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[Field Research]

## An Evaluation of the Research Potential in the Aeronautics Transport Mode in Europe\*

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### Abstract

**Purpose** - Our study aims to analyze and assess aeronautics transport, to bring comprehensive insight about the existing potential in the new member states, candidate countries, potential candidate countries, and associated states.

**Methodology** - The evaluation was carried out by applying qualitative methodology to the research results and on existing capabilities, to assess the overall research capability in the aeronautics transport mode of each country and region, in the European context.

**Results** - Overall, countries with the strongest potential are the Czech Republic, Poland, Hungary, and Romania. The aeronautics research potential was evaluated as weak in as many as 11 countries, with Estonia, Bosnia-Herzegovina, Macedonia, Montenegro, Albania, and Moldova being evaluated as weak in all categories, and Latvia, Croatia, and Serbia being evaluated as weak overall but having at least one category evaluated as medium.

**Conclusion** - Based on the research findings, there are recommendations regarding both the research policy and research activities related to the aeronautics transport mode. The findings contribute to the further development of EU aeronautics research and the aviation industry.

**Keywords:** Aeronautics, Transport, Central And Eastern European Countries, Qualitative Research.

### 1. Introduction

Aeronautics represents a pinnacle of manufacturing, employing large numbers of highly skilled people, spinning out technology to other sectors and yielding consistently large balance-of-payments benefits. This is a profitable and growing manufacturing sector, unlike many other parts of European manufacturing. The value added in the aeronautics and air transport sectors is high (Acare, 2010). The objective of airlines is to strive for efficiency of air traffic. Efficient air transport system brings significant economic benefits for society by connecting distant communities in the wider national and global economy (Barnhart et al., 2012).

It is necessary to be aware that the airline industry requires high investments. Global economic, ecological and political policies profoundly affect operations (Wensveen, 2011). On the performance as primarily affecting the cost of fuel and oil; pollution control; personnel cutbacks; global economic woes and recurring safety lapses (Kim & Youn, 2013; Youn & Seol, 1999).

Global airline industry cannot implement seamlessly or simultaneously. The airline industry has to influence to governments to increase bilateral negotiations between countries. It is important that the International Transport Association (IATA) find out the solution for air carriers that are in crises, and allows liberalization for expansion into new markets, diversification into new products, specialization in niche products (Wensveen, 2011)

#### 1.1. Literature review

The growth of air traffic over the past 50 years has been remarkable, and will continue in the future. Air transport is still one of the world's most important industries, driving economic and social progress. The global economic income of the aviation industry is estimated at 7.5% of the world Gross Domestic Product. Through the evolution of air transportation at European level it is clear to see how prosperity can bring along greater demand for mobility and with it an increased willingness for air

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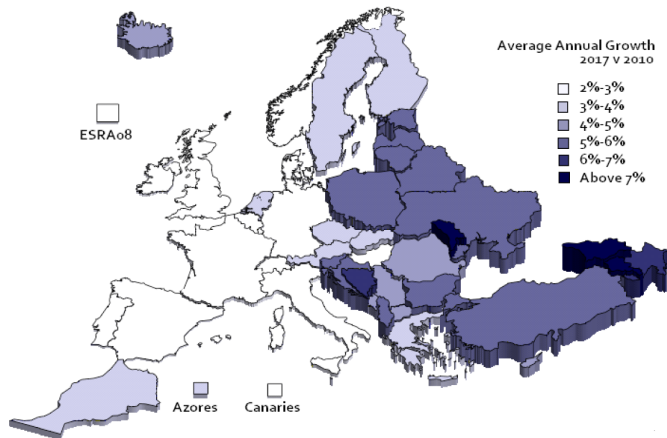
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travel. For the development of successful air transport mobility aeronautics transport research is needed (Acare, 2010).

During the past few decades amount of air traffic has increased and it is forecasted that the growth of air traffic will continue to increase in years to come (Eurocontrol, 2011) (see Figure 1). In view of this fact the aeronautics research potential capability is needed.



Source: Eurocontrol(2011).

<Figure 1> Average annual growth 2011 – 2017 per State

The aeronautics research programme in Europe adheres to guidelines set out in the Lisbon strategy and in the Transport White Paper, entitled 'European Transport Policy for 2010: Time to decide'. This document is similar to Vision 2020 report but covers all transport modes. It describes the overarching goals of improving the contribution of transport systems to society and industrial competitiveness within an enlarged EU, whilst minimising the negative impact and consequences of transport in relation to the environment, energy usage, security and public health (Aeronautics research, 2006).

