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# **Thermoplastic Composites Research and Infrastructures Benchmarking of Current Research Activities**

Thermoplastic Composites Infrastructure  
Cooperation Network - Coronet

Output from Task 3.1: Competitive Benchmarking  
***Final Version After Validation***

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# 1 Introduction

Europe has been at the forefront of thermoplastic composites research over the past decade. Recently, however, other regions have shown increased interest in thermoplastic composite materials and have invested significantly in research and technology.

In order to assess its current position with respect to research and research infrastructures, a competitive benchmarking study has been undertaken which shows how thermoplastic composites research activities and infrastructures in Europe compare to other materials and regions.

This report details the work undertaken within that study, as well as identifying the key results. This work forms the output of Task 3.1: Competitive Benchmarking, the first part of Task 3: Coordination of Future Research of the Thermoplastic Composites Infrastructure Cooperation Network - Coronet project, an Infrastructure Cooperation Network funded by the European Commission.

The subsequent task, 3.2, takes a look at the future of thermoplastic composites research through a foresight exercise, whilst the third

task 3.3 compares the future research and infrastructure requirements with those that are currently available in Europe.

Comparing Europe to its main competitor, North America, North American companies have been keen to use the strengths seen in Europe by developing and adopting European technologies in a number of areas. However, there are still particular gaps between the research activities of the two regions, for example in recycling technologies, nanocomposites, some processing technologies and materials property data.

This report identifies the major areas where thermoplastic composites research and infrastructures differ from other world regions.

# 2 Methodology

In order to assess the future direction that should be taken by the thermoplastic composites research community, it is important to first gain an impression of research activities that are currently being undertaken, both within Europe and outside it.

This benchmarking activity calls for the creation of a database of thermoplastic composites research, results and infrastructure, to show how thermoplastic composites activities and infrastructures in Europe compare to other materials and regions.

This comparison will show any gaps in current European thermoplastic composites research and research infrastructure.

A combination of two main methods was used to gather the information needed for this exercise:

- Direct consultation
- Technology scanning

Details of each method and its outputs are as follows:

## Direct Consultation

Direct consultation was the primary method of obtaining information on research projects and infrastructures, by one of the following methods:

- Direct approach to established organisations working in thermoplastic composites research

- Direct approach to regional and national funding bodies (e.g. EC, DTI (UK), NSF (US) etc.)

This work was distributed amongst the Coronet partners, with regional champions being used to collate information on research in their own country or region.

This activity was used as the main input into the research and infrastructure database, supported by a broader technology scanning exercise.

## Technology Scanning

Scanning involves the systematic analysis of documentary sources, and media coverage of issues is commonly used<sup>1</sup>. For science and technology areas, bibliometric approaches can be used to track the number of journal articles on a particular theme or the active areas of research in a particular technology area.

Activities in this area encompassed systematic examination of published information from a number of sources, including:

- Online composites technology media and worldwide news services
- Scientific and technical journals
- Trade publications
- Proceedings of major European and International conferences (e.g. SAMPE, ECCM, ICCM)

A comprehensive list of the sources used in this part of the exercise is shown in Annex 3. This

activity was used as a secondary input into the research and infrastructure database,

Using these two techniques, data was obtained on recent (starting after 01 Jan 2000), current and future research projects, results and infrastructure in Europe, North America (US and Canada) and Rest of World (Asia, Australasia and Africa).

A data input form (Annex 1) was used to ensure commonality of data prior to uploading it into a web-based database. This then allowed the data to be analysed and summarised in tabular form by research area (materials, processing etc.) and by region (Europe, North America and Rest of World).

Key research and key infrastructures were then highlighted in each of the research areas and each of the regions, allowing a direct side-by-side comparison of the relative activity in each region.

## **Validation**

The initial findings of this series of exercises were prepared in a draft format of this report.

This draft report was then circulated to the 129 original respondents to the foresight survey used in task 3.2, as well as to the task 3.2 workshop participants, inviting each to input additional comments on gaps in research and research infrastructure that had been reported. Their additional comments allowed us to amend the content of the report to better reflect their original thoughts, and also to include some areas of research and infrastructure that were thought to have been missed.

These changes have been incorporated into this second, validated report.

# 3 Database Implementation

To ensure that the research database was well accessed and well-used, it was decided to make it publicly available online through the Coronet web site ([www.coronet.eu.com](http://www.coronet.eu.com)). In this way the database could be constantly managed, edited and updated by all the Coronet partners using their existing login details, as well as allowing it to be accessed at any time by visitors to the site.

The decision to make the database available online added extra complexity to its creation, compared to that envisaged in the original work programme, but it was felt that online access and updating would give a more useful and current database.

The database was designed and created to allow online uploading, editing, searching and categorising of the data, integrated as a major new element within the Coronet website.

Each research project entry was broken down into a series of fields to allow easy searching and display of the data, as follows:

- Project title
- Acronym
- Description
- Partners
- Results
- Infrastructure
- Start date: (dd/mm/yy)
- End date: (dd/mm/yy)
- Actual/proposed
- Funding agency
- Contact
- Email
- URL

- Documents
- Photo/image
- Industry sector
- Region

The projects were also classified by the industry sector at which the project output was targeted, although for some of the more generic projects, more than one sector was identified as a potential application area. The classifications were:

- Aerospace
- Automotive
- Construction
- Defence
- Marine
- Medical
- Offshore/Mining
- Rail
- Sports
- Telecommunications
- Water/Gas
- Other

Finally, the database also records the broad region in which the project is undertaken, to allow comparison of activities between regions:

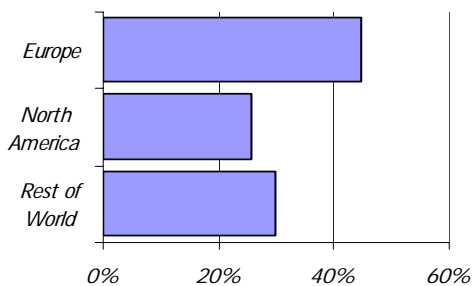
- Europe
- North America
- Rest of World

To populate the database, a standard input form was used to make certain that the records were fully completed and ensure commonality of data. A form was completed for each project, this form then being checked before being transcribed to the web-based database.

## Current Status

At the time of writing the research database held the details of 225 research projects, a significant enough number to be representative of the variation in projects currently being undertaken. For completeness, the full list of projects is given in Annex 2, although this only lists the Title, Researchers, Infrastructure, Funding Body and Application Sector. The full detail of each project is given in the Coronet web site.

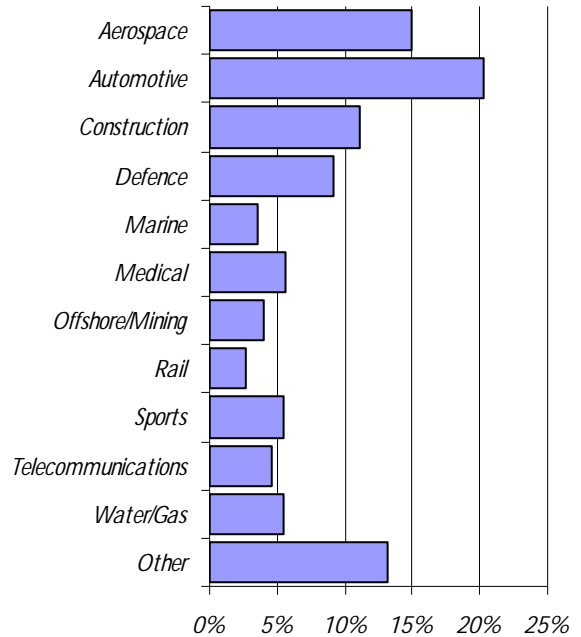
Figure 3.1 shows the percentage breakdown of projects for each of the main regions - Europe, North America and the rest of the World. .



**Figure 3.1: Projects analysed by Region**

The projects can also be classified into the general industrial application categories previously outlined. Figure 3.2 shows the percentage breakdown of projects by application sector, showing a clear dominance in automotive research, closely followed by aerospace and then more general research.

Visitors to the Coronet web site can either access the database through Activities-Worldwide Research (illustrated in Figure 3.3 overleaf) or Industries.



**Figure 3.2: Projects analysed by Sector**

To increase the value to end users and allow them to be taken directly to relevant research, the data is presented by sector (eg. Aerospace Research, Automotive Research etc). The user can then sort the data by sector, start date or end date, the project details being displayed in summary form, 10 projects per page. This is shown in Figure 3.4.

Finally, detailed information is accessed by clicking the project title or 'more details'. This takes the user to a screen where the full record is presented, including details of the research infrastructure and contact details, shown in Figure 3.5.

For organisations with login rights to the site, an edit button also appears on the summary screen, allowing the entry to be modified, updated or deleted through the same web page. These users can also enter projects directly into the web database.

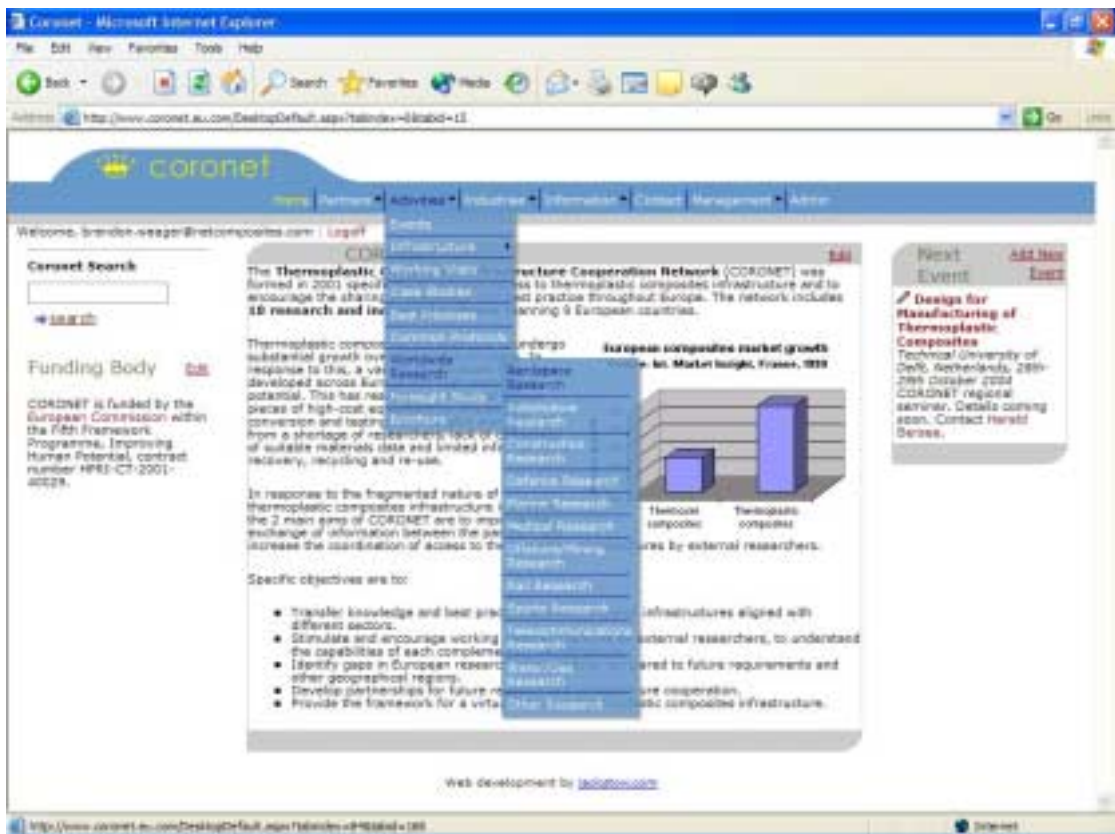


Figure 3.3: Accessing the database of research.

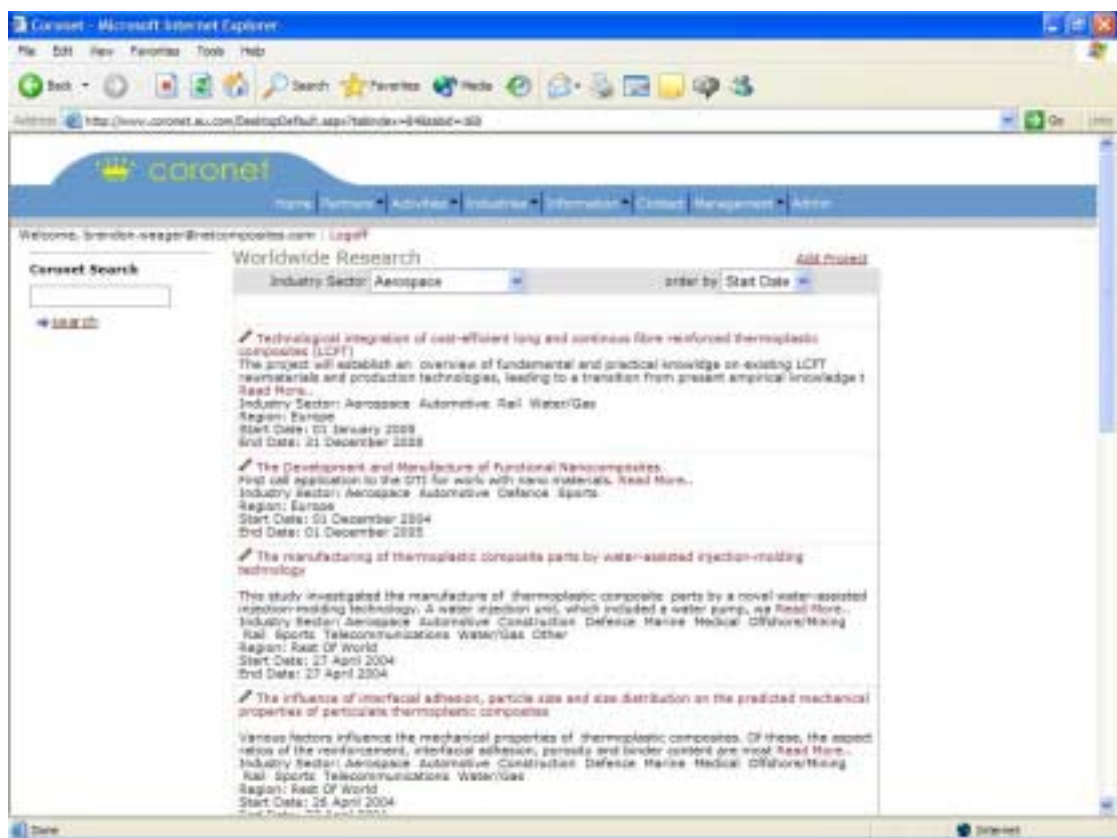


Figure 3.4: Summary search results for Aerospace sector.

