European Commission

THE FIFTH FRAMEWORK PROGRAMME

The Fifth Framework Programme focuses on Community Activities in the field of research, technological development and demonstration (RTD) for the period 1998 to 2002

WORK PROGRAMME

COMPETITIVE and SUSTAINABLE GROWTH

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1. INTRODUCTION

RTD&D activities should help to prepare the policy making, industrial and related service sectors for the challenges of the new millennium and to generate a strategic vision of research in all sectors throughout Europe. They will focus on clearly identified needs and on improving the information available to policy makers about the implications of technological and organisational change and opportunities for, and the effectiveness of, policy measures.

The structure of the programme "competitive and sustainable growth" giving support to the systems approach comprises three elements:

(i) A set of four key actions oriented to solve clearly identified socio-economic problems by developing critical technologies or methodologies and clustering, when appropriate, small and large, research and demonstration projects of industrial, basic, policy-driven or applied nature around specific and strategic common challenges:

- **innovative products, processes and organisation**
- **sustainable mobility and intermodality**
- **land transport and marine technologies**
- **new perspectives in aeronautics**

These actions will combine efforts in various research areas (e.g. materials, chemistry, physics, application of information technologies, clean technologies, human factors, socio-economic research, as well as training or accompanying measures) in order to achieve their objectives. The achievement of a critical mass will be essential to attain concrete and visible RTD results. This would necessitate, as appropriate, mobilising national and Community resources, in particular through calls for proposals targeted on RTD priorities and launched in these key actions to concentrate and better co-ordinate RTD efforts towards strategic European objectives, including pre-normative research in support of standardisation.

(ii) RTD on generic technologies helping to develop the scientific and technological base as well as qualified human capital in critical areas, and giving support to innovation across a range of applications:

- **materials and their production and transformation**
- **new materials and production technologies in the steel field**
- **measurements and testing**

(iii) Support for the more efficient utilisation of existing research infrastructures to provide an attractive networked environment in the fields covered by this programme.

Activities will be integrated and co-ordinated as necessary, within and between the different key and generic actions as well as with other programmes of FP5, with the JRC and with national programmes. This should provide mechanisms by which stakeholders including industry, public authorities and the research community can work jointly in response to common strategic problems.

2. KEY ACTIONS - DETAILS OF OBJECTIVES AND RTD PRIORITIES

2.1 INNOVATIVE PRODUCTS, PROCESSES AND ORGANISATION [1]

SOCIO-ECONOMIC OBJECTIVES AND EXPECTED OUTPUTS

A competitive industry of the future should play a key role in contributing to sustainable development through reduction of material content of products whilst increasing their service value, and through innovative, safer, cleaner and low natural resource intensity processes and products-services. Also new methods of organising production, service and logistics should be sought that reduce costs, time-to-market and make optimal use of human resources. Since industrial economic strength has increasingly been found in closely webbed interdependencies between firms, organisations and institutions, research objectives have to be considered not just within individual plants, construction sites or industries but throughout the extended value chains from raw materials to end-use products and services. Indicative medium term goals to which this Key Action should significantly contribute include:

a) *Contributing to modernisation of industry and adaptation to change*, through the combined effects of improved industrial capability and innovation capacity, while introducing more flexibility and capability to respond in real time to customer needs. Research should stimulate cross-sectoral exchanges and participation of SMEs, taking into account their specific needs and roles in the supply chain as well as approaches able to create and hold in Europe sufficient jobs to arrest the decline of industrial employment while improving the overall quality of work.

b) *Substantially [2] improving overall quality* within the value chain (quality is intimately linked to value for and timely satisfaction of customer needs at the lowest costs) and consequently *reducing "inefficiencies" and* overall *life-cycle product costs* by the same order of magnitude;

c) *Minimising resource consumption* (e.g. materials, energy, water) to *reduce substantially the overall "life cycle" impact of "product-service" provision and use.*

These goals should be dealt with in a synergetic way. They should not be regarded as absolute targets for individual projects but rather as broad indications of the direction towards which the European industrial system, supported by improved regulations, should evolve.

RESEARCH OBJECTIVES

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[1] This key action is addressed to all productive sectors (either high-tech or traditional ones), including related services. The term production covers all activities in the product cycle including extraction of raw materials manufacturing, processing, construction, distribution, servicing and recovery of end-products. The term "product" ranges from pre-processed raw materials, through intermediate materials, components and systems to mass produced or one-of-a-kind end-products or structures and associated services. The term « product-service » should be understood as physical products, which offer combined or integrated associated services. The term « Innovative products, … » in this context does not mean that any development of innovative product or process can be proposed for funding. Only proposed research activities can be accepted which meet the criteria described in this chapter..

[2] The term « substantially » means over 20-30% in the shorter term or over 10% per year in the longer term.

The Key action RTD objectives address critical problems linked with the research of efficiency, intelligence, environmental friendliness and organisation, around the three major phases of the industrial production lifecycle (see table below). The main challenge will be to integrate the complete aspects of design, production, operation/use and re-use until the end of the operative life, at both technical and organisational levels. This integrating task should bring together stakeholders sharing common strategic objectives and aiming at the development, validation and demonstration of new concepts, processes and systems. The RTD activities should combine, as appropriate, social science and organisational aspects with the classical priority technological developments, leaving to the participants their identification, choice and application.

PHASES / OBJECTIVES	A. DESIGN and PRE-PRODUCTION	B. PHYSICAL PRODUCTION	C. OPERATION & END-OF-LIFE
1.1. Efficient production	**1.1.1.** Integrated product-service design	**1.1.2.** Advanced production / construction technologies	**1.1.3.** Safe and reliable extended life of products and industrial systems
1.2. Intelligent production	**1.2.1.** Design of products and production systems	**1.2.2.** Intelligent manufacturing and processing	**1.2.3.** Monitoring and optimal use of industrial systems
1.3. Eco-efficient processes and design	**1.3.1**. Eco-efficient design of products and processes	**1.3.2.** Cleaner processes, products, and eco-efficient technologies	**1.3.3.** Product recovery and waste recycling
1.4. Organisation of production and work	**1.4.1.** New methods of organisation, work and human capital improvement	**1.4.2**. Adaptation of enterprises and human oriented production	**1.4.3.** Knowledge, learning and management of change

RTD activities should be considered as the first phase of the development of innovative products, processes, related services, and/or organisational systems. The deliverables expected as project outputs after the development phase include therefore any marketable or transferable product, process, design method, service, standard, know-how, methodology, network experience, etc.

Objective 1.1: Efficient production, including design, manufacturing & control

The aim is to develop European approaches for improved competitiveness, by enhancing industrial output in product/service combinations through innovative technologies, development of increased added value, quality, responsiveness to market and reduced time-to-market and material content. The goal is also to consider micro- and nano-scale technologies and engineering as well as innovative industrial products and systems with improved lifecycle performances.

1.1.1: Integrated "product-service" design

The aim is to increase the added value due to high functionality and service value, to reduce material intensity in the whole life of products, including manufacturing and construction processes, and to reduce time to market of new high quality goods. RTD should support development and application of modelling, simulation, design technologies, fast prototyping as well as of multi-technology integrated products. Attention should be given to lower barriers between designers, users and consumers and to achieve full integration in developing "product-service" combinations. **1.1.2:**

Advanced production and construction technologies

The aim is to develop systemic approaches for advanced manufacturing and construction, production equipment and facilities which will provide improved processing efficiency, accuracy and reliability while fully exploiting the properties of advanced materials and technologies. RTD should target in particular high precision technologies and methodologies, manufacture of complex products, modularisation and product miniaturisation, including manufacture and assembly of micro-systems.

1.1.3: Safe and reliable extended life of products and industrial systems

The target is to extend the life and optimal operation and use of products, production facilities and industrial systems through development and integration of technologies and methodologies such as new maintenance and repair schemes, control, monitoring and test systems. RTD activities should focus on technologies and methodologies for enhanced process, product and production system safety conformance and for improving life cycle costs, reliability, serviceability and quality.

Objective 1.2: Intelligent production

The aim is to optimise the level of performance (improved quality, minimisation of use of resources) of all elements of the European industrial environment through the deployment, integration and application of innovative technologies, including information society technologies (IST), in production and related logistics systems. RTD should take into account operators' requirements and optimum use of human resources. The activities should be concentrated on three domains for the deployment, application and integration of such technologies:

1.2.1: Design of products and production-service systems

The aim is to focus on the provision of flexible and interoperable supply-production-distribution systems for quality and customer-driven product design and manufacturing. Such RTD activities should support the digital product-service lifecycle design as well as the development of competitive production systems.

1.2.2: Intelligent manufacturing and processing

The aim is to support European approaches for development of a new generation of facilities, machinery, tools and equipment. RTD should address reconfigurable and flexible production means, autonomous cells, on-line control and knowledge-based management systems, to enhance performance (improved quality, minimisation of resources) of the overall production system.

1.2.3: Monitoring and optimal use of industrial systems

The aim is to support the extended life and optimal use of structures and industrial systems through efficient monitoring, maintenance and repair technologies. Research should in addition focus on on-going measurement and analysis of

impacts of the related processes and production systems on health, safety and environment, making use of life-cycle approaches.

Objective 1.3: Eco-efficient processes and design

The aim is to develop and validate global approaches to minimise “full life-cycle” impact of processes and products-services, taking into account all essential elements of the industrial system ranging from extraction through production to waste management, with emphasis on resource intensive processes and reduction and valorisation of waste. The activities should be concentrated on:

1.3.1: Eco-efficient design of products and processes

The aim is to support the development of methodologies, tools and technologies compatible with the challenges of sustainable growth through design approaches, use of renewable resources, and the development of advanced process-engineering solutions. RTD should focus on modelling, control engineering and on mastering basic phenomena such as synthesis, catalysis, separation and reaction mechanisms. Research activities would be geared by life cycle and whole industrial system concepts as well as by reduction of the use of resources.

1.3.2: Cleaner processes, products and eco-efficient technologies

The aim is to look for new technologies and/or approaches to save resources and reduce emissions, effluent and waste. RTD should aim at eco-efficient chemical process engineering, at development of new processes, at the utilisation of renewable raw materials, at the application of best and clean techniques to raw material processing, manufacturing, construction, operation and maintenance processes and at clean alternative solutions for effluent and emission suppression.

1.3.3: Product recovery and waste recycling

The aim is develop technologies and methodologies to improve disassembly, in-situ and on-line recovery of waste as well as development of novel processes for treatment, re-utilisation and safe disposal of waste. RTD will not only address products but also production plants, structures, facilities and equipment as well as impact monitoring, assessment of risks and support to enforcement of regulations.

Objective 1.4: Organisation of production and work

The goal is to move towards innovative high performance industrial systems, agile customer-driven networked industrial and related service enterprises, including SMEs, with multi-skilled highly motivated labour force, working in efficient, safe and pleasant workplaces and taking into consideration the diversity and specificity of European society and manufacturing tradition. RTD should if appropriate enable policy makers to draw conclusions about issues such as future industrial structures or skill needs.

1.4.1: New methods of organisation, work and human capital improvement

The aim is to develop organisational structures and work practices together with developments in industrial products, processes and services, and the appropriate human capital, competence and skills. It is intended to support the close integration and networking of people, organisations and technologies, recognising the importance of appropriate organisation, knowledge and technology management,

improved procurement methods and new decision making tools as a crucial input to innovation and competitive production.

1.4.2: Adaptation of enterprises and human oriented production

The aim is to facilitate the integration of new forms of work organisation techniques into the productive process and to improve performance of production systems, reinforcing RTD capabilities of industry and taking into account maximising socio-economic aspects i.e. employment, health, safety, workers' protection and job satisfaction. The impact of new business ideas (industrial products-services) and incorporation of a multiskilled workforce in work and organisations should be considered.

1.4.3: Knowledge, learning and management of change

The aim is to develop approaches and techniques, supporting where appropriate regulatory determinants, to enhance individuals and organisations' capacity to learn, be retrained, adapt and change by addressing jointly production, innovation, quality of life and preservation of environment goals. RTD should also support transition of society towards efficient and sustainable production and consumption.

STRATEGY AND PRIORITIES FOR THE FIRST 1999 CALL FOR PROPOSALS

The problem solving approach characterising this Framework programme needs, in addition to a reduced number of research objectives, to maintain concentration on few relevant priorities. Concentration of resources and efforts will be achieved through calls for proposals targeted on RTD priorities. Participants to these calls might submit proposals for the development and deployment of critical technologies (addressing all or part of the RTD objectives described above) as well as groups of projects (clusters) or single large proposals, with the objective to integrate and validate such technologies around strategic objectives. Projects could be also co-ordinated after evaluation, however on a voluntary basis, by the Commission services in order to better achieve the stated objectives. Such clusters [3] will show cross-sectoral ways of interaction (vertical –integrating SMEs as appropriate-, technological, etc.) as well as integration of RTD projects and other actions (e.g. accompanying measures).

Priorities for the calls are presented as "Targeted Research Actions" (TRA), to stimulate RTD integrating and co-ordinating approaches. TRAs 1 to 4 will be launched immediately. TRAs to be included in future calls will be confirmed and their content defined in accordance with the evolution of priorities.

Resources allocated to the first call in 1999 will mainly finance individual projects which could become building blocks for future possible clusters, including SME participation. Special attention should start to be given to co-ordination with other European and national RTD projects, including EUREKA.

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[3] Clusters may include projects implemented under EUREKA as well as under other Key Actions, such as « land transport and marine technologies » or other programmes such as « preserving the eco-system ».

TRA1: Customer-oriented and high-tech production

RTD activities should correspond to new production technologies and methodologies for large consumption products (final products as well as intermediate parts, components and related services) such as household appliances, textile and clothing, leather, construction, agro-industrial and furniture goods, packaging, technical equipment, etc. RTD activities under this topic may represent a response to new consumption and production patterns characterised by the customer involvement in the consumption chain and its impact in the market evolution. The aim is to support European RTD approaches for the development and reduction of the time-to-market of new high value added and high quality products, which respond in time to customer requirements. Their competitive success depends on ability to anticipate and respond to changing consumer needs as well as to improve production agility and to reduce costs. The impact of these products' life cycle on sustainable economic development has also to be taken into account at all stages of production and distribution. RTD efforts should therefore aim at improving efficiency of design, manufacturing, distribution, and recycling through "extended" life-cycle and production-cycle concepts. Organisational issues should address the development of new approaches to the organisation of work and associated needs for development of skills and adaptation to change.

Specific targets will concern improvement of overall quality and reduction of life cycle costs by 20-30% in the short term and 10% per year in the longer term. This will imply reduction of time-to-market, improvement of responsiveness-to-market, and optimisation of work organisation. All areas defined under research objectives 1.1 to 1.4 described above are concerned . Partnership might include product or technology developers, e.g. systems and equipment suppliers, industrial users, retailers, distributors and regulatory and standardisation authorities as well as consumer representatives. A large SME participation is to be expected.

TRA 2: Towards new and miniaturised products and processes

Development of new products and processes as well as their miniaturisation is a key objective to save resources while opening new markets for products and production systems. RTD actions should help to secure and enhance market share on this high potential growth sector with applications ranging from environment, health, transportation or communication. The RTD activities should address multi-disciplinary approaches to micro-and nano-manufacturing (e.g. micro-machining, micro-assembly, electrical/fluidic/optical interconnection, micro-packaging and encapsulation), advanced sensor technologies (e.g. chemical sensors, vision and other optical sensors, etc.), micro-actuator technologies (e.g. micro-motors and pumps) in combination with design, modelling, simulation and control software and electronics. This TRA addresses mainly research objectives 1.1, 1.2 and 1.3 described above and encompasses all industrial sectors.

The specific aim of RTD activities should be to deploy European approaches to improve cost and time to market of miniaturised products and devices, while increasing their quality, compatibility and reliability, by 20-30% in the short term and 10% per year in the longer term. An additional objective is to facilitate their integration into products and production systems aiming at enhanced performance,

reduced usage of resources and increased environmentally friendliness and recyclability, with a target of over 70% of recyclable products by 2020.

