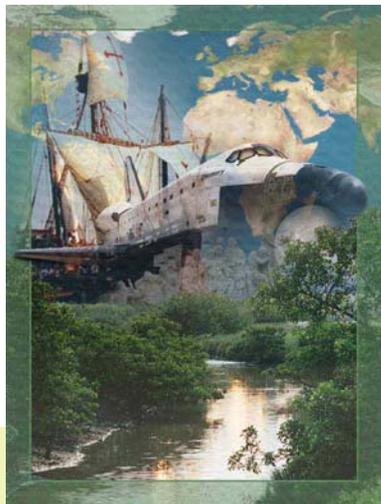


## **“INTERNATIONAL POLLUTION PREVENTION WORKSHOP”**

**Joint Partners in Pollution Prevention  
Partnering for Success**

# **Overview of Technology Transfer Activities at INEGI**

**(Institute of Mechanical Engineering and industrial Management)**



**F. Jorge Lino**

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September 22-23, 2004  
Cape Canaveral, Florida

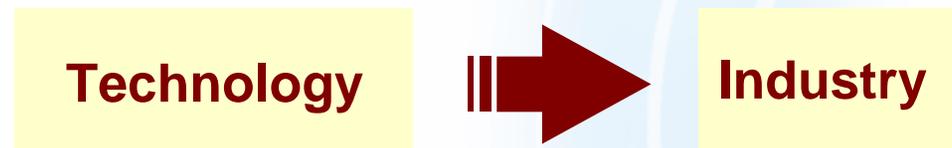
# OUTLINE

- Introduction – The Institute INEGI
- Examples of Projects

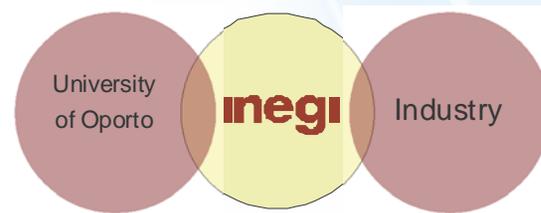
## Introduction

### **INEGI is a technological infrastructure:**

- R&D that improves shares of technology transfer and support to Portuguese industry;



- Integrated in University of Porto, creates an interface between University and Industry;

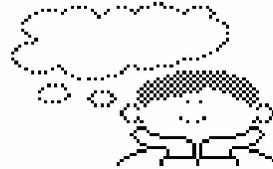


- with a simple structure and versatile management, allows operationalization and an efficient dialogue with companies.

## Introduction

**The INEGI is an usefull instrument for enterprises, with technological and human resources capable to promote its supported development.**