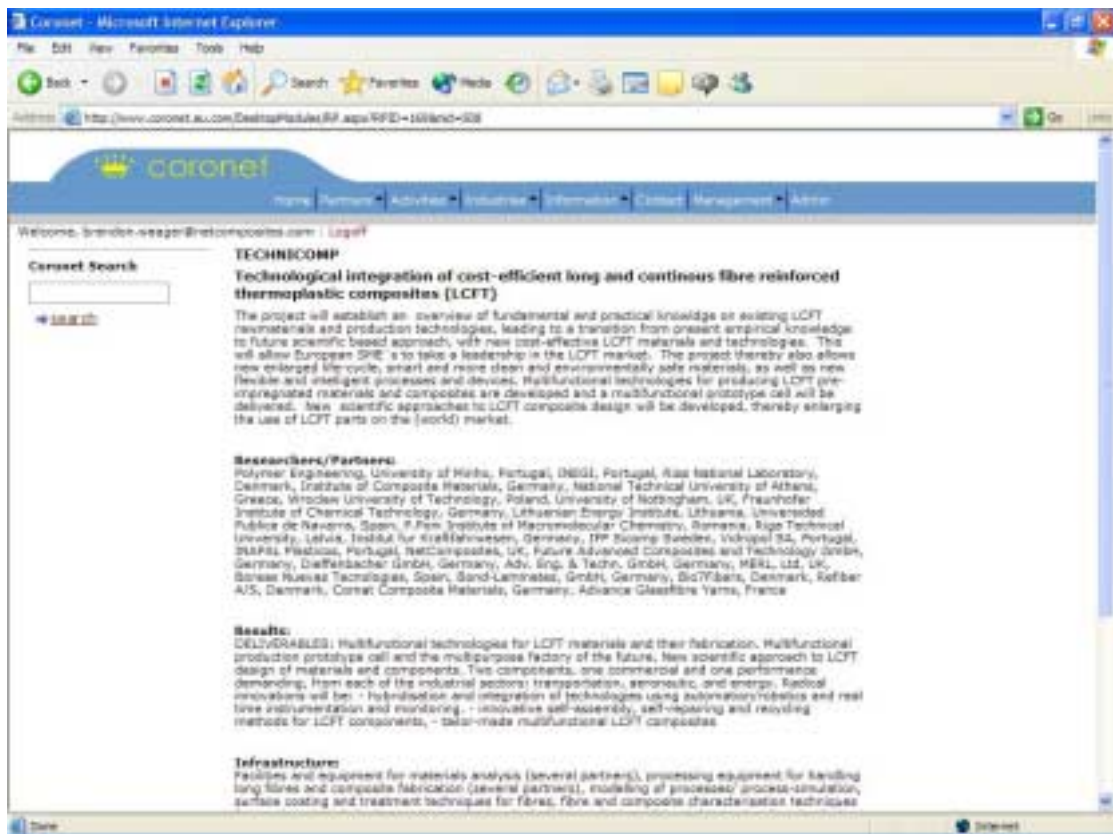


Figure 3.5: Detailed information for example research project.

# 4 Research and Infrastructure

As discussed, the regions compared are:

- Europe
- North America
- Rest of World

To facilitate easy comparison between the regions, projects were grouped together under five broad headings in a tabular format that allows the key project ideas and infrastructures to be studied quickly and easily. The five broad categories are:

- Materials
- Processing
- Modelling
- Post-processing
- Testing

Under each of these categories, details of current research activities are presented alongside the key infrastructures required to undertake the research. It was necessary to group the wide-ranging research activities into complimentary areas. These areas are:

## Materials

- Self-reinforced polymers
- Fluoropolymers
- LFT
- Nano-reinforced fibres
- Nanocomposites
- Vapour-grown carbon fibres
- Bio-polymers
- Biocompatible polymers
- Materials recycling
- Novel fibres & fillers
- Natural fibres

## Processing

- Thermoforming, stamping, compression
- Rubber & diaphragm forming
- Filament winding & braiding
- Injection moulding
- Pultrusion
- Vacuum processing
- Automated tape placement
- Thermoplastic RTM
- Heating techniques
- Rotational moulding
- Hybrid processing & sandwich structures

## Modelling

- Process modelling & formability
- Component modelling & design

## Post-processing

- Surface finishing
- Cutting techniques
- Joining & welding
- Repair

## Testing

- NDE & health monitoring
- Fire testing
- Impact & ballistics testing
- Fracture testing & damage tolerance
- Electrical property testing
- Environmental, creep & temperature testing

## Table of Research

A table comparing the research activities and infrastructure in Europe, North America and Rest of World is shown overleaf. Shading is used to indicate the amount of research activity in progress, from lowest (white) to highest (dark).

Materials	Europe		North America		Rest of World	
	Key research	Infrastructure	Key research	Infrastructure	Key research	Infrastructure
	Self-reinforced polymers	SrPP, carbon nano-reinforcement	Fibre-spinning, continuous lamination line (UK, D)	Poly-X rigid rod		SrPP
Fluoropolymers	Interfacial chemistry, rapid processing, stress-corrosion	Pull-winder (UK)				
LFT	Cost-effective processing, intelligent processing	Injection & compression (D), software, surface treatment	Military applications			
Nano-reinforced fibres	Fire retardance, carbon nanotube reinforced SrPP	Twin-screw extruder (UK)	Military & aerospace applications			
Nanocomposites	Layered silicates, carbon nanotubes, interface modification, PE, PA	Twin-screw extruders, analytical equipment	Carbon nanotubes, fibres & platelets, distribution, interface mod, PVC, PE	Twin-screw extruders (US), filament winder (US), analytical equipment		Rheomixer, analytical equipment (C)
Vapour-grown carbon fibres				Rheomixer (US)		
Bio-polymers	Cereals, caprolactone, cellulose, veg oils, lignin, polylactide	Processing & analytical equipment	Cellulose, PHB	Vacuum oven, twin-screw extruder (US)	Polyesteramide	
Biocompatible polymers	In-vitro and in-vivo assess's, bio-resorbable bone fixings, laser surface modification	Solid-state extrusion (D), laser (UK)	Carbon-polysulfone		PHB, carbon-polyethersulfone	Analytical equipment
Recycling	Fibre-spinning, crumb rubber, polyolefins	Centrifugal spinner (UK), compactors, environmental chamber (IRL)				
Novel fibres & fillers	Thermoplastic & steel fibres, phosphate glass	High temp furnace, fibre-drawing, EDX (UK)			Rubber toughening, ternary composites	
Natural fibres	Cellulose, flax, jute, sisal, hemp, wood, crop waste, high-performance	Fibre charact'n, XPS, TOF-SIMS, harvesting, defibration, treatment (D, DK)	Straw, wood, hemp, henequen, coir, jute	Vacuum oven, analytical equipment	Jute	Liquid proton nuclear magnetic resonance spectroscopy



	Europe		North America		Rest of World	
	Key research	Infrastructure	Key research	Infrastructure	Key research	Infrastructure
<b>Processing</b>						
Thermoforming, stamping, compression moulding	Optimization, modelling, deformable tooling	High capacity presses, proprietary software (S)	Intelligent processing, high volume processing	FEA software	Computer-aided thermoforming, local heating	
Rubber & diaphragm forming	Silicone tools, diaphragm forming, smart blank-holding, modelling	Smart blank-holder (NL), diaphragm forming machine (NL)				
Filament winding & braiding	Natural fibres, modelling, residual stress, continuous profiles, embedded optical fibres	Filament winders, tow-pregger (PT), braiders (S), ProSimFRT software (D)	Metal-polymer braiding	Braiding machine (US)	Micro-braiding, on-line consolidation	Tape winding (AUS), micro-braiding (J), 3-axis weaving machine, braider (T)
Injection moulding	Short-fibres, optimization, simulation of fibre orientation	MoldFlow software (IRL)	LFT, bio-composites, self-reinforced polymers		Wood-PP, bio-composites, water-assisted injection moulding	Lab-scale water injection unit (T)
Pultrusion	Fluoro-polymers, rebar, specific profiles	Pull-winder (UK), pultrusion machine (PT)	Commingled carbon-TP, PBT ex/pultrusion	TP pultrusion (US)	Commingled yarns, modelling	Lab-scale pultrusion(KO)
Vacuum processing	Low-cost processing, large parts	Simulation tools (D, NL)				
Automated tape placement	Optimised tow-placement, simulation	Tape-placement head on 6-axis robot (D), ProSimFRT software (D)	Optimised tow-placement, simulation	Automated tape-placement machines (US)	Modelling and characterisation of tape-placement	Tape-placement machine (KO)
Thermoplastic RTM	PA6, PA12, CBT, scaling-up	Pneumatic injection systems (D, CH)				
Heating techniques	Microwave, fast thermal response tools	Dynamic heating & cooling (CH)	Curie induction heating & lamination	SmartBond process	Local heating & stamping	
Rotational moulding			Rigid-rod LCP	Rotational moulder (US)		
Hybrid processing & sandwich structures	Over-injection moulding, fibre-metal laminates, paper cores	Continuous paper folding (B), prepreg lay-up (D), autoclave (DK)				







# 5 Comparison between Regions

## Materials

Research in self-reinforced polymers was noted in all regions. Europe was found to lead in processes for fabric/sheet materials, such as continuous lamination and compression moulding, whereas research in North America focused on injection moulding compounds.

Research in LFTs is currently based in Europe and North America. The European focus is on high-volume automotive applications, requiring advanced processing cells, although in North America, LFTs are being considered for military applications.

Nano-composites have received significant attention in all regions with no significant general differences noted, although vapour-grown carbon fibres only appear to be under investigation in North America. The main infrastructure requirements for nano-reinforced materials are analytical machines for nano-scale investigation.

As a subset of nanocomposites, nano-reinforced fibres are a significant recent development. In Europe, nanoreinforced fibres are being investigated for fire retardance and self-reinforced polymers, but there is less activity in North America and none recorded in the Rest of World. Other novel reinforcements, such as polymer and steel fibres, are receiving significant interest in Europe.

All regions are considering bio-derived polymers but European researchers appear to be considering the widest variety of bio-

sources, cereals, vegetable oils, lignin and polylactide in particular.

The area of bio-compatible polymers is of interest in all regions. They are receiving particular attention in the Far East where analytical facilities are strong. Research in fluoropolymers was exclusively European-based.

Recycling is currently dominated by Europe, principally due to regional legislation, but there is an implication on infrastructures as larger equipment and facilities are required to demonstrate that recycling can be commercially economic.

Natural fibre thermoplastic composites are a major research area in all regions. Perhaps the widest range of fibre types has been investigated in Europe, necessitating comprehensive facilities for defibration, chemical treatment and analysis.

## Processing

Thermoforming, stamping and compression moulding research is occurring in all regions, although Europe may lead in press and software infrastructure. Rubber & diaphragm forming is principally a European activity with key infrastructure such as diaphragm forming machines, smart blank-holder and proprietary software in the Netherlands. Outside of Europe and North America, cycle times for stamping have been reduced by local heating techniques, whilst high-speed thermal response moulds

have been developed in Europe for rapid processing.

There have been several recent developments in filament winding and braiding, most notably, filament winding of natural fibres in Europe and metal-polymer braids in North America and the rest of the world.

Research into injection moulding continues with fibre-orientation simulation in Europe, injection of self-reinforced polymers in North America and bio-composites in the Rest of the World. Specific infrastructure for novel water-assisted injection moulding exists in Taiwan.

Development of hybrid processing is underway exclusively in Europe. This has required large capital investment in over-injection moulding machines and hybrid processing cells.

Most apparent work on thermoplastic RTM is currently in Europe but there is a need for scaling-up of infrastructure for industrial application.

In pultrusion technology, both Europe and North America have infrastructures at a reasonable scale. All regions are considering commingled materials, with Europe developing pultrusion of fluoropolymers and North America investigating PBT.

Vacuum processing appears to be an exclusively European activity, with a current focus in Germany on large-scale structures and process simulation software. Conversely, rotational moulding of self-reinforced polymers has been investigated in North America

Automated tape placement, requiring significant capital investment, is a research activity underway in all regions with no significant differences noted.

## Modelling

Component and process modelling was found to be strong in all regions. Perhaps the only significant difference identified was a trend in

Europe for development of proprietary software, with other areas using standard packages.

## Post-Processing

Surface finishing and cutting of thermoplastic composites appear to be predominantly European research areas.

Joining, and welding in particular, has been investigated in all regions, with Europe and North America having the majority of induction, vibration and ultrasonic welding facilities and Australia concentrating on resistance welding.

Development of repair techniques has occurred in Europe and North America with a focus on self-healing systems and repair durability.

## Testing

Europe is strong on research into embedded sensors such as optical fibres, whilst in North America research is underway in guided acoustic (Lamb) waves for measuring stiffness coefficients.

Both Europe and North America are considering nano-reinforcements for fire retardance.

The field of impact and ballistic testing is concentrated in Europe and North America. In Europe, low and high-velocity impact test facilities exist for aircraft strike, bomb-blast protection, automotive crashworthiness and pedestrian safety. In North America, the main application is military armour so high-velocity test facilities exist.

Elevated temperature fracture testing is evident in North America and the Rest of the World but not in Europe; North America also has cryogenic test facilities for low-temperature testing.

Significant activity in all regions was found in environmental testing, with Europe having good fatigue, creep, wear and stress-corrosion facilities.

# 6 Comparison between Materials

Whilst there has been significant research, development and application in thermoplastic composite materials over recent years, competing materials have not stood still.

This section of the report therefore makes a brief comparison between the research activities of thermoplastic composites and other materials, based on the technology scanning activities that were undertaken.

## Metallic Materials

Steel has the advantage of highly established infrastructures and technologies for supply, repair and recycling, and recent research in this area has concentrated on high strength steels to give better strength to weight ratio and coating processes to overcome the inherent corrosion characteristics of the material.