TRA 3: Machinery, production equipment and systems for manufacturing

The aim of the RTD activities should be to facilitate the development, manufacturing and use of machines and production equipment needed in the factories of the future. Particular attention will be given to the development of new concepts of production and to the development of function tailored, user friendly and highly reliable machinery. Advances such as modularity, reconfigurability and multifunctionality for machinery may be realised together with the incorporation of intelligence through open, modular and distributed controls, into autonomous production systems. The easy maintenance, upgradability and recovery of production equipment will be fundamental to the target of sustainable production. Issues related to logistics and management tools, as well as the need to consider human factors and development of necessary skills, will also be addressed. This TRA addresses mainly research objectives 1.1, 1.2 and 1.4 described above.

Specific RTD goals are to provide major improvements in either one industrial production phase but for different type of machinery or in all phases for one type of machinery. The design and pre-production should be shortened by 20-30%. The physical production target is sustainability and about 30-50 % better "Quality". Concerning the operation and end of life of production equipment 30-40% improvement in use, re-use or recycling is expected. RTD activities should address three principle steps covered all in one single project or within co-ordinated projects: (a) concepts and developments of critical technologies for manufacturing processes, (b) integration of technologies through prototyping of next generation production systems, (c) demonstration & validation through process and technology integration.

TRA 4: Towards zero-waste in manufacturing and processing promoting eco-efficient industries

RTD activities should aim at facilitating the development of approaches for eco-efficient products and production. Competitive and sustainable growth can only be achieved through substantial modifications in the production and consumption patterns. Products of the future will need to be conceived, manufactured and used in such a way that they optimise the use of resources in all phases of their life cycle, including at the end of their useful life. Their manufacturing and processing have also to be improved through clean processes, closed loop approaches, emission management and clean up. On the approach to zero-waste industrial production, intense symbiotic interactions have therefore to be developed and in particular industrial ecology concepts, such as eco-parks, have to be further investigated. Attention for the 1999 call for proposals will be given to industrial sectors with high environmental and societal impact, for example agro-industries, consumer electronics and buildings. While individual proposals can address any of the research objectives 1.1 to 1.4 described above, they should clearly contribute to two priority goals: (a) "Prevention of Waste"; production processes should result in a substantial waste reduction for the next 20 years while observing overall a positive ecological balance. (b) "Recycling and Recovery"; before the year 2010, 50% of all goods should be recycled through re-use/recycling of components or recovery of materials. Long time developments should target 70% re-use/recycling before the year 2020.

Priorities to be detailed for further calls [4]:

TRA 5: Sustainable industrial plant, processing equipment and civil engineering infrastructure;

Industrial plants and civil engineering infrastructure are prerequisites for the EU's economic success and a means for creating wealth and security. However, their increasing size and abundance is now affecting Europe's environment and citizens' quality of life beyond sustainable levels. RTD should support future development to reverse this trend, internalising economic and ecological aspects from construction stage through operation and maintenance to final decommissioning.

TRA 6: Evolutionary "value-added" products-services;

A clear track towards competitive and sustainable growth is to provide increased value added in products by improving non-material aspects such as information, functionality, customisation and service. One characteristic of these "product-services" will be the ability to continuously evolve by incorporating technological advances, so that the comparative level of "utility" for customers with respect to totally new products is maintained. The development of upgradable, serviceable products with a long life expectancy ("products-services") is a chance for skilled employment at long term while at the same time reducing consumption of resources.

TRA 7: The agile networked manufacturing enterprise;

The emergence of information society will strongly influence the way in which industrial enterprises operate in order to supply in-time the right "products-services" to the customer. Manufacturing enterprises will be confronted with new challenges and opportunities, derived from new business dynamics and manufacturing paradigms, which will both impact on competitiveness and sustainability. The aim within companies will be to tighten the links between production, marketing and the product development functions, while in the extended enterprise enhancing the effectiveness of supply chains and production networks by further integration of the partners (both suppliers and customers) will be envisaged.

2.2 SUSTAINABLE MOBILITY AND INTERMODALITY

SOCIO-ECONOMIC OBJECTIVES AND EXPECTED OUTPUTS

Compared to the other key actions of this programme, this key action is largely policy-driven and therefore justifies a more detailed definition of the objectives and a more

[4] Same topics as above may remain of high importance for Calls in future years. In 2000 and 2001 clusters may be established bringing together existing RTD projects and related activities. A point of attention will be the co-ordination with and possible organisation of Joint Calls with the Generic Activity "Materials and their technologies for production and transformation".

direct involvement of policy-makers from Member States[5]. The key challenge is how to reconcile the increased demand for transport on the one hand and the need to reduce its impact on the physical, social and human environment on the other hand, and how to reduce the transport intensity of economic growth. This key action offers the opportunity to involve all stakeholders in facing this challenge and in enhancing innovation in the transport sector by fostering the use of new technologies, developing new services and providing new concepts and policies. The key action bases itself on an integrated systems approach to transport. As the road, rail, waterborne and air transport modes are at different stages of their development, their optimisation from a modal perspective will continue to be necessary. However, a major focus will be to enhance the integration between the different modes of transport in respect to infrastructure, operations, services, procedures and regulations. In other words, to enhance intermodality in order to enable a better use of existing capacities.

This key action will help the Union to further develop and implement the objectives of the Common Transport Policy [6] and those of national transport policies:

1. promoting transport **sustainability** from an economic, social and environmental point of view;

2. enhancing the **efficiency and quality** of transport systems and services;

3. improving **safety and security** and optimising the **human role and performance.**

It will also support other Community policies in such fields as energy, industry, environment, employment, cohesion and the fight against fraud, in co-ordination with other key actions as outlined under chapter 4.3. of this work programme.

For ***sustainability***, the aim is to promote a long-term balance between the growing demand for mobility on the one hand and the necessity to respect environmental, safety social and economic constraints on the other. Some parameters to guide the key action's activities should be to enable the transport sector to contribute to the realisation of ambitious standards for air quality and noise in a cost-effective way, and to reduce the growth of transport CO_2 emissions as well as to enhance the attractiveness and accessibility of more sustainable transport modes such as rail, inland waterways and short sea shipping and to increase the use of public transport.

For ***enhanced efficiency and quality*** the aim is to improve the overall cost-effectiveness and functioning of transport operations and infrastructure. Particular attention will be paid to how best integrate the respective strengths of all modes of

[5] In accordance with the rules for participation and dissemination and the European Commission regulation for implementing them, Member States and Associated States may have access, on presentation of reasoned request, to useful knowledge which is generated by RTD activities under this Key Action and is relevant to policy making.

[6] Reference documents on the Common Transport Policy are "Future development of the Common Transport Policy towards a Community framework for sustainable mobility" of December 1992 (COM(92)494) and the Communication on "The Common Transport Policy; Sustainable Mobility: Perspectives for the Future" of December 1998 (COM(98)716).

transport in order to provide door-to-door services for both passengers and freight. Some parameters should be focused for example to significantly reduce congestion in the networks by the year 2010; to reduce the average viability threshold for intermodal freight journeys in the European Union from ca 500 km to 200 km by the year 2010; to support Community policy in the field of transport charging across Europe and to integrate information technologies and second generation satellite navigation and positioning systems in the transport sector.

For ***safety, security and human factors*** the aim is to ensure a high level of safety and user-friendliness at an affordable cost for the individual user as well as for society. Parameters to be taken into account include the development and promotion of the use of new technological and behaviour-orientated tools to reduce the number, severity and impact of accidents, both in terms of safety and pollution prevention. The parameters should also significantly reduce the total number of fatal and other severe accidents, in particular in road transport and improve travellers' perception of security and to reduce loss or damage of goods.

RESEARCH OBJECTIVES

The key action's three RTD objectives, which contribute to achieving the policy goal of sustainable mobility, reflect the three main components of a modern integrated transport system:

(i) a regulatory and accountable framework reflecting socio-economic objectives;

(ii) an interoperable infrastructure which allows the operation of attractive, environmentally-friendly and efficient transport means;

(iii) modal and intermodal systems for managing operations and providing services.

Socio-economic scenarios	*Infrastructures and interfaces with transport means*	*Transport management*
2.1.1. Quantitative tools for decision-making	2.2.1. Infrastructure development & maintenance	2.3.1. Traffic management systems
2.1.2. Driving forces in transport	2.2.2. Environment	2.3.2. Transport and mobility services
2.1.3. Policies for sustainable mobility	2.2.3. Safety	2.3.3. Second generation GNSS
	2.2.4. Security	
	2.2.5. Human factors	

Objective 2.1: Socio-economic scenarios for mobility of people and goods

The aim is to develop strategies and tools for managing the impact of economic, social, political, demographic and technological developments on mobility demand and transport policies. Research will deliver the building blocks for a European strategic decision support and information system in the field of transport for policy-makers, authorities, industry and operators. The three major building blocks are quantitative tools, knowledge of today's and tomorrow's driving forces in transport and effective policies. These basic decision-support tools will provide the keys to further refine and operationalise the concept of sustainable mobility to further develop integrated transport systems in the specific European context.

2.1.1: Quantitative tools for decision-making

In order to anticipate, orient and respond to mobility needs, transport models have to be refined and developed to explain and predict the user's travel and transport decisions in a reliable way. They will also have to allow the evaluation of the impact of different transport policies and developments in terms of economic effects, employment, environment, safety and cohesion so that comprehensive assessments can be made. In particular, models and other evaluation tools will be designed that facilitate priority setting in the further development of the Trans-European Networks and the elaboration of other elements of the Common Transport Policy.

The **strategic information and evaluation systems** to be developed will support higher-level customised applications, guide decision-makers in planning the transport system and operations, and enable the assessment of projects and initiatives. The development of these systems requires new methodologies for data collection for specific transport domains where information is not available for use at European and global level such as mobility trends, origin-destination matrices, accidents, internal and external transport costs, emissions, both for passenger and for freight transport. It requires also setting up of coherent market observation tools and benchmarking methodologies, integration of assessment tools and models responding to policy-related queries, as well as improved models and evaluation methodologies.

2.1.2: Driving forces in transport

Present decisions and investments in transport determine the shape of Europe's future transport system. An early identification of future challenges and bottlenecks should enable decision-makers to better cater for current and future mobility needs. This requires the quantitative tools developed in sub-task 2.1.1. to be complemented with research into driving forces in transport that cannot be adequately addressed by quantitative forecasting tools.

Building integrated and sustainable transport systems in Europe to cater for current and future mobility needs will require research to produce structured and comprehensive frameworks which identify the political, social, economic, cultural, demographic and technological factors (including their impact assessment) which are likely to shape mobility and the transport business, including supply chain management, today and in the future. It will also require the preparation of long term reference scenarios, which portray sustainable mobility concepts for the future, defining their operational, technical and regulatory requirements and ways to get there. Prospects on how European integration, enlargement to the East, regional differences and subsidiarity are likely to

determine transport in the Union need to be addressed as well as an identification of the most effective strategies to develop integrated and sustainable transport systems in this particular European context, responding at the same time to the challenges and opportunities raised by a continued globalisation of economic activities.

2.1.3: Policies for Sustainable Mobility

The third building block consists of efficient policies for sustainable mobility, taking into account the tools developed under the preceding objectives. Research on policy evaluation, implementation, acceptance and their further development will enhance the decision-making process and the execution of policies at pan-European, EU, national and regional levels.

An improved **development and implementation of policies** require research on strategies for dealing with possibly conflicting policy objectives and their implementation in terms of transport demand, environmental and safety impact, social, economic and regional cohesion, land-use planning; policy evaluation that combines economic analysis, environmental impact and safety assessment; regulatory enforcement techniques and methods as well as tools to measure the impact of non-enforcement of regulations; optimal legal, institutional and organisational structures for the transport sector as well as evaluation of needs and opportunities for public intervention and public-private partnerships. Finally research will also have to address optimal pricing policies, their relationship with infrastructure investment and operational strategies, their impact on society and ways to increase their public acceptability.

Objective 2.2: Infrastructures and their interfaces with transport means and systems

The goal is to enhance interconnectivity and interoperability in order to promote efficiency in the transport system through further strengthening the modes and enhancing their integration in terms of infrastructure, transfer points, transport means (vehicles, vessels,…), equipment, operations, services and the regulatory framework. Strengthening the modes also implies improving safety and security as well as their environmental-friendliness.

2.2.1: Infrastructure development and maintenance

The operation of seamless intermodal door-to-door transport chains across Europe requires research to enable the cost-effective development and maintenance of infrastructures and nodal areas as well as to identify and realise promising alternative transport concepts.

The further **development, interconnection and interoperability of transport networks, in particular the Trans-European Transport Networks (TENs)** require research to address specifications for technical and administrative interoperability within and across modes; the identification of Trans-European and network effects of TENs and strategies to maximise their beneficial impacts; methodologies and best practices for improving the integration between local, regional and Trans-European and Pan-

European networks, particularly in cross-border situations including new concepts to optimise the intermodal use of cargo units.

The optimisation of **nodal areas and terminals**, key elements of seamless intermodal networks, requires planning and design tools to better integrate ports, airports and inland terminals in the network as well as good practice guidance in planning, financing and operating accessible passenger interchanges.

For an improved and cost-efficient **infrastructure maintenance,** research will provide tools for infrastructure management and maintenance such as methodologies for life cycle cost assessment and business process re-engineering, infrastructure materials and tools to optimise the interaction between the infrastructure and the vehicle and strategies for cost-effective and reliable maintenance of transport means as well as condition-based and reliability-centred systems for infrastructure management for all types of infrastructure and all safety-critical components.

In order to develop innovative and cost-effective **alternative transport concepts** and to assess their potential impact, research is required on two areas. First, the needs and opportunities for new transport means and systems over the next 10 to 30 years, such as the innovative use of pipelines, floating tunnels, automated underground distribution systems, large capacity transport means, including investigations as to how current means could fulfil future requirements and how innovative technologies can be integrated. Second, the safe, efficient and environmentally-friendly integration of new means of transport, e.g. high-speed vessels, into existing transport operations.

2.2.2: Environment

The aim is (1) to develop European harmonised methodologies to assess and monitor the effects of transport infrastructure and operations on the environment, and (2) to evaluate technologies, develop concepts and identify regulatory requirements to mitigate air pollution and noise from transport.

Decisions on environmental measures in transport require an adequate **assessment of the environmental impact of transport**. Therefore, research will have to address among other things measurement of noise and emissions, accidental and operational pollution, including regulated as well as non-regulated pollutants such as particulate matters and base metals as well as refinement of methodologies and procedures to evaluate the environmental impact of transport infrastructure master plans, international corridors and projects, as well as transport operations and alternative logistics chains and to integrate these into the broader socio-economic assessment (including Strategic and Environmental Assessments).

In order to **mitigate the environmental impact of transport**, research will have to address four areas. First, strategies for the abatement of noise and pollutant emissions in cities, at ports and airports and in the vicinity of large transport infrastructures. Second, new technical and regulatory requirements for enhancing the environmental compatibility of vehicle, train, aircraft and vessel operations. Third, specifications of environmentally compatible infrastructures, including solutions to lower their visual intrusion in the environment and lastly organisational and policy frameworks for the introduction and use of environmentally friendly transport means and systems.

2.2.3: Safety

The aim is to develop and implement systematic approaches to safety in all modes of transport within a cost-effectiveness perspective. Research should provide the foundation for harmonised pan-European safety regulations.

The development of methodologies for a **systematic safety approach and risk analysis** in transport requires first of all common methodologies and tools for hazard and risk analysis, for the establishment of safety requirement targets and related safety control procedures and for the elaboration of safety assurance and management procedures as well as systematic approaches to emergency situations, including passenger survivability and evacuation from transport means and all kinds of infrastructure and for search and rescue. Furthermore, methodologies for cost-effectiveness assessment of transport safety measures and vehicle design improvements and methods and tools for implementation and enforcement of safety regulations and strategies will need to be developed, including also for the transport of dangerous goods. Finally, rules and procedures for the integration and use of safety enhancing navigational, management and information systems and automated solutions as well as assessment of the role of the human element and how to ensure a positive impact of telematics on safety and the increased use of communication devices needs to be addressed, and should also take into account the results of the "User-friendly information society" (IST) programme.

Research will also address **specific safety issues,** such as the feasibility of transferring design methodologies and technologies to increase passenger survivability from the automobile area to aircraft, ships and railways, and vice-versa; safety risks of and solutions to the existence of different traffic signs and regulations across Europe; performance assessment of drivers' and crew behaviour and physical state in relation to illness, fatigue and the use or abuse of alcohol, various types of drugs and medicines as well as confidential reporting schemes for hazardous incidents.