## Introduction



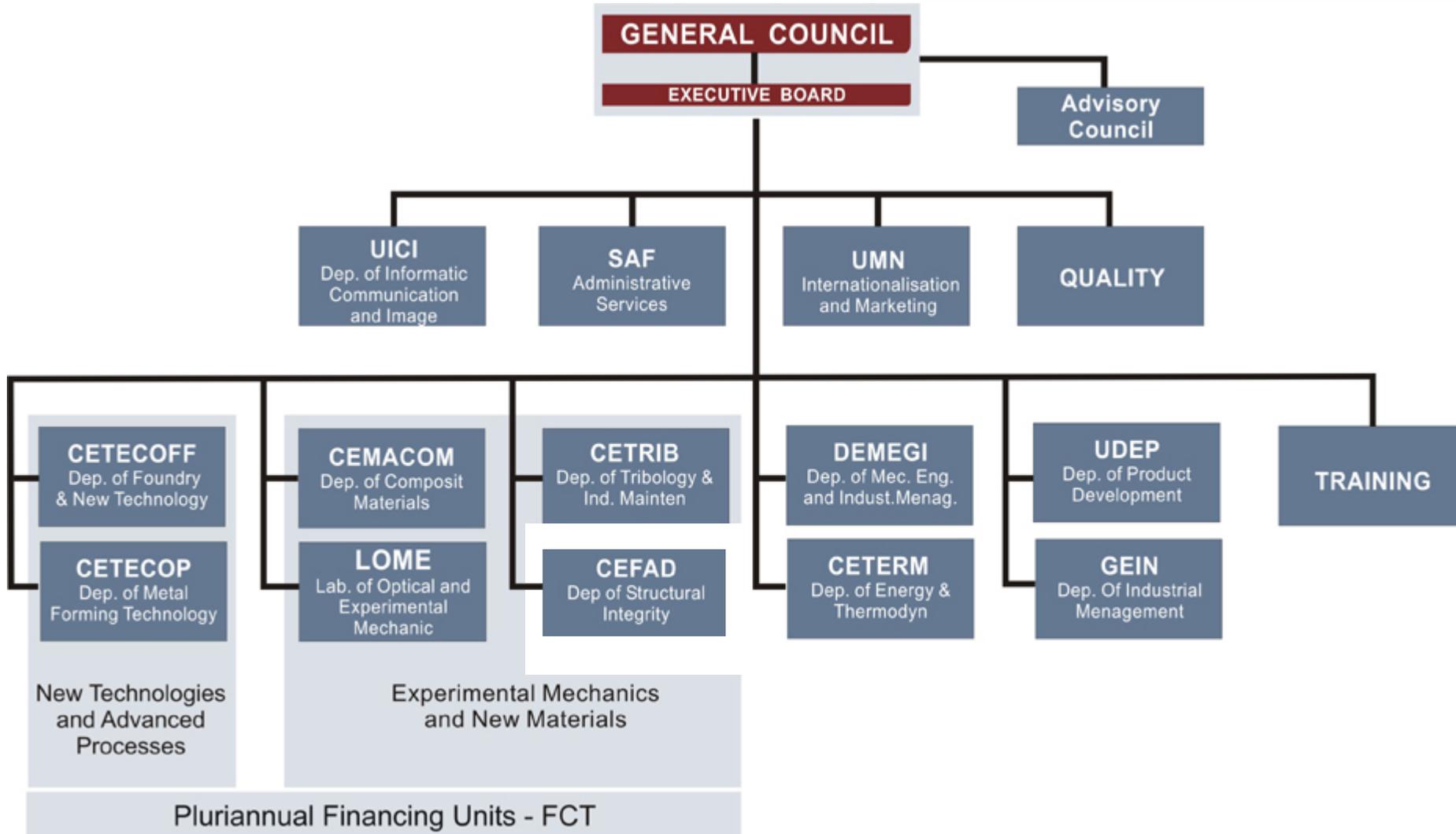
- It emerged when the F.E.U.P.'s Department of Mechanical Engineering and Industrial Management, recognized the necessity of an institute with its profile.



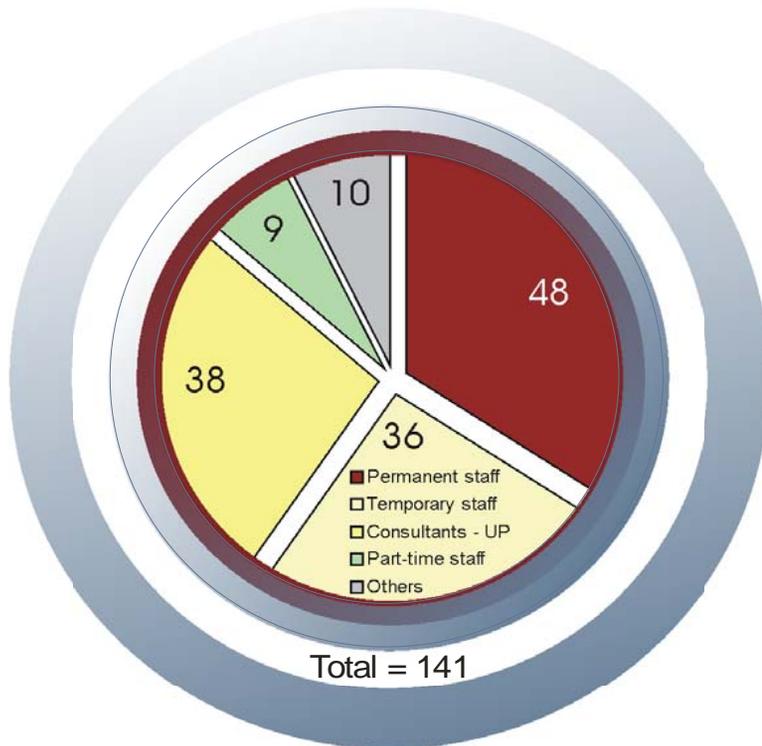
- The effective start took place in May of 1986, with the celebration of an agreement with the University of Porto.