Research activities in aluminium have concentrated on cost-effective forming technologies, as well as repair strategies in industries that are not used to working with this material. It is likely that the thermoplastic composites industry can learn from the repair strategies and some of the repair networks that have been put in place for aluminium. Work on foamed aluminium has also continued, but is generally still regarded as being too new and not yet cost-effective.

Magnesium and titanium have also undergone some significant research, but are yet to find new large scale applications.

In general, metallic materials score over thermoplastic composites in their recyclability, both in terms of technologies and the fact that there are existing networks and facilities to enable recycling. The choice of materials is also narrower and better understood, with broader process windows than in thermoplastic composites processing. Much of the recent research has concentrated on overcoming the relative weaknesses compared to thermoplastic composites, particularly lightweighting and corrosion performance.

Compared to that for thermoplastic composites, research infrastructure for metallic materials is typically larger and more expensive. It is also perceived that process and property prediction for metallic materials is easier due to the isotropic nature of the materials, whilst for thermoplastic composites a higher level of computational power is needed, along with more unique software.

## Polymers

One of the main research trends in polymers has been the continued improvement in mechanical and physical properties. Over the last 10 years the emphasis on research has been to move away from the development of highly specialised expensive polymers to development and improvement of new grades of the more common polymer systems.

This trend has continued apace with significant research being undertaken on nanocomposites, giving a unique crossover between the reinforcement characteristics of fibre-reinforced

composites and the processing and isotropy of conventional filled polymers. Nanocomposites also bring the performance ranges of polymers and polymer composites closer together.

Research into self-reinforced polymers, where a fibre and matrix are two different phases of the same material, or where crystalline reinforcement phases are formed within an amorphous bulk polymer matrix, has also grown significantly. This family of materials has also allowed the performance of polymer systems to significantly improve, and it is anticipated that research into self-reinforced materials will be significantly extended in the coming years.

## Thermoset Composites

Thermoplastic composites are often compared directly with thermoset composites, but in truth many of the application areas are quite different and the use of thermoset composites continues to grow.

In common with thermoplastic composites, research on thermoset composites has concentrated on cost-effective processing routes, reduction of environmental emissions, surface finishing systems and recycling methods.

Thermoplastic composites typically have a requirement for high pressure automated

processing infrastructure than their thermoset counterparts, which can more easily be formed with low pressure manual systems. This has implications on the research infrastructures for thermoplastic composites in Europe, which must be further enhanced to allow competitive development compared to other materials.

## Hybrids

In practice, it is unlikely that these materials will work alone in any given application and there is now a strong move towards using combinations of material for the best possible balance of cost and performance.

These combinations of materials can be seen both in hybrid structures, for instance where a strong metallic insert is overmoulded with a polymer system to give shape and features, as well as in hybrid materials, for instance where composite material sheet is laminated to aluminium sheet to give a formable material with the required combination of stiffness and strength.

As the demand for these hybrid materials and structures becomes stronger, so the research effort will need to further increase to take account of the diverse array of material combinations that are possible.

# Annex 1: Data Input Form

To create the database of thermoplastic composites research, results and infrastructure, a standard Word input form was used to make certain that the records were fully completed and ensure commonality of data.

A form was completed for each project, this form then being checked before being transcribed to the web-based database. Once users are familiar with the upload procedure they will be able to enter projects directly into the web database.

The Word-based form and the web-based form are both shown overleaf

## CORONET Database Data Input Card

<b>Project title:</b>	
<b>Acronym:</b>	

<b>Description:</b> <i>Please give a 1-2 paragraph outline of the work and its objectives</i>	
<b>Partners:</b> <i>Please list each partners and their country</i>	
<b>Results:</b> <i>Please give an outline of key results achieved</i>	
<b>Infrastructure:</b> <i>Please detail the key items of equipment used, together with their location</i>	

<b>Start date:</b> (dd/mm/yy)	
<b>End date:</b> (dd/mm/yy)	
<b>Actual/proposed:</b> <i>Is this an actual (current/past) project or proposed project?</i>	
<b>Funding agency:</b>	
<b>Contact:</b>	
<b>Email:</b>	
<b>URL:</b>	
<b>Documents:</b> <i>List any related documents (technical papers, press releases etc) and email them with this form</i>	
<b>Photo/image:</b> <i>List any photos or images (material, component, machine, logo etc) and email them with this form</i>	

<b>Industry sector:</b> (tick all that apply)	<b>Region:</b>
<input type="checkbox"/> Aerospace <input type="checkbox"/> Marine <input type="checkbox"/> Sports <input type="checkbox"/> Automotive <input type="checkbox"/> Medical <input type="checkbox"/> Telecommunications <input type="checkbox"/> Construction <input type="checkbox"/> Offshore/mining <input type="checkbox"/> Water/gas <input type="checkbox"/> Defence <input type="checkbox"/> Rail <input type="checkbox"/> Other	<input type="checkbox"/> Europe <input type="checkbox"/> North America <input type="checkbox"/> Rest of World

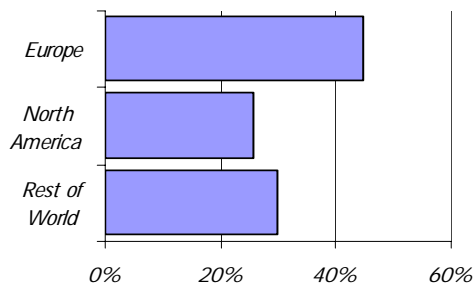


# Annex 2: Full List of Projects

At the time of writing the research database held the details of 225 research projects, a significant enough number to be representative of the variation in projects currently being undertaken.

For completeness, the full list of projects is given overleaf, listing only the Title, Researchers, Infrastructure, Funding Body and Application Sector. The full detail of each project is given in the Coronet web site.

These projects are broken down into worldwide regions (Europe, North America and the rest of the World). Figure A3.1 below shows the percentage breakdown of projects by region.



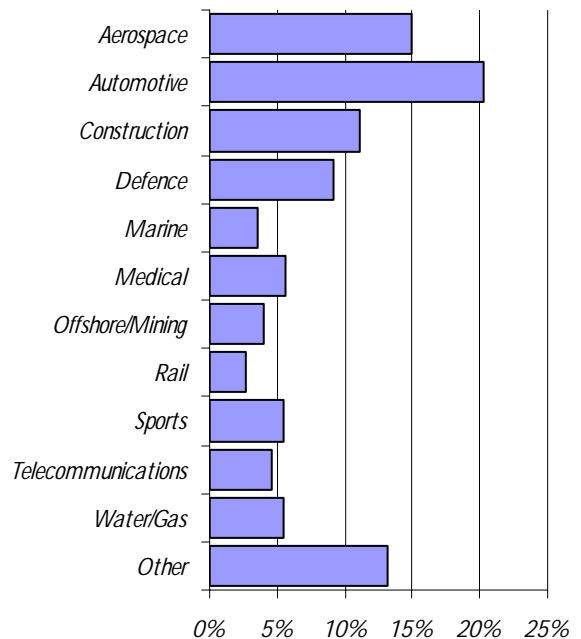
**Figure A3.1: Projects analysed by Region**

The projects can also be classified into the general industrial application categories below:

- Aerospace
- Automotive
- Construction
- Defence
- Marine
- Medical

- Offshore/Mining
- Rail
- Sports
- Telecommunications
- Water/Gas
- Other

Figure A3.2 below shows the percentage breakdown of projects by application sector, a number of projects being attributed to more



than one application sector

**Figure A3.2: Projects analysed by Sector**

The use of an interactive database on the Coronet web site also allows the projects to be searched and categorised in other ways.

Title	Researchers	Infrastructure	Funding Body	Sector
Assemblies of fiber reinforced thermoplastic parts out of qualified materials, using adapted welding techniques, for aerospace applications	Kok & Van Ebgelen BV (Netherlands-Coordinator), Tegra Ingeniera AL (Spain)		European Commission	Aerospace
Bond Assisted Single Step Assembly of Aircraft Structural Components	Fokker Aerostructures BV (Netherlands-Coordinator), Universidad Polytechnica de Madrid (Spain), Stichting Nationaal Lucht - en Ruimtevaart Laboratorium (Netherlands), Sonaca SA (Belgium), Gamesa Desarrillos Aeronauticos SA (Spain),		European Commission	Aerospace
Development and Innovation for Advanced Manufacturing of Thermoplastics	EADS/CRC France (France), Airbus France (France), Airbus Deutschland (Germany), Airbus Espana (Spain), Airbus UK (Great-Britain), Dassault Aviation (France), Eurocopter (France), LTSM - University of Patras (Greece), CIDAUT (Spain), LPW - University of Bayreuth (Germany), ACM (Germany), Irish Composite (Ireland), IVW (Germany)	A thermodynamic test rig for benchmarking different heating methods for in-situ consolidation of thermoplastic tape materials is used at IVW	European Commission	Aerospace
Impact Damage and Repair of Composite Structures	DLR (Germany - Coordinator), NLR (Netherlands), Qinetiq (UK), Cira- Italian Aerospace Research Center (Italy), Inta (Spain), Sicomp AB (Sweden), Onera (France), Saab (Sweden), Airbus Deutschland (Germany), EADS-CRC (France), BAE Systems (UK), Imperial College (UK), University of Sheffield (UK), EADS-M (Germany)		Garteur - Group for Aeronautical Research & Technology in Europe	Aerospace
Tow placement with new, thermoplastic semi-finished products for large structures	CTC GmbH (DE), Institut für Verbundwerkstoffe GmbH (DE), CAxOPEN product development technology GmbH (DE), Tenax Fibers GmbH (DE)	Automatic tape placement head, 6-axis robot with additional external rotation axis, heated tool platforms, the process simulation environment ProSimFRT (Process Simulator for Fiber Reinforced Thermoplastic Tapes), a thermodynamic test rig (IVW, Germany)	Bundesministerium für Bildung und Forschung (BMBF) (German Federal Ministry of Education and Research)	Aerospace
Welding of continuous fibre reinforced thermoplastics	TU Delft, Ten Cate Advanced Composites	Branson Ultrasonic welding equipment, home build resistance welding equipment, T2 Tons Zwick tensile test machine		Aerospace
Innovative liquid composite moulding for thermosetting and thermoplastic CF-composite materials for lightweight	Freiburger Materialforschungszentrum (Germany), IVW	Pneumatic Injection System, 2100 cc, for CBT injection Hot air oven (1000x1100x980mm), Small tool (200x200x2mm), for flat plates Modular tool (550x520x4mm), for flat plates and demonstration parts (Institut für Verbundwerkstoffe GmbH, Germany)	Deutsche Forschungsgemeinschaft	Aerospace Automotive
Towards Sustainable Manufacturing of Synthetic Composites	University of Nottingham (UK), Vetrotex (UK), Ellis Developments Ltd (UK)	High temperature furnaces Differential scanning calorimetry scanning electron microscopy and EDX X-ray diffractometry Fibre-drawing apparatus - all based in Nottingham, UK	EPSRC	Aerospace Automotive
Development of Industrial Computational Tools for the Design of Composite Components & Structures	AEA Technology Plc Engineering Solutions (UK), Ameron International (UK), B P Exploration Operating Co Ltd (UK), Capcis Ltd (UK), dstl (Farnborough) (UK), Ford Motor Company (UK), NPL (National Physical Laboratory) (UK), Materials Engineering Research Laboratory (UK)		EPSRC Grant Reference: GR/S60228/01	Aerospace Automotive Construction Defence Marine Medical Offshore/Mining Rail Sports Telecomms Water/Gas Other
The Effects of Manufacturing on the Design and Performance of Textile Composites	University of Nottingham (UK), Ford Motor Company (UK), Smiths Aerospace (UK), ESI Software (France), Formax UK Ltd (UK)	Software: TexGen, ABAQUS, Gambot	EPSRC Grant Reference: GR/N20362/01	Aerospace Automotive Construction Defence Marine Medical Offshore/Mining Rail Sports Telecomms Water/Gas Other
Modeling of Thermoplastic Composites Press-Forming Processes using Two-Phase Continuum Theory	SICOMP (S), IFP Research (S) and Chalmers University of Technology (S)	Press forming equipment (SICOMP / IFP Research), Proprietary numerical procedures and FEM code (SICOMP / CHALMERS UT), microscopy and testing equipment (IFP Research)	The Institute for Research and Competence Holding (IRECO) and Swedish Research Council (VR)	Aerospace Automotive Construction Defence Sports
Discontinuous induction welding of metal/fiber reinforced polymer composites	Institut für Verbundwerkstoffe and several departments of the Kaiserslautern University of Technology.	Interval hot press for the manufacturing of the fiber reinforced material. max. press length: 1400 mm, max. width: 660 mm, max. feed: 0.1 - 60 m/h max. temperature: 410 °C, max. moulding pressure: 25 bar (IVW). Induction welding equipment Pressing forces up to 3.1 kN, welding speed up to 5 m/min. Joining area depends on the coil design (IVW)	Deutsche Forschungsgemeinschaft (German Government)	Aerospace Automotive Construction Rail Sports Water/Gas