2.2.4: Security

Research should deliver strategies and tools to guarantee higher levels of security in transport. Improving **security** for passengers and cargo will require research, in co-operation with the IST programme, in three areas. First, reconciliation systems for luggage and goods in ships, aircraft and terminals. Second, security aspects of public transport, including automatic detection of security problems and incidents and security-enhancing conception and operation of facilities and transport means (including piracy prevention). Finally, harmonised security procedures for intermodal transport operations and organisation of measures on door-to-door transport chains as well as early warning and cargo security systems and measures.

2.2.5: Human factors

The aim is (1) to improve the human role and performance in transport operations, (2) to assess the future training needs and opportunities for jobs, while at the same time, (3) increasing the levels of comfort in and accessibility to transport means.

Improving the **human role and performance** in transport necessitates research to provide systematic approaches to the many factors which affect the interaction between human beings and automated systems in transport, such as the assessment of driver assistance systems and the development and acceptance of new procedures and technologies as well as the assessment of health effects of transport, including of transport at high speed and high altitude.

In the field of **training and education**, research will address the following issues : training tools and techniques for crisis management by staff in aircraft, vessels, vehicles and passenger interchanges; harmonised procedures to implement international regulations related to training and education; training and assistance systems for drivers and crew; new jobs, strategies for qualification and career development related to structural changes in rail, public transport and maritime transport, including ports as well as European educational and (re-) training needs for transport professionals, including the use of simulators.

Increased levels of **comfort and accessibility** in transport will be achieved through research on strategies to improve access to transport and identification of the wider socio-economic cross-sector benefits of accessible transport and new designs for transport means and terminals to be accessible to all people.

Objective 2.3: Modal and intermodal transport management systems

The aim is to develop and facilitate the deployment of high-performance systems for managing traffic and transport services both on a modal basis for air, waterborne, rail, road and urban transport, and for intermodal transport. The development of second generation satellite navigation and positioning systems is thereby seen as an important contributing tool. These activities will be undertaken in liaison with the programme for a user-friendly information society and will include the use of related information systems, their integration into the transport system and the validation of the resulting integrated systems, including institutional solutions for their deployment.

2.3.1: Traffic management systems

A more efficient, safe and environmentally friendly use of available infrastructures requires an appropriate management of traffic flows. The three main aims in this respect are: (1) to contribute to the development, integration and validation of advanced traffic management systems, including the exchange between and the use of information systems; (2) to establish a coherent, integrated transport management systems architecture across the transport chain; and (3) to fine tune demand management tools and policies and facilitate their deployment.

In order to improve **traffic flow management**, developments will be centred on the following four issues, building on the results obtained within FP4. First, assessment of new European concepts and functions of vessel traffic management and information

services (VTMIS) and river information services (RIS) for optimised waterborne transport management services including safe ship operations, contingency planning and increased traffic efficiency; improvement of navigational control and shore-based advice and pilotage; specific requirements for high speed craft. Second, extension of the European Rail Traffic Management System (ERTMS) towards the traffic management layers, including capacity analysis and allocation, building on the current signalling (ERTM/ETCS) and telecommunications (GSM-R) developments, including the use of an associated information infrastructure to support transport management activities and customer services. Third, validation in a structural way of the benefits and feasibility of the implementation of a European Air Traffic Management System (EATMS system), through integration and operational verification. Finally, transport policy assessment of automated guided vehicles and dynamic road traffic management systems, including incident management, covering operational procedures for data collection, processing, modelling and information provision to road users and road operators as well as the development of solutions to suit agreed levels of interoperability between road-based information and management systems across the EU.

Research also has to develop the basis for **integrated transport management architecture** across the transport chain, notably through the establishment of procedures for the exchange across modes and sectors of transport information and documents as well as of tools and methods to optimise the management of intermodal transport chains and the interconnection between nodal points, including their interfaces with incoming and outgoing traffic and integrating supporting information and communication systems. Finally, safe and efficient management of nodal points such as airports, ports and freight terminals will have to be addressed.

Demand management tools such as pricing policies and their practical implementation both across modes as well as in modal situations require research and development on design of transport pricing schemes, including distance-based road pricing systems and mobility management schemes at site and area level and for tourism related mobility, including the development of policy scenarios promoting mobility management.

2.3.2: Transport and mobility services

Increasing the transport system's efficiency and sustainability, and promoting a modal shift require improved and innovative transport and mobility services and strategies. RTD should help to: (1) lower the break-even distance of intermodal freight transport and enhance the quality of intermodal freight services, (2) improve the quality and use of collective passenger transport, non-motorised modes and taxis in local and regional passenger transport; and (3) enable a better use of existing infrastructure and capacities through common freight and passenger services.

In order to enhance the quality of intermodal **door-to-door freight and logistics** services in all modes, both in urban and rural areas, research activities will cover four areas. First, new strategies for intermodal transport with particular emphasis on innovative concepts for short and medium distance services for non-standardised cargoes and small consignments. Second, new organisational solutions to improve the service quality of goods-distribution within urban and rural areas, and between these

areas and freight centres. Third, the users requirements and the operational deployment of open and accessible information systems, building inter alia on electronic business, that will offer reliable real time information and other value added services to all actors in the transport chain with the aim of reducing their costs and to enable co-operative freight management. Finally, strategic tools to optimise the organisation of transport in the framework of logistic processes.

An improved **integration of individual modes** in the transport chain requires different organisational and technical solutions. Research will therefore address the following areas : the potential for rail/air freight services with innovative freight centres at airports; innovative concepts for door-to-door services integrating short sea shipping and inland navigation, in particular the role of waterborne transport management services in achieving efficient intermodal freight operations; emerging opportunities for new operational railway concepts and services, including the development of the European Rail Freight Freeways as part of door-to-door transport services and finally, intelligent intermodal transport equipment, including rail/road, to improve transport chain efficiency.

Improved **passenger transport systems and services** will be developed, validated and demonstrated in order to improve the quality and use of collective transport, non-motorised modes and taxis in local and regional transport. Research will address the following areas. First, intermediate mass transit systems to fill the gap between bus, tram and other public transport systems. Second, innovative customer-tailored services based upon specific traveller groups´ market needs such as mobility-impaired people, night-travellers, students and business-travellers. Third, use of non-motorised transport modes and taxis, especially in combination with public transport and finally, organisational and other requirements for door-to-door passenger services using inter alia integrated travel information, reservation, payment and ticketing.

In order to enhance the attractiveness of environmentally friendly transport modes at local, regional, national and international level and to promote behavioural change, through **common concepts for freight and passenger services**, research activities will cover good practice in planning and designing transport networks and services, particularly with regard to innovative financial and organisational partnerships for rural areas, city centres and low-density residential areas. It will also address strategies and tools for behavioural change in freight and passenger transport through awareness and marketing campaigns as well as standard European markets segmentation and a set of indicators for local transport and strategies for the promotion of its use for benchmarking and decision making.

2.3.3: Second Generation Satellite Navigation and Positioning Systems

The aim is to contribute to the development and implementation of a European strategy regarding the second-generation satellite navigation and positioning systems (GNSS). Whereas in the space and ground control segments the focus of the work will evolve from policy decisions regarding international co-operation, in the application segment, research will aim at fostering the utilisation of satellite navigation and positioning systems across the value-chain of the transport sector. With regard to **second-generation satellite navigation and positioning systems** (Galileo), research and development will

cover the following three areas in conjunction with the IST programme. First, the development of a technological and operational capability, enabling Europe to play a decisive role in future international, world-wide space co-operation agreements. In this context, appropriate co-ordination mechanisms will be implemented in order to ensure the maximum synergies with the work carried out by ESA and, where appropriate, potential users. Second, the development and implementation of a strategy for fostering the penetration of satellite-based navigation and positioning systems across the transport sector, as a performance enhancement in safety-critical applications, as a more cost-effective and operationally-efficient replacement of existing operational infrastructure, and as a means to support the creation of new value-added services, particularly in an intermodal context. Emphasis will be given to field demonstrations as well as to the consideration of the underpinning economic, institutional, legal and regulatory aspects. Third, the analysis of user requirements, opportunities and constraints linked to the specifics of the various transport modes and infrastructures.

STRATEGY AND MAIN RESEARCH TASKS FOR THE 1999 CALLS FOR PROPOSALS

The continuous evolution of transport demand, the concept of user-orientated door-to-door freight and passenger transport and the urgent need for integrating technologies into the transport system for enhancing sustainable mobility and intermodality require that all the research objectives of this key action are addressed in 1999. However, in selecting the tasks for 1999 calls, attention will be paid to relevant on-going FP4 projects, which have still to deliver important results. Particular attention will be given to the integration, validation, demonstration and assessment of their results to facilitate transport policy decisions at European, national and local levels. The problem solving approach already developed through concerted actions in several areas will be further expanded into new thematic networks involving nationally and Community funded projects, and the main stakeholders for the theme including policy makers.

Priority will be given to the following **thematic networks** to be set up as a result of the **first and second calls**, accompanied, where appropriate, by research tasks: (i) for socio-economic scenarios, networks will address: European transport information systems, transport modelling and exploration tools; understanding and predicting mobility trends and transport patterns; models for intermodal interurban transport planning; policy and project evaluation methodologies; benchmarking transport; public transport; (ii) for infrastructures and their interfaces with transport means and systems, attention will be paid to freight transfer points, terminals, ports and airports; transport and the environment; integration of new generation vehicles into the transport system; infrastructure maintenance and management; safety assessment as well as education, training and certification schemes in waterborne transport; cost-effectiveness assessment tools for road safety and environment measures; (iii) for modal and intermodal transport management systems, networking activities will be developed concerning air traffic management; waterborne traffic management and information services; mobility management; cost-effectiveness and acceptance of urban pricing; application of information technologies and communication systems to support intermodality in freight transport; urban freight distribution; rail freight services and concepts, quality in shipping and ports as well as strategies to promote waterborne transport. Satellite navigation and positioning systems for transport will

also be subject of a thematic network. These networks will involve on-going projects at European and national levels or from international organisations or from COST, but they will have to build mainly on the individual projects to be started as a result of the 1999 calls and further calls for proposals.

For the first periodic call in 1999, the tasks foreseen under the objective **socio-economic scenarios** will include , as far as quantitative tools for decision-making are concerned, the testing of methodologies for long distance passenger travel data; network transport accounts and marginal costs in relation to the fair payment for infrastructure use; analysis of the real cost of door-to-door intermodal transport services and the conditions to optimise it. As far as driving forces in transport are concerned, the tasks will relate to effects of changes in supply chain management on transport supply and demand; the future role of third party logistic service providers and their impact on transport; reducing transport intensity of economic growth. For policies for sustainable mobility, one task will address improving legal and organisational frameworks in local public transport.

With regard to **infrastructure and transport means**, tasks for the first periodic call in 1999 will cover the integration between local and regional rail, including cross-border links; the improvement of cross-border connections for local and regional passenger transport; the optimisation of the use of semi-trailers in the intermodal transport chain; the integration of horizontal transhipment techniques in intermodal transport operations; total airport optimisation by simulation including on the land-side; condition-based and reliability-centred maintenance of railway infrastructure; automated underground distribution and tube transportation systems. With regard to environment, tasks will cover the monitoring of emissions from transport (including particulates); in-service test procedures for road vehicle emissions; tools and strategies for reduced source noise and vibrations from trains. For safety, tasks will address the cost-effectiveness analysis of regulations and investments to optimise air transport safety; the improvement of the regulatory framework for the implementation of operational concepts and technologies in air transport; the cost-efficient integration of new safety technologies to improve quality shipping; the further development of road vehicle safety standards; drivers' and riders' physical fitness and physical state. As far as security is concerned, tasks will address security in local and regional public transport. Finally, with respect to human factors, tasks will address training to improve the safety of air transport operations; driver training and hazard perception; the promotion of the take-up of project results by leading educational institutions.

For **modal and intermodal transport management**, the first periodic call will address, with regard to traffic management systems, the extension of specifications for the European Rail Traffic Management System; the definition and management of a master plan for ATM validation; the test trial of advanced surface movement ground control systems; the assessment of user needs for road traffic information and traffic management and the reaction to methods of information provision; enhanced road traffic simulation for transport strategy assessment; implementation scenarios and impact assessment of advanced driver assistance systems; designs for inter-urban road pricing schemes and the testing of the effectiveness and acceptance of urban pricing schemes. As far as transport and mobility services are concerned, tasks will cover innovative waterborne transport concepts; mobility

management and new partnerships to encourage sustainable travel; travel awareness, communication, education and publicity.

With regard to the development of satellite navigation and positioning systems, in line with the policy agenda to be defined in the first half of 1999 and subject to the outcome of discussions at an informal Council in April 1999, a number of tasks would be launched in 1999 in a dedicated call, possibly across thematic programmes.

The policy agenda has an important influence on the setting of priorities for 1999. The above-mentioned tasks will be implemented through research projects and also through demonstrations. In certain cases, policy-driven research studies will be implemented through accompanying measures and will be funded up to 100% subject to the level of public interest.

2.3 LAND TRANSPORT AND MARINE TECHNOLOGIES

SOCIO-ECONOMIC OBJECTIVES AND EXPECTED OUTPUTS

The strategic aim for the land and marine transport sectors is to develop the technological infrastructure for the supply of future transport means and concepts. The overall aim is to support the expected growth in transport demands in a sustainable manner (covering urban, inter-urban and marine environments) and to maintain and consolidate the competitive position of the European road, waterborne-based, rail and intermodal supply industries. Measurable benefits to be brought by this key action are also linked to significant reductions in energy consumption and large increases in overall safety, reliability and availability. The objective should also be to prove commercial viability of technological solutions for a customer acceptable and integrated European transport system. For the maritime industry there are additional objectives of strengthening its economic and operational base though increased systemic innovation spanning the complete supply chain, since 50 to 80% of shipbuilding added valued is generated outside the yard.

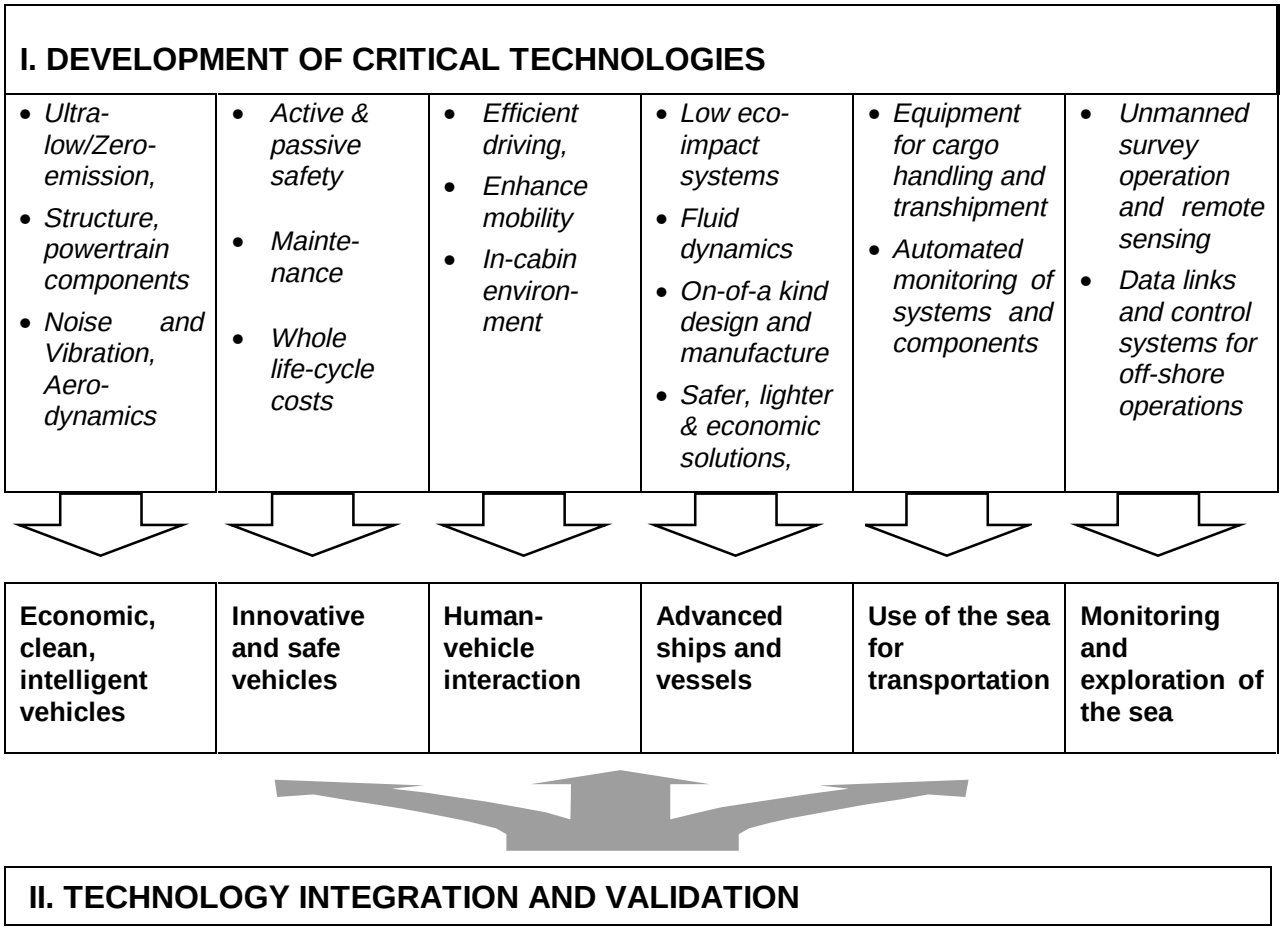
The research effort will be considered and organised around (a) the development of critical technologies and (b) their integration and validation around advanced industrial concepts in order to attain the following main deliverables:

