Contract no.: 013543

eumecha-pro

EUROPEAN MECHATRONICS FOR A NEW GENERATION OF PRODUCTION SYSTEMS

Coordination Action

Nanotechnology and nanosciences, knowledge-based multifunctional materials and new production processes and devices (NMP)

Publishable Final Activity Report

Period covered: from 01/04/2005 to 30/06/2007 **Date of preparation: 30/07/2006**

Start date of project: 01/04/2005 **Duration: 2 years**

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Revision 1

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1 Project objectives and major achievements

1.1 General project objectives

The central objective of EUMECHA-PRO is the following:

The goal of EUMECHA-PRO is to increase the ability of the European mechatronics research community to conceive - according to a common strategy and in strong cooperation with industry - the production systems for the factories of the future.

Eumecha-pro is developing industry roadmaps and research roadmaps.

- The industry roadmaps provide a structured view on future industrial expectations and are established for different production equipment sectors.
- The emerging technologies and integrated design approaches are associated to industry's requirements and reveal new industrial opportunities.
- On the other hand, the industrial targets orient research towards market needs.
- The research roadmaps furthermore provide a common framework for an efficient co-ordination of Europe's research resources

EUMECHA-PRO promotes the practice of the mechatronics design paradigm in industry. Best practices of mechatronic design have been identified and will promoted through industry-oriented workshops.

EUMECHA-PRO is striving towards a better educational framework that delivers excellent mechatronic engineers to the manufacturing industries. Mechatronics education requirements and approaches are analysed, resulting in a European vision on how education can be improved and be made more coherent across Europe.

Dissemination and exchange of information will take place through internet, publications as well as through small committee network meetings. Furthermore, EUMECHA-PRO will improve the coordination of various R&D funding mechanisms, in particular by feeding its deliverables into the "EUREKA Factory" platform and the European Commission's MANUFUTURE initiative.

1.2 Major achievements

1.2.1 WP 1 - Roadmapping

The first year concentrated on the identification of organisation specific research objectives and organisations-specific industrial visions and the synthesis of these objectives and visions in roadmaps.

A set of targets was developed which would become the skeleton of the roadmaps for different industrial sectors (agricultural machinery, machine tools, textile equipment…) and thematic research areas (flexibility, high performance, ….).

The third semester of the project did result in a further refinement of the target structure with the involvement of all project partners and the refinement of the significance of the targets for specific industrial sectors by complementing the information with additional external input (e.g. CECIMO and VDMA).

Using the conclusions from the workshops (See Work Package 2) the roadmaps where further adjusted. This was particularly the case for the roadmaps: 'Integrated design methods and tools', 'Reliability,

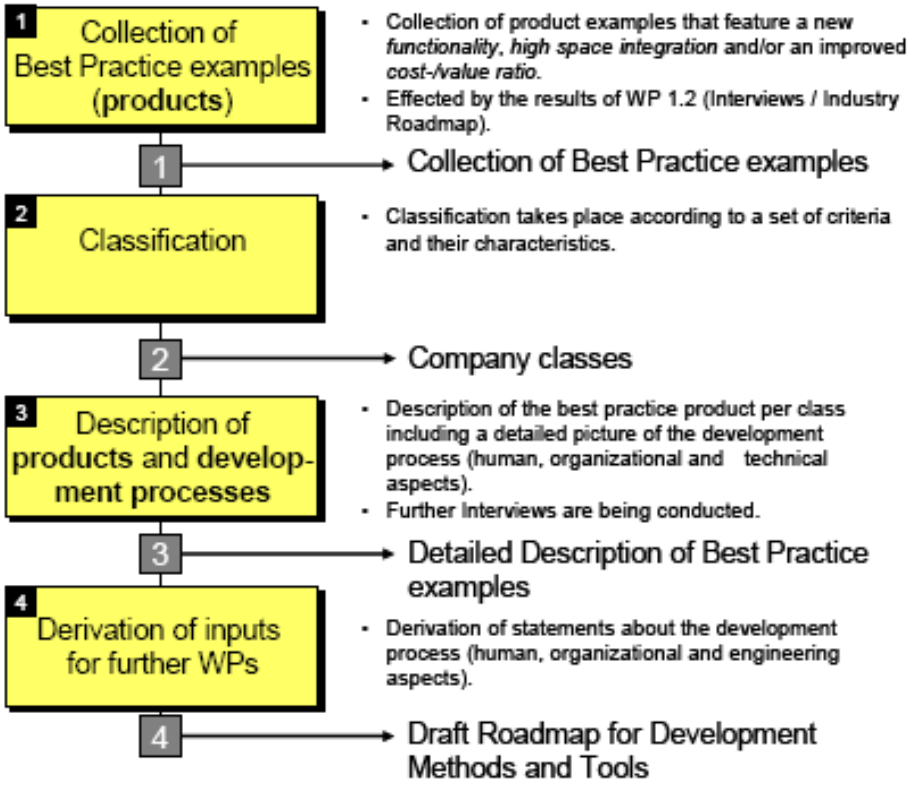
processing monitoring and diagnostics', 'User friendly, cognitive systems' and 'High precision, high performance'.