Title	Researchers	Infrastructure	Funding Body	Sector
Europe  The Development and Manufacture of Functional Nanocomposites	Co-ordination for this application is by QinetiQ (UK). Proposed partners include Security Composites Ltd (UK), British Aerospace Systems Engineering (UK), Airbus Industry (UK), Carr Reinforcements (UK), McLaren Racing Cars (UK) and others.		DTI £50M package to fund collaborative research and development projects in the Micro and Nanotechnology fields	Aerospace Automotive Defence Sports
Simulation of Composites Manufacturing Processes	ENSAM-Paris (France), MoldFlow (UK), Sandretto (Italy), Higher Education Authority (Ireland), Enterprise Ireland	60 Tonne Sandretto injection moulding machine, MoldFlow simulation software, Hounsfield uniaxial screw driven testing machine (all at UCD, Dublin)	Irish Government (Enterprise Ireland + Higher Education Authority)	Aerospace Automotive Marine Medical Sports Telecomms
R & D Programme: Structural Composites	Almedahls-Kinna (S), FOV Fabrics (S), Chelton Applied Composites (S), Polytec Composites Sweden (S A), Borås Wäveri (S), Saab Automobile (S), Engtex (S), Svenskt Konstsilke (S), Fagerdala Industri (S, D), Volvo Car Corporation (S) and Volvo Truck Corporation (S), ABB (S)	Preform development (Almedahls-Kinna, FOV Fabrics, Borås Wäveri, Engtex, Svenskt Konstsilke), Foam manufacturer (Fagerdala Industri) Composites manufactures (Chelton Applied Composites, Polytec Composites Sweden), OEM (ABB, SAAB, Volvo Car Corporation and Volvo Truck Corporation)	Private	Aerospace Automotive Marine Sports Other
Highly efficient process for the production of a new environmentally-friendly resin and of innovative composite materials using this resin in high tech and traditional industries.	Agroindustrie Recherche et Developpement SA (France-Coordinator), Preform Polymerwerkstoffe (Germany), Oigma Industria Aeronautica de Portugal SA (Portugal), TMG-Tecidos Plásticos e outros revestimentos industria automovel SA (Portugal), Unilin NV (Belgium), Dry DOughy SRL (Italy), Institut Francais du textile et de l'habillement (France), Pole Construction - Bordeaux (France)		European Commission	Aerospace Automotive Other
Feasibility study: Incorporation of nano-scale carbon fibres & single walled carbon nano-tubes to enhance properties of hot compacted polypropylene	University of Leeds UK (Coordinator), University of Cambridge (UK)	Twin screw extruder to mix nano-scale carbon fibres and polypropylene in melt and produce pellets, hot compaction (Leeds)	EPSRC Grant Reference: GR/S62000/01	Aerospace Automotive Rail
Technological integration of cost-efficient long and continuous fibre reinforced thermoplastic composites (LCFT)	Polymer Engineering, University of Minho, Portugal, INEGI, Portugal, Risø National Laboratory, Denmark, Institute of Composite Materials, Germany, National Technical University of Athens, Greece, Wroclaw University of Technology, Poland, University of Nottingham, UK, Fraunhofer Institute of Chemical Technology, Germany, Lithuanian Energy Institute, Lithuania, Universidad Publica de Navarra, Spain, P.Poni Institute of Macromolecular Chemistry, Romania, Riga Technical University, Latvia, Institut für Kraftfahrwesen, Germany, IFP Sicom Sweden, Vidropol SA, Portugal, INAPAL Plasticos, Portugal, NetComposites, UK, Future Advanced Composites and Technology GmbH, Germany, Dieffenbacher GmbH, Germany, Adv. Eng. & Techn. GmbH, Germany, MERL, Ltd, UK, Boreas Nuevas Tecnologias, Spain, Bond-Laminates, GmbH, Germany, Bio7Fibers, Denmark, Refiber A/S, Denmark, Comat Composite Materials, Germany, Advance Glassfibre Yarns, France	Facilities and equipment for materials analysis (several partners), processing equipment for handling long fibres and composite fabrication (several partners), modelling of processes/ process-simulation, surface coating and treatment techniques for fibres, fibre and composite characterisation techniques (several partners), both non-destructive methods (ultrasonic, X-ray), and destructive (mechanical properties, fracture mechanics), modelling analysis for materials properties and for components, microscope facilities (optical, TEM, SEM), test facilities for full scale test of components (some partners)	EC FP6, Integrated Project	Aerospace Automotive Rail Water/Gas
Novel Toughening Mechanisms For Fibre Composites	Queen Mary, University of London (UK), B A E Systems Plc (UK), Cytec Engineered Materials Ltd (UK), Matrice Materials Systems Ltd (UK)		EPSRC Grant Reference: GR/N63819/01	Aerospace Construction Defence Other
FFS, Future Aircraft Structures	DLR (Germany), EADS (Germany)	Water jet cutting of prepregs, - heated vacuum table: consolidation of rudder skin and welding the stringer with the VCT, molding of spar with the VCT likewise, - press welding equipment: welding of ribs. All equipments DLR Stuttgart	National Funding (Germany)	Aerospace Defence
Light Weight Construction for a Low Pressure Compressor with High Pressure Ratio	DLR (Germany), MTU - Aero Engines (Germany)	Computer assisted generation of prepreg lay up and simulation tool CAD, water jet for cutting of prepregs, heated vacuum table for consolidation of CFRP and joining of materials within a single vacuum consolidation step (DLR Stuttgart)	National Funding (Germany)	Aerospace Defence
Optimisation Of Laser Drilling Processes In The Aerospace Industry By The Development Of A Heat Flow Model	University of Cambridge (UK), Ministry of Defence (UK), B A E Systems Plc (UK), Rolls-Royce International Ltd (UK)		EPSRC Grant Reference: GR/M54445/01	Aerospace Defence
Nanotube wettability and modification - the key to hierarchical fibre-reinforced nanocomposites	Imperial College (UK), Security Composites Ltd (UK), Hunting Engineering (UK)	The majority of the equipment used within this project is to be found within Imperial College, Department of Chemistry. SCL will manufacture tube structures for evaluation as heat exchange tubes.	EPSRC	Aerospace Defence Medical
Scaling effects in fibre-metal laminates	University of Liverpool (UK-Coordinator), Gluco Ltd-Leeds Innovation Centre (UK)	Hot press, High speed tensile test machine, Drop-weight impact rig Gas gun, Blast chamber	EPSRC Grant Reference: GR/S25869/01	Aerospace Defence Offshore/Mining

Title	Researchers	Infrastructure	Funding Body	Sector
<b>Europe</b>				
Development of advanced microwave and light-weight high-speed thermo-response technology for woven textile-reinforced components	European PARTNERS :Eurocarbon BV, (NL), IFP SICOMP (SE) AG Kunststofftechnik Beiner (D) KG Regloplas (CH), AG StructoForm GmbH (D), Cyclics GmbH (D and USA), PROJECT CO-ORDINATOR:K.U.Leuven (B).	Braiding equipment at Eurocarbon, moulds and mould-making at Beiner, Injection moulding at Beiner, injection equipment at Structuform, dynamic heating and cooling at Regloplas, braiding equipment and analysis equipment at IFPSICOMP, full scale resin impregnation equipment at KULeuven, analysis equipment at KULeuven.	Project funded by the European Community under the "Competitive and Sustainable Growth" Programme (1998-2002)	Aerospace Water/Gas
A fundamental knowledge base for the production and use of thermoplastic folded honeycomb cores	Katholieke Universiteit Leuven (Belgium-Coordinator), Frantschach Coating (Belgium), Libeltex (Belgium), Johnson Controls (Belgium), Polynorm (Netherlands), Polyvision (Belgium), Toyota Motor Europe (Belgium), DaimlerChrysler (Germany), Rieter Automotive (France), Kayserberg Packaging (France)		IWT, Flemish Government & Eureka Project Partners	Automotive
Textile Thermoforming Of Composites	INASMET (E), TECNOTESSILE	Thermoforming GEISS 6000 (INASMET), mechanical test facilities (INASMET)	EC DG XII	Automotive
Advanced Integrated Decorating And Coating Technologies For Thermoformed Components	INASMET (E), UNIV OF PERUGIA (I), AXXYL (F), TOWNLIFE (I), FYTISA (E), VACUMM (E)		EC	Automotive
Automated environmentally friendly processing of structural thermoplastic composite components	Euro-Projects Ltd (U.K-Coordinator), Partners: Saint Gobain Vetrotex International Sa (France), Volkswagen Ag (Germany), Peguform France (France), Tecnos (Italy), Tvr Engineering (UK), Aachen University Of Technology (Germany)		European Commission	Automotive
Design - Process - Performance Interactions For Precision Products	University of Leeds (UK, Coordinator), University of Warwick (UK), University of Bradford (UK), Brikbys Plastics Ltd (UK), Moldflow Corporation (UK), Mitsui Machine Tool Europe (UK)		EPSRC Grant Reference: GR/S02433/01	Automotive
Development of Crash Resistant Sandwich Composites	University of Sheffield ARRC (UK-Coordinator), Partners: Ahlstrom Glass Fibre OY , FIBROCOM OY (Finland), SICOMP AB, BOX MODUL AB, APC Composit AB (Sweden), Netherland Organisation for Applied Scientific Research (Netherlands), Hübner Gummi Und Kunststoffe GmbH, Aachen University of Technology (IKV) (Germany), Ashland Italy S.p.A., D'Appolonia S.p.A., Costaferroviaria S.p.A., University of Perugia (Italy), National Technical University of Athens (Greece), Ifor Williams Trailers Ltd. (UK), Anthony Patrick & Murta Exportação LDA (Portugal), Irizar S. Coop, Advanced Technologies Research Institute (Spain)		European Commission	Automotive
Development Of Silicone Flexible Molds	INASMET (E), Plasticos Tolosa (E), Sitomolding (I), Poly-Armados, Sarl Aquitaine Plastiques et Composites (F), Composites de Navarra (E) and Olive Quimica (E)	Vacuum resin infusion (INASMET)	EC	Automotive
Development of thermoplastic composites body panels with high quality surface finish	University of Warwick (UK), Security Composites Ltd (UK), BI Composites (UK), MG Rover (UK)	Hydraulic press, 250T, 1000 x 1000mm for moulding thermoplastic sheet materials, double diaphragm forming machine with integral infra-red heating (single sided) (University of Warwick). 250T high speed rapid closing press (SCL).	UK Government, DTI, EPSRC, LINK Foresight programme	Automotive
Ecoefficient technologies and products based on natural fibres composites	University of Perugia (Italy-Coordinator), Partners: SAAB (Sweden), FIAT Research Centre (Italy), CELESA (Spain), INASMET (Spain), Finflax (Finland), APM (Portugal), University of Lulea (Sweden), University del Paese Basco (Spain)		European Commission	Automotive
Ecoefficient Technologies And Products Based On Natural Fiber Composites	INASMET (E), UNIV. PERUGIA (I), UNIV. LULEA (S), UNIV. PAIS VASCO (E), APM, FINFLAT (I), FIAT (I), SAAB (S), CELESA (I), FPK (E)	Thermoplastic injection facilities (INASMET), mechanical test facilities (INASMET)	EC DG XII	Automotive
Faraday: Design and Fabrication of Low NVH Multi Material Automotive Vehicle Structures	Oxford Brookes University (UK-Coordinator), Ford Motor Company (UK), Crompton Technology Group (UK), Salex Acoustic Materials (UK), Bi-Composites LTd (UK), Oxford Magnet Technology Ltd (UK)		EPSRC Grant Reference: GR/S27245/01	Automotive
Optimised thermoplastic pressure vessels for natural gas storage for automotive applications	Comat (Germany) ADETE (Germany) IVW (Germany)	An industrial scaled winding machine is used for winding tubes for fatigue test. For the fatigue tests a self developed test rig for performing tests under high pressure is used.	BMW i / Pronno	Automotive
Preliminary Investigations of Freeform High Pressure Vessel for Compressed Gases, Specially Compressed Natural Gases.	DLR (Germany), Gasversorgung Süddeutschland GmbH (Germany), Ingenieurgesellschaft Auto und Verkehr GmbH (Germany,) Ruhrgas (Germany), TI Automotive (Germany)	CAD and simulation tools as well as testing machines, DLR Stuttgart	national funding, Ministry of Economics (Wirtschaftsministerium), Baden-Württemberg	Automotive

Title	Researchers	Infrastructure	Funding Body	Sector
<b>Europe</b>				
Research and development of PP fibre reinforced thermoplastic composite materials, processing techniques and applications	BP Amoco Fabrics (UK), Lotus Cars (UK), London Taxis International (UK), BI Composites (UK), Trauma-Lite (UK), NetComposites (UK), The University of Warwick (UK)	Hydraulic press, 250T, 1000x1000mm, for moulding thermoplastic sheet materials, hot air oven, 300C, 1000x1000x1000mm, for pre-heating thermoplastic sheet materials (The University of Warwick, UK), Meyer KFK-S laminator, 1800mm wide, 0-150mm height, 0-18N/cm2, 220C, 2-25m/min, for laminating sandwich panels (Mey-Tech, UK), Diaphragm forming machine, 5bar, <200C, 750x500mm, for low-pressure forming (Diaphorm, US), Instron 1195 universal testing machine, 50kN load cell, environmental chamber, for material and joint testing (The University of Nottingham, UK)	DTI Foresight Vehicle Link (UK Government)	Automotive
Surface Quality of Continuously Fiber Reinforced Thermoplastics	IVW	double belt press, intermittent working continuous compression molding press, hydraulic press, methods of measurement for gloss, roughness, topography, waviness	DFG - Deutsche Forschungsgesellschaft	Automotive
The future use of composites in Transport	Newrail (UK-Coordinator), Centro Ricerche Fiat (Italy), EADS (Germany), Sicomp (Sweden), D'Appolonia (Italy), Institut fur Kunststoffverarbeitung (Germany), Inegi (Portugal), KU-Leuven (Belgium), University of Newcastle (UK), University of Zaragoza (Spain)		European Commission	Automotive
Development of wood-fibre based composite materials	Royal Technical Highschool (KTH), Sweden, Technical Highschool-Borås, Sweden, Risø National Laboratory, Denmark, Science Academy-Åbo, Finland	Facilities for chemical modification and treatment (Science Academy-Åbo), surface analysis (Risø), fibre mat measurements (KTH, Risø), mechanical testing equipment (KTH, Risø), fabrication facilities for composites (Risø, Technical Highschool-Borås), materials modelling (KTH, Risø)	Samnordisk Skogsforskning (Scandinavian Forest Research)	Automotive Construction
Novel intercalated polyurethane-organically modified layered silicate nanocomposites	Loughborough University (UK-Coordinator), Hyperlast Ltd(UK), DSTL-Farnborough (UK)		EPSRC Grant Reference: GR/S56115/01	Automotive Construction
Processing of Class-A Surface Smc (Sheet Moulding Compounds)	Ecole Polytechnique Federale De Lausanne (Switzerland), Vetrotex International S.A. (France), Union Carbide S.A. (Switzerland)		Eureka EI 2373 - SURFAS	Automotive Construction
Study of ternary composites based on mixtures of polypropylene-thermoplastic rubbers reinforced with natural fibres	Centres Des Materiaux De Grande Diffusion (Cmgd) (France)		CSIC-CNR (Spain)	Automotive Construction
Design Optimisation of Textile Composite Structures	University of Nottingham (UK), Qinetiq Ltd (UK), MSC Software Ltd (USA), Hexcel Composites Ltd (USA), Ford Motor Company (UK), Granta Design Ltd (UK), Polynorm Plastics B.V. (Netherlands), Saint-Gobain Vetrotex International (France), ESI Software (France)		EPSRC Grant Reference: GR/S67104/01	Automotive Construction Defence
High Quality, Low Density Pet (Polyethylene Terephthalate) For Core Materials In Composite Sandwich Constructions	Fagerdala Hicore As (Norway), Fagerdala Industrie Ab (Sweden), Polymer Tekniskt Centre (Sweden), Fagerdala Be-Ne-Lux S.A. (Belgium), National Institute Of Technology (Norway), B.C. Foam (Italy)		Eureka EI 3170 - PET COMPOSITE CORES	Automotive Construction Marine Other
Expultrusion: A Low Cost Method Of Thermoplastic Composite Pultrusion	MIT (US)	Pultrusion equipment		Automotive Construction Offshore/Mining Telecomms
Cellulosic fibres and biopolymers for optimised biocomposites	Risø National Laboratory (Materials Research and Plant Research), Danish universities, possibly Danish SME-enterprises	Fibre characterisation (chemical composition, molecular weight, crystallinity, strength), fibre surface analysis (XPS, TOF-SIMS), defibration techniques (retting, fungi treatment), polymer characterisation (e.g. viscosity), compaction of dry fibre assemblies, processing equipment for composites (press consolidation, autoclave consolidation), characterisation of composites (density, fibre content, porosity content), mechanical testing (tension, compression, fatigue), moisture/water absorption.	Risø National Laboratory, internal funding (for 12 months)	Automotive Construction Other
High performance hemp fibres and improved fibre network for composites	Risø National Laboratory, Royal Veterinary and Agricultural University, Technical University of Denmark, Danish Agricultural Science Foundation, Novozymes, (all partners : Denmark)	Fibre characterisation (chemical composition, molecular weight, crystallinity, strength), fibre surface analysis (XPS, TOF-SIMS), defibration techniques (retting, fungi treatment), polymer characterisation (e.g. viscosity), compaction of dry fibre assemblies, processing equipment for composites (press consolidation, autoclave consolidation), characterisation of composites (density, fibre content, porosity content), mechanical testing (tension, compression, fatigue), moisture/water absorption.	Danish Ministry of Science, Technology and Development	Automotive Construction Other