- *Improved fuel efficiency and reduction of emissions*: Contribution to the reduction of 30% in CO^2 emissions for new car fleet average, 20% for rail vehicles and 15 % of marine vessels by 2008 to 2012 time period against the 1995 state of art technologies for consumption of equivalent classes; Development and validation of Zero Emission Vehicles, and Equivalent Zero Emission Vehicles capable of market deployment by 2005/2010; Pass-by noise targets : 70 dBA for automobiles, 74 dBA for heavy vehicles based on standard homologation tests and reduction of 10 dBA in relation to present railway technology.
- *Improved performance*: For new and advanced vehicle, vessel and infrastructure concepts, improvements are sought of 30% to 50% in safety, reliability, maintainability, availability and operability. For railways increased reliability (by 25%) and availability (of 99% at peak traffic periods) is expected; Reference targets are reductions of life cycle costs and maintenance costs by 30%. For

ships, sub-sea vehicles and marine infrastructure design improvements are sought to reduce time to market by 15-20%, and to increase efficiency and reduce operating costs by 30% to 40%. In the case of intermodal logistic interfaces, advanced concepts should aim at increased reliability, energy efficiency and adaptability while, significantly speeding up (up to 50%) logistic operations.

- *Improved system competitiveness*: Halving of time-to-market and of costs is expected for the development of vehicle concepts and main infrastructure components. Further improvements may be feasible through the full co-operation between manufacturers, component suppliers and sub-contractors; In the medium term, advances of practices in integration of design and production operations might lead to improvements in vehicle quality and reliability of about 50%.

Where appropriate, for critical technologies common to land transport and marine technologies, opportunities will be sought to exploit the potential added value for cross-sectoral research activities.



RESEARCH OBJECTIVES

I. DEVELOPMENT OF CRITICAL TECHNOLOGIES

Objective 3.1: Critical technologies for road and rail transport

This section will cover R & D work on innovative on-board land transport vehicle technologies and systems which are to be integrated into future concepts of vehicle, including on-board systems for traffic management and control, aiming at improved environment, mobility, efficiency and safety performance. Traffic management activities will be undertaken where appropriate in liaison with the programme for a user-friendly information society and will include the application and validation of related information and integrated information systems.

3.1.1: Efficient, clean, & intelligent road and rail transport vehicle technologies

This research target focuses on propulsion, new low weight material and vehicle concepts, low noise and vibration suppression and improved aerodynamic performance. Key words include: ultra-low and near-zero-emission vehicle propulsion systems, powertrain optimisation technologies, technologies for vehicle structures and components, for vehicle noise and vibration suppression, for improved vehicle aerodynamics.

3.1.2: Innovative and safe road and rail transport vehicle concepts

This research target seeks to achieve 30-50% overall safety improvement through development of safety-associated vehicle features and technologies. Keywords include: vehicles' passive and active safety, vehicles' preventive maintenance, reduction of whole life-cycle costs. The aim is to increase vehicle capabilities for accident prevention while minimising passenger and pedestrian injuries.

3.1.3: Human/vehicle interaction

The research activities, which should result in a safe and friendly environment for driver and passenger, will involve multidisciplinary engineering, cognitive science and ergonomics and will be targeted at the development of tools and components for on- board systems. Key words are: microelectronics, micro-mechanics, optics, sensing, actuating, controlling. The objective will be the integration of enhanced human/machine interface systems, which allow the most effective driver/vehicle interaction, ensure reliable operation, support efficient management, and improve in-cabin ergonomics and overall comfort.

Objective 3.2: Critical marine technologies

The goal is to improve complex vessel and platform production and exploration processes through the development and application of new technologies and tools into multi-application marine environments. This should pave the way for the improvement of design methodologies and best practice at EU level.

3.2.1: Efficient, safe and environmentally friendly ships and vessels

Research will target at improved concepts for ships and vessels, and European approaches for concurrent and multi-site design, engineering or production specific to maritime industry. Key words are design technologies, manufacturing, decommissioning or dismantling, materials, powertrain and on-board systems linked to safety, clean environment and efficient marine operations.

3.2.2: Maximising interoperability and vessel performances

Research will target at improved concepts and innovative European approaches for vessels and port infrastructures, for reduction of operating costs, improvement of manoeuvrability of ships in restricted waters and ports, and efficient cargo handling and transhipment. Key words are: integrated technologies for fully automated vessel concepts, for effective vessel operation, maintenance and on-board monitoring, modular transhipment technologies.

3.2.3: Innovative technologies for the monitoring, exploration and sustainable exploitation of the sea

Research will seek to develop innovative technologies to ease accessibility to marine resources especially in difficult areas and conditions and facilitate the investigation of potential resources and monitoring of the sea and sea-bed [7].

[7] As a general guideline, proposals dealing with the monitoring and forecast of sea status and environmental related issues should be submitted to "Sustainable marine ecosystem". Proposals relating to technologies in the field of management of hydrocarbon reserves, as well as exploration and production technologies for

Activities would therefore focus on innovative technologies in particular for unmanned surveying and in-situ monitoring and industrial operations in the sea.

II. TECHNOLOGY INTEGRATION AND VALIDATION

The key action has identified Technology Platforms (TP) for technology integration and validation. Each TP would bring together the necessary range of advanced technologies into project(s) aiming at demonstrating, at engineering concept level, their feasibility in achieving strategic key action objectives. Six technology platforms are presented corresponding to different levels of maturity and readiness of the technologies to be integrated and thus validated within project(s). Priorities for these Technology Platforms (TP) are presented in two groups. In the first group, projects will be launched at the beginning of the programme, whereas those in the second group will require confirmation and their content further defined in accordance with the evolution of the key action.

First Group of TPs

TP 1: New land transport vehicle concepts; Enhanced systems efficiency

One aim is the development of energy-efficient, ultra-low and near-zero emission, intelligent engines running on conventional or alternative fuels fulfilling requirements of maintainability, durability and manufacturability at competitive cost. The development, integration and prototyping of environmentally friendly vehicle technologies for improved efficiency and significant reductions of gaseous (CO_2, NOx, CH, etc), acoustical emissions, vibration and noise, as well as improvement of electro-magnetic compatibility would be supported by design, engineering and manufacturing tools. The aim for hybrid/electric vehicles will be to demonstrate that emission free operation could be delivered via affordable, safe, reliable, effective and optimised technical solutions comparable to traditional vehicles. Development of integrated technological solutions would help the development of innovative propulsion concepts and operational control as well as new and advanced vehicle concepts. Expected results will be the acquisition of advanced powertrain systems with minimised environmental impact, allowing for enhanced efficiency, increased reliability and safety and reduced overall running costs.

TP 2: Advanced concepts for ships and vessels; Competitive shipbuilding

This system-configured ship concept deliverable will be the base for the integration of maritime related technologies and should bring together shipyards, suppliers, ship owners, operators and port authorities within the task of developing test elements in virtual or real format whose functionalities will be demonstrated and proved under real operating conditions. RTD should help to demonstrate streamline and seamless vessel development processes and systems through application of the latest digital design, visualisation and prototyping techniques. This platform should also support

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hydrocarbons should be addressed to the key action "Economic and efficient energy for a competitive Europe."

advanced production systems which can improve ship manufacturers' customer response, product quality, manufacturing process flexibility and control, all major determinants of manufacturing competitiveness. Set against demanding constraints such as environment, work force situation, relative cost of production and material availability, it is essential that the new and/or improved processes for producing component parts and/or assemblies are properly matched with targeted efficiency and safety gains as well as product performance and environmental requirements.

Second Group of TPs

TP3 Enhanced design and manufacturing for road vehicles.

The effort will aim at integrating all necessary technologies to exploit multidisciplinary and concurrent approaches where different aspects of vehicle system engineering and their associated cost structures are converging. RTD should support the development of future vehicle concepts realising targets of safety, environmental impact, intelligence, reliability, maintenance and comfort. The activities would focus on the integration and prototyping of tools, methods, systems, structures and organisational aspects for the supply of high quality, low cost vehicles. The approach will attempt to deliver methodologies and systems of production geared towards increased productivity, flexibility and quality of vehicle developmental processes.

TP4 Sustainable and modular train

The aim will be the development and prototyping of new technological concepts and relevant systems that would lead to the new generation of railway vehicles which are both more environmentally friendly, as well as, cost and operationally efficient. The strategic approach will attempt to reconcile "top-down" system engineering approaches to product development with "bottom-up" problem-oriented technical activities aimed at solving significant service and operational questions. Aspects of sustainability and modularity have to effectively comply with the principles of intermodality, mass customisation, and flexible customer response. Activities are expected to combine at system level user requirements, systems' architectural design and life-cycle cost guided by cost-benefit analyses; at operational level, product certification procedures and operational management practices; at technical level, integration of key rolling stock technologies and systems such as propulsion, on-board automation, structures, dynamic performance systems, at cabin environment noise and vibration.

TP5 Safe, efficient and environmentally friendly vessels and platforms.

The activity will support integration of critical technologies in delivering optimised concepts for safer, environmental-friendly and more efficient vessels and platforms. The goals to be fulfilled are: a) shortening the cycle for transport and handling of passengers, cars and rolling materials; b) improving the safety and realising the environmental impact during the transport and handling of dangerous cargo; c) improving the safety and comfort of passenger and comfort of passenger transport; d) developing new technology concepts for short sea, inland and polar shipping and

validating the integrated solution they may provide ; e) improving the efficiency of production and off-loading of floating structures for oil and gas; f) improving the efficiency of service, rescue, combating and assistance in case of calamities and other operations which support transport activities, the exploitation of resources at sea, coasts and inland as well as maintenance of related infrastructures; g) improving and/or upgrading existing means and systems to prolong life time, enhance economic efficiency and operability, adjust for new or enhanced needs and comply with recent statutory requirements on safety, environmental protection and working conditions for new buildings, conversions, life time lengthening etc of existing ships and platforms. For the rapid up-take of results, effort will be concentrated on fast vessels for passengers, cars and cargo; deep sea ships mainly for passengers and unit cargo, deep sea floating structures for production storage and off-loading of gas; unmanned, autonomous and remotely operated survey vehicles; new concepts for short sea shipping and polar shipping.

TP6 Efficient interoperability and transhipment

Effort will be concentrated on integrating technological advances delivered through critical technology research for advanced concepts for unitised cargo and for ship types operating in coastal, restricted and limited waters. Due consideration should be given to the integration of supporting measures needed for these ships and infrastructure aspects of maintenance, storage, distribution and assistance. The strategic aim is to provide demonstrable optimised concepts of use of multimodal cargo units reinforcing intermodal links with special emphasis on easing, improving and facilitating cargo flows between inland and sea.

STRATEGY AND PRIORITIES FOR THE FIRST 1999 CALL FOR PROPOSALS

The priorities are to optimise the benefits of European-wide RTD by recognising the need for an integrated approach around two major strands of work:

i) ***development of critical technologies***, identified as providing the most effective leverage in the two main avenues corresponding to the objectives of the key action. For land transport, priority is placed on more efficient, intelligent, clean and safe vehicles. For marine technologies, priority is placed on more efficient, safe and environmentally ships and innovative marine technologies particularly for unmanned operations.

All technical areas defined under objectives 3.1 and 3.2 are opened for submission of proposals.

ii) ***technology integration and validation,*** is a fundamental element of the implementation of the key action with the coherent grouping of RTD projects [8] around common strategic objectives. These targeted RTD activities will demonstrate the feasibility of attaining the strategic objectives of the key action. They will bring together manufacturers, suppliers and other relevant stakeholders, with the task of developing and benchmarking engineering concepts for future vehicles, vessels, platforms components or systems whose functionalities will have to be demonstrated. In particular, integration and demonstration activities will be used to

[8] Clusters may include projects implemented jointly with EUREKA

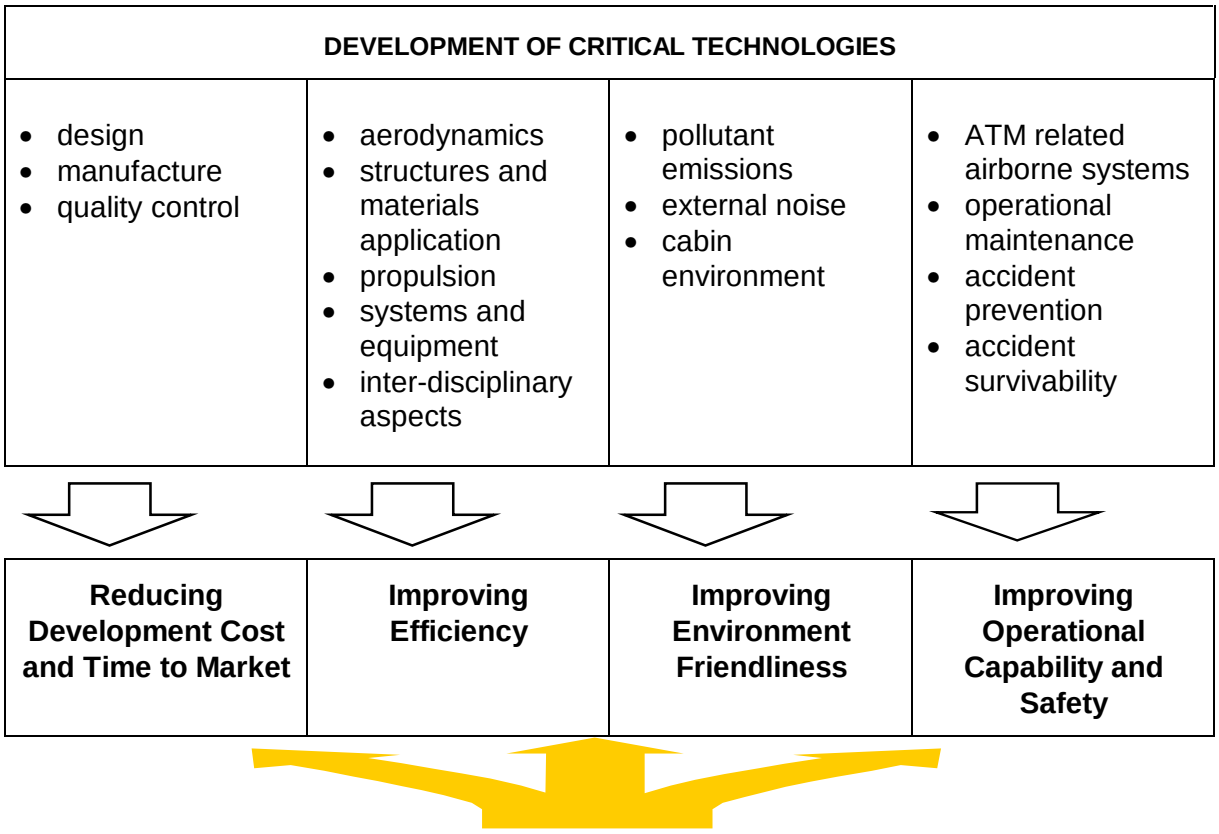
evaluate and further explore the potential of combination of technology packages in achieving economically viable alternatives of future land & marine transport concepts

For the first call, only TP1 "New land transport vehicle concepts; Enhanced systems efficiency" *and TP2 "*Advanced concepts for ships and vessels; Competitive shipbuilding" *are open for submission of proposal(s).*

2.4 NEW PERSPECTIVES IN AERONAUTICS

SOCIO-ECONOMIC OBJECTIVES AND EXPECTED OUTPUTS

Air transport is experiencing a remarkable growth and is expected to maintain and even increase growth rates over the following decades. Globally over 16000 new commercial aircraft worth more than 1000 billion ECU will have to be produced within the next 20 years to satisfy this demand. More than ever, it will be indispensable to respond to public demands for economical vehicles, with an optimum level of safety and environmental friendliness in relation to noise and pollution emissions. Europe's ability to provide answers to these challenges depends strongly on the level of its technologies and their incorporation by industry into products. The aim of this key action is to strengthen the competitiveness of the European aeronautic industry, including SMEs, while ensuring sustainable growth of air transportation with regard to environmental and safety issues.