## Introduction



## Introduction



- **48 Permanent staff**
- **36 Temporary staff**
- **38 Consultants - UP**
- **9 Part-time staff**
- **10 Others**

## Introduction

### INEGI

#### Spin-offs

#### Member of Associations

Without  
Participation

With Participation

Obsidiana - Engenharia e Design, Lda

ALTO – Perfis Pultrodidos

### INEGI

#### Spin-offs

#### Member of Associations

#### Without Participation

#### With Participation

OPT, SA - Optimização e Planeamento de Transportes, SA

Ideias Avançadas, SA

Protoclick, Lda

SRE, SA - Soluções Racionais de Energia, SA

NET - Novas Empresas e Tecnologias, SA

ICTPOL – Institute of Science and Polymer Technology

CATIM – Center of Technological Support to the Metallurgical & Mechanical Industry

CITEVE – Technological Center of the Textile and Clothes Industries of Portugal

Mercatura, Lda

**APAET** – Portuguese Association of Experimental Stress Analysis

**APGEI** – Portuguese Association of Engineering and Industrial Management

**Danotec** – Association of the Companies of Defense, Armament and New Technologies

**S.P.V.E.** – Portuguese Society of Viticulture and Oenology

**Relacre** – Association of Laboratories Believed of Portugal

**Portuguese Association of Foundry**

## Introduction

**The INEGi's purpose consists in connecting Industry and University in a harmonious, easy and efficient dialogue**



It stimulates



**Innovation and I&D**

it allows



**Pointing out the Portuguese Industry in the world wide trade**



## Introduction

Thus, INEGI mission is:

An institute of industrial research, which contributes for the development of national industry, through I&D, demonstration, technology transfer in the project and conception, materials, production, energy, maintenance, management and environment areas.



## Introduction

| ***For Companies*** |

| For University |

- Saving in staff formation;
- Availability of specialized services;
- Access to sophisticated equipment.

## Introduction

| For Companies |

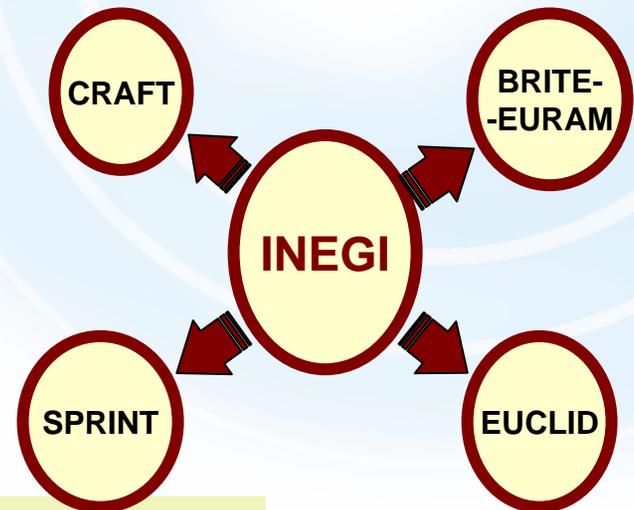
| ***For University*** |

- Creation of alternative ways of financing the acquisition of new equipment and specialized staff;
- Increase Professors and Researchers motivation;
- Investigation subjects and courses improvement and update;
- Professors and students contact directly with real industry problems.

## Introduction

### Mainly, there are three types of activity:

- Direct support to enterprises – technical consulting;
- I&DT contracts – nationals ( FCT, AdI, CCRN, IPQ, INETI, APAD), European Union ( CE, ESA);
- Continuing education – special courses & training programmes.



### **There is a great diversity of intervention areas:**

- Engineering and Industrial Management;
- Automation, Instrumentation and Control;
- Rapid Prototyping;
- Computer Aided Engineering;
- Tribology and Industrial Maintenance;

## Introduction

- Composite Materials;
- New Technologies for Foundry;
- Sheet Metal Forming Technologies;
- Energy and Thermal Engineering;
- Structural Integrity;

## Introduction

- Coatings;
- Vibrations & Noise Analysis;
- Experimental Stress Analysis & CND ;
- Mechanical Construction Project;
- Materials and Manufacturing Processes.

## Introduction

**| *Traditional* |**

| New |

- Mechanical & Metallurgical;
- Automobile;
- Transport;
- Chemical & Petrochemical;
- Cork;
- Wood and Furniture;
- Textile;
- Defense.