Title	Researchers	Infrastructure	Funding Body	Sector
<b>Europe</b>				
New classes of composite materials from renewable resources	Fraunhofer Institute for Chemical Technology (coordinator), several SME's, several research institutes, Risø National Laboratory	Equipment and facilities for chemical and physical analysis of materials, processing of materials. characterisation of materials (destructively and non-destructively), and for testing of components and products for performance, are available at the partners in general (details are not available, because the consortium partners have not been defined finally)	EC FP6, Integrated Project	Automotive Construction Other
Thermoplastic composite sandwich panel forming techniques development & applications into lightweight structures	Euro Projects (Lttc) Ltd. (UK), Halmatic Limited (UK), Avondale Coachcraft Ltd. (UK), Owen Brown Tents For Events (UK), Mobile Expandable Facilities Ab (Sweden), Sarna Xiro Gmbh (Germany), Rono Systemtechnik Gmbh Abteilung (Germany), Wacotech Gmbh & Co. Kg (Germany) Prometheus Developments Ltd. (UK), Tubus Bauer Gmbh (Germany), Rwth - Institut Fuer Kunststoffverarbeitung (Ikv) (Germany) Wihag Nutzfahrzeugtechnik Gmbh & Co (Germany)		Eureka E! 2535 - FACTORY PANELFORM	Automotive Construction Sports Telecomms Other
Long term properties of fibre reinforced thermoplastic components	Alfa Laval Separation AB, APC Composite AB, Chelton Applied Composites, IFP Research AB, Luleå University of Technology, MB-Sveda, Nanook Engineering, Royal Inst. of Technology, SICOMP AB, Volvo Car Corporation, Volvo Body Components Corporation, Volvo Truck Corporation, Xdin AB - SWEDENSymalit AG - SWITZERLAND	Creep rigs: Luleå University of Technology, Division of Polymer Engineering and SICOMP AB, Tensile test machines: Luleå University of Technology, Division of Polymer Engineering, Royal Inst. of Technology and SICOMP AB, Structural test rig: SICOMP AB, Differential Scanning Calorimetry: SICOMP AB, GMT presses: Volvo Body Components and SICOMP AB.	Swedish National Board for Industrial and Technical Development (NUTEK), P9651-1	Automotive Construction Marine Other
Anisotropic viscoelastic deformations of fiber-reinforced thermoplastics	Robert Bosch gmbh (Germany)		European Commission	Automotive Other
Control of variable structural in polyolefin blends and composites			Union Europea	Automotive Other
Halogen-free flame retardancy for long fibre reinforced thermoplastics (LFRT) – Development of material and an economic production process chain.	IWW (D)	Parallel controlled servohydraulic press (Manufacturer: Maschinenfabrik J. Dieffenbacher GmbH &amp; Co., maximum compression force: 6500 kN (parallel-controlled)) Twin screw extruder (Manufacturer: Fa. Brabender OHG, maximum output 11 kg/ h) and a combination of dispensing units (Manufacturer: Fa. Color Exakt Type PF 1200 und SM 1100 D), Single screw plasticizing unit (Manufacturer: Kannengiesser GmbH, screw diameter 150 mm, length/ diameter coefficient 26), Fire testing rigs according to UL 94 and DIN 53438 (all IWW)	Ministry of economics, traffic, agriculture and viniculture in Rhineland-Palatinate, Germany , "Stiftung Rheinland-Pfalz für Innovation" with the ref. numb. 8312-386261/402	Automotive Other
HybridNet - Organic-Inorganic Hybrids for Structural and Semi-Structural Applications	University of Surrey, University of Durham, Imperial College, Keele University, University of Kent at Canterbury, University of Leeds, &nbsp; Loughborough University, Nottingham Trent University, Queen Mary University of London, Sheffield Hallam University, University of Strathclyde, University of Surrey, University of Teesside, University of Oxford, Alderley Systems, Corus Group, Azko Nobel, BIP, Oxonica, MBDA, BLC Leather Technology, Quo-Tec, Du-Pont, Rolls Royce, Huntsman Tiioxide Underwriters Laboratories, Imerys Minerals, ICI, Jones Stroud Insulations, Qinetiq, DSTL, STI, EPSRC, RAPRA/Faraday Plastics, TWI, NPL (all UK)		EPSRC Grant Reference: GR/R38149/01	Construction
Improved fire safety and reduced losses through new insulation panel development	Process Plastics Ltd (UK), Arla Plastproduckter AB (Sweden), Alderley Materials (UK), Blagden Chemicals Ltd (UK), Claeb Management Services (UK), Hostaglas Ltd (UK), The Victoria University of Manchester (UK), Warrington Fire Research Centre (UK), Zaco PTI (BV (Netherlands)		European Commission	Construction
Optical Fiber Sensors Embedded In Civil Structures Composite Reinforcements	INASMET	RTM facilities (INASMET), mechanical test facilities (INASMET)	EC DG XII	Construction
Novel Clay-Polymer Nanocomposites Using Diversity-Discovery Methods: Synthesis, Processing & Testing.	University College London (UK)		EPSRC Grant Reference: GR/R30907/02	Construction Medical

Title	Researchers	Infrastructure	Funding Body	Sector
Development of Curved Non-Ferrous Reinforcement for Reinforced Concrete Applications	Eurocrete Limited (UK), University of Sheffield (UK), Technical University of Iasi (Romania), Sc Val Con Srl (Romania), Richards Moorhead Laing (UK), Altin Naehtechnik GmbH (Germany), Delta Nord (Belgium), Net Composites Limited (UK)		Eureka E! 2878 - CURVEDNFR	Construction Offshore/Mining
Reinforced fluoropolymer chimney liner	KEMA (NL), Rielant Power plant and supported by Dupont's composites and coating division	Environmental stress corrosion cracking setup (ESC)	TSA program	Construction Offshore/Mining
BLADECO reinforced thermoplastic windturbine rotorblade	KEMA (NL), Airpac (GE-wind), ATO-DLO, ECN, TUD material from comfill.	LCA-analysis software, Epsiflex fatigue machines	EET (national program)	Construction Other
New Products based on Cellulose-Thermoplastic Composite Technology, Material & Process Development	The Norwegian Pulp And Paper Research Institute (Pfi) (Norway), Borregaard Chemcell (Norway), Borealis As (Norway), Swedish Pulp And Paper Research Institute (Stfi) (Sweden)		Eureka E! 2995 - CELLPOLYCOMP	Construction Other
The Adhesion Of Multi-Component Polymeric Materials To Low Energy Substrates	University of Surrey (UK), Becker Industrial Coatings Ltd (UK)		EPSRC Grant Reference: GR/N65745/01	Construction Other
Light construction component	SME-company, Denmark, Risø National Laboratory, Denmark	Processing facilities for press consolidation and autoclave consolidation (520oC, 20 bar), mechanical testing equipment, microstructural characterisation (fibre content, porosity content, density)	internal funding	Construction Rail Sports
Development of Curved Non-Ferrous Reinforcement for Reinforced Concrete	Eurocrete (UK), Val-Con (RO), Richards Moorehead & Laing (UK), Fiberline (DK), Altin Nähetechnik (D), Delta Nord (B), Comfil (DK), Rubans Gallant (F), University of Sheffield (UK), Technical University Iasi (RO), NetComposites (UK)	Pultrusion equipment (Fiberline), stitching equipment (Altin), fibre commingling equipment (Comfil), fibre wrapping equipment (Rubans Gallant), beam casting and testing equipment (Sheffield), extrusion and pultrusion equipment (Iasi), beam casting and testing equipment (Iasi), compression and vacuum moulding equipment (NetComposites)	European Commission FP5 GROWTH CRAFT RTD (G1ST-CT-2002-50365)	Construction Telecomms Water/Gas
Manufacturing High Performance Fibre Reinforced Fluoropolymers for Applications in Extreme Environments	Imperial College London (UK)		EPSRC Grant Reference: GR/S75673/01	Medical
Biodegradable Bacterial Plastics from Cereals	UMIST (UK), Satake Corporation UK Division (UK), W &amp; H Marriage & Sons Ltd (UK)		EPSRC Grant Reference: GR/S24909/01	Medical Other
Nanocomposite matrices for glass fibre reinforced thermoplastic composite	University of Nottingham (UK)	Rheometer, Instron, Extruder. Injection machine	EPSRC	Medical Sports Telecomms Other
Development of quality assurance methodology of thermoplastic reinforced riser-pipes	KEMA (NL) subcontracted by Airborne, Other partners: SHELL exploration.	Sensors and non destructive testing (NDT) techniques	Senter BTS regeling	Offshore/Mining
Flexible composite production riser for deep water oil fields	ABB Offshore Systems AS (Norway-Coordinator) Comat Composite Materials Germany) Institut fuer Produktionstechnologie (Germany) Institut fuer Verbundwerkstoffe (Germany) Norske Hydro Research Centre Bergen (Norway) Sulzer Innotec (Switzerland) Twaron Products (Germany)		European Commission	Offshore/Mining
Flexible Composite Production Riser for Deep Water Oil Fields	ABB Offshore Systems AS (NO), Norsk Hydro a.s (NO), Fraunhofer Institut Produktionstechnologie (DE), Sulzer Innotec Ltd. (CH), Twaron Products GmbH (DE), Institut für Verbundwerkstoffe GmbH (DE), COMAT GmbH (DE)	Developed process simulation environment ProSimFRT (Process Simulator for Fiber Reinforced Thermoplastic Tapes), a thermodynamic test rig (IWW, Germany)	EU	Offshore/Mining
Consolidation and welding of thermoplastic pipes	KEMA (NL), Pipelife (former DRAKA Polva)	Heating techniques (dielectric, inductive, infrared), pipe and joint testing facilities	Senter-EUREKA	Offshore/Mining Water/Gas
Flexible composite production riser for deep water oil fields	ABB Offshore Systems AS (Norway - Coordinator) Partners: Comat Composite Materials (Germany), Institut fuer Produktionstechnologie (Germany), Institut fue Verbundwerkstoffe (Germany), Norske Hydro Research Centre Bergen (Norway), Sulzer Innotec (Switzerland), Twaron Products (Germany)		European Commission	Offshore/Mining Water/Gas
Seam Design for Bistable Composite Pipes: Secondment to Rolatube Technology Ltd.	University of Cambridge (UK), Rolatube Technology (UK)		EPSRC Grant Reference: GR/S81773/01	Offshore/Mining Water/Gas