TECHNOLOGIES INTEGRATION AND VALIDATION

1. low-cost, low-weight primary structures
2. efficient and environmentally friendly aeroengine
3. novel rotary-wing aircraft configuration
4. more autonomous aircraft in the future ATM system

The overall aim of the key action is reflected into four priorities with corresponding technical objectives, which make up the main drivers of the European RTD action:

- *reduction of aircraft procurement costs*, with the target of reducing production costs by 35% and development time by 15 to 30%;
- *improvement of the efficiency and performance of aircraft,* with the target of reducing fuel consumption by 20% and general improvement of its reliability and direct operating cost;
- *reduction of impacts related to noise and climate as well as improvement of passenger environment.* Objectives are reduction of emissions of NOx by 80% and CO_2 by 20%, and decreasing external noise and cabin noise by 10 dB each;
- *improvement of the operational capability of the aircraft in the air transport system and of its safety*, with targets of increasing airspace capacity, reducing aircraft maintenance costs by 25% and decreasing accident rates by at least the same factor than the growth of traffic.

The quantified objectives correspond to a medium term of eight to ten years and should be regarded as guiding targets of the RTD action, taking the present state-of-the-art as the reference point. The aircraft is regarded as including its systems and components. The achievement of each objective will be the result of the combination of contributing technologies in a multidisciplinary and multisectoral activity. Research will bring together manufacturers and suppliers including SMEs, research institutes and academia, operators and regulatory authorities.

APPROACH: TWO MAJOR STRANDS

The work programme is structured in a way to optimise the benefits of European-wide RTD by recognising the need for an integrated approach. It distinguishes two major strands of work:

- ***development of critical technologies***, that with a medium and long term perspective will lead research to extend and improve the technology base on a number of critical disciplines; these are seen as providing the most effective leverage with respect to the socio-economic objectives of the key action;
- ***technologies integration and validation,*** which, with a shorter term perspective, is designed to reduce the risk associated to the application of innovative developments. This RTD work is most relevant to the technical complexity inherent in aeronautical products, which are the result of the combination of multiple systems and technologies. Within "*Technology platforms*" projects will normally be of a larger size than a simple RTD project; in most cases, they will encompass integration of technologies in test rigs, flying test beds or simulators.

RESEARCH OBJECTIVES

I. DEVELOPMENT OF CRITICAL TECHNOLOGIES

Objective 4.1: Reducing Aircraft development cost and time to market

Research should aim at facilitating the introduction and combination of the newest technologies able to contribute to substantial gains in time-to-market and production costs. Advanced design approaches exploiting information technologies should facilitate concurrent engineering practices in support of the design for the whole product life cycle as well as distributed inter-company design environments. Novel manufacturing and assembly processes associated to advanced materials would achieve cost reduction and production flexibility while ensuring safety requirements. Development and deployment of technologies for distributed multi-site production systems would pave the way to increased industrial partnerships and reinforced co-operation across the supply chain.

4.1.1: Advanced design systems and tools:

RTD objectives are to help reduce time-to-market by 15 to 30 % and development costs by 35 % while ensuring improved response to market and society needs. RTD should address the development of concurrent engineering environments; development and validation of multi-disciplinary optimisation methods; advanced modelling and simulation tools, including virtual reality, in support of virtual prototyping, and knowledge-based systems to support design activities.

4.1.2: Manufacturing:

Research objectives are to help reducing manufacturing costs by 30 % while improving working conditions and organisational capacities of enterprises. RTD should address the development and validation of intelligent and flexible manufacturing methodologies in support of advanced airframe assembly concepts and cost-effective manufacturing processes for airframe, engine and equipment parts best adapted to exploit the properties of advanced materials.

4.1.3: Product quality control:

The research emphasis should be on development of specific methodologies for continuous quality/cost control measures in the design and manufacturing stages. Particular attention should be given to the supply chain aspects. RTD should address the development of new inventory/configuration control procedures to deploy across the supply chain; advanced in-process inspection and test techniques; and development of knowledge based diagnosis.

Objective 4.2: Improving aircraft efficiency

The objective of the research work is to improve aircraft Direct Operating Cost through a substantial reduction in fuel consumption while ensuring and improving safety aspects. It will be possible by the combination of technology advances: (1) to reduce drag and improve lift-to-drag ratio by improved aerodynamic designs; (2) to reduce aircraft Operating Weight Empty by increased introduction of advanced lightweight, cost-efficient structures and of power-optimised and safer, integrated

flight controls, systems and equipment; (3) to improve engine efficiency with higher performance propulsion systems and propulsion controls.

4.2.1: Aerodynamics:

Research objectives are to support reduction of aerodynamic drag by 20% in 10 years and improvement of the overall aerodynamic efficiency of the aircraft in take-off, climb, cruise, approach and landing. RTD should address the development and validation of high-performance technologies, systems and support tools for drag reduction; theoretical and experimental methods for prediction and control of boundary layer behaviour; systems and technologies to enable adaptive wing concepts; computational methods and novel technologies for high-lift aerodynamics at low-speed; CFD tools and integrated design methods.

4.2.2: Structures and materials application:

Research objectives are to help reducing weight by 20% in 10 years at no extra manufacturing cost and without reduction of structural life. RTD should address the development and validation of improved theoretical tools for the simulation of structural behaviour; new structural concepts for increased use of advance materials in primary structures; tools and technologies for application of "smart materials" and realisation of "smart structures" integrating sensors-structure-control-effector.

4.2.3: Propulsion:

RTD objectives are to support in 10 years fuel economy by 20% and consequently reduce emissions of greenhouse gases by the same factor, as well as to increase engine thrust-to-weight ratio by 40%. RTD should address new and improved engine cycle concepts; numerical aerothermodynamics methods for design of turbo-machinery components; application of medium and high-temperature materials; techniques and concepts in support of the design of "smart" engine control systems; technologies for improved mechanical transmission systems for rotorcraft and engines, as well as innovative concepts such as compound propulsion.

4.2.4: Systems and equipment:

Objectives are to reduce power take-up by 10% and weight by 20% of on-board systems with at least the current levels of safety, cost-effectiveness, reliability and maintainability, while meeting better functional requirements. RTD should address power generation and technologies in support of a more electric aircraft concept; low-power demanding flight control systems; improved modelling and design methods for landing gear and braking systems; techniques for improved reliability of fuel management systems; application of fibre optics to cabin utility systems, passenger services and avionic systems; development of underlying technologies and procedures for implementation of integrated modular concepts; application of advanced displays and sensors in cockpit functions.

4.2.5: Configurational and interdisciplinary aspects:

Research objectives are to provide analysis capability in support of improved as well as novel aircraft configurations. RTD should address methodologies and

technologies for multidisciplinary airframe-engine integration; development of improved analytical tools for the prediction and technologies for the prevention of static and dynamic aeroelastic phenomena.

Objective 4.3: Improving environmental friendliness of aircraft

Considering the increasing society pressure with regard to environmental consequences of the projected growth in air traffic, aircraft size and emissions, research is needed to improve technologies for reducing engine emissions. Reduction of external noise is in addition becoming increasingly important for the growth of aircraft operations and aircraft size. It is also necessary to improve total cabin environment as a combination of physical aspects such as noise, vibration and air quality, as well as human-factor-related aspects. This research should help to ensure passenger and citizen acceptance of future vehicles.

4.3.1: Low pollutant emissions:

Research objectives are the development of combustor concepts to achieve a significant reduction of engine emissions of NO_x and particulates, as well as improving knowledge of the nature and effects of emissions in support of the development of a new emissions parameter for certification as recommended by ICAO/CAEP. The specific targets for NO_x reduction are: i) 80% in the LTO cycle, and ii) to an emission index of 8 gr. per kg fuel burnt in cruise/climb. RTD will address tools and technologies for low-NO_x combustors; efficient combustion systems; measurement and modelling of the composition of engine exhaust gas emissions and its distribution within the jet and plume; establishment and evaluation of a global inventory of 3-D distribution of emissions; development of the technical background in support of the development of new emissions parameter covering the whole aircraft operation.

4.3.2: External noise:

RTD objectives are to reduce external perceived noise by 10 dB in 10 years through new design technologies as well as through advanced active control technologies. RTD should address prediction methods and tools for reduction of noise at the source; technologies for active noise and vibration control; modelling of the far-field noise radiation; development of the technical background in support of improved noise certification parameters and procedures; modelling of sonic boom.

4.3.3: Cabin environment:

Objectives are to improve the environmental conditions in the cabin and cockpit and enhance crew and passenger comfort. Medium term targets concerning noise levels are a reduction of 5-10 dB for turbofan aircraft and 10-15 dB for turbo-propeller and rotary wing aircraft. RTD should cover advanced methods for prediction and reduction of noise and vibration in the cabin; development and validation of subjective noise and vibration criteria for cabin environments; concepts for enhanced global cabin environments; technologies for cost-efficient cabin humidification and removal of CO_2.

Objective 4.4: Improving operational capability and safety of aircraft

New technologies, including satellite based navigation and communications and new flight management systems, have the potential for changing significantly the way airspace is managed. To exploit this potential on-board technologies need to be developed and validated to equip the aircraft for future operational requirements. With the expected growth of air traffic and the foreseeable use of larger airliners carrying a greater number of passengers, the current accident rates must be improved so that aviation safety records continue at the highest standards. RTD work is therefore needed based in particular on an improved understanding of the causes of accidents, and of the human-machine interface aspects. Also the design of aircraft will have to incorporate the best knowledge to improve survivability in the event of accidents.

4.4.1: Air traffic management (ATM) related air borne systems:

RTD objectives are to increase airspace and airport capacity through a more autonomous operation of aircraft consistent with the future European ATM concept. RTD should address advanced on-board flight management functions optimising pilot's role and workload; integration of advanced on-board technologies in support of navigation in the approach, landing and ground movement; application and integration of airborne communication and surveillance technologies.

4.4.2: Operational Maintenance:

Objectives are to reduce maintenance costs by 25 % in the medium term and by 40% in 10 years while improving reliability of maintenance operations. RTD should address overall maintenance cost with improved maintenance systems; development of "smart" maintenance systems with self-inspection and self-repair capability; improved non-destructive test and analysis; methodologies to maintain integrity of ageing aircraft.

4.4.3: Accident prevention:

Objectives are to reduce aircraft accident rate by at least the same factor than the growth of air traffic. RTD should be centred around the development of improved aviation safety metrics; improved understanding of the human-machine interaction and crew performance in the cockpit; technologies to improve the situation awareness of the pilot; application and validation of airborne technologies for in-flight and on-ground aircraft collision avoidance; methodologies and technologies for alleviation and avoidance of wake vortex formation and encounter; prediction, detection and monitoring of ice accumulation; technologies for protection against lightning effects.

4.4.4: Accident survivability:

Objectives are to effectively reduce the number of casualties or passengers injured in case of survivable accidents. RTD should address development of prediction tools as well as design techniques and structural concepts for improved airframe behaviour in case of crash; methodologies for prediction and mitigation of fires in the aircraft.

II. TECHNOLOGIES INTEGRATION AND VALIDATION

The key action has identified Technology Platforms (TP) for technology integration and validation. Each TP would bring together a range of advanced technologies into a project representing a priority in the capability to develop future aircraft. The technology platforms are presented in two groups corresponding to different levels of readiness of the technologies to integrate within the projects. Those in the first group will be launched more immediately on the basis of existing technologies, whereas the ones in the second group will require further development of the comprised technologies. The list of the platforms in this group will be confirmed and their content defined in accordance with the evolution of priorities in the key action.

First Group of TPs

TP 1: Low-cost, low-weight primary structures

This TP is the response to the challenge for the structural designer, particularly of the wing and fuselage of commercial aircraft, to select a cost-efficient combination of materials and structural concepts that can optimise weight while reducing development, production and operation costs. It will provide for the development, integration and validation of design and manufacturing concepts in full-scale primary structures. Principal technologies to bring around relate to: novel materials, multidisciplinary optimisation methods, manufacturing/assembling processes, simulation and numerical prediction tools, structural testing technologies, structural repair and monitoring techniques. The integration and validation task will have a two-folded focus: (1) on a full-size fuselage section of a large aircraft including not less than 25 frames, windows, doors and sub-passenger floor structures; (2) a representative part of a semispan wing structure, including the centre wing box, inner and outer wing boxes, wing-to-body and engine pylon fittings. The aim of the project is to prove the feasibility of achieving 20% reduction in both airframe first price and weight, thus resulting in a 15% reduction in Direct Operating Cost (DOC). The TP shall make optimum use of technologies developed and activities carried out under the EU framework as well as national and industrial programmes.

It will comprise three principal phases: (a) *Specification of platforms, technologies and processes.* In particular, the structural concepts applicable in the fuselage test article will include welding of integrally stiffened extruded panels and hybrid laminates (GLARE) for the shells, and polymeric composites for sub-floor and other internal structures employing Resin Transfer Molding (RTM), Resin Film Infusion (RFI) or other advanced processes. The semispan wing article will include the centre section (wing carry-through) box and outer box in polymeric composites using RTM, RFI and automated lay-up techniques. The inner box section (between the centre and outer boxes) will be metallic with integrally stiffened skins. Adhesive bonding and mechanical fastening will be used as appropriate for assembly; (b*) Research, design, manufacturing and assembly of test articles*, and (c) *Testing and validation*.

TP 2: Efficient and environmentally friendly aero-engine

This TP represents the European response to the double challenge of improving the competitiveness of its aero-engine manufacturing industry and actively contributing to curbing man-made climate change related to aviation. Consequently, the RTD activity will be based on a two pronged approach. The first will be focused on proving the technical feasibility of best available component technologies in an engine with a

conventional performance cycle. The second will be targeted on significant emission reductions of NOx and CO_2, through the full-scale validation of an advanced engine performance cycle using an intercooled and recuperated engine core. Both approaches will be based on integration and validation of the critical technologies derived from research projects under previous Framework Programmes and newly proposed FP5 technology activities as well as from national and own industry programmes. RTD work should focus on development and integration of technologies in the following areas: aero-thermodynamics of the turbomachinery components including advanced CFD-tools, combustion including chemical kinetics, measurement techniques and cooling concepts, high temperature resistant and low weight/high strength materials, systems engineering including manufacturing techniques. The integration of technologies will contribute to an overall reduction of fuel consumption, pollutant emissions, maintenance costs and the first costs of ownership including delays and cancellations related to the aero-engine deficiencies. Due to the character of technologies at stake, the two approaches in the project might require different engine test beds. The targets of the activity will be:

- for the approach with a conventional engine cycle, reductions in: specific fuel consumption and emissions of CO_2 by 10 %, emissions of NOx by 60 % compared to the current ICAO-96 standard, cost of ownership of propulsion system by 20 %, propulsion related delays and cancellations by 60 %, time to market by 50 %,
- for the approach based on an advanced engine cycle, reductions in: specific fuel consumption and CO_2 emissions in excess of 20 %, emissions of NOx and other major and minor exhaust gas species by more than 80 %, life cycle costs by 30 %.

