



MAPPING OF CAPABILITIES AND EXPERTISE WITHIN THE AEROSPACE INDUSTRY IN CANADA AND EUROPE PART 3: ACHIEVEMENTS, ENDORSEMENTS AND RECOMMENDATIONS

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CONTENT

1	INTRODUCTION.....	4
2	ACHIEVEMENTS OF CANNAPE WP1.....	6
2.1	Future Collaboration between Europe and Canada.....	9
2.2	Canadian review.....	11
2.2.1	List of Enablers.....	11
2.2.2	Weighting factors.....	11
3	RECOMMENDATIONS AND ENDORSEMENTS	13

ACRONYMS

A

ACARE..... Advisory Council for Aviation Research and Innovation in Europe

F

FP..... Framework Programme

FP7..... Framework Programme 7

I

IPR..... Intelligent Property Rights

L

L1..... Level 1

L2..... Level 2

R

R&D..... Research and Development

R&I..... Research and Innovation

R&ID..... Research and Innovation Development

R&TD..... Research and Technology Development

W

WP1..... Work Package 1

1 INTRODUCTION

CANNAPE is an EC FP7 funded Co-ordinated Support Action, (CSA), with the overall aim of increasing collaboration between Canada and Europe in the field of Aeronautics and Aviation Research and Innovation. Before the start of the CSA in May, 2011, there had been no EC collaborative, aeronautics projects with Canadian partners although Canada had been recognised by Europeans as having expertise and capability in the field.

The 15 European partners and 5 Canadian partners of CANNAPE, as well as many other representatives of Canadian networks and organisations have met this overall aim by addressing the following:

- exploring the potential for enhancing cooperation through further analysis, (mapping of themes and topics), of aeronautics and air transport R&D cooperation between the EU and Canada;
- developing a technology roadmap that will have clear objectives with identified partners, with the involvement of Canadian partners, who are representative of key, enabling Canadian organisations;
- developing and enhancing networks and partnerships between EU and Canada in identified technical themes ideally suited for mutually beneficial aeronautics and air transport R&D cooperation;
- promoting Canadian participation in the aeronautics and air transport activities of FP7 through focused workshops, information and advisory services.

The last two of these bullet points has resulted in several L1 and L2 funded projects from the FP7 5th and 6th Calls, which was a significant advance when moving on from a zero level of collaboration in 2011. In the 5th Call, which favoured L1 projects, the Canadian success rate for L1 projects was 11% and for L2 projects it was 100%. Similarly, for the 6th Call which favoured L2 projects, the success rate for L1 projects was 20% and it was 100% for L2 projects. This success needs to be built upon for the future, beyond the end of the CANNAPE Project. To enable this to happen, the first two bullet points above need to be achieved.

WP1 of the CANNAPE initiative represents the first attempt to significantly capture the complementary capabilities and needs of the EU and Canada in aeronautics and aviation Research and Innovation Development (R&ID). One of the primary objectives of CANNAPE is to identify areas of mutual interest and benefit and explore potential opportunities for future partnerships and collaborations in Aeronautics and Aviation R&I. Strategic analysis in WP1 is focussed on Horizon 2020, as FP7 is coming to an end.

To facilitate and promote partnerships, in addition to identifying areas of mutual interest, a basic “knowledge” of each partner’s expertise, skills, capabilities and resources is also needed. Such information is essential to supporting and maximising efforts to develop and enhance collaborative relationships between researchers and institutions, leading to the creation of programmes directed at solving challenges with global relevance.

In order to support the reciprocal knowledge a mapping of the existing R&TD competences in Canada and the EU has been developed, including governmental, research and private sectors, as well as the “institutional enablers encompassing the cooperation and legislative frameworks and policies.”

This document summarises the “Achievements, Endorsements and Recommendations” from WP1. This includes findings during the mapping and correlation process described in Part 2 of the deliverable D1.1.

