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**COMMUNICATION FROM THE COMMISSION TO THE COUNCIL AND THE
EUROPEAN PARLIAMENT**

**Research and innovation for Europe's future mobility
Developing a European transport technology strategy**

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1. RESEARCH AND INNOVATION IN SUPPORT OF TRANSPORT POLICY

The 2011 White Paper on Transport¹ presents proposals for transforming the European transport system into a competitive system that will further improve mobility and continue to support economic growth and employment. It sets ambitious objectives for reducing Europe's dependence on imported oil, improving the environment, reducing accidents and cutting sharply greenhouse gas emissions. These objectives have to be seen in the context of a continuous growth in transport demand, differences in the evolution of the transport modes, demographic changes and a dwindling investment capacity of public authorities.

Incremental changes will not be enough to confront the challenges facing Europe and its transport sector. Instead, governments and the transport sector at large must break away from conventionalism. New ideas, pioneering strategies, and entrepreneurship are needed to respond to the new reality. What is at stake is not only the viability of the European transport system but also, given transport's impact on economic growth and job creation potential, the achievement of a smart, sustainable and inclusive European economy, as outlined in Europe 2020².

It is therefore essential that Europe's research and innovation capacities are mobilised to support transport policy objectives and societal goals. The White Paper proposes to set up a "Single European Transport Area" to serve the 500 million citizens in the internal market. The size of this market will allow for the large-scale testing of a diversity of innovative technologies and services, reaping scale and scope economies and creating strong home markets for Europe's globally operating transport industries. This approach interlinks innovation with the other three dimensions of the White Paper: the internal market, infrastructure development and international cooperation.

In this Communication, the Commission summarises the results of a first stocktaking on research and innovation in the EU transport sector. It reviews the shortcomings of Europe's transport innovation system and presents initial proposals on how to tackle them. The Communication will be the starting point for the elaboration of a European strategic transport technology plan, which will effectively be the White Paper's research and innovation pillar. This plan will outline the priority fields with the highest relevance for research and innovation, address the efficiency of the innovation chain, and propose specific actions to overcome barriers to deployment.

2. UNLEASHING THE UNTAPPED INNOVATION POTENTIAL OF THE EUROPEAN TRANSPORT SECTOR

Transport services and the manufacturing industry contribute significantly to Europe's competitiveness. The EU transport services and storage sector, including postal and courier activities, provided 5.1% of total value added and 5.0% of total employment (around 11 million persons employed). When manufacturing of transport equipment, trade and repairing of motor vehicles and motorcycles are included, transport holds a share of 7.9% of value added and 8.2% of employment, or 18 million persons. Many SMEs in the transport manufacturing sector invest heavily in research and development (R&D).

¹ Roadmap to a Single European Transport Area - Towards a competitive and resource efficient transport system, COM (2011) 144 final

² *Europe 2020: A strategy for smart, sustainable and inclusive growth*, COM (2010) 2020 final

The transport sector is faced with a growing number of global competitors who are keen to innovate and invest. In today's fast evolving world, Europe cannot afford to lag behind, and its businesses must be able to absorb innovative technologies and business models that will maintain Europe's position as world leader in transport.

An analysis of the innovation capacities of the transport sector³ suggests that in 2008, corporate transport R&D investments by EU-based companies amounted to more than €39 billion⁴. This makes transport the largest industrial R&D investing sector in the EU. A further €4.2 billion was invested by Member States and the EU. EU-based companies account for more than 40% of worldwide industrial R&D investments related to transport, ahead of Japanese and US-based companies each accounting for about one quarter.

Compared to the private sector and Member States, the EU's current investment in transport research and innovation is modest in monetary terms, but its leverage is high. It provided about €600 million per year in the 7th Framework Programme for research, technological development and demonstration activities. Funding from the Trans-European Transport Network programme, Cohesion Fund and European Regional Development Fund (ERDF) supports market uptake and deployment. The EU also fulfils an important role of coordination through a variety of instruments and partnerships, such as European Technology Platforms and Joint Technology Initiatives and is a forerunner in proposing broad political commitments and regulatory requirements.