An evolutionary approach to the integration and validation of the technologies needed will be used. This would comprise three main phases: (a) *Systems definition*, (b) *commissioning, manufacture and assembly.* The subsystems defined for the conventional cycle approach will include the turbine, combustor, compressor, control system and nacelle. For the advance engine cycle, they will include the compressor, combustor, turbine, intercooler and exhaust gas recuperator; (c) *functional tests and validation.*

TP 3: Novel rotary-wing aircraft configuration

This TP is the response to overcome the limitations of current rotary-wing aircraft through the tilt-rotor concept, so providing for a high speed Vertical Take-off and Landing capability in European commercial aviation. The overall objective is to be able to deliver a performance in hover similar to an helicopter, a cruise speed comparable to current turbo-propeller aeroplanes and lower operating costs than modern helicopters while assuring improved passenger comfort levels. The research activities will be based on the development, integration of technologies and their validation at components level and on a full scale Ground Test Article. This feasibility proof at ground test scale will represent an essential step prior to flight demonstration that is beyond the scope of this activity. The full scale article and comprised technologies should correspond to an aircraft with Maximum Take-off Weight of less than 10 tons, maximum range greater than 750 Nm (1390 Km) and maximum speed greater than 300 Kts.(556 Km/h) at sea level. RTD work should focus on development and integration of technologies in the following areas: main rotor system including hub, blades, power transmission and tilting mechanisms, flight

control system including tilt control, wing, fuselage and nacelle structures, aero-elastic stability including wing-rotor coupling and rotor-propeller whirl stability, aerodynamics, stability and control, including wing optimisation, wing-fuselage and wing-nacelle integration, system engineering including hydraulics, fuel, pneumatics, electrical and ice protection.

The validation activity will comprise three main phases and should be constructed in a building-block approach supported by extensive socio-economic studies: (a) *Systems definition.* Components and system specifications will include in particular: rotor performance in hover and cruise, gear box power requirements, cross-shaft and tilt mechanism design criteria, rotor mount structural criteria, wing structural design criteria, wing aerodynamic download coefficient in hover, wing lift, drag and pitching moment coefficients, systems performance. (b) *Design, manufacturing, testing of component*, (c) *integration and testing of the Ground Test Article.*

TP4: More autonomous aircraft in the future air traffic management system

This activity, focused on the airborne package of the system, represents the European response to the need for transforming research results into operational ATM procedures. It will select Communication Navigation and Surveillance (CNS) airborne technologies and integrate them in an avionics platform for validation in an ATM scenario defined in line with the European initiative. Although focusing mainly on the Airborne segment, RTD should take into account the ground segment, embracing its required new functions, in the definition of the ATM scenario. In particular, it should ensure interoperability with the integration and validation platform for the ground based ATM systel developed under key action 2. Validation activities, in addition to flight testing, will make maximum use of existing facilities such as flight and ATM simulators and ATC centres equipped with pre-operational or modified platforms developed in the context of Eurocontrol or other EU funded projects. Validation will be established in terms of : i) feasibility of an economical implementation of the ATM related airborne system in existing transport aircraft; ii) human-machine interface aspects and iii) certification issues.. The project will comprise (a) *Selection and integration of airborne technologies* (b) *Validation*.

Second Group of TPs

TP 5: Power-optimised aircraft

Technologies to optimise energy consumption of the different systems on-board an aircraft have tended to be focused at component rather than overall aircraft system levels. Recent developments have also tended to use electrical power to replace hydraulic, pneumatic and mechanical power systems. The increased number and complexity of energy-consuming applications and systems demand an integrated optimisation of power distribution and share in the aircraft that results in reduced non-propulsive energy consumption. This TP addresses the integration into an aircraft system architecture of alternative power generation and utilisation technologies for validation of the architecture and the systems. The project aims at proving the feasibility of a 25% reduction in non-propulsive peak power consumption while reducing weight and operational maintenance. The integration of the systems architecture will involve a common platform for systems simulation according to the

"hardware-in-the-loop" concept as a central feature. The final proof of feasibility will be shown in "iron-bird" tests and full scale flight tests.

TP 6: Low external noise aircraft

Public reaction to external noise from aircraft is one of the most important potential constraints limiting the future growth of air transport. During the last two decades the attention of noise reduction research has been placed mainly on the engine as the dominant noise source, resulting in substantial decrease of noise levels. However further progress can only be achieved by the combination of developments in several different elements: engine source noise, nacelle technology, airframe-generated noise and installation effects as well as low noise flight operational procedures. The integration and interaction of these different elements and the corresponding noise reduction technologies acting upon them is the target of the activity under this TP. The objective is to demonstrate the feasibility of reduction of perceived noise levels of at least 5 dB through application of low noise airframe and powerplant technology and at least 3 dB through low noise operational procedures by means of ground and laboratory tests and full scale flight tests.

TP 7: low noise aircraft cabin

Comfort is becoming a more stringent customer requirement for any type of aircraft, large as well as commuter transport or rotorcraft. The noise level is one of the most important factors contributing to the passenger perception of cabin comfort especially in medium and long distance flights. The importance of the noise issue will be exacerbated with the introduction of large commercial aircraft with more powerful noise sources and longer flight times. Many techniques for significantly reducing noise focused on the different links in the noise transmission mechanism from the sources to the passengers have been applied in the last years with diverse degrees of success. The activity of this TP is targeted at proving the feasibility of achieving substantial reduction of noise levels inside the passenger and crew cabins by the integration of acoustic treatment solutions with minimum cost and weight penalties. The project will demonstrate a reduction in both overall sound pressure level and speech interference level of 5 dB in commercial turbofan aircraft cabins by means of full-scale flight tests supported with ground and laboratory testing.

TP 8: Novel fixed-wing aircraft configuration

Today's commercial transport aircraft present the classical configuration consisting of a fuselage for the cabin, a wing to lift it and horizontal and vertical tail-planes at the rear part of the fuselage for stability and control. This typical configuration is fully adapted to technologies developed in the last decades. Since then several technological improvements are reaching a level of maturity that will allow to perform a novel optimisation of the global architecture of the aircraft, taking advantage of all progress in the domains of aerodynamics, structures, flight controls, multidisciplinary design, etc. The activity of this TP will be the validation of novel aircraft configurations for lifting and flight stability and control taking into account safety and certification issues. The aim is to demonstrate an increased operational efficiency of civil aircraft incorporating such novel configurations in response to market forecasts. The project will be based on the integration of technologies developed under

Community, national or industry funded programmes and their validation in full-scale flight tests supported by ground and wind tunnels tests.

TP 9: Integrated and modular aircraft electronic systems

The advances experienced in electronics technologies have expanded the range of their aeronautical applications and the number of avionics systems on board an aircraft. However, focused in the fulfilment of their individual functions, the development of the different electronic systems has tended to be done independently. Modularity of the components and their integration into a cost-efficient, performing overall architecture is a growing necessity. This TP will represent the response of the European aircraft integrators and avionics suppliers to this necessity. It will validate the feasibility of an integrated and modular avionics system able to perform all the required functions for aircraft operations satisfying both criteria of reliability and cost effectiveness. Objectives are to reduce overall avionics system weight, volume and power consumption by 30%, while decreasing its development time and cost of ownership. The project will represent also a decisive contribution to the evolution of international on-board electronics standards, particularly related to avionics packaging and integration, high-speed data buses, software reusability and flexibility and tools to measure compliance with required functions.

STRATEGY AND PRIORITIES FOR THE FIRST 1999 CALL FOR PROPOSALS

For the first call of the 5th Framework Programme a full coverage of all the critical technologies is appropriate. With regard to technology platforms, the choice is based on the industry needs in areas where technologies are ready for integration and validation. The first 1999 call for proposals will therefore be focused on: (a) *Development of critical technologies*: all technical areas defined under Objective 4.1 to 4.4 ; (b) *Technologies integration and validation*: the four technology platforms TP1 to TP4 defined under the First group of TPs.

3. GENERIC ACTIVITIES AND SUPPORT TO RESEARCH INFRASTRUCTURES

3.1 MATERIALS AND THEIR TECHNOLOGIES FOR PRODUCTION AND TRANSFORMATION

RATIONALE AND SOCIO-ECONOMIC OBJECTIVES

RTD in this Generic Action will mainly be of a medium and long-term nature. One of the key aspects of medium and long-term generic research is that it is often not related to one specific application but to applications for more than one product or sector. Material properties and performance, including for natural materials, are also closely linked to materials production and transformation. Research on new and improved materials will therefore be carried out in parallel to, and closely integrated with, RTD on materials processing technologies. The main specific objectives are to:

- **Support advanced materials applications needed for improved quality of life.** This includes characterisation, modelling and testing for functional or structural applications.
- **Develop sustainable materials production and transformation technologies**, which can ensure quality, reliability, sustainability and cost-effectiveness of materials to allow optimum incorporation into new products, especially in the context of shorter production cycles.
- **Improve safety and reliability**. Materials properties and degradation mechanisms have a major impact on society: e.g. structural integrity of buildings (e.g. subject to ageing or earthquakes) or transport vehicles as well as efficiency and reliability of industrial processes and products.
- **Promote the efficient use and reuse of materials**. Focus on "full life-cycle approach" will lead to an increasing stream of high quality "secondary" raw materials. This should make a major contribution to a sustainable society.

RESEARCH OBJECTIVES

Specific objectives are important to be mentioned in relation with materials research.

- The first one refers to research at the nanoscale (1-100 nm) and on surface technologies. This research has the potential for a wide variety of applications. In particular the use of nano-particles to improve material properties has large potential applications. Nano-structured materials may also allow further miniaturisation of electronic systems.
- The second one refers to the rapid growth of the functional materials market reflecting their increasing importance for the industry and the society, in particular biomaterials or opto-electronic materials. RTD on functional materials involves a large spectrum of materials research (alloys, ceramics, polymers, surface or interfacial science).
- Materials development is largely based on chemistry, and in particular on fine and specialty chemicals, characterised by relatively small production capacities. There is here a clear scope for materials and process improvement in efficiency, selectivity, flexibility and sustainability, as well as development of new synthesis routes and their specific process engineering. Processes allowing an increased use of renewable raw materials will receive particular attention**.**
- For structural materials mechanical properties are a major issue. The basic understanding of degradation mechanisms is also a prerequisite. These materials are key to major industries, in particular for construction or transport. Extending properties and performance such as lighter weight, higher strength, higher temperature, fire and corrosion resistance, etc, while ensuring environment compatibility and recyclability, should be priority objectives.
- Research on sustainable use of materials should aim at an integrated approach where the use of materials is optimised and where the use of recycled raw materials is increased by confronting the major technical barriers.

This implies the following four research priorities:

Objective 5.1: Cross-cutting generic materials technologies

RTD projects should demonstrate large impact(s) at European level, leading to multisectoral applications for products and processes with improved performance for the consumer or the user. This applies especially to molecular engineering and nanotechnology including processing of particles, layers and structures, as well as to surface engineering and interfacial science and technologies. Research is also needed to expand the limits of current techniques expected to lead to environmentally safe new production technologies for novel composites, lined, coated and/or surface treated materials.

Objective 5.2: Advanced functional materials

RTD will focus both on the development and processing of improved and new functional materials, such as magnetic, electronic or electrochemical materials and devices, superconducting materials, materials for displays, sensors and actuators. Research should also focus on materials and devices for optical applications and opto-electronics. Another focus should be bio-mimetic materials and materials for bio-medical applications, such as artificial and hybrid tissues, materials for implants and minimally invasive devices, or for biosensors. Particular attention will be given to the environmental compatibility of these functional materials.

Objective 5.3: Sustainable chemistry

RTD in this area is focussed on generic chemical issues, advanced polymers, and fine or specialty chemicals and solid state chemistry. The overall aim is to achieve a sustainable chemistry based on clean processing routes and efficient use of resources, including the use of renewable raw materials, for example for the production of organic chemicals. Research is also needed towards higher added value and safer materials (e.g. “smart”, multifunctional, packaging materials). RTD tasks should include functional materials for chemical engineering, including catalysts and materials for separation technologies, as well as on formulation engineering and new synthesis routes, supramolecular chemistry and chemistry for new materials, including colloidal systems and nanostructured materials.

Objective 5.4: Expanding the limits and durability of structural materials

Objectives are: to expand the performance characteristics (e.g. strength, temperature, toughness); to ensure environmentally friendly materials and production processes; to improve safety and reliability by understanding deterioration and failure mechanisms (e.g. wear, corrosion). RTD should focus on expanding the limits of structural materials, such as advanced metals and alloys, construction materials, metal-matrix composites, ceramics, polymers and ceramic or polymer matrix composites. Attention should also be given to the quality of recycled secondary raw materials [9], including compatibility of materials and environmental pollution.

[9] Sustainable use and processing of materials has a major relevance to support the key actions, in particular “innovative products, processes and organisation”. This Key action will give particular attention to raw material processing, recycling processes and to the management of industrial waste.

STRATEGY AND PRIORITIES FOR THE FIRST 1999 CALL FOR PROPOSALS

Materials RTD is by nature a diverse and heterogeneous area, related to virtually all technologies addressed in the 5th FP. All research objectives 5.1 to 5.4 will be open in 1999 but priority will be given to medium to long term research activities related to "Sustainable and Competitive Growth". To achieve Community added value and critical mass, the calls for proposals will consider RTD projects and co-ordination activities aiming at (a) generic and multisectoral aspects around the above mentioned topics as well as at (b) short to medium term objectives related with the priorities identified in the key actions. Clusters will play a key role in co-ordinating community research activities and in stimulating collaboration between research funded at various levels e.g. in Member states and third countries. Co-ordination will also be assured with related projects and actions in other specific Programmes, in particular the programme on "innovation and participation of SMEs", including cooperative research (CRAFT).

3.2 NEW AND IMPROVED MATERIALS AND PRODUCTION TECHNOLOGIES IN THE STEEL FIELD

RATIONALE, SOCIO ECONOMIC AND RESEARCH OBJECTIVES

In view of the expiry of the ECSC Treaty in 2002, and the conclusions of the Amsterdam European Council (June 1997), there is an urgent need to speed up the progressive insertion of coal and steel research into the framework programme. The objective is to reduce costs, improve user satisfaction, and increase value added, to the benefit of both the iron and steel industry and suppliers, end users and other research partners.

Objective 5.5: Iron and steel production:

More added-value, cost-effective, flexible and environmental-friendly production routes are aimed at, such as new coal-based direct ironmaking and improved scrap-based steelmaking. Research in cokemaking for metallurgical reactors and up-grading of iron and steelmaking by-products are also addressed.

Objective 5.6: Steel casting, rolling and downstream treatment

Compact, flexible, clean, energy- and cost-effective production lines are aimed at, toward more customer-oriented products with higher quality. On-line, real-time analysis and measurements for improved process control, integrated information management and closed-loop processing are also addressed.

Objective 5.7: Steel Utilisation

More added-value and "intelligent" products are aimed at, such as steel grades with improved characteristics and in-service performance. Particular attention is paid to manufacturability (e.g. forming, joining), "de-materialisation", life-cycle approach and eco-design.

STRATEGY AND PRIORITIES FOR THE FIRST 1999 CALL FOR PROPOSALS

Iron and steelmaking consist in a complex continuum of different technologies, several of them are addressed within other RTD activities foreseen in the 5th FP as well as in the ECSC Steel RTD Programme. All research objectives 5.5 to 5.7 will be considered in 1999 but priority will be given to topics of medium to long term multi-sectoral potential impact, such as the better understanding of the laws of physics and chemistry in metallurgical reactors and product treatment, better data acquisition and modelling for improved process control. Priority for the calls for proposals is also given to shorter-term projects which may be critical to solving problems identified in the key actions. The inclusion in clusters of projects related with production and use of steel, encompassing RTD projects funded in other Key actions and Thematic Programmes, and in the ECSC Steel RTD Programme is envisaged.

3.3 MEASUREMENTS AND TESTING

RATIONALE AND SOCIO-ECONOMIC OBJECTIVES

The three socio-economic objectives are:

- **Prenormative research and technical support to standardisation**

Research will focus on the development and validation of measurement and testing methods and the production of scientific and technical data needed to define performance, reliability and safety requirements for products and services. Research will also be carried out on the development of certified reference materials needed in support of Community policies, in particular, for the implementation of directives.

- **The fight against fraud**

Research will focus on the development of the measurement and testing methods that are needed in order to detect and prevent fraud and to protect the economic interests of enterprises and society and the health and safety of citizens. The long-term aim will be to keep the know-how and technology ahead of the defrauder.