The Vision 2020 describes Air Transport and Aeronautics as 'Key Assets for the Future of Europe' and quantifies ambitious goals to meet society's needs and to win global leadership. It calls for an air transport system able to cope with a tripled air traffic demand with fivefold safety, halved cost, a 99% punctuality and limited environmental impact in 17 years from now. The European way to reach these goals is outlined in the EUROCONTROL EATMP Programme (i.e. Airport Operations) and ATM2000+ Strategy as well as the ACARE SRA work. These identify airports as the future bottlenecks of air transport and foresee mid-term solutions in enhanced operational concepts, supported by new decision-making or decision-support tools to ensure more efficient use of the airport infrastructure. According to ACARE, the 'Advanced Surface Movement Guidance & Control System (A-SMGCS) and affiliated issues are seen as key R&D topics'. Holistic approaches like A SMGCS are perceived as the most promising way to achieve the necessary paradigm shift (Acare, 2011).

Two top-level objectives in the European aeronautic vision called Vision 2020 are (European Aeronautics):

- meeting society's needs, in terms of demand for air transport, travel fares, travel comfort, safety, security and environmental impact; and
- ensuring European leadership in the global civil aviation market, by enabling it to produce cost-effective, operationally attractive and, performance-wise, highly efficient products at the pinnacle of current technologies.

Some of the ambitious goals for year 2020, as defined in the ACARE Strategic Research Agenda (SRA, 2010) and were identified by Sgouridis, Bonnefoy and Hansman (2005) are:

- > 80% cut in NOx emissions,
- > halving perceived aircraft noise,
- > five-fold reduction in accidents,
- > air traffic system capable of handling 16 million flights a year,
- > 50% cut in CO2 emissions per pass-Km,
- > 99% of all flights within 15 minutes of timetable.

The Aeronautics Unit in DG Research of the EC is the main focal point for information on European research programmes. Aeronautics is part of the EC's Seventh Framework Programme (FP7) which runs from 2007-2013 and offers a wide range of opportunities for industrial organisations to combine their research efforts with SMEs (small and medium-sized enterprises) and academic or research establishments. The calls, including aeronautics, are regularly published on the EC's Cordis website (Cordis, 2011) and presented during EC organised info-days.

The importance of the newly launched CLEAN SKY Joint Technology Initiative (JTI) and the SESAR initiative play important part in the achievement of Europe's short- and long-term aeronautics transport objectives. These two EU initiatives present opportunities for TransNEW countries' aeronautics organisations to learn about European collaborative research and European aeronautics research priorities. The Clean Sky JTI (Clean Sky JTI, 2011) is a private-public initiative involving the EC and European industry which aims to develop breakthrough technologies to reduce environmental impact. Research is funded in six domains: green regional aircraft, SMART fixed wing aircraft, green rotorcraft, sustainable and green engines, systems for green operation, and eco-design. Meanwhile, the SESAR JU25 aims to develop a modernised air traffic management system for Europe to ensure the safety and fluidity of air transport over the next thirty years, make flying more environmentally friendly and reduce the costs of air traffic management (Single European Sky, 2011).

This qualitative research evaluates impacts of completed aeronautics research and examines how aeronautics-related research is managed, delivered and funded in some European countries.

## 1.2. Objectives

During the past years, a great number of important aeronautics research projects have been successfully concluded and

implemented. Within the Framework Programmes and within national programmes, valuable work has been carried out. The article on aeronautics mode provides an overview of aeronautics research in the countries that have been divided into four different regions:

- Baltic States: Estonia, Lithuania, Latvia;
- Central Europe: Czech Republic, Hungary, Poland, Slovakia;
- West Balkans: Bosnia-Herzegovina, Croatia, Kosovo, FYR Macedonia, Montenegro, Serbia, Slovenia and
- South Balkans and Mediterranean: Albania, Bulgaria, Cyprus, Malta, Moldova, Romania, Turkey.

Article enables insight into research results and capabilities in order to stimulate better inclusion of researchers into research arena.

The main purpose of this article is to evaluate the research potential capabilities of the in Aeronautics transport mode. The objectives of this report are:

- to evaluate the potentials in Aeronautics transport mode research,
- to highlight the opportunities and priorities in Aeronautics transport mode research at national and regional level and
- to give recommendations on national and regional Aeronautics transport research priorities, compatibilities with the national policies, possible future developments and collaborations.