When looking at innovation capacities, transport comprises highly heterogeneous sub-sectors, each exposed to different market pressures, to different drivers for innovation and user requirements. In some sub-sectors, there is a mismatch between the market players that are active in developing and those that are active in deploying solutions. Other specificities are the different institutional set-ups of transport policy making across Member States, and their diverging transport research, innovation and deployment priorities. As a result, Europe does not fully exploit the benefits that could be gained from a better alignment of transport research and innovation efforts among Member States or within different transport industries. A true European Research and Innovation Area for transport is still to be put in place.

So far, the focus of EU-funded research and innovation activities has largely been on research and less on the demonstration, market uptake and full deployment of new solutions, although full cycle commitments exist in cases such as ERTMS⁵, SESAR⁶ or Galileo⁷. To unleash the transport sector's full innovation potential and address the challenges outlined above, the Commission proposes a new approach. A diversified portfolio of public and private sources of finance will be needed, including new financial instruments to increase the leverage of public budgets and a further move towards the 'user pays' principle.

³ *Mapping Innovation in the European Transport System*, EC Joint Research Centre, Institute for Prospective Technical Studies (2011)

⁴ This refers to own-funded R&D investments, hence it excludes publicly funded research activities to the extent possible in order to avoid double-counting with public R&D investments.

⁵ European Rail Traffic Management System

⁶ Single European Sky ATM Research

⁷ Europe's state-of-the-art global satellite navigation system

3. THE VISION FOR FUTURE EUROPEAN TRANSPORT AND MOBILITY

A Vision of how European transport might develop can usefully serve as a basis for a reflection on research and innovation and on the solutions that are necessary to support the White Paper objectives. It is based on the analysis⁸ that provided the foundation under the White Paper on Transport and a Scientific Assessment of Strategic Transport Technologies⁹.

The Vision outlined below has to take into account the anticipated evolution of the European transport manufacturing industry. Our industry will continue its shift from a cost-based competitive advantage to one based on high value-added linked to innovation in the conception, production and operation of complex systems and services. This will support employment and growth. The introduction of new materials and production processes will bring new technology partners into the transport manufacturing sector. Together with stronger cross-fertilisation between the transport modes, this will strengthen the innovative character of the sector, yield greener products, and strengthen the value of the European label for high quality products and services.

3.1. User-oriented integrated transport

In the future, a stronger interaction between transport, energy and information and communication technologies and networks will lead to improvements in environmental performance and resource efficiency. Transport will see a shift towards a mobility that is largely based on the use of alternative fuels, sustainable energy sources and increased use of energy-efficient and environmentally friendly transport means. Alternative propulsion systems and smart communication technologies will be at the heart of a new generation of clean and 'connected' vehicles.

The transport system will become fully integrated, and intermodal, allowing travellers and freight to switch seamlessly between modes and across borders. Growing end-user demand coupled with further development of the internal market will bring new services, higher reliability and more flexibility for passengers and cargo owners. All major airports and seaports will be inter-connected with the railway network. This will be supported by fully intermodal information, reservation and payment systems and services. Intermodal terminals and platforms for passenger and freight will be smartly designed and endowed with advanced equipment, for example to facilitate seamless freight transshipment.

New approaches in tracking, tracing and management of freight will result in highly efficient, affordable, paperless logistics services. Goods will be delivered within guaranteed, delivery times. In the transport safety and security domains, technology will help to provide a response to society's demands for 'zero-casualties' and 'maximum security' visions.

In the medium term, a new architecture for a user-oriented European transport management, information and payment system, based on state-of-the-art positioning, communication and monitoring technology, will be implemented. For the shorter term, existing modal management and information systems will be further improved, deployed and, whenever appropriate, extended with interfaces to other modes allowing for seamless travel and logistics services.