2 ACHIEVEMENTS OF CANNAPE WP1

WP1 of the CANNAPE support action was originally designed to build a basic knowledge for future collaboration between Europe and Canada, prior to the CANNAPE workshops taking place. During the course of the project, the scope was enlarged to include a more strategic point of view. This was due to the rapid momentum of the CANNAPE workshops and the readiness of Canadian data. On top of this, during the CANNAPE project, Europe redefined its strategy and produced the ACARE SRIA, and Canada underwent a government led Aerospace Review. WP1 had to adapt to the new situation. It produced a methodology for identifying technology areas in which Canada has both research expertise and industrial intensity, which form a solid foundation for future collaboration between Europe and other countries in the area of aeronautics and aviation, using Canada as an example of a country without a national strategy or roadmap.

Specifically, the achievements for CANNAPE are:

- A better understanding and overview of funding systems and instruments in Europe and Canada;
- A methodology for correlation of interest and capabilities even if Canada has not a strategic R&TD roadmap;
- A ranked list of topics for future collaboration between Europe and Canada in aeronautics R&I and potentially relevant for coordinated calls in Horizon 2020;
- Greater recognition and appreciation by European and Canadian partners of the great potential for collaboration.
- Enhanced Canadian awareness of the importance of having a strategic R&TD roadmap
- Increased Canadian awareness of effective methods and tools for establishing a Canadian strategic R&TD roadmap
- Three major programmes of EC-funded research involving Canadian participants in strategic areas of technology development emerged from the CANNAPE initiative.

Canadian participants have also observed a number of notable achievements:

- The Canadian R&TD community (industry, industry organizations, research organizations, and government) has come together in an unprecedented way and established a forum for sharing intelligence on Canadian R&TD activities and interests.
- The Canadian R&TD community has built a fairly comprehensive inventory of past and current R&TD areas where there is considerable research expertise and industrial intensity, which will help define future priorities and which sets the stage for identifying areas where the EU and Canadian interests intersect. This initiative has set the stage for further refinement with a future looking perspective.
- This initiative has allowed a mapping of these areas of interest and demonstrated to the Europeans the depth and breadth of Canadian capability and expertise in aerospace related R&TD

- The CANNAPE exercise has identified the potential need for a funding mechanism that would match the European counterpart mechanism so as to facilitate collaborative R&TD and improve the chances of Canadian success in the bidding process (e.g. coordinated call approach).
- The CANNAPE exercise has provided Canadians with a greater understanding of the European process and of the FP programs elements. It has set the stage and opened doors for collaboration under Horizon 2020.
- The CANNAPE exercise has raised awareness amongst Canadian industry, research organizations and government of the value of the 'top down' approach taken by the EU in defining priorities for R&TD activities – beginning with societal goals and then determining areas of focus and allocation of resources that will enable meaningful progress towards those goals. Such an approach recognizes the importance of broadening the scope of initiatives to seek a greater degree of benefit from inter-industry collaboration (e.g. transport vs. aerospace).

OBJECTIVE 1:

Explore the potential for enhancing cooperation through further analysis (mapping of themes and topics) of aeronautics and air transport R&D cooperation between the EU and Canada (WP1)

ACHIEVEMENTS UNDER OBJECTIVE 1:

- A methodology for correlation of interest and capabilities even if Canada has not a current strategic R&TD roadmap;
- Ranked list of topics for future collaboration between Europe and Canada in aeronautics R&TD and potentially relevant for coordinated calls in Horizon 2020
- An overview about current situation of the funding instruments and opportunities for EU-Canada RTD projects in cooperation, either at Member States level, European level and Canadian level.
- An achievement going beyond the specific CANNAPE objectives has been obtained in that the methodology for correlation developed through this process might be applied also in other supporting action projects with other countries that may not have a technology roadmap. However, the resulting data base will be different, and the weighting factors for the ranking will have to be properly adapted.

WP1 of the CANNAPE support action was originally designed to build the basic knowledge and foundation for future collaborations between Europe and Canada, prior to the workshops taking place. During the project, the scope enlarged to encompass a more strategic perspective. This was due to the rapid momentum of the CANNAPE workshops and the readiness of Canadian data.