These refinements where used to compile the eumecha-pro publication, which was presented to the public at an event in Brussels on 18 and 19 June 2007 (see Work Package 3).

1.2.2 WP 2 - Best Practice, training and education

Task 1: Mechatronics best practice in production systems

The work performed can be summarised as follows.



Since no one can judge in advance whether a process is best practice or not, the following approach was taken: first best or at least good practice products were identified (e.g. products that have an attractive cost- value ratio, a new functionality or a high spatial integration) and then the development process to which these products were developed was described. The "best practice" examples shown in the report were named by industry experts from various industries.

This report shows how four different classes of companies develop mechatronic products. The relevant data was collected in eight industry interviews from various sectors. In order to judge whether the processes are good or not, a method was used to construct a theoretically optimal process, which then can be seen as a theoretical benchmark. All found processes were compared with this benchmark process and gaps were identified.

Depending on each class these gaps were different. Two gaps though are so obvious that a clear field of research and knowledge transfer can be identified: Every class had discrepancies in comparison to the benchmark process in using development methods and tools.

The company classes that resulted from the classification, are the following:

Manufacturers of Complex Systems :
- Companies of medium size
- Medium number of developers
- Complex products
- Medium number of products
- Medium term R&D-focus
- New- and adjustment constructions
- Single to small batches
- System provider

- Chiron
- Kuka Robotics
- Lindauer Dornier
- Servus (Österreich)
- Fidia S.p.A (Italien)

Manufacturers of High-End Systems:
- Medium to large companies
- Large number of developers
- Highly complex products
- Small number of products
- Long term R&D-focus
- New- and adjustment constructions
- Medium to large batches
- System provider