⁸ A sustainable future for transport: Towards an integrated, technology-led and user friendly system, COM (2009), 279 final

⁹ Scientific Assessment of Strategic Transport Technologies, EC Joint Research Centre (2011)

Transport infrastructure will change. Modern infrastructure will increasingly incorporate new components which make it smart (intelligent, ICT-enabled and automated), green (new light and recyclable materials) and intermodal (automated terminals, hubs, and equipment). It will integrate the provision of alternative fuels and innovative management and operation systems. The trans-European transport core-network will be an important showcase in this context. New infrastructure will be characterised by climate resilience, shorter downtime and low maintenance costs.

3.2. Sustainable long distance, intercity and urban transport

New generations of clean, safe and silent road vehicles, aircrafts, vessels and trains will replace the transport means that we currently use. However, the lifetimes of aircrafts, vessels and trains are long, which means that – save for retrofitting – the benefits will emerge only slowly. Future aircraft, combined with a paradigm shift in organising air traffic management, will bring major environmental benefits and efficiency gains to a sector which will continue to see a strong market growth.

Medium distance waterborne and rail transport will win passenger and freight markets by using newly developed, dedicated transport means. A modal shift of longer distance freight transport towards waterborne and rail will require those modes to provide a level of service that is competitive to road transport. Road-based freight transport over medium distances and passenger transport by coach will increasingly use new types of vehicles on dedicated green infrastructure networks.

While avoiding curbing mobility, gradually tightening emission regulations for new passenger cars will favour the use of alternative propulsion, particularly in urban centres. New personal transport modes with minimal resource use will emerge, alongside the increasing take up of cycling and walking in redesigned urban areas. Logistics and goods delivery and distribution services in urban areas will be low-noise and will converge towards becoming carbon-free. New distribution models for urban freight will be implemented.

The development of public transport services will become concentrated in urban areas, as it is there that public transport can increase its market share. Public transport will increasingly rely on electricity. Totally new business models for public and private transport services might emerge, such as shared ownership of transport means. A new generation of personal mobility means, which may be connected and turn into 'individualised' public transport systems, may take off in early-adopter locations. Customised and green bus, coach, microbus or taxi transport will ensure 'accessibility on (electronic) demand' in rural areas.

4. STRENGTHENING EUROPE'S TRANSPORT RESEARCH AND INNOVATION SYSTEM

The above Vision will not become a reality unless the European transport research and innovation system delivers the necessary new solutions. This will require strategic actions in four fields.

Firstly, the research and innovation anchorage in transport policy should be strengthened. The Innovation Union Flagship¹⁰ underlines the need for a strategic approach to innovation. The Commission's proposal for Horizon 2020¹¹ highlights smart, green and integrated transport as one of the six major societal challenges where European research and innovation can make a

¹⁰ *Europe 2020 flagship initiative: Innovation Union*, COM (2010) 546 final

¹¹ *Horizon 2020 - The Framework Programme for Research and Innovation*, COM (2011) 808 final

real difference. In addition, the White Paper on Transport calls for the integration of the transport modes into a European transport system, overcoming the current modal silos.

Secondly, across sectors and actors, the alignment of efforts should be improved. Whereas, in general, multiple research efforts enhance the probability of breakthroughs and increase the range of solutions, the particularities of innovation in the transport sector suggest that joint or coordinated efforts may be more effective in specific fields. For example, transport service providers often refer to an insufficient or premature supply of innovative solutions whereas the producers of transport solutions often wait for clear market signals to develop new solutions, not always fully understanding the user needs¹².

Thirdly, the technology lock-in and institutional silos should be overcome. Existing structures and stakeholder alliances do not allow exploiting the full potential of transport innovation originating from other modes and sectors. For example, transport innovation could be more strongly influenced by developments in other sectors such as telecommunication and energy. Transport operators that have an interest in adopting such innovative solutions often operate at low profit margins and have limited incentives to invest in new solutions.

Finally, the extensive assets, high investment needs, and high barriers faced by new market entrants prevent the transport sector from bringing the necessary transformative solutions to the market. The problem of the 'valley of death' between research and development on the one side, and innovation and market uptake on the other hand, has already been highlighted in the Communication on the Innovation Union Flagship. It clearly applies to the transport sector.

