

## The consortium

### Overview

The **multi-national consortium** and the participation of major industrial companies demonstrates the strong interest in the proposal throughout Europe.

The **consortium** itself consists of **11 partners** from **various European countries** (4):

- **one software developer**, expert in numerical casting simulation (**D**)
- **two universities**, expert in castings materials and in the integration of models into numerical simulation tools (**S**), (**I**)
- **one service provider** for engineering services, supplier of numerical simulation tools (**S**)
- **one software developer**, expert in optimisation and software integration (**I**)
- **one university**, expert in aluminium casting and numerical simulation including residual stress calculation (**DK**)
- **one foundry** for mass scale production of cast iron and aluminium components (**I**)
- **four automotive companies**, with a strong background in aluminium utilisation (**I**), (**D**), (**D**), (**D**)

A description of each partner organisation is given in Table 1.

### Overview of the consortium

Participant		Organisation Name (abbreviated)	Country	Size (employees)	Business Activity/Main Mission /Area of activity	RTD role in Project
Activity Code	Nr.					
REC	1	Centro Ricerche Fiat (CRF)	I	S6	Vehicle manufacturer	Project co-ordinator. Component Integration-Automotive industry (Gravity casting: Cylinder head)
IND	2	Magma (MAGMA)	D	S4	Software company	Horizontal integration
REC	3	Engin Soft (EST)	I	S4	Software and engineering company	Software developer. Expert in optimisation and software integration. Exploitation and dissemination
HES	4	Università di Padova (DTG)	I	S7	Higher education	Quality Mapping, Microstructural investigations, properties
HES	5	Jönköping University (HJ)	S	S5	Higher education	Aluminium Microstructural modelling, properties
SER	6	Foundrysoft (FS)	S	S2	Software company	Implementation of models and programming
HES	7	Danish Technical University (DTU)	DK	S6	Higher education	Modelling of residual stresses
IND	8	Teksid (Teksid)	I	S7	Castings supplier	Casting support and validation methodologies
IND	9	Daimler Chrysler AG	D	S6	Vehicle manufacturer	Demonstrator : Cylinder Head-Optimisation

		(DC)				
REC	10	Ford (Ford)	D	S7	Vehicle manufacturer	Demonstrators : Transmission case
OTH	11	AUDI (AUDI)	D	S7	Vehicle manufacturer	Demonstrator : Die Cast Component

## **C7.2 - Description of participants**

### **C7.2.1 Centro Ricerche Fiat (CRF)**

Fiat Research Centre (CRF) is an industrial organisation whose mission is to promote, develop and transfer innovative processes, giving partners a competitive edge. Partners include: Fiat Sectors, external SMEs, National Research Agencies and the European Commission.

CRF's mission is to focus on the following key objectives: the development of innovative products, the implementation of ground-breaking processes (manufacturing & organisational), the expansion of new methodologies and staff training.

CRF's core competence is centred on land transport: vehicles, propulsion systems, components, and their associated manufacturing processes and methodologies for product development. In developing and applying its core competencies, significant emphasis is given to the transfer of advanced technologies from automotive applications to other industrial activities. This allows CRF to actively support the technological growth of SMEs (non-automotive centred) in fields such as business process re-engineering, advanced product/process methodologies, micro-mechanics and optics, IT methodologies and telematics.

CRF has 830 employees, of whom are 750 researchers, organised in the following main technical areas: Engines, Vehicles, Electronic Systems, Business Information Technologies, Advanced Product/Process Technologies and Product Design. Among the of the leading facilities are the Electromagnetic Compatibility and Acoustic Chambers, NVH labs, Laser Centre, Optoelectronics and Microtechnologies Laboratories, Engine, Fluid dynamics and Rapid Prototyping and Reverse Engineering facilities.

In order to cover a very wide technological reach, CRF has developed a global network with national and international institutes, private and public research organisations, universities and companies, through the promotion of common research activities, associations, conferences and seminars and job placements for research workers. CRF has participated in projects sponsored by the National Research Council (CNR), the Research National Programme (PNR), the EUREKA programme, and in over 100 projects within the European Union R&TD Programmes.

### **C7.2.2 MAGMA**

MAGMA Gießereitechnologie GmbH is a leading supplier of engineering solutions for foundry process optimisation worldwide. The company specialises in numerical simulation of various casting processes using CV-FDM methods employing staggered grids. MAGMA's simulation software programme MAGMASOFT® is used by the majority of foundry companies in Europe and worldwide, as a powerful tool for supporting casting design and the process layout. As an extension to the standard MAGMASOFT® programme, MAGMA offers special calculation modules for all common casting procedures, which are tailored to specific process needs. Total

involvement, experimental feedback and ongoing customer relations, as well as the skills of more than 20 foundry engineers and metallurgists among its 80 staff members worldwide have led to MAGMA's comprehensive know-how in casting layout and design.