This article also provide essential information for aeronautics stakeholders, policy makers, ACARE Evaluation Working Group

<Table 1> Qualitative indicators for the assessment of aeronautic research potential

NATIONAL CONTEXT	
STRONG	The national context is highly favourable to aeronautics research with regard to all influencing aspects: - a real demand for aeronautics research reflected by a coherent policy and strategy in the area, on-going and planned developments and investments, etc. - an efficient research policy coordinated by well organised institutional structure. Transport (aeronautics) research is be part of national research priorities, - good level of R&D funding (in general and/or for aeronautics research).
MEDIUM	At least one of the influencing factors above is not favourable to aeronautics research. However, the overall conditions are still favourable.
WEAK	All the influencing factors above are unfavourable to aeronautics research; aeronautics research is not encouraged and supported at any level.
RESEARCHERS SPECIALISED IN AERONAUTIC MODE	
STRONG	Well-developed aeronautics research community characterised by: - a large number of researchers specialised in aeronautics transport or having some interest in aeronautics transport research, acting in various types of organisations (universities/research institutes, industry, private companies, etc.).
MEDIUM	Defined by a lower number of researchers acting in aeronautics research in a reduced number of organisations.
WEAK	Characterised by a relatively insignificant number of researchers with capabilities in aeronautics research.
REPRESENTATIVE ORGANISATIONS	
STRONG	Characterised by: - active aeronautics research organisations at national level (dealing primary with aeronautics research), - organisations employ relatively high number of researchers (internationally renowned scholars and/or experts) in aeronautics field, - organisations have managed to produce outstanding scientific results like innovations, novel technical solutions, important publications, presentations at important conferences, etc.
MEDIUM	At least one (maximum two) of the characteristics above exists. There are some organisations with capabilities in aeronautics research, but not at all levels/categories.
WEAK	Characterised by a much reduced number of organisations involved in aeronautics research; none of the characteristics above apply.

Note: The figures used to characterise criteria 2 (representative organisations) and 3 above (number of researchers) was assessed with respect to the demand for aeronautics research and specific geographic and demographic aspects of each country.

Source: Own Research

and provide a database of past, existing and previous national and European projects.

## 2. Methodology

In order to assess the research capabilities in aeronautics transport mode customized methodology has been developed. The methodology assesses the research potentials achieved in aeronautics research.

Hypothesis: There are differences between EU countries in research potential in aeronautics transport mode.

### 2.1. Evaluation of the Research Potential in Aeronautics Transport Mode

Evaluation methodology for assessment of the research potential in aeronautics transport mode research is based on the assessment of the most important aspects which characterise the research potential of each country. These include assessment of following aspects:

1. The national context (including the institutional structure and regulatory framework related to transport and transport research - with specific reference to the aeronautics transport mode);
2. Organisations with expertise in aeronautics transport mode research;
3. Researchers specialised and acting in aeronautics transport mode research.

In order to assess the capability in aeronautics research potential for each country, qualitative method with following criteria was used:

1. National context (with specific reference to the aeronautics mode) – to determine both the demand for aeronautics research and the available facilities and possibilities offered taking into consideration:

- Transport policies and strategies relevant for the aeronautics sector (legal framework, planned developments, priority topics etc.);

- Research policies relevant for transport/aeronautics research (priority areas, funding schemes and criteria, etc.);

2. Reference organisations with expertise in aeronautics research or capable being involved in such activity (organisations from aviation industry, authorities, institutions specialised in general transport research, etc.);

3. Researchers specialised in the aeronautics mode that were identified.

The criteria above were assessed using qualitative indicators. The methodology developed for the aeronautics mode uses following indicators: STRONG, MEDIUM and WEAK as depicted in Table 1. On the basis of the assessment of each criterion, the overall potential in aeronautics research is evaluated for each country.

## 3. Results

### 3.1. Evaluation of the Potential in Aeronautics transport mode research

For each country separate evaluation was carried out. Based on the results conclusions were drawn which should contribute to further improvement of the aeronautics research in mentioned countries.

### 3.2. Research potential in Aeronautics transport mode in TransNEW countries

Following the methodology described, the research potential (including aspects on the national context, organisations and researchers) is presented in detail. The evaluation is based on project national reports as primary sources supplemented with other reliable, direct sources (researchers from the analysed countries, official websites etc.). A summary and assessment of the overall situation and country are made.

As result, the Aeronautics transport mode research potentials are assessed and receive a certain qualitative evaluation STRONG, MEDIUM and WEAK.

&lt;Table 2&gt; Qualitative evaluation of the potential in aeronautics research in TransNEW countries