5. INITIATIVES TO IMPROVE THE INNOVATION CAPACITY OF THE TRANSPORT SECTOR

The Commission proposes different initiatives to implement the necessary actions. They will contribute to the reaching policy objectives and support the implementation of the Transport challenge in Horizon 2020.

5.1. Increasing the transport policy focus

The process of common strategic end-to-end programming will provide an important tool to strengthen the innovation system. The Vision acts as a starting point for this work. To achieve the Vision, the Commission outlines three comprehensive research and innovation areas, where concrete and deployable results must be achieved in the next twenty years.

- In the area of transport means, a paradigm shift towards alternative propulsion systems, alternative fuels and smart communication technologies should result in the development of clean, smart, safe and silent rail and road vehicles, aircraft and vessels and better interface with the infrastructure. This includes developments in components, materials, and enabling technologies. While better serving the needs of the European user, the global competitive edge of the European transport manufacturing industry should be enhanced.
- In the area of infrastructure, progress is needed on smart, green, low-maintenance and climate resilient infrastructure, including for the provision of alternative fuels, modal traffic management and information systems which can support user services, demand management, and other solutions related to optimised infrastructure usage.

¹² *Summary Analysis of Responses to a Country Survey on Innovation in Transport*, International Transport Forum (2010)

- In the area of transport services and operations, major advances are needed on seamless and efficient services for passenger and freight transport to allow stronger integration of all transport modes, in particular in urban and inter-urban areas and on well-designed nodes and efficient transshipment equipment. Progress is also needed on integrated multimodal information, traffic and demand management at European level, seamless logistics and innovative urban mobility solutions, including high quality public transport.

Safety and security-related issues and ICT applications will be mainstreamed throughout the areas, as well as user needs such as accessibility, as they have implications for vehicles, infrastructure and services. Socio-economic and exploratory research will also be necessary.

To achieve actual deployment of new solutions contributing to European transport policy objectives, European research and innovation activities must be focused. Annex 1 presents the three innovation areas and their ten identified priority fields¹³ and how they relate to the White Paper's goals and targets. The ten priority fields' offer based on expert judgement, a significant potential for contributing to the White Paper's objectives by 2030, or for some fields by up to 2050, and take into account the specificities of the individual modes and multimodal issues. They represent neither a final position nor a list of priorities for future research and innovation programmes.

The priority areas represent the basis for the organisation of a road mapping exercise, to be launched in September 2012. They aim at focusing European research and innovation activities and funding on deployable technologies effectively contributing to policy objectives. It will also aim at identifying existing gaps and addressing weaknesses along the innovation chain. Its end-result will be a roadmap for each priority area, identifying funding, instruments and actors and foreseeing monitoring mechanisms able to take on board evolving contexts. Particular emphasis will be put on fields where market failures exist or where joint or coordinated efforts can speed up the uptake of new technologies.

The road mapping will be a consultative process involving stakeholders in identifying where action at European level can yield the biggest impact. For each priority area, consensus will be sought on the requirements arising from policy objectives and the European technological state of the art. When possible, roadmaps prepared by stakeholders will be the starting point. This process will be underpinned by a scientific approach, challenging the roadmaps from the point of view of overcoming fragmentation to be able to step up ambitions and to achieve a critical mass on deploying solutions. In other areas, especially those addressing cross-modal issues where sound roadmaps are lacking, the task will require a greater effort.

The resulting set of roadmaps will be at the heart of the European strategic transport technology plan. They will serve as a basis for future work within the Commission, e.g. the preparation of work programmes for Horizon 2020, identification of funding requirements, legislative proposals that have potential in stimulating deployment, etc.

5.2. Better aligning efforts

The Commission proposes to progress on partnerships and on improving governance of the innovation chain. The existing transport-related public-private partnerships and European Technology Platforms have already developed useful roadmaps and strategic research

¹³ The research and innovation areas and priority fields are presented in greater detail in the staff working document *Preliminary Descriptions of Research and Innovation Areas and Priority Fields* (2012).

agendas, in particular for modal issues. Additional or improved public-private coordination mechanisms might be explored. Joint Programming, in the form of partnerships among Member States facilitated by the Commission, may also have a further potential to be explored.