## Introduction

| Traditional |

| ***New*** |

- Aeronautical;
- Aeroespacial.

## Introduction

**Activity Average Volume:**

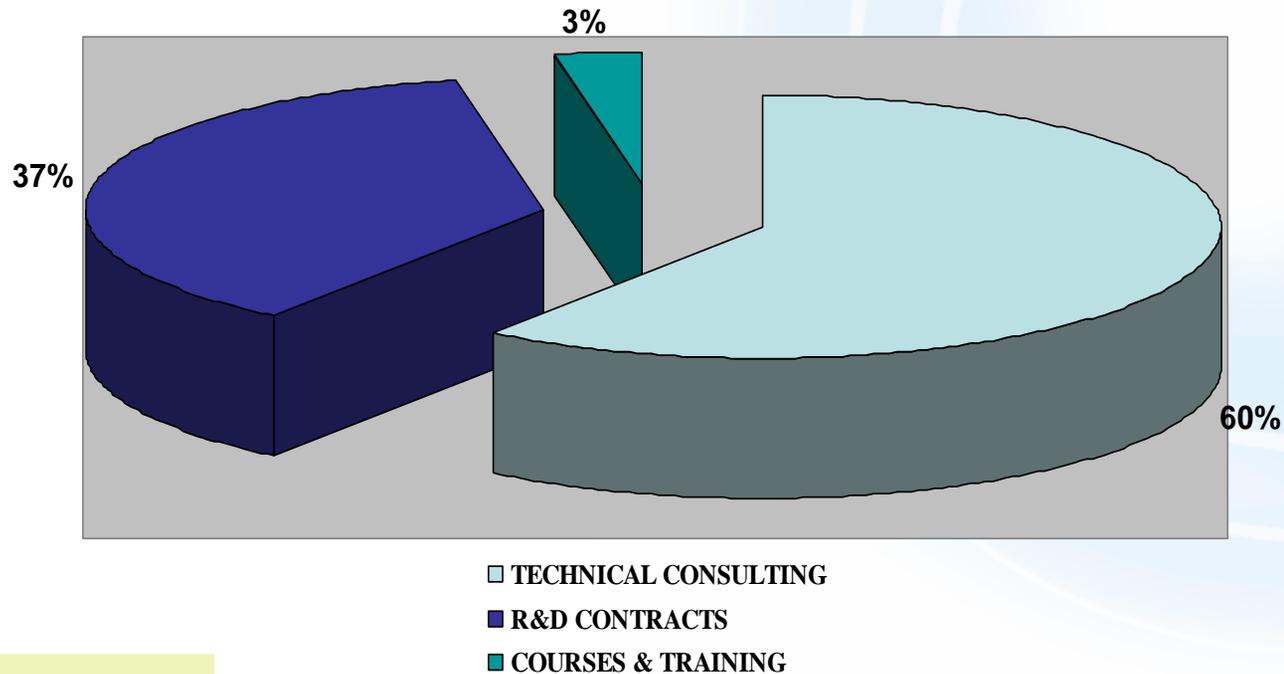
3.500.000 €/Year

**Investment in Equipment Update:**

500.000 €/Year

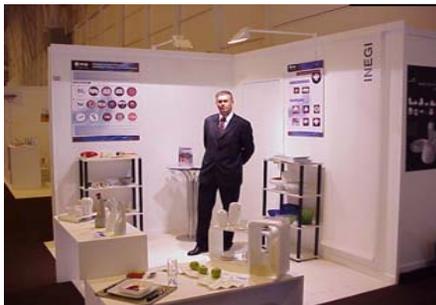
**Scientific Publications:**

304 /Year



## Introduction

- **Aerospatiale**(F) ● CSL-Centre Spatiale de Liège (B) ● Seinbichler Optotechnik (D) ● Dassault Aviation (F) ● Alenia (I)
- Sonaca SA (B) ● Per Udsen (DK) ● TPD-TNO (NL) ● ISL-Institute Saint-Louis (F) ● I ABG (D) ● HOLO-3 (F)
- DUT-Delft Univ. of Techn. (NL) ● Alusingen (D) ● Teroson (D) ● CRIB (B) ● CIC-Cranfield Impact Centre (UK) ● WTCB (B)
- NVTM (B) ● NLR (NL) ● High Tech Plast. (NL) ● Grabowski & Poort (NL) ● Deuts. Aerospace AG (D)
- Onera (F) ● Dornier (D) ● Arplan (B) ● Syngoglas (B) ● Structural Europe (B) ● Banindustri (S) ● Borealis (S)
- Kuleuven (B) ● Plastech (B) ● **SAAB** (S) ● **ABB Transportation** (S) ● Sistema Compositi (I) ● Baesema (UK)
- FAG (D) ● GE Elastics (UK) ● Westlands (UK) ● **AIRBUS** (UK) ● Imperial College (UK)
- Turbomeca (F) ● Hispano-Suiza (F) ● Snecma (F) ● **Rolls Royce**, PLC (UK) ● PLC (UK)
- **BMW/Rolls Royles** (D) ● INSA de Lyon (F) ● Leeds Univ. (UK) ● **Renault** (F)
- British Aerospace (UK) ● Ettemeyer (D) ● CRF/FIAT (I) ● PSA(F) ● ITO-University of Stutt. (D)
- ETH (CH) ● Nuclear Electric (UK) ● Fokker Aircraft BV (NL) ● **Daimler Benz Aerospace** (D)
- The Welding Institute (UK) ● GKSS Forschungszentrum (D) ● AEA Reactor Services (UK)



*INEGI at IN'NOVA Lisbon (Portugal)*



*INEGI at Hannover (Germany) fair*



*INEGI at FIL Lisbon (Portugal)*

## Introduction



**Actual Facilities**



**New Facilities**

## • **Concluding**

**INEGI is a good interface between Industry and University**

**INEGI has played a relief role in the national scientific and technological system, for instance in the process of technology transfer, in order to increase the activities of innovation and R&D in the industrial sector.