Country	Evaluation Criteria			Overall Evaluation Comments / Indicator
	National Context Comments / Indicator	Researchers Comments / Indicator	Organisations Comments / Indicator	
BALTIC STATES				
Estonia	Transport policy document (The Transport Development Plan 2006-2013) ensures sustainable development of the transport sector. No general transport research policy exists; relation to national transport plan is unclear. No specific transport funding organisation or programme. Aeronautics is not defined as priority.	Few capable researchers specialised in aeronautics field. Researchers on aeronautics do not collaborate and research is not coordinated. Activities in aeronautics research are scarce and sporadic.	Even though Academy of aeronautics exists, no publications or information on research carried out is available. If results exist, they are poorly promoted or not publicly available. Good close cooperation between aeronautics enterprises and higher educational institutions.	Overall weak potential due to non-existence of research policy, no correlation between Transport plan and research activities and lack of coordinated approach in aeronautics research.
	WEAK	WEAK	MEDIUM	WEAK
Latvia	The National Transport Development Programme defines air transport policy Transport (and aeronautics) research is not identified as a priority - transport research policy is not defined. No specific transport research funding organisation or programme.	Aeronautical and space research has a long term tradition in Latvia. Some capable aeronautics researchers in aeronautics institutions/organisations. Several research organisations active in aeronautics related research.	Good achievements of Aviation Institute in the field of aeronautics. No collaboration in aeronautics field at national level. No significant collaboration between aeronautics industry and research institutions/organisations.	Overall weak potential due to lack of aeronautical industry, weak cooperation between existing aeronautics research related organisations.
	WEAK	MEDIUM	WEAK	WEAK
Lithuania	The Civil Aviation Strategy in the Liberalised Market until 2015 clearly defines main objectives - primarily on creating conditions for the activities of civil aviation enterprises. No transport research agenda nor general research programme. There is no funding system for aeronautics research - bodies and structures that support R&D activities exist but none of these directly support transport.	There are some capable researchers in aeronautics field. Researchers are active in international projects.	Lithuanian National Aeronautics Technology Platform (LNATP) facilitates strong collaboration between aeronautics industry and research institutions/organisations. Universities are the most active when it comes to transport (including aeronautics) projects	Overall medium potential, with gaps in organised structures and no funding system for national projects in aeronautics field.
	WEAK	MEDIUM	MEDIUM	MEDIUM
CENTRAL EUROPE				
Czech Republic	Excellent tradition in aeronautics industry and research. Clearly defined R&D	Large number of researchers specialised in aeronautics, both from research	Strong organisations and associations in aeronautics field. Significant collaboration	Overall a strong potential which with still some room for improvement with regard to improved politics on

	<p>policy (thematic priorities were defined in several documents).</p> <p>Good level of R&amp;D funding through national programmes managed by an efficient institutional structure.</p> <p>Ministry of Transport launches specific calls for transport (including aeronautics) projects.</p>	<p>institutions and industry.</p> <p>Significant interest of researchers from universities and research institutions and industry researchers in EU funding.</p> <p>Good educational structure for aeronautics domain.</p>	<p>between research institutes/organisations and aeronautics industry.</p> <p>Czech aircraft industry companies are organized in an Association of the aviation manufacturers-ALV.</p>	aeronautics research.	
	STRONG	STRONG	STRONG	STRONG	
Hungary	<p>Good tradition in aeronautics industry and research.</p> <p>No specific aeronautics strategies or policies.</p> <p>Transport (including aeronautics) is defined as one of the investment priorities.</p>	<p>Very well educated researchers with regard to aeronautics.</p> <p>Researchers are very active in international projects.</p>	<p>Many aeronautics research centres conducting aeronautics research.</p> <p>Organisations specialised in aeronautics research exists.</p> <p>Hungarian Aerospace Technology Platform, (representing more than 50 SMEs in the fields of design, R&amp;D, testing and manufacturing) brings together aeronautical and space organisations to perform research locally and internationally.</p> <p>Active membership in aeronautics technology platform.</p>	Overall a strong potential due to very good collaboration structures and transport investment priorities.	
	MEDIUM	STRONG	STRONG	STRONG	
Poland	<p>Transport policy is well defined in several documents: National Development Strategy for 2007-2015, National Strategic Reference Frameworks for 2007-2013, Operational Program of Infrastructure and Environment and State Transport Policy - aeronautics is defined as national priority.</p> <p>Program for airports and ground-based systems network development is key document on aeronautics development.</p> <p>National research strategy does not address transport as a priority however Aeronautics Strategic Research Agenda was recently developed but not yet</p>	<p>Very well educated aeronautics related researchers.</p> <p>Researchers are very active in international projects.</p>	<p>Several active organisations specialised in aeronautics research area (e.g. the Institute of Aviation)</p> <p>Strong integration between Polish industry and research as a result of active Polish Technology Platform for Aeronautics</p> <p>Very active membership in different European initiatives like: ACARE, ASD, IMG4, JTI, EASN.</p>	Overall strong potential due to clear financing scheme for aeronautics research projects, well-educated researchers and organisations specialised in aeronautics mode, good international collaboration.	