Regular and reliable information to policy makers and private sector stakeholders can facilitate the monitoring and steering of the development and deployment of innovative solutions. For this purpose, the Commission intends to establish a Transport Research and Innovation Monitoring and Information System (TRIMIS). TRIMIS will be the Commission's instrument to map technology trends and research and innovation capacities. It may be linked with the Commission's Transport Research & Innovation Portal, an additional information source.

Finally, global environmental challenges need a coordinated global response. The race for sustainable mobility runs across continents. This means that integrating an international dimension in European transport research and innovation is important for Europe's success. In particular working towards global agreements and standards (e.g. on ICAO and IMO level) is vital to the global development, commercialisation, and deployment of innovative solutions that can help achieve sustainable mobility. Europe will need to establish strong international partnerships that serve its regulatory and commercial interests.

5.3. Beyond the comfort zone: breaking through technology lock-in

Stimulating innovation in mobility and transport will require mobilising not only mature segments of the transport market but also to blend them with existing or new emerging players from, for example, the telecommunications, content generation, financial services or energy supply market. As a result, a contrast between interests and entrepreneurial cultures may be created that is conducive to non-conventional and visionary thinking. The strategic transport technology plan will therefore also aim to:

- Exploit convergences between distinct fields such as transport, energy, information and telecommunication services, territorial development, environment etc. that can generate added-value for the mobility of businesses and consumers and for broad policy purposes, such as growth and employment. These should be pursued through a fresh approach based on new system-based concepts and pioneering ideas;
- Design a set of "out of the box" operating principles and instruments as well as trans disciplinary approaches to stimulate entrepreneurship, e.g. prize competitions, new venture capital schemes, smart public procurement etc. that can provide timely and adequate public responses to the requirements of the users communities and the dynamics of the marketplace;
- Create a new dynamics of innovation in transport that can promote a renaissance of the sector at large, making it attractive to a new generation of talents, innovators and entrepreneurs. Coordinated investments in training and education might be necessary. Competitiveness of SMEs in the sector can be supported by better access to finance, easier access to European and international markets and reduction of red-tape.

5.4. Efficient deployment of innovative solutions

The above measures will help to focus, align efforts and create new dynamics. However, to ensure a fast, large-scale market uptake and deployment of new transport technologies and

services, and without jeopardising the Single Market, in the case of market failures public intervention may also take the form of regulation, standards to ensure interoperability or continuity of service, intellectual property rights, procurement and financial incentives. The EU can mitigate distortions caused by subsidies and by generating revenues.

The strategic transport technology plan will support the implementation of the funding programmes proposed by the Commission for the next multiannual financial framework. This includes Horizon 2020, the Connecting Europe Facility¹⁴, the ERDF and Cohesion Fund¹⁵, and the Programme for the Competitiveness of Enterprises and SMEs¹⁶. The European Investment Bank will be invited to intensify the provision of preferential loans via the Risk Sharing Finance Facility (RSFF), expand its lending to the transport sector based on its new lending policy¹⁷ and provide increased technical assistance to public and private stakeholders.

6. THE OPPORTUNITIES AND CHALLENGES OF TRANSPORT TECHNOLOGY DEPLOYMENT

Reaching our policy goals will require many of today's transport systems and solutions to be replaced by new ones over a relatively short period of time. The additional investment needed in innovative vehicles, equipment and charging infrastructure to achieve the emission reduction goals for the European transport system is estimated at one trillion euro between 2010 and 2030¹⁸. This seems a large sum, but the amount is roughly the same as EU households spend on transport in one year¹⁹.

Although the investment costs are not negligible, the market introduction of new solutions is mainly prevented by the lack of economic incentives for changes at 'systems-level', both for users and suppliers. Yet, the deployment of new green, smart, safe, and efficient transport solutions provides a tremendous opportunity for achieving our environmental and climate objectives as well as for increasing European competitiveness.