MAGMA has developed many customer support activities to optimise processes and design new parts for a wide range of materials. For engineering and service activities MAGMA has a team of foundry engineers and their know-how is also the basis of dedicated and process driven software development. MAGMA is also involved in a number of projects dealing with various materials other than metals.

### C7.2.3 Engin Soft Trading (EST)

**ENGIN SOFT TRADING s.r.l. (EST)** is an Italian SME founded in 1984 but having roots back to 1973 and operating in the field of numerical simulation. The company covers most of the areas where such technologies have practical applications, including mechanics, fluid dynamics, acoustics, metallurgy, foundry processes, porous media, environmental engineering etc. The company offers services and skills that are strictly interconnected in a 'matrix', both with regard to key technologies, and to the knowledge required to make the best use of them. The matrix of activities covers 'vertical technologies' (i.e. software and methods in the above CAE fields), 'horizontal technologies' (i.e. tools and competencies which are required to connect the specific applications, such as IT applications, optimisation, CAD/CAE integration), and multidisciplinary knowledge and expertise. The company is also a research centre recognised by the Italian Ministry of University and Research for numerical methods.

With regards to the present proposal, it is noteworthy that among the 'horizontal technologies' EST was responsible for the management of FRONTIER, an EC framework IV project dedicated to the development of a multi-objective collaborative design environment. Technologies developed so far in this area are suitable for application to process optimisation. Moreover EST is in a position to supply the necessary engineering and metallurgy background for the successful application of technology. This means that the role of EST fits perfectly the requirements of the IDEAL project. Furthermore, most of people involved in this proposal have well established relationships and good track records of participation in widespread research projects, funded both by the EC and by other agencies.

### C7.2.4 University of Padova – DTG

**The Department of Management and Engineering, Padova University (DTG)** brings together the expertise of several research groups focused on industrial automation, management of innovation and of projects, operations management, metallurgy, energetics, and production organization and management. Being an industry oriented Institute, with a metallurgy section, DTG has extensive experience in the study of metallurgical processes, in evaluation and simulation, as well as in correlating the results of simulations with experimental data. The Department's European experience includes the participation in the BRITE, TEMPUS, ERASMUS and LEONARDO EC Programs.

Inside the Metallurgy group, foundry technologies are given a great deal of emphasis. With reference to aluminium foundries, research is focused on the microstructural (light microscopy, image analysis, scanning electron microscopy, microprobe, etc.) investigations on castings and on the setting of correlations among processing parameters, microstructures and final properties. This activity is recognized by:

- national and International research contracts,
- various co-operation contracts with aluminium foundries,
- the scientific responsibility of the Leonardo Education and Training Pilot Project COPROFOUND, on numerical simulation of foundry processes,
- the conveniorship of the Italian Standard Board for Aluminium Foundries (GL 10 of UNIMET),
- several courses held on behalf of the Italian Foundries Association (ASSOFOND) and of the Italian Association of Metallurgy (AIM),
- numerous international scientific and technological papers,
- the significant number of students graduating with a thesis on foundry technologies (some 10 each year).

### C7.2.5 Jönköping University (HJ)

Jonkoping University, School of Engineering, offers BSc, MSc and PhD studies in mechanical engineering. The main research area is in foundry, castings and materials technology. The research activities can be divided into process technology, relation of process, material and microstructure of the casting and relationship between microstructure and mechanical properties. The research is based on numerical modelling and simulation of foundry processes and cast materials. The research profile examines the whole subject of development, manufacturing, usage and re-cycling of the component. A great part of the work is carried out within "virtual casting", that is casting simulation information technology, the modelling of microstructure in cast iron and its role in defect formation and mechanical properties. Micro modelling is also extended to other materials.

The Foundry Centre is located in Jonkoping, which encompasses Jonkoping University, the Swedish Foundry Association and the Scandinavian Foundry School. This is the national centre of shaped castings in Sweden and the leading casting organisation in the Nordic countries.

### C7.2.6 Foundrysoft (FS)

Foundrysoft is a development company working with microstructure modelling for casting alloys. For several years Foundrysoft has developed a well-established collaboration with MAGMA GmbH, and has the main responsibility for developing the add-on module MAGMAIron. Before Foundrysoft AB was founded in 1997, MAGMAsoft activities were performed with INGUS HB. In MAGMAIron, all relevant phase transformations in cast irons are described by nucleation and kinetic growth laws, thereby permitting the prediction of the final product as cast microstructure, which thereafter is used for the calculation of mechanical properties. The continuous improvement of models, and the addition of new features in MAGMAIron is today being carried out by Foundrysoft AB together with MAGMA GmbH.

In addition to support and development activities of MAGMAIron, Foundrysoft AB also provides training and education in the optimal use of the software.