In addition, during the CANNAPE project, Europe redefined its strategy and produced the ACARE SRIA, and Canada underwent a government-led Aerospace Review of current aerospace related programs and policies which will have a major impact on the Canadian industry's future R&TD initiatives and ability to engage in national and international R&TD collaboration. The result was that WP1 adapted to the new situation. It produced a methodology for guiding decisions on topics for future collaborations between Europe and other countries in the area of aeronautics and

aviation, using Canada as the example of a country without a current national strategy or roadmap.

As mentioned above, the ranking is made adopting weighting factors from a Canadian perspective: networking, interest, capability. These factors correlated with the European SRIA allowed the development of a ranked list of topics.

However, it must be clearly noted that these rankings are based on the historical Canadian R&TD activities and do not necessarily represent either a complete or well-balanced strategic view of Canadian R&TD priorities going forward. They are a reflection and indication of Canada's current capabilities and level of research intensity. Given the absence of a current technology roadmap which looks to the future, there is a recognition that further work will be required to ensure that the lists or topics emerging from this initiative will be carefully vetted to ensure that the initiatives are looking to the future. In this context, Canada is undertaking an initiative to update its prioritization of technology efforts as part of the follow-on activities arising from the Aerospace Review recommendations and Budget commitments.

This important element will have to be considered in the future when defining any Canada-EU coordinated calls, so that Canadians and the EU ensure the willingness of both sides to cooperate on specific topics. For instance, on both sides you may expect a high industrial interest on a specific topic of strategic importance but also, due to competitive reasons, the total closure to international cooperation.

OBJECTIVE 2:

Develop and enhance networks and partnerships between EU and Canada in identified technical themes ideally suited for mutually beneficial aeronautics and air transport R&D cooperation

OBJECTIVE 3:

Promote Canadian participation in the aeronautics and air transport activities of FP7 through focused workshops, information and advisory services.

ACHIEVEMENTS UNDER OBJECTIVES 2 AND 3:

Workshops and awareness initiatives have identified numerous projects and demonstrated to Canadians and Europeans that there is a great degree potential for collaborative R&TD. Canadian researchers held good discussions at all workshops to discuss the topics where Canadians have particularly strong expertise.

Examples include:

- High Altitude Icing: flight and ground testing, detection, simulation & tools
- Composites: predict damage, post-damage strength, enhance composite laminate properties, automated repair
- Alternative Fuels: safety biofuel application in aircraft, engine and combustion monitoring, modelling and validation
- UAVs: reliability engineering and control engineering, certification, flight test range in Alberta

One achievement that goes beyond the specified CANNAPE objectives has been obtained, viz:

The methodology for correlation developed here, might be applied also to other support action projects. If other countries use the methodology then the resulting data base could be different, and the weighting factors for the ranking will have to be adapted properly.

2.1 FUTURE COLLABORATION BETWEEN EUROPE AND CANADA

The basis of the technique was to use the ACARE SRIA, which is signed up to by many European stakeholders. The SRIA, in its current form, provides strategic information on technology themes, but without any timescales. Canada is currently working on an initiative to prioritise technology themes. However, without the benefit of an updated technology roadmap, a fairly comprehensive database of past and current R&TD areas where there is considerable research expertise and industrial intensity was developed by the Canadian stakeholders involved in CANNAPE, e.g. CRIAQ, GARDN, NSERC, CCMRD and NRC. Attributes were then given weighting factors, either singularly or as a combination. A Canadian data base of this size and complexity was not in existence before the start of CANNAPE and has been found to be very effective by the Canadian partners.

This 'database' or 'inventory' served as the basis of mapping areas of intersection and common interests between Canada and the EU. There is, however, an important caveat in that more work has to be done to take into account the Canadian priorities as the current initiative of prioritization takes place in Canada. The resulting product will help define future Canadian R&TD priorities, help with future technology roadmapping initiatives, and set the stage for identifying areas where the EU and Canadian interests intersect.