- Polysius
- Claas
- Gildemeister
- Trumpf
- Wittenstein

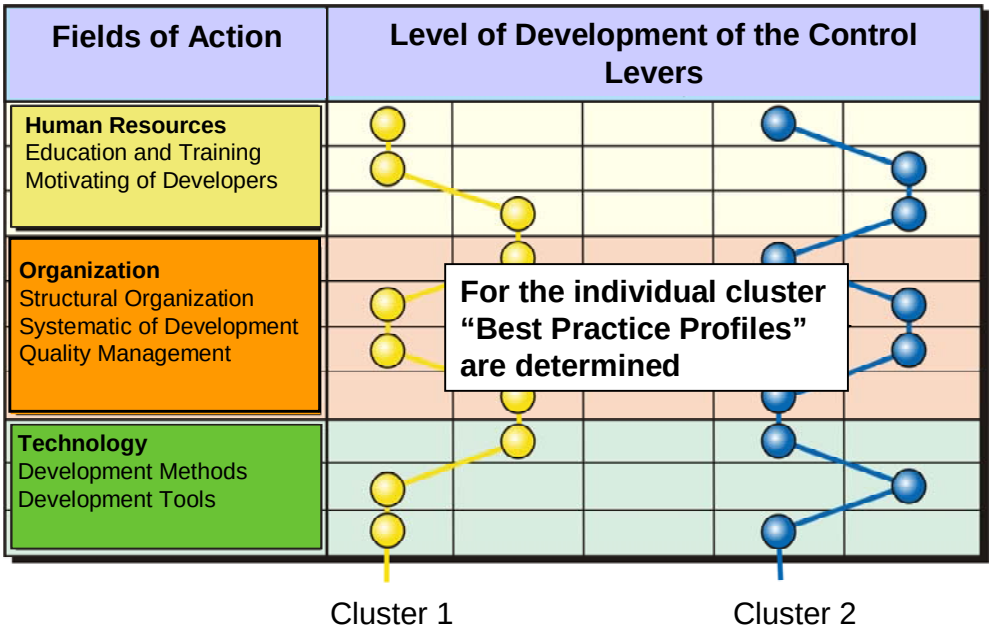
Manufacturers of Sophisticated Components:
- Large Companies
- Medium to large number of developers
- Products of little to medium complexity
- Medium to large number of products
- Short to medium term R&D-focus
- Alternative constructions
- Large batches
- Supplier of components

- ABB
- Bosch Rexroth
- KSB - Pumpen
- Siemens A&D
- Kaeser-Kompressoren
- ZF-Lenksysteme

Manufacturers of Customized Systems:
- Small Companies
- Few developers
- Medium product complexity
- Small number of products
- Short to medium term R&D-focus
- New- and adjustment constructions
- Single production
- System provider

- S. Möhringer Anlagenbau
- Newall Measurement Systems (UK)
- VISCOM
- SEHO
- Hesse und Knipps

Typical profiles of the ‘control levers’ were identified per cluster:



Product and development processes are described for each cluster

The main conclusions of the work have been described in the Eumecha-pro publication (See dissemination and use).

Task 2. Workshops

In total six workshops where organised at different premises:

- "High performance and reliability", November 15th (with evening dinner on the 14th), Linz (in cooperation with the Linz Centre of Mechatronics), Austria
- "Mechatronics design methods and tools", December 5th and 6th (with evening dinner on the 5th), Heinz Nixdorf Institute, Paderborn, Germany
- "Flexibility, reconfigurability, adaptiveness" (+ user friendly machines), **16 January 2007**, KTH, Stockholm
- "Process monitoring and diagnostics" (sensors, data processing, self-learning…), February 15th pm and February 16th am), KU Leuven + Flanders' Mechatronics Technology Centre, Belgium
- "Precision engineering", TU Delft, the Netherlands (18 April 2007)
- 'User friendly, cognitive systems and robotics' , Fraunhofer IPA, Germany (23-24 May 2007)

Task 3: Education

KTH made a 'tour of interviews' among universities in the consortium (University Twente, TU Delft, KU Leuven, RWTH Aachen, Johannes Keppler University (associated to LCM in Linz), Loughborough University and the University of Paderborn (HNI)).

Meanwhile, while performing the roadmapping interviews for WP1, the industrial roadmappers (AGORIA, DECUBBER and FhG-IPA) had queried the industrial organisations with respect to their requirements for skilled personnel and training.

In the last reporting period, an intermediate deliverable D8 was compiled by KTH and delivered to the EC. An expert group meeting was held in Stockholm on 15 January, where the CDIO concept was presented (**c**onceive-**d**esign-**i**mplement and **o**perate). Following that expert group meeting, KTH compiled the final deliverable D12. Establishing a 'European common vision on mechatronics education'.

In the light of the proposed necessary steps toward a common European vision of mechatronics education presented above, a possible roadmap could be based on the following strategic activities.