Title	Researchers	Infrastructure	Funding Body	Sector
Use Of Natural Fibres For The Development Of Reinforced Thermoplastic Pipe, With Investigation Of Through-Life Costs	University of Newcastle upon Tyne (UK), PERA Innovation (UK), South West Water Ltd (UK), Insys Ltd (UK), Uponor Aldyl Ltd (UK), Ridgeway Co-Extrusion Technology Ltd (UK), Halliburton Wellstream Limited, Haswell Moulding Technology, Spendmotion Engineering		EPSRC Grant Reference: GR/S25791/01	Offshore/Mining Water/Gas
Steel Reinforced Thermoplastics	Katholieke Universiteit Leuven (Belgium-Coordinator), Bekaert NV (Belgium), Ecole Polytechnique Federale de Lausanne (Switzerland), WTCM-CRIF (Belgium)		IWT, Flemish Government	Other
A Concerted European Effort for the Advancement of Multiphase Thermoplastics	Cranfield University (UK), Institut Charles Sadron (France)		European Commission	Other
A structurally novel thermoplastic matrix: its behaviour and organisation	Rhodia Recherches SA (France)		European Commission	Other
Advanced Numerical Techniques in R&D on Processing and Properties of Textiles and Textile Composites	katolieke Universiteit-Leuven (Belgium-Coordinator), Centexbel (Belgium), Vrije Universiteit Brussel (Belgium)		IWT, Flemish Government	Other
Development of a low cost process for the manufacture of storage and pressure vessels using novel composite thermoplastic materials	Rotofab Ltd (Ireland-Coordinator), Partners: Polymer Development Centre (Ireland), Alan Yorke Engineering Ltd (U.K), Matrix Polymers Ltd (U.K), Persico Spa (Italy), Perspektiv A/S (Denmark)		European Commission	Other
Development of hybrid moulding technologies for continuous fibre and self-reinforced thermoplastic materials	Structoform Spritzgiessen Anisotroper Strukturkomponenten GM (Germany-Coordinator), Eurocarbon BV (Netherlands), Federal Institute for Material Research and Testing (Germany), Promolding BV (Netherlands), Savoy Moulage SA (France), Sulzer Innotec AG (Switzerland)		European Commission	Other
Development of quick non expensive moulds for preseries of plastic and composite components	Elecqui SA (Spain), Inasmet (Spain), Industrial Tajo scl (Spain), Iveco Fiat SPA (Italy), Tritech Precision Products (UK), Protips Technics SL (Spain)		European Commission	Other
F25 NOVCOMPS- "Novel low environment impact polymer matrix composites"	University of Wales, Bangor (UK), Univ Warwick (UK), Queens Univ Belfast (Ireland), Advance Enterprises Ltd (UK), Bio Fibre Ltd (UK), Borden Chemicals Ltd (UK), CARA Plastics Inc (UK), Andy Fox BoatBuild Fergusons Irish Linen & Co.Ltd (Ireland), Preform Bio-Composites Gmbh & Co Ltd (Germany)		EPSRC Grant Reference: GR/R88748/01	Other
High performance scratch-resistant coatings applied to thermoplastic articles by in-mould coating processes	Nanogate Technologies (Germany-Coordinator), KICA BV (Netherlands)		European Commission	Other
Introduction of lightweight, low cost, hi-impact performing composites into the furniture industry	Aalto ltd (UK), Aidima (Spain), Buckinghamshire College of Higher Education (UK), DKI Plast A/S (Denmark), Euro-Projects (UK), Fira International Ltd (UK), Federico Finer SA (Spain), Furniture Industry Research Association (UK), Perfil Madera (Spain), Specialist Banking Furniture (UK), Vetrotex International (France)		European Commission	Other
Investigation on the use of fibre reinforced plastics with integrated sensors in plant engineering and construction	Lehrstuhl für Strömungs- und Verdrängermaschinen (SAM) Universität Kaiserslautern (Germany)	Filament winding machine, 7 axis, 3 spindles, Ø1500 mm, 4000 mm (IVW, Germany), Magnetic clutch pumps, test bench according to DIN 1944, measurement data acquisition system VIBROCAM 5000 (SAM, Germany)	DFG Deutsche Forschungsgemeinschaft	Other
Load optimisation of fibre reinforced filament wound thermoplastic components by induction of residual stresses	IVW	Filament winding machine, 7 axis, 3 spindles, Ø 1500 mm, 4000 mm, residual stress test device, (IVW, Germany)	Deutsche Forschungsgemeinschaft	Other
Long-Life Pipe Technology To Save Energy, Reduce Power Station Co2 Emissions And Reduce Process Plant Leakage	Security Composites Ltd (UK), Flexcomposites (NL), ACS Advanced Composite Systems GmbH (D), Polisilk SA (ES), Fibafo Ltd (UK), RTD providers: INEGI (PT), PERA (UK), Subcontractor: KEMA (NL)	pullwinder at PERA	ENERSAVE CRAFT PROJECT (CONTRACT NO: ENK5-CT-2001-30003)	Other

Title	Researchers	Infrastructure	Funding Body	Sector
<b>Europe</b>				
Microstructure and Micromechanics of Natural and Regenerated Cellulose Fibres	UMIST (UK), Renishaw Plc (UK), University of Leeds (UK), Accordis Ltd (UK), Cordenka (Germany)		EPSRC Grant Reference: GR/S44471/01	Other
Modified By Wood Fillers Recycled Polyethylene For Europallets Application	Krakow University of Technology (Poland)	Femap 7.1 software, Ansys 5.7 software.		Other
Nanocomposite Fire Retardants for Synthetic Fibres	Boton Institute (UK-Coordinator), University of Sheffield (UK), Rhodia (UK), Accordis Specialty Fibres (UK), Unifi Tye Ltd (UK)		EPSRC Grant Reference: GR/S24367/01	Other
Novel Biocompostable Materials Graft Copolymerisation Of Starch With E-Caprolactone	University of York (UK), Solvay Interlox Ltd (UK), Marks & Spencer plc (UK), Northern Foods plc (UK)		EPSRC Grant Reference: GR/M29405/01	Other
Novel Fibre-Metal Laminates Based On Thermoplastic- Matrix Composites	University of Liverpool (UK), Dupont Electronics (UK), E A Technology Ltd (UK)		EPSRC Grant Reference: GR/M89348/01	Other
Novel Polyolefin Nano-Composites Based on Tailored Polyethylene Copolymers and Organophilic Layered Silicates	University of Surrey (UK)		EPSRC Grant Reference: GR/R94718/01	Other
Processing, Properties, Structure of Nanocomposites for Industrial Applications	University of Perugia (Italy-Coordinator), Partners: Fiat Research Center (Italy), Lulea University of Technology (Sweden), INASMET (Spain), Industria Auxiliar Alavesa S.A. (Spain), Foundation of Research and Technology Hellas (Greece), NetComposites Ltd (U.K), Sheffield Hallam University (U.K), Nanopowders Industries (Israel), KPA Kenett-Preminger Associates Ltd (Israel), Institute of Chemical Research (Romania), Triesa Poliamidas S.A. (Spain), LONZA SpA (Italy).		European Commission	Other
Recycling of crumb rubber and polyolefin waste by producing thermoplastic elastomers	University of Palermo (Italy-Coordinator), Partners: Institut Fuer Verbundwerkstoffe Gmbh (Germany), Institute Of Chemical Physics - Russian Academy of Sciences (Russia), National Academy of Sciences (Ukraine)		European Commission	Other
Ropa: Centrifugal Spinning Of Recycled Thermoplastic Polymer Waste	University of Leeds (UK)		EPSRC Grant Reference: GR/N23769/01	Other
Ropa: Low Cost Manufacture Of Continuous Fibre Reinforced Thermoplastic Pipes, Response To Combined Loads	University of Newcastle (UK)		EPSRC Grant Reference: GR/N37056/01	Other
Substantive Intumescent Flame Retardents For Functional Fibrous Polymers	Bolton Institute (UK), Albright & Wilson Ltd (UK)			Other
Vacuum Forming as low-cost production method for high-quality products	Dutch Composites BV (Netherlands), Proven Engineering Products Ltd (UK)		European Commission	Other
High performance economical efficient continuous fibre reinforced thermoplastic protective toe cap	Esjot-Goldenberg SA (France-Coordinator), BR Goodrich Chemicals NV (Belgium), Bond-Laminates gmbh (Germany), IVW (Germany), PERA (UK), Urho Viljanmaa oy-Jalas (Finland), Weiser gmbh (Germany), tec-knit (Germany)		European Commission	Sports
Collaboration With Ericsson In The Development Of A Mobile Phone	INASMET (E), Ericsson	Mechanical test facilities (INASMET)	Private	Telecomms
Development of a low cost plastic composite (crop waste / thermoplastic matrix) to manufacture water contact applications	Mifsud SL (Spain - Coordinator) N.Linos Ltd (Greece),		European Commission	Water/Gas
Filament Winding of Thermoplastic Composites	INEGI - Institute of Mechanical Engineering and Industrial Managment (Portugal), Vidropol S.A. (Portugal), University of Minho (Portugal)	Hydraulic press, 200T, 400x400mm, for moulding thermoplastic sheet materials, Pultrex Filament Winding Machine, The towpreger machine developed at INEGI, Instron 4208 univeral testing machine, 300kN load cell.	ICPME 2000-2001	Water/Gas

Title	Researchers	Infrastructure	Funding Body	Sector
<b>Europe</b>				
Research and development of an intelligent power and data transmission composite coiled tubing for the exploration of hydrocarbons	Shell International Exploration & Production BV (Netherlands - Coordinator), Partners: Airborne Development BV (Netherlands), BJ Services Company Ltd (U.K), BJ Services International BV (Netherlands), Corrocean ASA (Norway), Deutag Europe (Germany), Katholieke University Leuven (Belgium), Smartec SA (Switzerland), Swiss Federal Institute of Technology (Switzerland)		European Commission	Water/Gas
Recycled Waste in Highway Design and Construction	Irish Tar & Bitumen, Roadstone plc, Enterprise Ireland	Compactors (gyratory and roller) + environmental test chamber (4m x 3m x 10m) + servohydraulic machines (up to 250kN capacity) (all at UCD, Dublin)	Irish Government (Enterprise Ireland)	
Modelling thermoforming of thermoplastic composites	Ten Cate Advanced Composites, Polymer Materials & Engineering (TU-Delft), ESI	400 tons rubber forming press		Aerospace
Smart blankholder for rubber forming	Ten Cate Advanced Composites, Polymer Materials & Engineering (TU-Delft)	400 tons rubber forming press		Aerospace
Draping of Engineered Prepregs and Reinforced Thermoplastics	University of Nottingham (UK), ESI International (France), MSC. Software Ltd. (USA), Saint-Gobain Vetrotex (France), Ford Motor Company (UK), BAE SYSTEMS (UK), QinetiQ (UK), BP Amoco (UK), The University of Cambridge (UK), The University of Leeds (UK)	Software: PAMSTAMP/FORM	EPSRC Grant Reference GR/M77864/01	Aerospace Automotive Construction Defence Marine Medical Offshore/Mining Rail Sports Telecomms Water/Gas Other
Preform design for low cost composites processing	University of Nottingham (UK), Ford Motor Company (UK)	Two Dimensional Braiding Facility: 48 carrier braiding machine, a mandrel haul-off and bobbin winder, biaxial or triaxial braid, manual or PC control.	Ford Motor Company	Aerospace Automotive Construction Defence Marine Medical Offshore/Mining Rail Sports Telecomms Water/Gas Other
Diaphragm forming	Ten Cate Advanced Composites, Polymer Materials & Engineering (TU-Delft), Bond Laminates	Flat platen press, Press clave, autoclave		Aerospace Automotive Other
Liquid moulding of thermoplastic composites	DSM, Ten Cate Advanced Composites, Polymer Materials & Engineering (TU-Delft)	Mini mixing unit, Vacuum infusion equipment, 2 Tons Zwich tensile test machine		Aerospace Automotive Other
Microcracking of semi-crystalline thermoplastic composites	DSM, Ten Cate Advanced Composites, Polymer Materials & Engineering (TU-Delft), Bond Laminates	Flat platen press, DSC, DMA, Optical microscopes, SEM, 400 tons rubber forming press		Aerospace Automotive Other
Composite Structures for Pedestrian Safety	University of Nottingham (UK), St Gobain Vetrotex (France), Dow Automotive (USA), Europrojects (UK), MIRA (UK), Security Composites (UK), Ellis Developments (UK)	R-Royce IR Oven, Bradley & Turton Press, Pratt & Whitney Hot Air Oven, Vacuum table, Hounsfield Universal Testing machine, Rosand Drop load Tower, Microscope with Aphelion software, Bandsaw and Guillotine shearing machine. FE software: LS-DYNA(tm) and PAM-CRASH(tm)	EPSRC/NIMRC(Nottingham Innovative Manufacturing Research Centre)	Automotive
Crashworthy Automotive Structures Using Thermoplastic Composites	University of Nottingham (UK), ESI International (France), Pre Nexus Migration (UK), Rover Group Ltd (UK), Motor Industry Research Association (UK), Ford Motor Co Ltd (UK), SAINT-GOBAIN VETROTEX INTERNATIONAL S.A. (France), Borealis AS (Norway)		EPSRC Grant Reference: GR/M26640/01	Automotive
Hybrid processing of composite/metal laminates for lightweight automotive body structures	University of Nottingham (UK), Ford Motor Company (USA), Aican International (UK), Ford Motor Company (UK)		Ford Motor Company	Automotive
Research, Development And Demonstration Of Novel Processing Techniques For Structural Thermoplastic Composite Poles	Euro Projects (Lttc) Ltd (UK), Gt Glasfiber (Denmark), Twinrov A/S (Denmark), Saertex Wagener GmbH & Co. Kg (Denmark), Canzeal Enterprises Ltd. (Canada), Accusoft Services Corporation (Canada)		Eureka, E! 2534 - THERMOPOLE	Construction Telecomms Other
Development of advanced Microwave and light-weight high-speed thermo-Response Mould Technology for woven textile-reinforced thermoplastic Components	Katholieke Universiteit Leuven (Belgium-Coordinator), Cooperative Verkoop-en productieverenging van aarappelme (Netherlands), Cree AG (Switzerland), Cyclics Corporation(USA), Eurocarbon BV (Netherlands), IFP Sicomp AB (Sweden), Kunststofftechnik Beiner KG (Germany), Regoplas AG (Switzerland), Stewart Automotive Research LLC (USA), Structoform Spritzgiessen Anisotroper Strukturkomponenten GM (Germany), Weber Manufacturing Limited (Canada)	Braiding equipment at Eurocarbon, moulds and mould-making at Beiner, Injection moulding at Beiner, injection equipment at Structoform, dynamic heating and cooling at Regloplas, braiding equipment and analysis equipment at IFPSCOMP, full scale resin impregnation equipment at KULeuven, analysis equipment at KULeuven.	European Commission	Other

Title	Researchers	Infrastructure	Funding Body	Sector
<b>Europe</b>				
Bomb Blast Protection using Novel Lightweight Materials	University of Liverpool (UK), University of Cape Town (South Africa), LINPAC Environmental (UK), Gluco Ltd (Leeds Innovation Centre) (UK), BP Ltd (Braeside) (UK)		EPSRC Grant Reference: GR/S64165/01	Construction Defence
Environment-friendly packaging solutions for enhanced storage and quality of southern Africa's fruit and nut exports	Swedish Institute for Food Research & Biotechnology (Sweden-Coordinator), University of Pretoria (South Africa), Institute of Food Research (UK), Council for Scientific and Industrial Research (South Africa), Universidade Eduardo Mondlane (Mozambique), University of Mauritius (Mauritius), National Research Council of Italy (Italy)		European Commission	Other