As shown in part 2 "Strategic Technology Mapping Analysis" of the deliverable D1.1 the analysis of the funded research in Canada was done by a correlation between Canadian data about funded projects and European Strategic Research and Innovation Agenda (SRIA). The five SRIA challenges are; #1 Meeting Societal and Market Needs; #2 Maintaining and extending industrial leadership; #3 Protecting the environment and the energy supply; #4 Ensuring Safety and Security; #5 Prioritising research, testing capabilities and education, against which enablers were listed. The correlation consisted of creating spider diagrams where Canadian attributes were plotted. The result of the correlation produced a list of 17 Enablers, (as classified in the ACARE SRIA - see Table 1 and Table 2), associated with challenges. The weighting factors were derived from the Canadian project data. For example, the level of funding is one factor used in weighting. The higher the weighting factor should indicate the more likeliness of Canadian funding for research being made available. Weighting factors range from 1 to 3, with a possible top mark of 27 for the overall CANNAPE weighting.

This list represents possible topics for future collaboration between Europe and Canada. However, it is worthy of note that the first 9 topics listed in Table 1 have an overall weighting far exceeding that of the remaining 8 topics on the list in Table 2.

# of Topic	SRIA Challenge	SRIA Cluster of Enablers	Enablers of Common Interest to the EU and Canada	Overall CANNAPE weighting
1	2	Competitiveness	Technology Demonstration and flight Test	27
2	1	Aviation	System Intelligence, Automatism, Human and Autonomy - Providing a range of automation solutions from support to the human role through to total automation (autonomous operation) in some areas	18
3	2	Competitiveness	Efficient Development & Manufacturing Processes	18
4	3	An extraordinary technological effort to define the air vehicles of the future that minimize environmental impact and energy consumption	Overall designs of air vehicles that minimize environmental impact and fuel consumption	18
5	3	An extraordinary technological effort to define the air vehicles of the future that minimize environmental impact and energy consumption	An extraordinary technological effort to define propulsion systems of the future that minimize environmental impact and energy consumption	18
6	4	Air-vehicle operations and traffic management	Operational mission management systems and procedures - Protection and responses which enable hazard risk management through appropriate tools including atmospheric models enabling the optimisation of trajectories to ensure hazard and collision avoidance	9
7	3	A dynamic management of target allocation, results survey and research priorities	Continuous performance evaluation along the whole solution development process - from research through development and into service	8
8	3	An extraordinary technological effort to define the air vehicles of the future that minimize environmental impact and energy consumption	An extraordinary technological effort to define the air vehicles of the future that minimize environmental impact and energy consumption	6

TABLE 1: TOP-9 LIST OF ENABLERS FOR FUTURE COOPERATION BETWEEN THE EU AND CANADA

# of Topic	SRIA Challenge	SRIA Cluster of Enablers	Enablers of Common Interest to the EU and Canada	Overall CANNAPE weighting
9	4	Human factors	Human-centred automation	6
10	2	Competitiveness	Efficient Certification	2
11	3	A dynamic management of target allocation, results survey and research priorities	A global approach in the search for solutions for minimizing the environmental impact and maximizing sustainable energy supplies of the aviation industry	2
12	3	An extraordinary technological effort to define the air vehicles of the future that minimize environmental impact and energy consumption	To develop enabling Technologies for Low Environmental Impact and Minimum fuel consumption	2
13	3	Providing Aviation with the necessary quantity of affordable alternative energy sources	Availability of innovative production processes for economically competitive and sustainable drop-in fuels	2
14	3	Providing Aviation with the necessary quantity of affordable alternative energy sources	Enlargement of the drop-in fuel family	2
15	3	Providing Aviation with the necessary quantity of affordable alternative energy sources	Radically new solutions, low carbon content or more advanced solutions	2
16	4	Design, manufacturing and Certification	Resilience: Methodologies and tools, products and services which ensure the air transport system is resilient by design and operation to current and predicted safety and security threat and hazard evolution. IT security concepts resilient against cyber-at	2
17	4	Human factors	New crew and team concepts	2

TABLE 2: LIST OF ENABLERS RANKED FROM 10 TO 17 FOR FUTURE COOPERATION BETWEEN THE EU AND CANADA

2.2 CANADIAN REVIEW

2.2.1 LIST OF ENABLERS

Some technologies areas such as composites and avionics could only be related to limited Enablers. These are in fact related to more global challenges than the current SRIA model proposes. In reality, they span large areas of technology development that could be better represented by more granular enablers.