- **Improvement of quality**

Research will concentrate on the development of new and improved generic measurement and testing methods and the establishment of the international traceability of measurements. Methodologies will also be developed to measure the quality of industrial products and services.

RESEARCH OBJECTIVES [10]

Objective 6.1: Instrumentation

The research to be carried out will develop new and improved instrumentation and measuring systems, including software, with the capabilities required by the end-

[10] RTD activities for the development or improvement of European standards or supporting other specific programmes, in particular for Certified reference materials, will be implemented through dedicated calls.

users, such as improved performance and reliability, intelligent operation, cost-efficiency and suitability for use in the field or on production lines.

Sensors, screening systems and instruments for the fight against fraud: Instrumentation will be developed that is required for verifying the authenticity and origin of industrial products and materials, as well as paper documents, bank notes, and cultural artefacts. In addition, instrumentation will also be developed for detecting adulterations, toxic and illegally used substances and illegally traded goods, for the verification of the identity of persons, for identifying markers and objects indicating the origin of goods, and for verifying authenticity in the electronic transfer of currency.

Instrumentation for improvement of quality: Instrumentation will be developed that will improve the quality of measurements for industry and service sectors as well as that is required for the establishment of the international traceability of measurements. The activities will include not only hardware development, but also development and validation of metrological software.

Objective 6.2: Methodologies for Measurements and Testing

RTD to be carried out will cover not only the development and the improvement of measurement and testing methods, but also the development and the improvement of sampling strategies and data bases and the production of scientific and technical data needed for the definition of performance, reliability and safety requirements.

Methodologies to support standardisation and Community policies: The new Approach Directives [11] lay down the essential requirements which products have to meet before they can be placed on the market but do not give technical specifications. Directives where some of the standards will need research include those on explosive atmospheres, safety of machinery, electromagnetic compatibility, packaging and packaging waste, pressure equipment, personal protective equipment and toys. Other RTD activities, co- and pre-normative, related to the objectives of this programme will cover the development, improvement and validation of measurement and testing methods as well as the production of scientific and metrological data needed to define performance, reliability and safety requirements for industrial products and services [12].

The activities will be implemented through dedicated calls only (see chapter 4) and the priority research topics will be chosen in consultation with the relevant standardisation bodies.

Measurements and testing anti-fraud methodologies: Methodologies will be developed that are needed to in order to provide reliable evidence for successful prosecution, and to support the development and implementation of anti-fraud regulations. The methodologies developed will enable the authenticity and the origin

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11 A list of New Approach directives is given in the Commission Report to the Council and the European Parliament on "Efficiency and accountability in European Standardisation"

12 Pre- and co-normative research in the areas of agriculture, food, health care and the environment, will be the responsibility of the relevant thematic programme.

of products, components and materials, including cultural artefacts, to be checked. They will also enable illegally used substances or components, forbidden drugs in sport, illegal drug trafficking and illegal (animal) trading to be detected and the identity of persons to be confirmed. They will also allow products to be correctly categorised with respect to the application of custom tariffs and the control of quotas and subsidies. The long-term aim of all the activities will be the harmonisation of methodologies and they will be implemented exclusively by means of dedicated calls.

Measurements and testing methodologies in support of quality: Methodologies will be developed to improve the traceability and reliability of measurements and to exploit techniques with potential to become the basis for new measurement techniques of industrial importance. RTD will focus on development of measurement and testing methodologies that are needed for (traditional, new and emerging) industrial products, processes and services, as well as for monitoring production and for controlling effluents and emissions. New tools will be developed such as novel calibrants, transfer standards, reference methods, software, chemometrical methods, expert systems, and sampling techniques. Intercomparisons will be carried out to identify sources of errors. Methodologies will be developed to enable the customer perceived quality of industrial products and services to be measured, and to ensure a sound and comparable basis for rating products and services.

Objective 6.3: Support to the development of Certified Reference Materials (CRMs)

Certified reference materials (CRMs), being used as calibrants and for quality control, are important for providing traceability in chemical and biological measurements. CRMs are also needed to provide traceability for some physical measurements, in particular for materials testing. The activities will be implemented exclusively by means of dedicated calls.

CRMs for European standards: Particular CRMs representative of manufactured products will be developed to verify quality and safety standards and for testing of materials following a standard method. CRMs will also be developed that are needed in support of directives and Community policies, in particular, in the fields of agriculture, food, health care and the environment.

Reference substances and materials for anti-fraud: CRMs will be developed that are required for checking the authenticity of materials and components, for the control of subsidies and quotas, for the verification of product categorisation in relation to custom tariffs, for the detection of illegal substances and dangerous goods, for the detection of illegal drugs in sport, for the determination of the origin and age of cultural artefacts, for the identification of persons.

CRMs for traceability and calibration: CRMs will be developed that are needed for the calibration and performance testing of instruments, for material testing, for product testing and process monitoring, for chemical and biological analysis of industrial importance.

STRATEGY AND PRIORITIES FOR THE 1999 CALLS FOR PROPOSALS

The first periodic call in 1999 will cover research objective 6.1 *Instrumentation* and part of research objective 6.2 *Measurements and testing methodologies in support of quality*. For the research objectives not covered in the periodic calls, a call for expressions of interest will be launched. The first dedicated call in 1999 will primarily cover topics in support to standardisation. Within Competitive and Sustainable Growth, co-ordination will be assured for projects related to pre- and co-normative research. Co-ordination with other programmes will primarily concern projects related to the fight against fraud and certified reference materials.

3.4 SUPPORT FOR RESEARCH INFRASTRUCTURES

Activities would aim at (i) the optimum utilisation of geographically dispersed medium / large scale research facilities, (ii) the rapid transfer and implementation of RTD results into industrial applications, and (iii) the improvement of interoperability and common protocols. Community support will be directed towards creating a synergistic use of European infrastructure. Emphasis will be also put on increasing cohesion between Member states on strategic R&D needs and exploitation of results.

Objective 7.1: Support activities to medium and large scale facilities

These activities will aim at identifying and implementing solutions for improved transnational access and networking for optimum use of medium and large scale facilities having a strong and innovative scientific, technical or socio-economic relevance to the Programme. The initial phase will be to identify and prioritise areas justifying substantial effort at European level. The next phase would be to provide up-to-date, www-based inventories including performance characteristics and access availability for potential users.

Objective 7.2: Setting up of virtual institutes

The objective of the activity is to facilitate the rapid exploitation of RTD-results into industrial applications. Geographically dispersed complementary research and industrial capabilities will be linked creating entities with a potential to become independent and self-supporting. These virtual institutes, created from departments of industries, service companies, research centres, universities and laboratories, etc., will use advanced Information and communication and knowledge management tools to provide the industry, notably SMEs, with high standard services for research, technology transfer and exploitation of RTD results in relevant and advanced technology fields.

Objective 7.3: Reference data bases

Reference databases have been identified as a means to support the development of the European research fabric. Efforts will include the cataloguing of databases of priority interest to European industry and services and the setting-up of networks of relevant data bases and their stakeholders. Focus will be on activities ensuring both content and structure of databases regarding their accessibility, comparability and quality. The overall objective is to bring together selected databases using adequate platforms, which allow effective support to researchers and users at EU level.

Objective 7.4: Measurement and Quality Management Infrastructures

The aim is to develop and strengthen the European metrology infrastructure, to reinforce traceability and to improve cohesion of metrology systems. One important means will be to support the production of Certified Reference Materials [13]. Activities will also aim at promoting a harmonised approach to quality management in organisations and enterprises, in particular SMEs.

STRATEGY AND PRIORITIES FOR THE 1999 CALL FOR PROPOSALS

This part of the programme will be implemented through dedicated calls, using mainly the modality of thematic networks. Calls for tender will be launched for the production of CRMs. In 1999, priority will be given to Objectives 7.2 and 7.4.

4. MODALITIES FOR IMPLEMENTATION

4.1 CALLS FOR PROPOSALS

Implementation of RTD activities is carried out mainly [14] through the following types of calls for proposals:

- **Calls for proposals with fixed dates (periodic calls).** These are open for submission of proposals within a defined scope and with fixed deadlines. The scope is defined, for each call, in the sections "Strategy and priorities for the calls for proposals" of the work programme and specified in the call published in the Official Journal. The deadlines are outlined in the indicative timetable for programme implementation and specified in each call published in the Official Journal.
- **Open calls.** These are launched at the start of the programme for SME Specific Measures, Marie Curie Fellowships, accompanying measures and International initiatives, such as IMS, and remain open until the last year of the Framework Programme, with periodic evaluations (2/3 per year).
- **Dedicated calls.** These are normally published one or twice a year and are restricted to a number of very specific topics and/or activities with supporting documents available to specify objectives of required activities. The Commission will publish a *call for expressions of interest* inviting interested parties to suggest

[13] RTD necessary to develop such materials is covered by the generic activity "Measurement & Testing". Production of CRMs will be implemented through calls for tender.

[14] Certain accompanying measures will be implemented through other processes. Services to the Commission (studies, production of Certified Reference Materials, etc) will be carried out following specific calls for tenders, to be launched as appropriate. Recourse to external experts will be based on calls for candidates. Unsolicited applications for a subsidy may also be supported.

ideas for topics (RTD and infrastructure related needs) in some of the areas to be covered by these calls.

Additional information may be provided at the announcement of the call, in particular on tasks to be launched in relation to Key Action 2.

4.2 MODALITIES

The programme is implemented in accordance with the Council Decision concerning the rules for participation and dissemination. The main implementation modalities are: (1) **Shared-cost actions** (RTD, demonstration, combined RTD/demonstration projects, Co-operative research (CRAFT) projects, Exploratory Awards) and (2) **Co-ordination activities**.(Thematic Networks, Concerted Actions) To achieve Community added value and critical mass, networks of RTD projects will be set up in a number of RTD domains. These networks should play a key role in co-ordinating research within and between EU programmes and in stimulating collaboration between research funded at various levels e.g. in Member states and third countries.

The programme will implement special measures to facilitate and encourage the participation of SMEs in RTD and demonstration activities. These measures consist of **Co-operative Research (CRAFT)** and **Exploratory Awards**. The measures aimed at encouraging and facilitating SME participation in RTD activities relate to projects which show great potential as regards innovation and which fall within the overall objectives of the thematic programmes. In other words, they do not have to relate specifically to the key actions, generic technologies and research infrastructure. As such, these measures allow for a “bottom up” character since proposals may be submitted for the objectives and priorities of the thematic programmes in their entirety. The implementation of the SME specific measures follows the common rules established in the horizontal programme “*Innovation and the participation of SMEs*”, in order to ensure transparency for the beneficiaries. These rules include common contractual and proposal evaluation, a single complementary entry point for the reception of proposals for SME specific measures, common rules for eligibility and for scientific and technological evaluation; common legal and financial provisions as well as a harmonised and rapid feedback to applicants.

In addition, the programme supports two other types of action: (3) **“Marie Curie” Training fellowships** and (4) **accompanying measures.**

Marie Curie Training Fellowships are defined in the programme *“improving the human research potential and the socio-economic base*”. The following types, to be linked to objectives of this programme, are offered: **Industry Host Fellowships** (post-graduate and post-doctorate) and **Experienced Researchers Fellowships** (“category 40”).

Accompanying measures are implemented according to Annex III of the specific programme. They contribute to its effective implementation, to the up-dating of the work programme, the preparation of future activities and the dissemination of results. They encompass activities for the monitoring of the programme, the assessment of

RTD impacts as well as studies and recourse to external expertise, including setting up of monitoring or evaluation panels and expert groups. They allow support to international co-operation activities (e.g. IMS). They include activities to provide specific training, information and assistance and to promote the diffusion, exploitation, transfer and take-up [15] of RTD results, aimed at the broad user community, notably SMEs. They also cover support to scientific and technical meetings as well as innovation support events (e.g. investment fora), publications, web sites, etc. They can also consist of support activities (e.g. production of CRMs) or collaborative research studies contributing to initiatives of public or policy interest in relation with the Key actions.

Measures implemented through an open call published at the start of the programme cover: studies contributing to the implementation of the actions of the programme and in preparation of future activities; innovation support actions to promote the diffusion, transfer, exploitation and broad take-up of results; awareness, assistance and information exchange actions; training actions in support of RTD objectives and activities of the programme.

Accompanying measures consisting of policy driven research contributing to specific priorities of Key Action 2 “sustainable mobility and intermodality” are implemented through periodic and dedicated calls. Some measures addressing specific topics may be included in dedicated calls.

4.3 COORDINATION

The co-ordinating forum for all research elements within FP5 that relate to this programme, in particular transport research topics, will be the « Board of Directors » of programme 3.

Co-ordinating arrangements within and between the different key and generic actions as well as with other programmes will follow the framework defined in annex III of the programme. They may take one or several of the following forms: common management structure (e.g. for SME related activities); co-ordinated calls, including where appropriate joint calls; co-ordination in the evaluation and selection procedure, including where appropriate joint evaluation and transfer of proposals; co-ordinated implementation of projects and cross-programme clusters of projects. Co-ordination with the other thematic programmes is based on the principle that activities linked with development of life sciences, or technologies for energy, environment or the Information Society will be concentrated in the relevant programmes. Activities dealing with integration and adaptation of these technologies in applications relating to competitive and sustainable growth will be conducted in this programme.

Thematic Programme 3	**Examples of areas for possible co-ordination with**

[15] Take up measures involving significant technical work should normally be included in RTD, demonstration or combined RTD / demonstration projects submitted in response to periodic calls

domains	**other programmes in FP5**
KA1	*IST* with Thematic Programme 2 *Production technologies* with Thematic Programme 4
KA2	*Traffic management and GNSS* with Thematic Programme 2 *Emissions and land use planning* with Thematic Programme 4 *Health related aspects* with Thematic Programme 1
KA3	*Advanced vehicle concepts* with Thematic Programmes 2 & 4 *Sust. management of the sea* with Programme 4
KA4	*On board systems* with Thematic Programme 2 *Control of emissions* with Thematic Programme 4
Generic Technologies	*Materials* with Programmes 1,2 & 4 and the JRC *Anti-fraud* with Programmes 1 & 2 and the JRC *Reference materials* with Programmes 1 & 4 and the JRC *Support to standardisation* with Programmes 1 & 4
Support to research infrastructure	*Access to facilities* with Activity 4

The international dimension of the programme will complement the actions of the Programme "*confirming the international role of Community research*". Activities that may be implemented jointly with other frameworks (e.g. COST, Eureka, IMS) will be carried out in accordance with the rules established for FP5. Activities would normally be focused on the exchange of information. This programme will be open to participation by researchers from outside the EU and Associated States according to the rules of participation set out in the Decision pursuant to article 130J of the Treaty. The programme 'Confirming the International Role of Community Research' provides funding for bursaries to young scientists from Developing Countries (including Emerging Economies and Mediterranean partner Countries) to come to Europe to work in projects of this programme for a period of up to 6 months.

The "competitive and sustainable growth" programme will place special emphasis on the dissemination, transfer, utilisation and/or exploitation of R&D results leading to innovation. To this end the programme will carry out activities in co-ordination with the "*Innovation and the participation of SMEs »* programme, inter-alia, to promote the transfer and exploitation of EC RTD results, to provide information on EC RTD results, to assist in preparing management tools to promote the exploitation of EC RTD results by the consortia and to monitor with the help of adequate tools, such as the Technology Implementation Plan and technology audits, the further use of RTD results, to assist with the assessment of the efficiency and effectiveness of the assistance network for technology transfer, of joint actions between the thematic programmes and the horizontal programme and of the Innovation Units or Innovation/SME units.

The horizontal programme "*Improving the human research potential and the socio-economic knowledge base»* establishes the common rules for the implementation of the Marie Curie Fellowships, in order to ensure the consistent high quality and prestige of the schemes. These rules include a common definition of Marie Curie Fellowships, a Single Entry Point for the reception of all Marie Curie Fellowship proposals, common rules for eligibility and for evaluation, common legal and financial provisions as well as a harmonised feedback to applicants and monitoring of the fellows.