Detailed design of curriculum for European Mechatronics Master

This curriculum would be based on a combination of the best practices identified at a smaller number of EUMECHA-PRO universities. Each university would contribute with a detailed list of mechatronics courses offered at their university and recommend courses that either are considered necessary for a common base for the European program or courses that would be considered as examples of the specialties (best practices) at the respective university.

The European Mechatronics Master curriculum would then be compiled of a set of basic, common courses that could be taken at any of the participating universities together with a set of modules offered by the participating universities each dwelling into the specialties (best practices) of the university.

The curriculum would preferably have the following setup:

- One – two semesters: Common mechatronics base, possible to be studied at any partner university
- Three – Four specialty modules: Varying from one single course to a set of courses comprising one full semester.
- Thesis project: Offered in cooperation with industry or research groups.

A number of 'ideal' pathways, or curricula, would be designed for different purposes, specified for different industrial areas or research groups. Examples would be automotive industry or medical technology.

Establishing the European Mechatronics Master program

The program could be established with the support of a number of funding programs:

1. Erasmus Mundus
   With the deadline for the next application process in April 2008, sufficient time exists for the network to produce an attractive application. The Erasmus Mundus program would include three to four of the partner universities with a well specified curriculum.

2. Atlantis
   The deadline for the next application process is unknown at the moment. In this program, a US university would be invited to the network, with a slightly smaller number of European universities.

3. Erasmus program
   This existing exchange program immediately enables the exchange of individual students, and modules could be offered among the partner universities at once.

1.2.3 WP 3 - Networking and Information Dissemination

The main objectives where achieved:

- Establish a web site and web portal that promotes EUMECHA-PRO and its results, as well as mechatronics in general.
- Publish the roadmaps in order to create a wide awareness about the roadmap process.
- Promote EUMECHA-PRO at conferences.
- Organise expert group meetings, so that experts in specific topics can get acquainted with eachother and with one another's work. (This was eventually done in combination with the workshops in WP 2)
- Assure the interaction with the wider research and industrial community in the EUMECHA-PRO activities.
- Interaction with the EUREKA-FACTORY platform and the Manufuture initiative

Until near to the end of the project, the dissemination of eumecha-pro results was thus far concentrated on the Manufuture / Leadership context (presentation where given by DECUBBER at the two Manufuture Conferences in July (Stuttgart) and October (Tampere) and the eumecha-pro results where contributed to the Leadership Specific Support Action. Also the Manufuture National and Regional Technology Platform meetings where a good occasion to spread the news about the eumecha-pro results. This lead to the identification of 'Mechatronics and Intelligent Manufacturing' of a Manufuture Vertical NRTP pilot action. Furthermore, connections where exploited with the Eureka (PRO-)Factory umbrella in order to investigate ways to sustain the eumecha-pro community at Eureka level, this way converting the roadmaps into industrial projects

In addition, a professional publication (Deliverable D10) was prepared in conjunction with a public event that was organised in cooperation with Manufuture Germany (VDMA) in Brussels on 18-19 June. The publication as well as the presentations from the event (attended by 100 people) are available after registration on the www.eumecha.org/forum.

1.2.4 WP 4 - Management

The project management (AGORIA/DECUBBER) concentrated on assuring a good interface with the Manufuture and FP7 context.

Furthermore, the options for continuation of the eumecha-platform where investigated. See chapter 'Dissemination and Use'

2 Dissemination and use

As mentioned, the options for continuation of the eumecha-platform where investigated. This resulted in the following approach, that was communicated to the Manufuture National and Regional Platform Community and the EUREKA PRO-FACTORY community:

New PRO-FACTORY initiative in the field of
'Mechatronics and Intelligent Manufacturing':
the EUMECHA project

Introduction

From April 2005 until June 2007, the FP6 coordination action 'eumecha-pro', 'European Mechatronics for a new Generation of Production Systems', was carried out (see: www.eumecha.org). The project that brought together a group of centres of excellence in that field was initiated through a pilot action funded by the Belgian Science Policy Office (Belspo) and coordinated by AGORIA (Belgian Federation of the Technology Industry).