**

## *Examples of Projects*

# *Examples of Projects*

## Examples of Projects

### Project: Design of a Metal / Plastic Automotive Pedal System



#### Description:

This project aimed to demonstrate to potential clients of ACECIA, the capabilities of design-in (conception, development, engineering) and prototyping, of this group of companies. The base for all the development work was a previous project involving ACECIA companies. The work performed had into account the production capabilities of the institutions involved, namely the materials and applied technologies. Analyzing the loads to be applied and functional aspects, a metal/plastic pedal system was developed. The accelerator and clutch pedal and the support basis were performed in plastic, while the brake pedal was conceived in metal.

#### Partners:

**ACECIA** - COMPONENTES INTEGRADOS PARA A INDÚSTRIA AUTOMÓVEL, ACE

## Examples of Projects

### Project: **Support to the Design of a Side Bodywork Panel of a Train Carriage**



#### Description:

This project consisted in supporting the definition of a side bodywork panel with sandwich structure for a train carriage. Based in a solution previously existent, the following tasks were performed in cooperation with the company:

- Analysis of the previously existent solution;
- Definition and specification of improvements taking into account the manufacturing possibilities and the necessary requirements in terms of mechanical behavior, aesthetics, safety and durability;
- Support in prototypes manufacturing;
- Definition of a set of tests in order to validate the chosen solution;
- Participation in the solution validation carrying out tests on fire behavior.

#### Partners:

**ADTRANZ**

## Examples of Projects

### Project: **PSEUDOSEAT Structural Validation of Motor Vehicle Seats by Pseudodynamic Analysis**



#### Description:

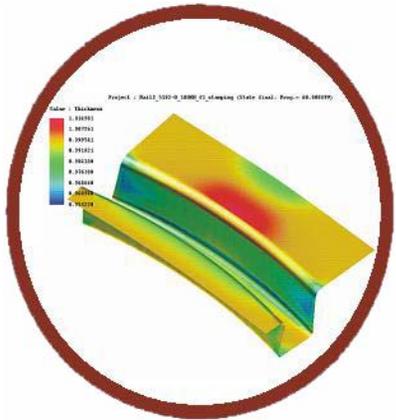
This project had the objective of developing testing equipment for validation of seats in the intermediate stages of development using pseudodynamic techniques. The homologation procedure of motor vehicle seats is based in two standard dynamic tests. The first aims to evaluate the seat's behavior when hit by the back passenger, while the second evaluates the effect of a passenger using a safety belt, both in the case of a sudden deceleration (for instance due to an accident). The conceived equipment allows to perform in a quasi-static manner the described tests being the dynamic character added by the use of pseudodynamic techniques.