	implemented. Clear national financing scheme for R&D projects as well as industry applied projects.				
	STRONG	STRONG	STRONG	STRONG	
Slovakia	Transport policy and objectives are well defined "Strategy of the Development of Transport of the Slovak Republic until 2020". Clearly defined R&D policy, good coordination through well-organized institutional structure No specific aeronautics strategies or policies. Lack of funding for transport research (decrease of national funding in recent years)	There few groups of researchers dealing with aeronautics research. Several national and international aeronautics projects were conducted. Despite lack of funding and strategic focus researchers are relatively successful (project implementation).	There are no organisations specialised for aeronautics research. Some basic aeronautics research performed within Department of Air Transport of the Faculty of Operation and Economics of Transport and Communications. Research in the field of air transport is not the priority issue of transport research in Slovakia.	Overall medium potential due to minimalistic character of national aeronautic network and practically no aeronautic industry sector. Research in the field of aeronautics remains sporadic but several research results were produced.	
	MEDIUM	MEDIUM	WEAK	MEDIUM	
WEST BALKANS					
Bosnia-Herzegovina	National transport policy is still in draft phase, individual transport infrastructure strategies in adopted in individual Entities, no clear and coherent transport strategy (policy) for the country. Clearly defined R&D policy in "Science and development Strategy 2010-2015" – aeronautics is not defined as a priority. Low level of national funding, no transport specific funding organisations.	Lack of researchers specialised in aeronautics mode. Few existing researchers not active internationally and no national projects were identified.	The research in BiH is mainly conducted by the public universities and a few other public research organisations. No active organisation in aeronautics field was found. No involvement in EU funded and national aeronautics projects.	Overall weak potential due to no transport policy, lack of researchers, no organisations specialised in aeronautics mode and no aeronautical projects.	
	WEAK	WEAK	WEAK	WEAK	
Croatia	Several key documents define the development of national transport (including aeronautics). National air quality protection and improvement plan 2008-2011 is the most important strategic document regarding aeronautics. Adequate levels of national funding through national programmes, no clear transport research	Several aeronautics researchers at Department of Aeronautical Engineering at FMENA. Some research and technological projects conducted (mainly for Croatia Airlines). Researchers are not active in international projects. Only 6.94% of all national transport researchers are active	Faculty of Mechanical Engineering and Naval Architecture - Department of Aeronautical Engineering at FMENA are organisations conducted aeronautics research. No other organisations specialised in aeronautics research. Weak aeronautics industry generating very limited demand for R&D.	Overall weak potential due to international inactivity, weak aeronautical industry and weak cooperation between industry and R&D sector.	

	<p>themes or priorities Standards of access to market and external aviation policy of the community are harmonized.</p>	<p>in aeronautics.</p>			
	<p>MEDIUM</p>	<p>WEAK</p>	<p>WEAK</p>	<p>WEAK</p>	
<p>Kosovo</p>	<p>Multimodal Transport Strategy and Action recently adopted but is not publicly accessible yet. National research funding was set-up in 2010; transport research is not a priority. No specific funding body for transport research. Lack of available funds for transport.</p>	<p>Lack of researchers, especially in aeronautics mode. No researchers active in national and international aeronautics projects.</p>	<p>No organisations specialised in aeronautics research. No aeronautical industry.</p>	<p>Overall a weak potential: - no active researchers - no aeronautics industry - no demand for aeronautics R&amp;D - very limited funds for research</p>	
	<p>WEAK</p>	<p>WEAK</p>	<p>WEAK</p>	<p>WEAK</p>	
<p>Macedonia</p>	<p>National policy on transport "National Transport Strategy" defines main objectives - primarily on modernisation of transport system. "National strategy for development of aviation" sets objectives within aeronautics sector –mainly on upgrading the air transport operations and standards. R&amp;D policy adopted ("National Program for Research Activity") - transport (including aeronautics) is not listed as a national priority. No funding devoted specifically to transport research. Overall low level of research funding due to low level of GDP.</p>	<p>Lack of researchers specialised in aeronautics transport mode. Existing researchers are not active in national and international aeronautics projects.</p>	<p>There are no organisations dealing with aeronautics research. No aeronautics industry that would facilitate research.</p>	<p>Overall weak potential with serious gaps in education and organised structures for aeronautics research.</p>	
	<p>WEAK</p>	<p>WEAK</p>	<p>WEAK</p>	<p>WEAK</p>	
<p>Montenegro</p>	<p>Well defined national policy in transport (the "National Strategy of Transport" periodically monitored through progress reports. Clearly defined R&amp;D policy "Strategy for scientific-activity of Montenegro". Transport research is not seen as a priority but it has its place within all defined priorities</p>	<p>Deficiency of aeronautics research experts/researchers. Few national aeronautics projects conducted mainly on legislative issues – no research projects were conducted.</p>	<p>There are no aeronautics organisations conducting aeronautics projects. No participation in EU funded aeronautics projects.</p>	<p>Overall weak potential due to insufficient number of aeronautics experts and researchers, low funding for research and no strategy for development of R&amp;D in transport sector.</p>	