Eumecha-pro has contributed to the European ManuFuture Technology Platform by establishing roadmaps, of which the cross-sectorial roadmaps where captured in a publication that was promoted at a public event in Brussels on 18 and 19 June 2007 (*). These roadmaps focus on multi-disciplinary and integrated design methods and tools, adaptive production systems, high performance (high precision - high speed), reliability and process monitoring, sustainable manufacturing and user friendly and cognitive production systems.

Recently, EUREKA FACTORY was converted in EUREKA 'PRO-FACTORY'. Besides the original EUREKA FACTORY goals to stimulate manufacturing innovation and the creation of research and innovation projects, EUREKA PRO-FACTORY wishes to support umbrella-like projects that stimulate research and networking in specific domains (cfr. BESTPRODUCT-TENEEST).

Based on the facts described above, the establishment of a 'Mechatronics and Intelligent Manufacturing' umbrella-like EUREKA project is proposed, initially coordinated by AGORIA., with the acronym 'EUMECHA' (using this way the domain name www.eumecha.org which has been used to host the eumecha-pro website thus far and which is owned by AGORIA). Beside the creation of concrete EUREKA-projects, the establishment of an EUREKA-cluster is envisaged (cfr. MEDEA Plus).

The EUMECHA initiative is in line with the earlier DNA-project ('Dynamic Novation of Artefacts'). An original combination of technologies and the introduction of new enabling technologies are considered by Orgalime as a successful innovation receipt for the established industries.

Definition phase and implementation phase

The activities of EUMECHA will start with a definition phase (August 2007 – March 2008), co-ordinated by AGORIA with the support of Belspo. The resulting action plan and consortium agreement should define the work packages and secure the financing of the project activities during the next two years (March 2008 – March 2010).

De definition phase has to result in a network in which the research community and the industry are actively involved. During the implementation phase the creation of industry-oriented EUREKA projects and the preparation of a new EUREKA cluster are the main tasks. From March 2010 on the cluster organisation should be operational and able to take over the activities of EUMECHA.

Goals and expected results

The essential goals of the "Mechatronics and Intelligent Manufacturing" umbrella-like project will be:

1) *Stimulate the initiation of industry-led research projects which are funded following the EUREKA rules.*
2) *Increase the capability of the relevant industrial and research community to continuously assess the potential innovation impact of new developments, detect the industrial needs and prioritise the roadmaps.*
3) *Create a viable 'Mechatronics and Intelligent Manufacturing' cluster organisation.*

The expected results are:

1) *Ongoing EUREKA research projects initiated by the EUMECHA project.*
2) *A regular mechanism for adjusting and refining roadmaps and detecting industrial research priorities with the EUREKA representatives (and the National and Regional ManuFuture platforms) from the participating countries. These priorities will be fed to the encompassing ManuFuture Platform and to the Framework Programme for the next calls.*
3) *A regular mechanism for identifying best practices in cooperation with the EUREKA representatives (and the National and Regional ManuFuture platforms) from the participating countries. Best practices are very stimulating examples for industrial companies.*
4) *Resulting from that, an updated roadmap and best practice publication promoted yearly at a public networking event.*
5) *A plan for the creation of the new EUREKA cluster and to assure the continuity of this cluster.*
6) *A group of industrial companies and funding organisations willing to support the cluster initiative for a sufficient long period of time.*

Items 1), 2), 3) and 4) will be gradually developed from the start of the EUMECHA project. The continuous development of these activities, together with an appropriate governing structure, should create conditions which are favourable to shape the new 'Mechatronics and Intelligent Manufacturing' cluster. In parallel the establishment of this cluster will be prepared (Items 5 and 6).

(*) 'European Mechatronics for a new Generation of Production Systems – The Roadmap':
http://www.agoria.be/s/p.exe/WService=WWW/webextra/prg/izContentWeb?SessionLID=3&vUserID=999999&vWebSessionID=2217&MyOrDaily=daily&EnewsID=36525