#### Partners:

**INETI** - INSTITUTO NACIONAL DE ENGENHARIA E TECNOLOGIA INDUSTRIAL  
**SUNVIAUTO** - INDÚSTRIA DE COMPONENTES AUTOMÓVEIS, S.A.

## Examples of Projects

### Project: Digital Die Design System - International Project Intelligent Manufacturing - Systems - IMS 96004



#### Description:

The project aims at developing the necessary key background for constructing a digital die design system. The results of the project will greatly help constructing new software systems on the basis of world-wide accepted standards to be proposed by the present consortium, and are expected to have a significant and positive effect on the design and production environment of a sheet-stamping plant.

#### Partners:

**SOLLAC LEDEPP - DAIMLER BENZ AG; VOLVO CAR CORPORATION; RENAULT AUTOMOBILES; PECHNINEY CRV ; COCKERILL-SAMBRE R&D;AUTOFORM; UTS;CNRS LPMTM; DEM FCTUC**

## Examples of Projects

### Project: **Brite Euram - An accurate Plasticity Model of Texture, Strain Path Induced Anisotropy and Forming Limits for Computer Aided Sheet Metal Forming**

#### Description:

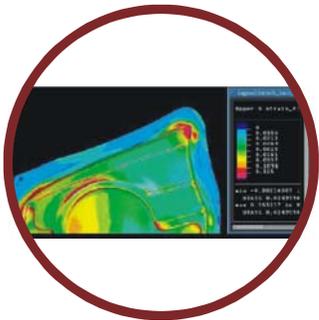
The objective of this research project is to develop a constitutive model of the plastic behavior of metal sheet, taking into account its most relevant aspects for single and multistage stamping operation.

Existing advanced plasticity models of texture and strain path induced anisotropy will be further developed into an original untied model which captures the inference of the microscopic physical mechanisms that govern the macroscopic plastic behavior, i.e. crystallographic textures and dislocation structures.

The resulting models will be of vital importance for the development of accurate product development of all kind of sheet metal parts in, e.g., automotive, canning, aerospace, and “white-ware” industries.

#### Partners:

**K.U.LEUVEN; CNRS; FEUP; OCAS; HOOGOVENS; BMW; RENAULT; ESI**



## Examples of Projects

### Project: **Development of Rapid Prototyping Technologies, Rapid Tooling and Metallic / Plastic Conversion of Prototypes**



#### Description:

The goal is to create a national network and to provide rapid prototypes using the techniques, such as, SLA, LOM, SLS Plastics, SLS Metals. A complementary goal is to produce functional prototypes by using conversion technologies.

#### Partners:

**FUNDIÇÃO DE ÉVORA**  
**AGILITEC**  
**IBEROMOLDES**  
**FERESPE**  
**NOVODESIGN**  
**CENTIMFE**  
**INETI**

## Examples of Projects

### Project: Rapid Tooling for Plastic Injection by Investment Casting

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#### Description:

Development of the technology to produce high quality metallic moulds for plastic injection by pouring a metal in a ceramic mould.

#### Partners:

**ERNESTO SÃO SIMÃO**

## Examples of Projects

### Project: **EcoMarathon**



#### Description:

Development of a concept car for minimum fuel consumption and reduced emissions. This car participates each year in Shell Eco-Marathon competition

#### Partners:

SHELL, FEUP, SALVADOR CAETANO



## Examples of Projects

### Project: **Cooperation in the Definition of a Dismantling Centre for End-of-Live-Vehicles (ELV)**

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#### Description:

Assistance in the definition of a dismantling center for vehicles that reach the end of their useful life. These centers are part of a large structure to enhance ELV and their wastes which comprehends the reuse of parts that are in good conditions, recycling of materials after sorting, energetic recovery of wastes and controlled landfill disposal of remaining wastes. The performed work consisted in giving support in fields related with mechanical engineering, management and logistics.

#### Partners:

RECICLATA - RECOLHA, RECICLAGEM E TRANSFORMAÇÃO DE METAL, S.A.

## *Examples of Projects*

### **Project: Structures Reinforcement With Carbon Fibres**

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#### **Description:**

Development of new carbon fibers reinforcements for bridge applications to repair or increase the load capacity.