### C7.2.7 Danish Technical University (DTU)

DTU is the leading centre of engineering education and research in Denmark and the largest technical university in Northern Europe. The University's research and teaching is provided by 16 departments and a number of major independent centres established as joint ventures between DTU and companies and research institutes in the region. Like all modern universities, DTU also operates a number of dynamic ad-hoc centres in which the driving force resides in collaboration across different fields of research and organisations.

The University embraces most of the engineering disciplines, and trains engineers to Bachelor, Masters and PhD level. In addition, the University offers a comprehensive continuing education programme, with a number of courses taught in English. The University has 6000 students preparing for Bachelor and Masters degrees, 600 PhD students and takes 400 foreign students a year on English-taught courses.

The "Process Modelling Group" in the Department of Manufacturing Engineering and Management at DTU is the national centre of excellence for research and education in numerical modelling of solidification processes. Research within the group focuses on the development and implementation of numerical models for analysis and optimisation of casting and welding processes. The research is genuinely interdisciplinary, involving applied mathematics, materials science and process technology. The group's research programme involves a range of strongly interacting themes including "*Thermo-mechanical Process Modelling Applying Finite Volume Methods*", "*Modelling Thermal Distortions and Stresses in Welding*" and "*Numerical Modelling of Rapid Solidification Processes*".

The research follows two pathways: the first is aimed at understanding and describing the local phenomena such as microstructural formation in casting, welds or spray formed materials. In the second, the complexity of the model is adjusted to a level appropriate for an application-oriented analysis where the demand for fine accuracy is exchanged for the ability to simulate large scale structures. The latter has been carried out in the field of casting simulation for process optimisation with considerable success and the group has been collaborating with MAGMA GmbH, Germany, on the development of the CV-method for thermomechanical analyses for a decade. Furthermore, the group has been participating in relevant projects funded by the Danish Technical Research Council (STVF), Nordic Industrial Fund (NI) and projects within the European Union R&TD Programmes, among others.

### C7.2.8 Teksid S.p.A. (Teksid)

Teksid, which includes the Aluminium Foundry Division and the Iron Foundry Division, was spun off as a separate company in January 1978, when FIAT, which had had metalworking operations since 1917, decided to merge these two divisions.

Teksid is a world leader in the production of iron and aluminium castings for the automotive industry, with operations in Europe, North and South America and Asia.

Its strategy is to ensure a fruitful partnership with its customers in terms of codesign and simultaneous engineering as well as investigating new materials to obtain lighter and more reliable components.

The Iron Foundry Division is a worldleading manufacturer of grey and nodular iron castings, whose quality is continuously tuned to the ever more exacting demands of the automotive industry.

The extensive product range embraces many essential castings:

- Grey iron: cylinder blocks, cylinder heads, camshafts, bake disks, and drums and parts of for the refrigeration industry;
- Nodular iron: crankshafts, con-rods, camshafts, steering knuckles, suspension arms and end brake parts.

The main plants in Italy are located in Carmagnola, Crescentino, and Rovigo.

The Aluminium Foundry Division is a worldleading manufacturer of aluminium castings for the automotive industry (such as the FIAT group and other leading European, North American and Asian car manufacturers).

The principal castings of the Aluminium Foundry Division are in:

- permanent moulds: cylinder heads, cylinder blocks, intake manifolds;
- pressure die-castings: cylinder blocks, differential and transmission housings, gearboxes;
- lost-foam: intake manifolds, camshaft carrier housings, cylinder heads, cylinder blocks;
- low-pressure suspension arms, structural components, bed plate.

The main plants in Italy are located in Carmagnola and Borgaretto.

### C7.2.9 DaimlerChrysler (DC)

DaimlerChrysler AG is a public company incorporated in the Federal Republic of Germany (Commercial Register in Stuttgart, Abt. B No. 19360) and is the result of the merger of the Chrysler Corporation and Daimler-Benz in 1998. The company is the successor corporation to Daimler-Benz Aktiengesellschaft and now comprises the respective businesses, stockholder groups, management and other constituencies of Chrysler and Daimler-Benz.

DaimlerChrysler provides a wide range of transportation products and financial and other services. It is the third largest automobile manufacturer in the world in terms of revenue (1998: Euro 132 billion). In 1998, the Group operated in seven business segments:

**Passenger Cars: Mercedes-Benz, Smart.** DaimlerChrysler is world renowned for its high quality Mercedes-Benz passenger cars, which reflect a long tradition of exceptional engineering, performance, service and safety.

The Smart Car, a new micro compact passenger car that defines a new market segment, is specifically designed for urban mobility. The Passenger Cars Mercedes-Benz and Smart segment contributed approximately 23% of the Group's revenues in 1998.