	<p>Low level of national funding.</p> <p>There is no strong liaison between transport research policy and national transport plan. Aeronautics is not a national priority.</p>				
	WEAK	WEAK	WEAK	WEAK	
Serbia	<p>The transport policy is defined in "The Strategy of railway, road, water, air and intermodal transport development in the Republic of Serbia from 2008 to 2015".</p> <p>There is no particular policy or strategy for aeronautics transport. Transport-oriented projects are funded through the Technological Development Programme.</p>	<p>Lack of aeronautics researchers.</p> <p>Weak participation in national and international aeronautics projects.</p>	<p>There are no organisations specialised in aeronautics research area.</p> <p>Lack of participation in EU aeronautics projects.</p> <p>Weak collaboration at national and EU level.</p>	<p>Weak potential due mainly to recent history events which influenced all economical and social aspects of the country.</p>	
	MEDIUM	WEAK	WEAK	WEAK	
Slovenia	<p>Aeronautic transport policy defined in the National Transport Policy Plan (The National Transport Policy Plan May 2006).</p> <p>No specific strategy or policy related to aeronautics transport. Favourable national research funding and institutional framework. There are no specific founding bodies for transport.</p> <p>There is no transport research plan.</p>	<p>Small groups at faculties are active in aeronautics research. Researchers are active internationally (participating in international transport conferences).</p>	<p>There are no organisations specialised in aeronautics research area.</p>	<p>Overall a medium potential, achieved mainly because of the good level of national R&amp;D funding.</p>	
	MEDIUM	MEDIUM	MEDIUM	MEDIUM	
SOUTH BALKAN AND MEDITERRANEAN					
Albania	<p>Transport sector is not prioritised in the national R&amp;D programme.</p> <p>Low level of national R&amp;D funding.</p> <p>No funding programme devoted to transport research.</p> <p>Significant investments into transport infrastructure are planned – mainly into road network.</p> <p>No formal strategy for transport research.</p>	<p>Very low number of researchers in aeronautic field.</p> <p>No participation in EU funded projects and low participation national aeronautic projects.</p>	<p>Studies about aeronautics are carried out only by the National Air Traffic Agency. Aeronautics experts/researchers in this organisation are scarce.</p> <p>No involvement in EU funded programmes and projects, low involvement in national projects.</p>	<p>Overall weak potential due to the weak national context.</p> <p>Aeronautics and aeronautics research are not national priority.</p> <p>There are no national centres/institutions/organisations conducting aeronautics research.</p>	
	WEAK	WEAK	WEAK	WEAK	

Bulgaria	<p>Six main policy and strategic documents defining the transport sector.</p> <p>National Roadmap for Research Infrastructure adopted, with regard to aeronautics national research priorities are not defined</p> <p>Very low level of national R&amp;D funding.</p> <p>Transport-oriented projects and research activities implemented through the EU Development Programmes</p>	<p>Moderate number of researchers active in aeronautics field.</p> <p>Researchers are active in national and international aeronautics projects.</p> <p>Existing researchers are not specialized only in aeronautics research</p>	<p>Several organisations active in aeronautics research,</p> <p>Good collaboration with international aeronautics research organisations.</p> <p>Weak link with industrial institutions.</p>	<p>Overall medium potential which would benefit much from better national funding and collaboration with aeronautics industry.</p> <p>Further specialization of researchers could enhance the aeronautics research.</p>
	WEAK	MEDIUM	MEDIUM	MEDIUM
Cyprus	<p>Transport policy is defined in various official documents.</p> <p>Advanced institutional framework for research was only recently established.</p> <p>There is no national funding specifically supporting transport (including aeronautics) research.</p> <p>Transport research is still in an embryonic state compared to other research.</p>	<p>Large number of researchers active in areas directly or indirectly related to aeronautics.</p> <p>Researchers have established good cooperation with international organisations.</p>	<p>Several organisations are active on aeronautics related topics; none of them are focused primarily on aeronautics.</p> <p>Involvement of institutions and organisations in EU funded aeronautics projects.</p> <p>National research was not carried out in aeronautics transport.</p> <p>Strong involvement into EU funded aeronautics research.</p>	<p>Overall medium potential which would benefit from a clearer transport research policy and national funding.</p>
	WEAK	MEDIUM	MEDIUM	MEDIUM
Malta	<p>Transport strategy is still under development, current policies in the field of aviation incoherent and not seen as priority.</p> <p>The National Strategy for Research and Innovation defines the research and innovation strategies – transport including aeronautics can be funded under several different programmes.</p> <p>National funding in general does not favour aeronautics.</p> <p>Weak link between transport policy and R&amp;D.</p>	<p>Low, but capable number of researchers performing aeronautics R&amp;D.</p> <p>Malta has a focussed aeronautics network in which stakeholders interact to actively work together in various areas such as education and research.</p>	<p>The University of Malta Department of Electronic Systems Engineering department is very active in aeronautics field and involved in several European and National R&amp;D Projects.</p> <p>There is no other research centres specialised in aeronautics field.</p> <p>Good European collaboration.</p>	<p>Overall medium potential due to the very low level of national funding, lack of transport strategy.</p> <p>Capable researchers are active and are active internationally, good educational background.</p>
	WEAK	MEDIUM	MEDIUM	MEDIUM
Moldova	<p>National Transport Plan does not exist, several other regulations cover all transport modes,</p>	<p>Volume of aeronautics researchers is reduced.</p> <p>Absence of a specialised education</p>	<p>There are no organisations specialised in aeronautics research.</p>	<p>Overall weak potential due to very weak national context, low level of existing research due to serious structural, macroeconomic and political problems of</p>