Title	Researchers	Infrastructure	Funding Body	Sector
<b>North America</b>				
Dry Ribbon for Heated Head Automated Fiber Placement	Old Dominion University (US), NASA Langley Research Center (US), Cytec-Fiberite (US)	Automated tape placement machines (Cincinnati and NASA), universal testing machines		Aerospace
Influence of Clay Exfoliation On The Physical Properties of Montmorillonite/Polyethylene Composites	Queen's University (Canada), Nanocor (US), Alcan (US)	Scintag XDS 2000 diffractometer, Reologica ViscoTech instrument, Seiko series differential scanning calorimeter (DSC), Monsanto T-10 universal testing machine, Rotational and capillary rheometers for rheological characterization of polymer melts, ZSK-30mm twin-screw extruder and a Haake PolyLab batch mixer/single screw extruder, injection molding equipment, optical shearing system, including hot stage and microscope	Natural Sciences and Engineering Research Council (NSERC)	Aerospace
Low-Cost, Thermoplastic Composite Processing for Open-Section Structural Components	Automated Dynamics Corp. (US)		NSF SBIR (award 22624)	Aerospace
Prediction of Long-Term Strength of Thermoplastic Composites Using Time-Temperature Superposition	NASA Langley Research Center (US)		NASA	Aerospace
Self-Reinforced Polymers For Aircraft Cabin Interiors	Maxdem Inc. (US)		NSF SBIR (award 26961)	Aerospace
Tape-Drop Transient Model For In-Situ Automated Tape Placement Of Thermoplastic Composites	NASA Langley Research Center (US), Old Dominion University (US)		NASA	Aerospace
Thermal/Mechanical Response of a Polymer Matrix Composite at Cryogenic Temperatures	NASA Langley Research Center (US)	Vacuum consolidation equipment, dynamic mechanical analyser, universal testing machine		Aerospace
Use of Guided Acoustic Waves to Assess the Effects of Thermal-Mechanical Cycling on Composite Stiffness	NASA Langley Research Center (US)		NASA	Aerospace
Investigations on Transport Phenomena Governing Interfacial Bonding Evolution in Thermoplastic Composites	Univ of Connecticut (US)		NSF SBIR (award 9912093)	Aerospace Automotive
Modeling Of Forming Of Fabric-Reinforced Thermoplastic Composites	Industrial Materials Institute, NRC (Canada)			Aerospace Automotive
Low Cost Non-Autoclave Processing Of Ultrahigh-Modulus Carbon Fiber Thermoplastic Composites	Taylor S R & Assocs (US), Thermoplastic Pultrusions Inc (US)	Thermoplastic pultrusion equipment	NSF SBIR (award 16001)	Aerospace Automotive Construction Sports
Accelerated Strength Testing of Thermoplastic Composites	NASA Langley Research Center (US), Texas A&M University (US)	Hydraulic universal testing machine with environmental chamber and hydraulic wedge grips		Aerospace Automotive Defence
Curie Temperature Control Of The Induction Heating Process	University of Delaware (US)		Army Research Laboratory Materials Center of Excellence (US)	Aerospace Automotive Defence
Incorporation of Carbon Nanotubes into Nylon Filaments	Eltron Research, Inc (US)		NSF SBIR (award 0321695)	Aerospace Automotive Defence
Intelligent Material and Process Design for Stamping of Structural Composites	Northwestern University (US), University of Massachusetts (US), Ford Scientific Research Laboratory (US)	ABAQUS/Standard, oven, press	National Science Foundation and Ford Motor Company (US)	Aerospace Automotive Defence
A Partnership for Innovations in Nanocomposites Technology	Tuskegee University (US), Advanced Composite Technologies & Associates Inc. (US), Auburn University (US), NANOTEK Instruments Inc. (US)	Extrusion machine, compression molding machine, Rheometric Minimat Test machine.	NSF partnerships for innovation program (US)	Aerospace Automotive Defence Medical Sports

Title	Researchers	Infrastructure	Funding Body	Sector
North America				
Center for Advanced Polymer and Composite Engineering	Ohio State University (US), Florida State University (US), University of Wisconsin at Madison (US)		National Science Foundation Industry/University Cooperative Research Center (US)	Aerospace Automotive Defence Medical Sports Telecomms Other
Interphase Development for Nanofiber Reinforced Thermoplastic Composites	Applied Sciences, Inc (US)		NSF SBIR (award 0060540)	Aerospace Automotive Defence Sports
Mechanism of Deformation and Toughening in Amorphous and Semi-crystalline Thermoplastics Modified with Micro and Nano-scale Fillers	MIT (US)			Aerospace Automotive Medical Sports
The synthesis of carbon nanotube-thermoplastic composites	University of Delaware (US)	Hot press, universal testing machine	National Science Foundation (US)	Aerospace Automotive Medical Sports
Thermal And Electrical Analysis Of Vapor Grown Carbon Nanofiber (Vgcnf)/ Lcp Composites	Department of Mechanical Engineering, University of Texas Pan American (US)	Haake Rheomixer 600 miniaturized internal mixer for mixing LCP and nano fibres, TA Instrument TGA-DTA 2960 for thermal gravimetric analysis, TA Instrument DSC 2010 for differential scanning calorimetry, JANDEL Model RM2 resistivity apparatus.	National Science Foundation (US), Texas Advanced Research (Technology) Program	Aerospace Automotive Medical Telecomms Other
Pultrusion of Carbon Fiber Reinforced Thermoplastic Composites	Quadrax Advanced Materials, Systems, Inc (US), Morrison Molded Fiber Glass (US), Lockheed (US), Composite Structures (US)		NSF SBIR (award 26472)	Aerospace Construction
A Simplified Method Of Determining "Effective" Composite Lamina Elastic Properties	Wichita State University (US), Absolute Value, Inc. (US)			Aerospace Defence
Alternative Heating Technology for Thermoplastic Composites and Adhesive Bond Processing	Production Products Mfg & Sales, Inc (US), Southern Research Institute (US), McDonnell Douglas Aerospace (US)		NSF SBIR (award 36970)	Aerospace Defence
Effect Of Elevated Temperature And Loading Rate On Delamination Fracture Toughness	NASA Langley Research Center (US), Nebraska University (US), Baylor University (US)	100 kN hydraulic testing machine, 4.4 kN inline load cell, environmental chamber		Aerospace Defence
Rapid Automated Induction Lamination	University of Delaware (US)		Army Research Laboratory Materials Centre of Excellence (US)	Aerospace Defence
Self-healing structural composites with electromagnetic functionality	University of California San Diego (US)	ARO DAAD19-00-1-0525 to the University of California, San Diego		Aerospace Defence Medical Telecomms Other
Tensile Response Of Carbon Nanocomposites	Tuskegee University's Center for Advanced Material (T-CAM)	Mechanical blender, Wayne Yellow Label Table Top Extruder, Wayne Desktop Filament Winder, Tetrahedron MTP Press Compression Molder, JEOL JSM 5800 Scanning Electron Microscope (SEM), Phillips-201 Transmission Electron Microscope (TEM), Rigaku D/MAX 2200 X-Ray Diffractometer, TA Instruments Thermo Gravimetric Analysis (TGA), ISOMET Cutter, Universal Analysis 2000-TA Instruments data acquisition system, Rheometric Minimat tensile tester with 1 kN Load Cell.	Ship Structures Division of the Office of Naval Research (Grant No. N00014-90-J-11995) and the National Science Foundation (Grant No. HRD -976871)	Aerospace Marine Other
Conductivity Of Thermoplastic Composites Compounded Of Glass Fibers And Carbon Nanofibers	General Motors (US), Applied Sciences, Inc. (US)	Bench-top CS-183 MiniMax Molder by Custom Scientific Instruments used for fabricating carbon nanofiber/polymer composite specimens, Brabender Plasti-Coder DIGI system mixer (C.W. Brabender Instruments, Inc.)		Aerospace Medical Telecomms Other
AUTO21 polymer composites	École Polytechnique, Concordia University, University of British Columbia, Université de Sherbrooke, University of Toronto, University of New Brunswick, Université de Québec à Trois-Rivières, University of Toronto, Royal Military College of Canada, Queen's University, McGill University (all Canada), Ford Motor Company (US)		AUTO21 (Canada)	Automotive

Title	Researchers	Infrastructure	Funding Body	Sector
<b>North America</b>				
Green Composites From Natural Fibers And Bacterial Bioplastic	Michigan State University (US)	Vacuum oven for drying pellets and fibres, twin-screw extruder ZSK 30 (Werner-Pfleiderer), 6 temperature zones, 85-ton Cincinnati-Milacron press, injection moulding machine, United Calibration Corp SFM – 20 universal testing machine, TMI notch cutter, Testing Machines Inc. 43-02-01 Monitor/Impact testing machine, 5 ft-lb pendulum, TA instruments 2980 Dynamic Mechanical Analyzer (DMA).	NSF/PREMISE Award Number DMI 225925, Year 2002	Automotive
Impact Behavior Of Long Fiber Thermoplastic (Lft) Composites	The University of Alabama at Birmingham (US), Southern Research Institute (US)	Gas-gun for impact testing, 10 m/s to 100 m/s, 38.1 mm diameter projectiles, ProChrono Digital chronographs for measuring incident and residual velocity of projectiles.	Department of Transportation, Federal Transit Administration Project AL-26-7001	Automotive
Injection Molded Eco-Friendly Biocomposites From Natural Fiber And Cellulosic Bio-Plastic	Michigan State University (US)	Twin-screw extruder for melting, mixing and extruding material, United Calibration Corp. SFM-20 universal testing machine, Izod impact tester from Testing Machines Inc. 43-OA-01, TMI Notching Cutter TMI 22-05, TA dynamic mechanical analyzer (DMA) 2980	NSF/Environmental Protection Agency (Award No. DMI-0124789)	Automotive
Innovative Cost-Effective Long-Fiber Thermoplastic Composites for Next-Generation Vehicles Applications	Frontier Polymers (US)		NSF SBIR (award 0232706)	Automotive
Modeling of Co-mingled Glass/Thermoplastic Fabrics for Low Cost/High Volume Composites Manufacturing	Univ of Mass Lowell (US), Ford Motor Company (US)		NSF SBIR (award 9800483)	Automotive
Molecular Composite Plastics For Lightweight Green Cars	Maxdem Inc. (US)		NSF SBIR (award 27221)	Automotive
Sustainable Composite Materials from Renewable Resources for Automotive Applications	Michigan State University (US)		NSF Technology for a Sustainable Environment (US)	Automotive
Thermoplastic Composite With Aligned Vgcf Fiber	Ohio University (US)	Coperion Buss Kneader for compounding VGCF-Nylon 6 pellets, Pro-Fax 6301 dual shell dry blender for blending master-batch and polymer pellets, Leistritz LSM 30.34 twin screw extruder used for mixing, melting, and extruding, Tinius Olsen 1000 tensile test machine, 500N load cell, MTS MODEL 632.11B-20 extensometer, Jeol JSM-5300 scanning electron microscope		Automotive
Thermoplastic Matrix Composites For Structural Automotive Applications	University of Michigan-Dearborn (US)		Department of Energy CARAT program (US)	Automotive
Cellulose Fiber-Reinforced Thermoplastic Composites: Processing and Product Characteristics	Virginia Polytechnic Institute and State University (US)			Automotive Construction
Melt-Blended Wood Fiber-Thermoplastic Composites	Forest Products Laboratory (US)			Automotive Construction
Straw-thermoplastic composites	Idaho National Engineering and Environmental Laboratory (US)			Automotive Construction
Rotationally Molded Liquid Crystalline Polymers	Luna Innovations Incorporated (US), Virginia Polytechnic Institute and State University (US)	Instron 4202 universal testing machine, laboratory scale rotational molding equipment		Automotive Construction Marine Sports Water/Gas Other
Active Metal Joining of Thermoplastic Matrix Composites	Oryx Technology, Inc. (US)		NSF SBIR (award 26296)	Automotive Defence
Metallic Coil-Polymer Braid Composites: Material Processing and Characterization	Center of Excellence for Advanced Materials University of California San Diego (US), Drexel University (US)	Braiding machine (Drexel University)		Automotive Defence Telecomms
The Effect Of Fiber Misalignment On Parameter Determination Using Picture Frame Test	McGill University (Canada), Industrial Materials Institute, NRC (Canada)		CliMRI	Automotive Other

Title	Researchers	Infrastructure	Funding Body	Sector
Fracture Characterization Of Engineering Thermoplastic Blends And Composites	University of Texas at Austin (US)			Automotive Sports Telecomms
The Effects of Weathering on Wood-Thermoplastic Composites Intended for Outdoor Applications	Forest Products Laboratory (US), University of Wisconsin (US), Teel-Global Resource Technologies LLC (US)	Compression moulding equipment, Minolta CR-200 Chroma Meter, universal testing machine		Construction
Thermoplastic Materials For Rigidizable Space Systems	University of Delaware (US)		ILC Dover (US)	Construction
Application of Self-Reinforced Thermoplastics as Lightweight Armor Materials	Maxdem, Inc. (US)		NSF SBIR (award 26471)	Defence
Automated Fiber Placement (AFP) Process for Polymer Composite Sabots	AUTOMATED DYNAMICS CORP. (US)		NSF SBIR (award 32807)	Defence
Composite Materials for Ballistic Protective Helmets	U.S. Army Soldier and Biological Chemical Command, Natick (US)	V50 ballistic impact test facilities		Defence
Long fiber reinforced thermoplastics for military applications	U.S. Army Research Laboratory, Aberdeen Proving Grounds, MD, USA University of Alabama at Birmingham, AL, USA National Composites Center, Kettering, OH, USA.		US ARL	Defence
Moldable Self-Reinforced Plastics for Lightweight Rocket Components	Maxdem, Inc. (US)		NSF SBIR (award 28077)	Defence
Non-Polluting Composites Remanufacturing and Repair for Military Application	U.S. Army Research Laboratory			Defence
Processing and Characterization of Welded Bonds Between Thermoset and Thermoplastic Composites	Army Reseach Laboratory (US), Swiss Federal Institute of Technology (CH), University of Delaware (US)	Autoclave, resistance welder	US Army	Defence
Self-Reinforced Rigid Plastics for Body Armor Applications	Maxdem, Inc. (US)		NSF SBIR (award 32917)	Defence
An Advanced Composite Postformable Bone Plate	Sparta Inc (US)		NSF SBIR (award 17418)	Medical
Graphite Nanoplatelets As Nano-Reinforcements For Polymers: Comparison Between A Thermoset And A Thermoplastic Matrix	Michigan State University (US)	Ultrasonic processor for pulverising graphite flakes, vibratory mill for milling graphite flakes, DSM Micro 15 Compounder, (vertical, co-rotating twin-screw microextruder) for melt-blending polymer and reinforcement, Daga Micro Injector for injection moulding test specimens, United Calibration Corp.universal testing machine	NASA LaRC, "Graphite Nanoreinforcements for Aerospace Nanocomposites" NAG1-01004	Medical Telecomms Other
Effects of Geometric Optimization of Plug-supported End-caps on the Performance of Thick Thermoplastic Composite Pressure Vessels under External Hydrostatic Pressure	University of Hawaii at Manoa (US)			Offshore/Mining Water/Gas
Design and Manufacture of Stitch Bonded Thermoplastic Textile Composites	Auburn University (US), National Research Center (Egypt)		NSF SBIR (award 9811019)	Aerospace Automotive