**Passenger Cars and Trucks Chrysler, Plymouth, Jeeps, Dodge.** This segment consists of the automotive operations of DaimlerChrysler Corporation, formerly Chrysler Corporation. DaimlerChrysler Corporation manufactures, assembles and sells cars and trucks under the brand names Chrysler, Plymouth, Jeep and Dodge. In 1998, this segment contributed approximately 43% of the Group's revenues.

**Commercial Vehicles Mercedes-Benz, Freightliner, Sterling, Setra.** DaimlerChrysler manufactures and sells commercial vehicles under the brand names Mercedes-Benz, Freightliner, Sterling and Setra. It is the world's leading manufacturer of trucks over 6 metric tons (t) GVW and of buses over 8t GVW. With worldwide facilities, the Group has the world's most developed network for the production and assembly of commercial vehicles and core components. It also has a worldwide distribution and service network. This segment contributed approximately 17% of the Group's revenues in 1998.

**Chrysler Financial Services.** Chrysler Financial Services includes the operations of Chrysler Financial Company L.L.C., its consolidated subsidiaries, and managed operations in Mexico. Chrysler Financial Services principally engages in providing consumer and dealer automotive financing for the products of the DaimlerChrysler Corporation, including retail and lease financing for vehicles, dealer inventory and other financing needs. It also provides dealer property and casualty insurance and dealer facility development and management, primarily for Chrysler, Plymouth, Jeep and Dodge dealers and their customers. Chrysler Financial Services contributed approximately 2% of the Group's revenues in 1998.

**Aerospace.** Principal Aerospace activities include the development, production and sale of commercial aircraft and helicopters, defence and civil systems, aero engines, military aircraft, satellites, and space infrastructure. DaimlerChrysler Aerospace is the German partner (with a 37.9% share) in the European Airbus consortium Airbus Industrie G.I.E. Aerospace contributed approximately 7% of the Group's revenues in 1998.

**Other.** This segment includes the operating businesses Rail Systems, Automotive Electronics and MTU/ Diesel Engines. It contributed approximately 2% of the Group's revenues in 1998.

As of December 31, 1998, the DaimlerChrysler Group had approximately 441,500 employees, approximately 53% of whom were employed in Germany and 27% in the United States. As of December 31, 1998, DaimlerChrysler AG had more than 1.4 million stockholders.

## C7.2.10 Ford Forschungszentrum (FORD)

Ford Forschungszentrum Aachen GmbH (Ford) was founded in 1994 as the European research centre of the Ford Motor Company to support all European brands including Jaguar, Volvo, Aston Martin, Pivco and Ford and to co-ordinate all research activities for the European market. Researchers at the Ford keep a keen eye on the future needs of customers and have a heightened appreciation for societal concerns. Innovative solutions and a deeper understanding of the environmental impact of our products enable research, together with product development and manufacturing engineers, to incorporate new technology and processes to satisfy both customer desires and societal demands.

Located in the heart of Europe, the Ford Forschungszentrum Aachen is involved in collaborative research with more than 40 universities in 12 European countries. This is also a part of the philosophy called "leveraged research". Through these interactions Ford Forschungszentrum Aachen is able to access highly specific expertise and laboratory facilities.

In addition to working on collaborative projects with Ford locations world-wide, Ford staff work with external European partners via organisations such as the German Automobile Association (VDA), and EUCAR, the European Automotive Industry's pre-competitive research organisation.

Ford currently has approximately 130 regular employees. The European staff represent 14 different nationalities. Of the technical staff, 70% have PhDs and the others have Diplomas or Masters degrees. The Advanced

Materials Technology Group major emphasis is placed on lightweight component concepts, related high performance material developments and enabling manufacturing technologies.

#### C7.2.11 AUDI AG (AUDI)

Audi is a German car manufacturer with major production sites in Germany, Hungary, China, Brazil and CKD plants in many other countries. As an affiliated partner of the Volkswagen group Audi is dedicated to the development and production of premium cars, which follow the company's slogan "Vorsprung durch Technik". In 2000 AUDI delivered approximately 650,000 cars to customers yielding a total turnover of almost Euro 20 billion. Currently more than 49000 employees work for the company worldwide.

CAE simulation tools are generally used to shorten the design process where they are particularly used for crash and occupant safety analysis. AUDI has more than 10 years experience in the simulation of structural crashworthiness. As a leader in automotive Aluminium technology the R&D department is deeply involved in designing future generations of low weight vehicles for a significant reduction of fuel consumption and CO<sup>2</sup> output.

AUDI is an end-user of simulation software and will directly benefit through the planned development of this project. Improved reliability in failure prediction is a critical issue today. The main activities that involve AUDI in the project are horizontal integration of process simulation into design chain (WP 1), validation and assessment of material properties (WP 3), and final validations using a die casted aluminium structural part (WP 7). A simulation specialist from the CAE (Simulation) department with almost 10 years experience will be assigned to the project.