Given the urgency and diversity of the challenges that lay ahead, political debate is needed on how stakeholders, Member States and the Commission can commit to, and achieve, a faster and more efficient emergence and deployment of innovative solutions. Taking into account the pressure that the current economic crisis and its aftermath will put on public budgets, priorities will need to be set and the appropriate instruments (such as financial incentives, regulation, standards, politically set industrial targets, voluntary commitments and coordination actions) to be put in place to stimulate deployment in every priority field.

Europe's transport system needs to be adapted. Decision makers need to take position on the balance between the different instruments, taking into account the urgency, acceptability and affordability of implementing the innovative solutions that are necessary to achieve our policy goals. Citizens' awareness should be increased and incentive measures could help to stimulate changes in consumer behaviour that are coherent with technology innovation, thus facilitating market uptake and increasing demand for advanced products and services. In this context, any debate on costs has to be seen against the costs of non-action.

¹⁴ *A Growth Package for Integrated European Infrastructures*, COM (2011), 676 final
¹⁵ http://ec.europa.eu/regional_policy/what/future/proposals_2014_2020_en.cfm

¹⁶ *Proposal for a Regulation of the European Parliament and the Council establishing a Programme for the Competitiveness of Enterprises and small and medium-sized enterprises (2014 - 2020)*, COM(2011) 834 final

¹⁷ EIB transport lending policy: <http://www.eib.org/projects/publications/eib-transport-lending-policy.htm>

¹⁸ *Impact Assessment Accompanying the White Paper on Transport*, SEC (2011) 358 final, p.84

¹⁹ 13.6% of household expenditure. Source: Eurostat.

7. TAKING THE WORK FORWARD

This communication presents the Commission's proposal on how transport research and innovation could contribute to the ambitious objectives of the White Paper on Transport and support the implementation of Horizon 2020.

The Commission invites the Council and Parliament to:

- Confirm the objective of better aligning transport research and innovation with European transport policy goals, taking into account the current economic and political reality;
- Agree to focus efforts on delivering pioneering and sustainable transport solutions at a European, national and local level through innovative technologies, new service approaches and entrepreneurship;
- Consider how to find the appropriate balance between different instruments necessary for market uptake and deployment;
- Endorse the approach for the preparation of a European strategic transport technology plan, and the options for further actions, as outlined in this communication.

ANNEX: Research and innovation areas, priority fields, and their policy relevance

This table presents how technological innovation in each priority fields is expected to contribute to the White Paper's goals.

Research and innovation area	Priority field	The ten White Paper goals									
		Low emitting city transport and logistics	Low-carbon fuels in aviation and maritime	Freight modal shift from road transport	EU-wide high-speed rail network	Multimodal TEN-T core network	Long-term comprehensive network	Traffic management systems in all modes	Multimodal transport information	Close to zero fatalities in road transport	Towards 'user pays' and 'polluter pays'
Clean, efficient, safe, silent and smart transport means	<i>Clean, efficient, safe, silent and smart road vehicles</i>	■								■	
	<i>Clean, efficient, safe, silent and smart aircraft</i>		■					■			
	<i>Clean, efficient, safe, silent and smart vessels</i>		■	■							
	<i>Clean, efficient, safe, silent and smart rail vehicles</i>			■	■						
Infrastructure and smart systems	<i>Smart, green, low-maintenance and climate resilient infrastructure</i>			■	■	■	■			■	
	<i>Europe-wide alternative fuel distribution infrastructures</i>	■	■	■							
	<i>Efficient modal traffic management systems (incl. capacity and demand management)</i>		■	■	■	■		■	■	■	■
Transport services and operations for passengers and freight	<i>Integrated cross-modal information and management services</i>		■	■		■	■		■		
	<i>Seamless logistics</i>	■	■	■					■		
	<i>Integrated and innovative urban mobility and transport</i>	■							■	■	

■ Major contribution anticipated from this priority field to reach the White Paper's goal

■ Some contribution anticipated from this priority field to reach the White Paper's goal