Support for research infrastructure is provided by thematic programmes, as well as by this horizontal programme which has the responsibility of drawing up and publishing on a regular basis a "map" showing for all classes of research infrastructure to which specific programme(s) they may apply for support. Specific measures will also be taken by this horizontal programme to ensure co-ordination of the socio-economic research to be implemented within the current programme. Socio-economic research can be funded as well by the key action on « improving the socio-economic knowledge base » and the horizontal programme, which will draw up an annual report on socio-economic research in the Fifth Framework Programme.

Exchange of information and collaboration with the direct actions of the JRC[16] will be developed, where appropriate, in particular in areas related to materials research, fight against fraud and production of Certified Reference Materials (CRMs).

4.4 ROAD MAP

A road map is established and periodically updated for the execution of the programme. Information is provided in chapters 5 and 6 [17]. An annual revision of this

[16] For information on the JRC Work Programme, visit the JRC home page at http://www.jrc.org.

[17] The competent Director General can advance or delay the opening date for the calls within the limit of one month. In this case a notice will be published in the Official Journal at the date initially scheduled for the call.

work programme is foreseen, in due time for the following calls, to adapt RTD priorities and objectives to technological, social or economic developments.

5. INDICATIVE BUDGET AND CALENDAR FOR IMPLEMENTING THE ACTIONS

5.1 Budget per research domain

	KA 1	KA 2	KA 3	KA 4	MAT*	M&T	INFRAST.	TOTAL
Total (EUR million)	731 (27,0%)	371 (13,7%)	320 (11,8%)	700 (25,9%)	410 (15,2%)	136 (5,0%)	37 (1,4%)	2705 (100%) **

* Including "phasing in" of steel research
** Including maximum EUR 175 million (6,5 %) for personnel & administration, EUR 38 million for calls for tenders (remaining therefore EUR 2492 million for research related activities, of which EUR 270 million minimum to be allocated to SMEs).

5.2 Budget distribution per domain and per type of call

	KA 1	KA 2	KA 3	KA 4	MAT*	M&T	INFRAST.	TOTAL
Periodic calls	565	270	255	590	324	67		2071
Dedicated calls	5	47	5	5	5	45	34	146
Open calls	102	25	35	50	50	13		275
Total (EUR million)	672 (27,0%)	342 (13,7%)	295 (11,8%)	645 (25,9%)	379 (15,2%)	125 (5,0%)	34 (1,4%)	2492 (100%)

5.3 Budget to be committed annually according to the different type of calls

	1999	2000	2001	2002
Periodic calls	*573*	*495*	*500*	*503*
Dedicated calls	*0*	*45*	*55*	*46*
Open calls	*30*	*60*	*85*	*100*
Total (EUR million)	603	600	640	649

5.4 Indicative budget to be spent according to the different modalities

	RTD	Demo	SME specific measures	Co-ordination[4]	Marie Curie fellowships	Accomp. measures.	TOTAL *18*
Periodic calls	1823	100		100		48	2071
Dedicated calls	90 [1]			34 [5]		22	146
Open calls	35 [2]		200 [3]		12	28 [6]	275
Total (EUR million)	1948	100	200	134	12	98	2492

(1) Corresponding to policy-driven research and feasibility studies for Certified Reference Materials
(2) Corresponding to the "IMS" initiative of which 5 to be spent in 1999
(3) Any modification of this amount will affect the whole programme
(4) Thematic Networks and Concerted Actions
(5) Corresponding to "support to research infrastructures" (networking of organisations)
(6) Including requests for subsidies

5.5 Indicative calendar for periodic calls (indicative figures)

	1st year	2nd year	3rd year	4th year
Opening dates [19]	*16 March 1999*	*15 December 1999 + 15 June 2000*	*15 December 2000 + 15 June 2001*	*No call*
Closing respective dates	*15 June 1999*	*15 March 2000 + 15 September 2000*	*15 March 2001+ 15 September 2001*	
RTD objectives	*See table below*	*Focused according to the results of 1st call **	*Revised work programme **	
To be committed the same year	*573*	*338*	*168*	** including if appropriate cross-programme(s) research priorities*
To be committed the next year	*157*	*332*	*503*	

[18] The Commission reserves the right not to commit the entire budget available for each call.

[19] A second call may be launched if proposals resulting from the first call do not fulfil the Programme objectives.

Total (EUR million)	730	670	671	

5.6 Indicative calendar for the dedicated calls

	1st year	2nd year	3rd year	4th year
Opening dates	*15 June 1999*	*15 Oct. 1999 + 15 April 2000*	*15 Oct. 2000 + 15 April 2001*	*No call*
Respective closing dates	*15 Sept. 1999 (for KA2) 15 Nov. 1999*	*15 March + 15 Sept. 2000*	*15 March + 15 Sept. 2001*	
Objectives	*Policy driven research activities related to specific objectives, in particular: parts of objectives 2.1 to 2.3 of KA 2 objectives 6.3 and part of 6.2 of M&T*			*For some of the areas, an open call for expressions of interest will be published at the beginning of the programme with closing date in May 2001.*
	Support to research infrastructures: objectives 7.1 to 7.4			
	Specific accompanying measures			

5.7 Indicative calendar for the open calls

Type of action	Opening/closing dates	Proposals are evaluated by batches according to the following deadlines for receipt
Marie Curie Fellowships: - Industry Host Fellowships - Experienced Researchers Fellowships	16 March 1999 / 20 March 2002	02/06/1999, 19/11/1999, 22/03/2000, 18/09/2000, 21/03/2001, 19/09/2001, 20/03/2002
SME specific Measures: - Exploratory Awards	16 March 1999 / 18 April 2001	14/04/1999, 15/09/1999, 12/01/2000, 26/04/2000, 13/09/2000, 17/01/2001, 18/04/2001
- Co-operative research (CRAFT)	16 March 1999 / 17 April 2002	15/09/1999, 12/01/2000, 26/04/2000, 13/09/2000, 17/01/2001, 18/04/2001, 19/09/2001, 16/01/2002, 17/04/2002
IMS (RTD Projects)	16 March 1999 / 15 Sept 2000(1)	15/06/1999, 15/12/1999, 01/04/2000, 15/09/2000

Accompanying measures	16 March 1999 / 15 March 2002	15/06/1999, 15/11/1999, 15/03/2000, 15/09/2000, 15/03/2001, 15/09/2001, 15/03/2002

(1) may be extended following the revision of the work programme

6. PRIORITIES AND INDICATIVE BUDGETS FOR THE 1999 CALLS FOR RTD ACTIONS

	RTD Priorities for the first periodic call in 1999	RTD objectives	*Indicative figure in EUR mio*	*to be committed in 1999*	Modalities
KA 1	▪ **Customer-oriented and high-tech production** ▪ **Towards new and miniaturised products and processes** ▪ **Machinery, production equipment and systems for manufacturing** ▪ **Towards zero-waste in manufacturing and processing** ▪ **Promoting eco-efficient industries**	Objectives 1.1 to 1.4	*150*	*125*	*R&D, demonstration, and combined projects*
KA 2	▪ **Socio-economic scenarios** ▪ **Research for infrastructures and their interfaces with transport means and systems** ▪ **Modal and intermodal transport management systems**	Objectives 2.1 to 2.3	*90*	*80*	*Thematic Networks*
KA 3	▪ ***development of critical technologies*** ▪ ***technology integration and validation*:** ▪ **New land transport vehicle concepts; Enhanced systems efficiency** ▪ **Advanced concepts for ships and vessels; Competitive shipbuilding**	Objectives 3.1 and 3.2	*80*	*35*	
KA 4	▪ ***development of critical technologies*** ▪ ***technology integration and validation*** ▪ **Low-cost, low-weight primary structures** ▪ **Efficient and environmentally friendly aero-engine** ▪ **Novel rotary-wing aircraft configuration** ▪ **More autonomous aircraft in the future air traffic management system**	Objectives 4.1 to 4.4	*245*	*195*	*Concerted Actions*
MAT	▪ **Cross-cutting generic materials technologies** ▪ **Advanced functional materials** ▪ **Sustainable chemistry** ▪ **Expanding the limits and durability of structural materials** ▪ **Iron and steel production** ▪ **Steel casting, rolling and downstream treatment** ▪ **Steel utilisation**	Objectives 5.1 to 5.7 Multi-sectoral and medium to long term research	*125*	*105*	*Specific accompanying measures related to Key Action 2*
M&T	• **Instrumentation** • **Methodologies in support of quality**	Objectives 6.1 + part of 6.2	*40*	*33*	

TOTAL		730 EUR million	573 EUR million

Dedicated call	• **feasibility studies for Certified Reference Materials** • **policy-driven activities related in particular to specific objectives of KA 2 and M&T** • **Support to research infrastructures** • **Specific accompanying measures**	44 EUR million	0 EUR million
Open call	• **Marie Curie fellowships** • **SME Specific Measures** • **IMS (RTD Projects)** • **Accompanying measures**	275 EUR million	30 EUR million

7. CRITERIA FOR SELECTION

RTD actions have to be selected according to criteria reflecting the overall objectives of the programme. These criteria, to be respected by all research activities, have been designed applying the selection criteria set for FP 5. They are grouped in five categories. Any proposals evaluated below set thresholds (specified in the Guide for proposers) in those categories will not be considered for funding:

Ensuring Scientific &Technical excellence			**Quality of approach, partnership & management**			**Stimulating Community Added Value**			**Answering to societal needs**			**Economic development and S&T perspectives**		
For RTD activities including accompanying measures, those five categories would normally be given equal weight.														
Scientific & Technological quality and relevance to programme objectives	Adequacy of the scientific & Technological approach	Degree of innovative character	Quality of approach for project execution and management	Quality of partnership, including efficient involvement of users	Appropriateness of financial aspects and RTD related resources	Contribution to solving problems with a European dimension	Support to EU policies as well as to standards & reglementations	European added value of the consortium / Complementarity / transnationality of consortium	Implication on quality of life, health and safety	Implication on employment prospects as well as skill use and skill development	Implication on environment & resources	Strategic impact / contribution to competitiveness / partners and users interest	Contribution to growth / usefulness and range of applications / exploitation plans	Contribution to technological progress / dissemination strategies

These criteria should also be respected during the execution of the research activities in order to achieve overall excellence and consistency. They will be used to assess activities and help quantify impacts, providing information that will enable a timely and appropriate programme management response. The evaluation of the potential impact of new knowledge, technologies,

products, processes or materials resulting from RTD actions will be a permanent activity of this programme, ensuring in this way an effective implementation of the Council decision.

8. Annex: Glossary

Accompanying measures	*Actions contributing to the implementation of a **specific programme** or the preparation of future activities.*
Cluster	*Clustering is a programme implementation concept, which aims at realising and maximising European Added Value within a given field. A cluster is defined as a group of synergistic and complementary projects..*
Concerted actions	*Actions co-ordinating **RTD** projects already funded by the **Member States.***
CORDIS	*Community Research and Development Information Service. The service (http://www.cordis.lu/) consists of an internet site providing information on Community **RTD**, together with paper-based and electronic information services.*
COST	*European Co-operation in the Field of Scientific and Technical Research, founded in 1971. It now comprises two types of projects; a) concerted action projects forming an integral part of a community R&D programme, which are open on a multilateral basis to COST third state participation. b) concerted action projects, not forming part of a Community programme, proposed either by COST states or by the Commission.*
CRAFT	*Co-operative Research Action For Technology. A special measure designed to encourage the participation of **SMEs** in European research projects. It enables at least three mutually independent SMEs from at least two **Member states** to jointly commission research carried out by a third party.*
Direct RTD actions	*Actions carried out for the Commission by the **JRC**.*
ECSC Treaty	*"European Coal and Steel Community" Treaty signed in 1951 which comes to an end in 2002.*
EEA: European Economic Area.	*A Treaty signed on 2 May 1992, creating between the EU Member States and the member countries of EFTA (except Switzerland) a single economic area for the free movement of goods and services and co-operation in particular on research. Members participate in the **Framework Programme** as **Associated States**.*
Eureka	*A framework set up in 1985 through which industry and research institutes from 25 European countries and the European Commission develop and exploit technologies crucial to global competitiveness and a better quality of life.*
External Advisory Group (EAG)	*The role of the External Advisory Groups is to provide the Commission with independent advice concerning the content and direction of research work to be carried out under the **key actions** of the Fifth **Framework Programme**.*
Framework Programme (FP)	*A multi-annual (normally five-year) programme defining EU **RTD** policy, priorities and the overall budget to be allocated. It is implemented through **specific programmes** making up the four **activities** mandated by the Treaty.*
FP5 Activity	*The **framework programme** is divided into four activities: (1) implementation of **RTD** programmes; (2) promotion of co-operation in the field of Community RTD with third [countries and international organisations;(3) dissemination and optimisation of the results of Community RTD; (4) stimulation of training and mobility of researchers in the Community.*

Horizontal Programme	*A **specific programme** of a **framework programme** covering an aspect of research applicable to all research domains, such as international co-operation, innovation, and training.*
IMS – Intelligent Manufacturing Systems	*IMS is an industry-led, international RTD initiative established in 1995 to develop next generation of manufacturing and processing technologies. It is open to EU Member states and Norway as well as Australia, Canada, Japan, Switzerland, United States.*
Indirect RTD actions	*Actions carried out by external contractors (all actions called for in the **FP** except the **direct actions** of the **JRC**).*
Industrial enterprises/industries	*Undertakings, public or private, which are subject to market forces and create wealth by exploiting processes, producing materials and products or furnishing industrial services. Research centres and consultancies are normally not considered as industrial enterprises.*
JRC	*Joint Research Centre of the European Commission.*
Key action (KA)	*The Fifth **Framework Programme** consists of s**pecific programmes which** are divided into 19 key actions (plus activities allowing RTD on **generic technologies** and support to **research infrastructure**). Each key action has its defined set of objectives, addresses critical problems and ensures an integrated, problem-solving approach. It targets many and varied aspects of economic and social issues, and normally supports the entire spectrum of disciplines and activities, ranging from basic research, through applied and generic research, to development & demonstration.*
Long term	*For most domains, greater than eight years.*
M&T	*Generic activity on Measurement and Testing*
MAT	*Generic activity on Materials and their technologies for production and transformation and New and improved materials and production technologies in the steel field.*
Medium term	*For most domains, between five and eight years*
Outputs	*Direct and indirect impacts emerging from RTD project execution. Outputs are also understood as practical outcomes of RTD activities, in particular the Key Actions.*
Roadmap	*An indicative timetable per **specific programme** indicating also organisation and budget for the calls for proposals.*
Short term	*For most domains less than five years*
SME	*Small and Medium-sized Enterprises. A common definition at the Commission level is: a maximum of 250 employees, a turnover of less than 40 mio EURO or a balance sheet of less than 27 mio EURO, and less than 25% owned by one, or more, non-SMEs - except an investment or venture capital company not exercising control. For the purpose of the SME specific measures, an eligible SME is not a research organisation nor a consulting company.*
SME Exploratory awards	*Support, lasting no longer than 12 months, for an exploratory phase of a potential **RTD** project.*

Specific programmes	*Detailed **RTD** programmes that implement the **framework programme**. They set out the RTD areas to be supported and the budgets available for such support. See also **Thematic Programmes** and **Horizontal Programmes***
Targeted Research Action (TRA)	*A programme implementation concept, which aims at focussing research activities around strategic priority areas of a **key action**.*
Take-up measure	*Activity stimulating diffusion and utilisation of technologies implemented by RTD projects or accompanying measures.*
Thematic network	*Contractual modality allowing for the co-ordination of a) organisations; b) RTD projects.*
Technology Platform (TP)	*A programme implementation concept, defined in the **Work Programme**, which aims at integrating technologies to attain the strategic objectives of the **Key Actions**. It should bring together manufacturers, suppliers and other relevant stakeholders with the task of developing and benchmarking engineering concepts for future vehicles, systems or components, whose functionalities should be validated.*
Thematic Programme	*A **specific programme** of the 5th **FP** covering a particular, though broad, research area such as the life sciences or information society. The framework programme's first activity comprises four thematic programmes. They are again divided into a number of **key actions**, RTD on **generic technologies** and Support to **research infrastructures**.*
Virtual institute	*Main objective is to link research organisations or departments using advanced information and communication technologies for a service oriented content, i.e. providing comprehensive **RTD** answers to industrial needs, notably **SME**s. A virtual institute should be capable of becoming a self-financing legal entity.*
Work programme	*A description of the research objectives and priorities required to achieve the strategic objectives of a **Specific Programme**.*