	<p>Strategy for the development of civil aviation 2007-2012 covers aeronautics transport mode (which makes a brief analysis of the current situation and recommend detailed measures and activities. Low level of R&amp;D funding.</p>	<p>system in aeronautics. Language problems - English language was totally neglected during the appurtenance to the former USSR. Brain drain of skilled professionals and researchers (especially from the new generation). Difficulties for young researchers in achieving expertise in the absence of important national and European projects.</p>	<p>Weak national and international collaboration.</p>	<p>the country.</p>
	WEAK	WEAK	WEAK	WEAK
Romania	<p>Aeronautics transport policy included in the general strategic documents (National Development Plan 2007-2013, The Sectorial Operational Programme –Transport and the Romanian’s National Strategy for Sustainable Development – Horizons 2013-2020-2030. Transport is considered as a foremost priority. No particular policy or strategy for aeronautic sector. Low level of national research funding.</p>	<p>High number of competent researchers active in aeronautics. Strong educational structure. Researchers participate in international aeronautics projects.</p>	<p>Research centres specialised in aeronautic field exists and are active. Good collaboration with international aeronautics research organisations. Weak interest of aeronautics industry for collaboration with research institutions/organisations</p>	<p>Strong potential, better cooperation between aeronautics industry and aeronautics research institutions/organisations would further enhance aeronautics research. Good results despite low level of national funding.</p>
	MEDIUM	STRONG	STRONG	STRONG
Turkey	<p>Two main policy documents for the transport sector (The Strategy Document of Transport 2009-2013 and DPT Annual Report 2010). Study document Vision 2023, specifying general technology activity areas in transport and aeronautics transportation mode, under development. The research policy is more general not giving priority to any specific sector.</p>	<p>Groups of capable aeronautics researchers, with good educational background, active. Lack of researchers coming from national universities however many researchers are educated on universities in USA (strong cooperation) There are capable groups of researchers dealing with aeronautics research.</p>	<p>Aeronautics industry is quite developed, with the existence of the Turkish Aerospace Industries Inc (TAI). TAI has a large number of suppliers which conduct research projects in Industrial R&amp;D research programme. Strong interest of industry in research. Lack of national public research institutes specialised in aeronautics and air transport.</p>	<p>Lack of transport policies to rebalance the transport modes hinders innovation especially for the large scale integrated R&amp;D projects. The interest of the public institutions on aeronautics research projects is low. Good educational background of researchers will enhance aeronautics research in the future.</p>
	MEDIUM	MEDIUM	MEDIUM	MEDIUM

Source: own research

## 4. Discussion

One of the important findings in this section is that scope and quality of aeronautics transport research varies significantly in selected European countries. Table below presents an overview of countries' evaluation region.

sideration political instability and recent turbulent history (Balkan war) which have affected all countries in question, the situation is not unexpected. Especially Bosnia-Herzegovina, Kosovo, Macedonia, Montenegro and Serbia were strongly affected while Slovenia and Croatia have managed to create suitable research environment. But as the aeronautics industry, which would facili

<Table 3> Overview of countries' potential evaluation

Country	Evaluation criteria			
	National context	Researchers	Organisations	Overall evaluation
BALTIC STATES				
Estonia	WEAK	WEAK	MEDIUM	WEAK
Latvia	WEAK	MEDIUM	WEAK	WEAK
Lithuania	WEAK	MEDIUM	MEDIUM	MEDIUM
CENTRAL EUROPE				
Czech Republic	STRONG	STRONG	STRONG	STRONG
Hungary	MEDIUM	STRONG	STRONG	STRONG
Poland	STRONG	STRONG	STRONG	STRONG
Slovakia	MEDIUM	MEDIUM	WEAK	MEDIUM
WEST BALKANS				
Bosnia-Herzegovina	WEAK	WEAK	WEAK	WEAK
Croatia	MEDIUM	WEAK	WEAK	WEAK
Kosovo	WEAK	WEAK	WEAK	WEAK
Macedonia	WEAK	WEAK	WEAK	WEAK
Montenegro	WEAK	WEAK	WEAK	WEAK
Serbia	MEDIUM	WEAK	WEAK	WEAK
Slovenia	MEDIUM	MEDIUM	MEDIUM	MEDIUM
SOUTH BALKAN AND MEDITERRANEAN				
Albania	WEAK	WEAK	WEAK	WEAK
Bulgaria	WEAK	MEDIUM	MEDIUM	MEDIUM
Cyprus	WEAK	MEDIUM	MEDIUM	MEDIUM
Malta	WEAK	MEDIUM	MEDIUM	MEDIUM
Moldova	WEAK	WEAK	WEAK	WEAK
Romania	MEDIUM	STRONG	STRONG	STRONG
Turkey	MEDIUM	MEDIUM	MEDIUM	MEDIUM

