towards more applied results, through the manufacture of industrial parts and gathering their process data. This more practical approach has been adopted after analysis of the literature on forming limits in ISF which show a lack of standard procedure, and that the results depend on the methodology adopted



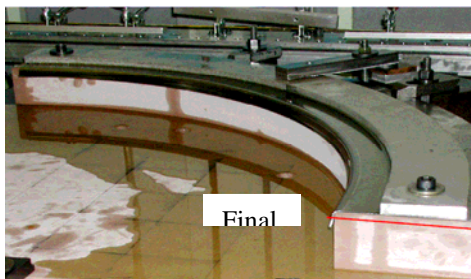
Benchmark parts formed within Flexform to investigate forming parameters

- Development of advanced forming tools is being performed as well as the investigation on the use of tools non-specific to ISF, such as cold forming tools from Ecoroll



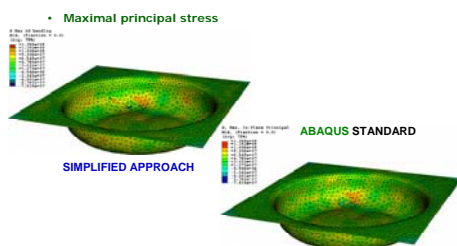
Burnishing tool from Ecoroll used for ISF

- New process steps are being investigated with the objective to improve the global process: improve parts quality, reduced spring-back, incorporate finishing operation. For example the possibility to perform bending operations with the same set-up of the incremental sheet forming process has been studied successfully. The impact of heat treatments has also shown to be interesting to release stresses in the parts before trimming.



Bending operation in a specially developed ISF set-up

- The development of a specific simulation software combining incremental and simplified approach is ongoing



Preliminary results from the algorithms under development

- Investigation on the influence of scaling up of a geometry is on-going

#### *Dissemination activities*

Finally dissemination tasks have been performed by the consortium during the first year, in the form of presence at fairs such as Maquitech 2007 in Barcelona, TCT 2007 in Coventry, preparation of publications, and preparation of the project's web-site which can be accessed on <http://www.flexform.org/>