#### **Partners:**

**JAE, STAP, LNEC**

## *Examples of Projects*

### Project: **BIALCONSUL**

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#### Description:

Development of gas cleaning system on a gaseous effluent at Bial

#### Partners:

**BIAL**

## Examples of Projects

### Project: **Audicast**

#### Description:

Wind measuring campaigns, technical and economical feasibility studies, participations in the preparation of the call for tenders, evaluation of the proposals for turbines supply and wind farm performance evaluation.

#### Partners:

**EÓLICA DA CABREIRA**



## Examples of Projects

### Project: Research and Development of Burners for Water Heaters for Domestic Use

#### Description:

Research and Development of new gas burning systems to be used in water heaters for domestic use to fulfill the Power and Environment requirements

#### Partners:

**Vulcano**



## Examples of Projects

### **Project: SHEAR- Shearographic system for NDT of structures in composite materials**



#### Description:

Development of a Shearographic equipment for non destructive inspection of composite structures. This prototype uses laser radiation for illumination and allows field inspection with no contact with the components.

#### Partners:

**OGMA(P)**

**FCTUC (P)**

**ACADEMIA DA FORÇA AÉREA (P)**

## Examples of Projects

### Project: **Aeronautical Application Technology - Global Diagnostic and Damage Detection Methods - Holographic Methods**

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#### Description:

Development of prototypes for on site non destructive inspection of aeronautic composite structures and components. In the scope of this project INEGI developed a prototype for NDI using Holographic techniques.

#### Partners:

**AEROSPATIALE (F); OGMA (P); SONACA (B);  
NLR (H); DASSAULT AVIATION (F); PER UDSEN (D);  
STEINBICHLER (A); DASA (A); IABG (A); ISL (F)**

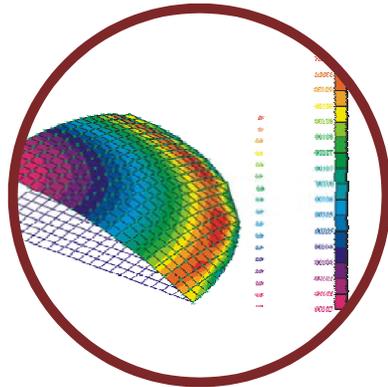
## Examples of Projects

### Project: **Simulation of damage in advanced composite structures.**

#### Description:

The objective of the project is to develop a method for modeling progressive mixed mode delamination and fracture in advance fiber composite materials.

Research in these areas is coordinated with the role of the Mechanics & Durability Branch in the NASA Langley Research Center Reusable Launching Vehicle Program. This project was started under the Statement of Work NAS1-97046, Task Assignment 361-Structural Mechanics, and is waiting for the approval of the funding by NASA HQ.

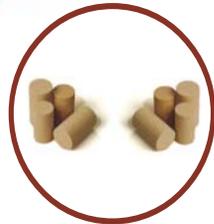


#### Partners:

**Nasa**

## Examples of Projects

### Project: Automatic Production System for Cork Stoppers



#### Description:

This project was aimed to develop a stopper production system that protect people from injuries during the cutting process, decrease the waste of raw material, and increase productivity. The cork generation process comprises three stages: (1) cut the bark of cork-tree in thin and long pieces, (2) cut the stopper rough shape, and (3) Finish the stopper shape using grinding processes. For each one of these stages, an automatic machine was developed enabling an automatic stopper generation process.

#### Partners:

**CORGOM**

## *Examples of Projects*

### **Project: Development of Composites using Technical Textiles**

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#### **Description:**

Development of composites with technical textiles for automotive industry. Structural and process simulation was applied on the automotive arts.

#### **Partners:**

**CITEVE, ALTO, SALVADOR CAETANO**

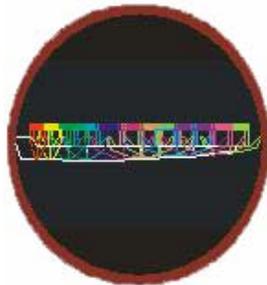
## Examples of Projects

### Project: **Development of an Innovative Methodology in the Manufacturing of Aluminium Boats**

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#### Description:

Development of techniques of boat construction with CAD/CAM technology and CNC Punch Press



***INEGI,***



***The challenge of the future***

***since 1986***

**Thank you**