2.2.2 WEIGHTING FACTORS

The weighting factors used were a first approximation to establish priorities. Although the results indicate clear areas of common interest; a more detailed mapping should

be carried out to improve the model with more specific weighting factors such as number of collaborators and the ratio of companies and research entities. In the case of a Co-ordinated Call, ideally 4 or 5 enablers would be prioritised, covering multiple challenges/enabler clusters. Consideration would have to be given to Enablers under a competitiveness heading, where IPR may become an issue.

Three weighting factors and one “mixed weighting factor” were defined:

1. Total money spent on Canadian projects associated with each SRIA Volume 2 Enabler: this represents the Canadian’s INTEREST for the related topic.

Advantage: information easy to collect and use.

Disadvantage: money spent on a project is usually not associated with one single technical topic so the use of this information as is, without details may not be rigorous.

Disadvantage: past experience/money spent does not necessarily represent where the future efforts should be focused as the monies spent may have been on projects that have now achieved technological maturity.

2. Total number of Canadian projects associated with each SRIA Volume 2 Enabler: this represents the NETWORKING developed by Canadians on the related topic.

Advantage: information easy to collect and use.

Disadvantage: does not really describe how connected and powerful this network is.

3. The Average TRL of the Canadian projects associated with each SRIA Volume 2 Enabler: this represents the CAPABILITY of Canadians on the related topic.

Advantage: easy-to-understand way to measure the Canadian industry’s maturity, as TRL is an internationally acknowledged scale.

Disadvantage: as for the Total money spent on projects, there may be different topics covered in one single project, at different TRL levels, so this data may generate errors as well.

4. Another “mixed weighting factor” was calculated using the three weighting factors defined above. It represents a global picture of the potential synergies for each Enabler.

Advantage: this averages errors generated on the three weighting factors.

Disadvantage: may dilute a relevant figure observed on one weighting factor.

In general the methodology allowed an initial mapping and identification of common areas of interest. However, it is important to recognize that the weakness of the methodology resides in the fact that the data was looking to the past and did not benefit from a future looking roadmap. The results therefore provide an indication of potential areas of cooperation and give a measure of the interests and strengths of Canadian R&D to date but it should be noted that some of the areas which have a lower rating might be, in effect, areas where the future lies.

3 RECOMMENDATIONS AND ENDORSEMENTS

As a result of the recent Aerospace Review of Canadian Government programs and policies and the Federal Government Budget 2013 commitments, the Canadian industry is poised to develop a framework for ensuring that its R&TD efforts and initiatives are focused, prioritized and forward looking.

It is recommended that once the prioritizing of technologies is completed, a further analysis of the results of the WP1 be undertaken to define a more current set of topics of common interest. This will then allow industry to be ready for when the Horizon 2020 call comes as the Aviation community will be required to produce a 2-year roadmap along with 3-year planning for Horizon 2020.

It is also recognized that Canada could potentially benefit from a better alignment of its funding mechanisms that would allow greater synergies between Canadian and EU programmes and therefore provide Canadian industry and research organizations such as universities with a greater chance of successfully receiving funding for collaborative Canada-EU initiatives. Again, this is an issue being addressed as part of the follow-on to the Aerospace Review. In this context, a 2 year work plan for continued collaboration would help map out the required actions and initiatives that will build on the CANNAPE results and ensure continued collaboration between Canada and the EU.

As a final recommendation, there is a need to establish the parameters and a framework for continued communications between Canadian and European partners, including sharing of information, workshops on potential topics of common interest, meeting of key people at air shows, and support to firms who are preparing proposals to ensure they achieve the required level in the project evaluation so as to be successful in obtaining funding.