Source: Own Research

As shown in table 3 the evaluation of aeronautics research potential varies significantly however within individual region the differences between countries are smaller. Countries from the Baltic region were evaluated as weak to medium but in all three countries national contexts were evaluated as weak. On the other hand the Central region has strong potential with exception of Slovakia which is lagging behind (especially with regard to organisational structures).

The West Balkan was evaluated as overall the weakest region where only one country out of seven has medium potential (Slovenia) while all other have weak potential. Taking into con-

tate research, is not strong in this region the aeronautics research potential remains low.

The aeronautics research potential varies significantly within the South Balkans and Mediterranean region. While on one hand Albania and Moldova were evaluated as weak in all categories, having almost no potential, on the other hand Romania was evaluated as country with strong potential. All other countries fall somewhere in between these two extremes and were evaluated as countries with medium potential.

What is rather concerning is the fact that the national context in 12 out of the 21 countries has been evaluated as weak, in 7

countries as medium and only in 2 countries as strong.

Overall the countries with strongest potential are the Czech Republic, Poland, Hungary and Romania which is not surprising given the fact that aeronautics research has good tradition in all four countries.

On the other hand aeronautics research potential was evaluated as weak in as much as 11 countries with Estonia, Bosnia-Herzegovina, Macedonia, Montenegro, Albania and Moldova being evaluated as weak in all categories, and Latvia, Croatia and Serbia being evaluated as weak overall but having at least one category evaluated as medium.

## 5. Recommendations

Based on the report findings, this section gives recommendations regarding both the research policy and research activities related to the aeronautics transport mode. However as the evaluated potential varies significantly recommendations might not be applicable to all countries.

### 5.1. Recommendations on research policy:

- Several TransNEW countries should finalise their research agendas with special consideration on national transport system's gap between supply and demand (including aeronautics transport system);
- Absence of transport research policy (including aeronautics) in some TransNEW countries should be considered as a gap in transport policy making, raising a threat for making inappropriate planning decisions. Development of general transport research policies, covering all modes of transport, eliminating current gaps in research areas should be considered.
- Collaboration between policy makers and aeronautics organisations should be enhanced especially with regard to formation of transport research policies (including aeronautics);
- A clear link should be established between what is declared in (transport) policy and strategic documents and what is declared in research policies, strategies and the ensuing calls for projects and commissioning of project and studies. This is namely often not the case in TransNEW countries.
- Establishment of specific funding bodies for transport (including aeronautics) research would be beneficial in many TransNEW countries.
- Principles of the private-public partnership, when financing aeronautics research, should be applied;
- Public authorities should pay more attention to research collaboration with RTD Performers, especially in research for public institutions programmes. This would enhance the level of cooperation and create a PPP (private public partnership) model in the industry;
- National associations should take more active role in dis-

seminating information regarding research programmes, determining research policies, clustering activities and deployment of new technologies in industry;

- Harmonisation of national and regional research priorities in aeronautics mode with European priorities and strategies is strongly advisable for some countries where this is not the case;
- Encourage the involvement of aeronautics transport researchers in the EU research networks;
- Encourage taking over the coordination of aeronautics projects. The number of projects coordinated by organisations from TransNEW countries seems to be very poor.

### 5.2. Technical recommendations:

- TransNEW countries' companies dealing with aeronautics transport should be encouraged to join the most active international organisations related to aeronautics sector;
- Balance between air traffic development and environmental protection should be given more attention;
- Improvement of aeronautics transport research networks and platforms enabling better possibilities to get international transport research funding, especially EU funds;
- Researchers in aeronautics field should be more active and visible on the internet, using national and international collaboration platforms. This would both be useful for researchers looking for projects and for possible investors looking for researchers for specific activities. Also possibilities for international collaboration or increased mobility would be enhanced;
- Important aeronautics and air transport research events, workshops, brokerage activities should be brought to TransNEW countries to bring attention to the existing RTD potential;
- Improvement of the impact of research outcomes (mainly in terms of implementation of results in commercial applications, standards and other regulations);
- The outcomes of projects should be clearly focused on the needs of aeronautics transport research mode stakeholders;
- Collaboration between private investors and researchers in aeronautics field should be strengthened: collaboration could be very beneficial both for the private investors and the researchers, for reducing cost, increasing competitiveness and developing aeronautics transport research

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