Title	Researchers	Infrastructure	Funding Body	Sector
<b>Rest of the World</b>				
A method of stress analysis for interfacial property evaluation in thermoplastic composites	The University of Tokyo (Japan), Science University of Tokyo (Japan)	Single fibre pull-out apparatus, photolithography, optical microscope equipped with a CCD camera and tensile loading device.		Aerospace Automotive Construction Defence Marine Medical Offshore/Mining Rail Sports Telecomms Water/Gas Other
An intelligent inverse method for characterization of textile reinforced thermoplastic composites using a hyperelastic constitutive model	McGill University (Canada)	Instron tensile test machine mounted with a 1 kN load cell and a temperature-conditioning chamber.		Aerospace Automotive Construction Defence Marine Medical Offshore/Mining Rail Sports Telecomms Water/Gas Other
Characterization of boundary conditions during thermoplastic composite tape lay-up process using an inverse method	Seoul National University (Korea)			Aerospace Automotive Construction Defence Marine Medical Offshore/Mining Rail Sports Telecomms Water/Gas Other
Computer-Aided Thermoforming Of Frtp With Digital Image-Based Measurement Of Large Strain Distribution	Department of Manufacturing Science, Osaka University (Japan), Department of Mechanical Engineering, Osaka Prefectural College of Technology (Japan)			Aerospace Automotive Construction Defence Marine Medical Offshore/Mining Rail Sports Telecomms Water/Gas Other
Evaluation of bias-extension and picture-frame test methods for the measurement of intraply shear properties of PP/glass commingled fabrics	National Research Council (Canada)	Instron tensile test machine mounted with a 1 kN load cell and a temperature conditioning chamber, bias extension rig, picture frame rig.		Aerospace Automotive Construction Defence Marine Medical Offshore/Mining Rail Sports Telecomms Water/Gas Other
Fabrication and mechanical properties of aramid-nylon plain knitted composites	Kyoto Institute of Technology (Japan)	Differential scanning calorimeter (DSC, 7-series, Perkin-Elmer Instruments, MA), hot plate moulding, Instron Universal Testing Machine (type 4206)		Aerospace Automotive Construction Defence Marine Medical Offshore/Mining Rail Sports Telecomms Water/Gas Other
Non-orthogonal constitutive equation for woven fabric reinforced thermoplastic composites	Michigan State University (US), Seoul National University (South Korea)	ABAQUS explicit FEA software	Korea Science and Engineering Foundation (KOSEF)	Aerospace Automotive Construction Defence Marine Medical Offshore/Mining Rail Sports Telecomms Water/Gas Other
Organic short fibre/thermoplastic composites: morphology and thermorheological analysis	Laval University (Canada), Université Claude-Bernard (France)	Leistritz LSM-30-34 co-rotating twin-screw extruder, Liquid proton nuclear magnetic resonance spectroscopy (Bruker AC-300), scanning electron microscopy (JEOL JSM 840A)	Natural Sciences and Engineering Research Council (Canada)	Aerospace Automotive Construction Defence Marine Medical Offshore/Mining Rail Sports Telecomms Water/Gas Other

Title	Researchers	Infrastructure	Funding Body	Sector
Rest of the World				
Processing and characterization of 3D woven and braided thermoplastic composites	Feng Chia University (Taiwan)	3-axis orthogonal weaving machine, braider, compression molding equipment, Instron 4468 universal testing machine.	National Science Council of Taiwan, R.O.C. (grant NSC 87-2216-E-035-025)	Aerospace Automotive Construction Defence Marine Medical Offshore/Mining Rail Sports Telecomms Water/Gas Other
Study On The Formability Of Thermoplastic Laminar Composite Depending On The Types Of Fabric	Yeungnam University (Korea)	Press for consolidation of thermoplastic composites, bandsaw for cutting materials, Image-Pro V3 image analysis software		Aerospace Automotive Construction Defence Marine Medical Offshore/Mining Rail Sports Telecomms Water/Gas Other
The effects of hole locations and hole sizes on damaged behaviour of woven thermoplastic composites	School of Industrial Technology, Universiti Sains (Malaysia)	SIRNA prepregger system, compression molding equipment.		Aerospace Automotive Construction Defence Marine Medical Offshore/Mining Rail Sports Telecomms Water/Gas Other
The influence of interfacial adhesion, particle size and size distribution on the predicted mechanical properties of particulate thermoplastic composites	University of Pretoria (SA)	Compression moulding equipment		Aerospace Automotive Construction Defence Marine Medical Offshore/Mining Rail Sports Telecomms Water/Gas Other
The manufacturing of thermoplastic composite parts by water-assisted injection-molding technology	Chang Gung University (Taiwan)	Lab scale water injection unit, 80-ton reciprocating injection-molding machine, LabVIEW software (National Instruments USA), scanning electron microscope (Jeol Model 5410)	National Science Council of Taiwan, ROC (grant NSC91-2216-E-182-005)	Aerospace Automotive Construction Defence Marine Medical Offshore/Mining Rail Sports Telecomms Water/Gas Other
Thermoplastic Polymer Fibre Composites	Cooperative Research Centre for Polymers (Australia)			Aerospace Automotive Construction Defence Marine Medical Offshore/Mining Rail Sports Telecomms Water/Gas Other
Electrical and impact properties of the hybrid knitted inlaid fabric reinforced polypropylene composites	National Taipei University of Technology (Taiwan), Chinese Culture University of Technology (Taiwan), Aerospace Industrial Development Corporation (Taiwan), Electronics Test Center (Taiwan)	Fibre commingling equipment, 5G semi-automatic flat knitting machine, compression moulding equipment, electromagnetic radiation test equipment, drop-weight impact test machine.		Aerospace Automotive Construction Defence Marine Medical Telecomms Other
Stamp forming of locally heated thermoplastic composites	National Yunlin University of Science and Technology (Taiwan)	Infrared strip heater, press		Aerospace Automotive Construction Defence Medical Rail Sports
Electromagnetic shielding effectiveness of copper/glass fiber knitted fabric reinforced polypropylene composites	National Taipei University of Technology (Taiwan), The National University of Singapore, Chinese Culture University of Technology (Taiwan)			Aerospace Automotive Construction Defence Medical Telecomms Other
Influence of solid lubricants and fibre reinforcement on wear behaviour of polyethersulphone	Indian Institute of Technology, Delhi (India)	Du Pont 2100 thermal analyser (DCS, TGA etc.), pin-on-disc wear rig.	Council for Scientific and Industrial Research (India)	Aerospace Automotive Defence Other

Title	Researchers	Infrastructure	Funding Body	Sector
<b>Rest of the World</b>				
Effect of alkyl quaternary ammonium on processing discoloration of melt-intercalated PVC-montmorillonite composites	Shanghai Jiao Tong University (China)	Haake Rheocord 90 for melt-blending, compression moulding equipment, Dmax-rC X-ray diffractometer, Jem-1200EX transmission electron microscope (TEM), Leica Ultracut UCT microtome, Perkin-Elmer Paragon 1000 Fourier transform infrared spectrometer, Perkin-Elmer Lambda 20 UV-VIS spectrometer, Perkin-Elmer TGA7 thermal analysis system, Spherical Hazemeter M57, Rheometric Scientific(tm) ARES (Advanced Rheometric Expansion System), Instron 4465 Universal Tensile Tester, Ray-Ran Universal Pendulum Impact Tester		Aerospace Automotive Defence Sports Telecomms Other
Characteristics of CF/PEI tape winding process with on-line consolidation	University of Sydney (AU)	Tape winding apparatus.	University of Sydney, Australian Research Council (ARC)	Aerospace Automotive Defence Sports Water/Gas Other
Interlaminar fracture toughness of CF/PEI composites at elevated temperatures: roles of matrix toughness and fibre/matrix adhesion	University of Sydney (AU)	Instron 5567 universal testing machine with environmental chamber, compression moulding press with heating.		Aerospace Defence
Resistance welding of thermosetting composite/thermoplastic composite joints	University of Sydney (AU)			Aerospace Defence
The dependence of the fracture toughness of thermoplastic composite laminates on interfacial interaction	Zhongshan University (China), Guangdong University of Technology (China)		National Natural Science Foundation of China (Grant No. 59725307)	Aerospace Defence Sports Other
Interlaminar fracture properties of fibre reinforced natural rubber/polypropylene composites	The National University of Malaysia	Compression moulding equipment, SEM, SINTECH 6 universal testing machine with TestWorks(tm) software		Automotive
Effects Of Processing Condition On Morphology And Mechanical Behaviour Of Pp/Pp Composites	Hong Kong University of Science and Technology (Hong Kong), Sumitomo Chemical Co. Ltd. (Japan), Kyoto Institute of Technology (Japan), Tokyo Institute of Technology (Japan)	10-hole spinneret for melt-spinning fibres, drawing machine (HW-500: Ohba Kikai), scanning electron microscope (SEM), programmable hot press machine (PHI DT5000), universal testing machine with environmental chamber, video extensometer, CEAST Razor Notching Machine for machining Charpy notches.		Automotive Construction Medical Sports Water/Gas Other
The Effect of Silane Coupling Agents with Different Organofunctional Groups on the Interfacial Characteristics of Glass Fiber-Reinforced Nylon 6 Composites	Kumoh National Institute of Technology (Korea), Korea Institute of Science and Technology (Korea)	Heated press, thermogravimetric analyzer (TGA 951, TA Instrument), Instron 4467 universal testing machine, dynamic mechanical analyzer (DMA 983, TA Instrument)	Ministry of Science and Technology, Korea.	Automotive Construction Offshore/Mining Rail Sports Telecomms Water/Gas Other
A model for a thermoplastic pultrusion process using commingled yarns	Seoul National University (South Korea), IWV (Germany)	Laboratory scale thermoplastic pultrusion machine, universal testing machine (Zwick 1485) equipped with a hot chamber, optical microscope.	Korea Ministry of Science and Technology	Automotive Construction Other
A Study on Biodegradable Composite Prepared from Jute Felt and Polyesteramide (BAK)	N.S.M. City College (India), Indian Jute Industries Research Association, Michigan State University (US), Ravenshaw College (India)	Compression moulding equipment, Instron IX-4303 universal testing machine, Mettler TC 11 4000 thermal analyzer, Nicolet Magna-IR 550 spectrophotometer, Cambridge Stereoscan 100 SEM		Automotive Construction Other
Injection molded wood-polypropylene	Forestry and Forest Products Research Institute (Japan), Chinese Academy of Forestry	Please detail the key items of equipment used, together with their location Oven, high speed mixer, co-rotating intermeshing twin-screw extruder, rotary microtome equipped with a glass knife (Microm HM 340E), scanning electron microscope (Jeol JSM-840).		Automotive Construction Other
The mechanical properties of unidirectional thermoplastic composites manufactured by a micro-braiding technique	Kyoto Institute of Technology (Japan), University of Tokyo (Japan)	Compression moulding equipment, universal testing machine		Automotive Defence
Pp/Gf/Epr Composites - Deformation Mechanism	Sharif University of Technology (Iran), University of Pisa (Italy)			Automotive Sports Other

Title	Researchers	Infrastructure	Funding Body	Sector
<b>Rest of the World</b>				
Characterization Of Toughening Behavior In Fiber-Containing Rubber-Toughened Nylon 6.6	University of Sydney (AU), Nanyang Technological University (Singapore)			Automotive Sports Telecomms Other
Impact Fatigue Of Thermoplastic Composites	Yamagata University (Japan)			Construction Offshore/Mining Water/Gas
Thermal de-consolidation of thermoplastic matrix composites - migration of voids and re-consolidation	University of Sydney (AU)		Australian Research Council (ARC)	Construction Water/Gas
Advanced Composites for Orthopaedic Applications	Advanced Composites Mission (India), M/s. S H Pitkar Orthotools Pvt. Ltd (India)			Medical
Feasibility of knitted carbon/PEEK composites for orthopedic bone plates	The National University of Singapore, Tongji University (China), Kyoto Institute of Technology (Japan)	Micro-braiding equipment, hot press, INSTRON universal testing machine (Type 4303)		Medical
Mechanical Properties Of Injection Molded Hydroxyapatite-Polyetheretherketone Biocomposites	Nanyang Technological University (Singapore)			Medical
Production And Evaluation Of Biodegradable Composites Based On Phb-Phv Copolymer	Nanyang Technological University (Singapore)			Medical
Jute-Thermoplastic Composites for Footwear	Advanced Composites Mission (India), APL Polyfab (P) Ltd (India), Indian Jute Industries Research Association			Medical Sports Other

# Annex 3: Bibliography & References

## Bibliography of Publications Scanned

Journal of Thermoplastic Composite Materials  
Sage Publications

Composite Science and Technology  
Elsevier Ltd

Polymer  
Elsevier Ltd

NetComposites News, 2001-2004  
NetComposites Ltd

Composites Part A  
Elsevier Ltd

ECCM 10: European Conference on Composite Materials  
Brugge, June 2002

Polymer Testing  
Elsevier

ICC4: International Conference on Composite Materials  
San Diego, July 2003

Journal of Materials Processing Technology  
Elsevier

Advanced Composites Bulletin, 1999-2004  
International Newsletters Ltd

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Dayton, September 2003

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European Foundation for the Improvement of Living and Working Conditions, 2003