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COMMISSION STAFF WORKING DOCUMENT

IMPACT ASSESSMENT

Accompanying the document

Proposal for a
COUNCIL REGULATION

on the Clean Sky 2 Joint Undertaking

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1. PROCEDURAL ISSUES AND CONSULTATION OF INTERESTED PARTIES

1.1. Background in the development of the legislative proposal

1. Decision No 1982/2006/EC of the European Parliament and of the Council of 18 December 2006 concerning the Seventh Framework Programme, provides basis for a Community contribution to the establishment of long term public private partnerships in the form of Joint Technology Initiatives.

2. In 2008, Council Regulation (EC) 71/2008 established the Clean Sky Joint Undertaking, a Public Private Partnership (PPP) between the European Commission and the Aeronautics Industry for a period up to 31 December 2017 with a budget of €1.6 billion, equally shared between European Commission and the European aeronautics industry.

3. The White Paper “Roadmap to a Single European Transport Area – Towards a Competitive and Resource Efficient Transport System”[1] stipulates that joint European efforts will bring the greatest European added value in areas such as clean, safe and silent vehicles for all different modes of transport, from road vehicles to ships, barges, rolling stock in rail and aircraft.

4. The Commission Communication "Partnering in Research and Innovation"[2] indicates that the partnering approach in PPP can help to address major societal challenges and strengthen Europe's competitive position by making the R&I cycle more efficient and shortening the time from research to market. It can also contribute to environmental and resource efficiency objectives. When the necessary commitment to partnering exists, Europe can excel in science and technology and achieve critical mass.

5. The Commission's proposal for "Horizon 2020"[3] provides a legislative basis for future EU PPPs in Research and Innovation. It stipulates that "Horizon 2020" may be implemented through PPP where all the partners concerned commit to support the development and implementation of research and innovation activities of strategic importance to the Union's competitiveness and industrial leadership or to address specific societal challenges.

6. According to the proposal, the PPP shall be identified based on the following criteria:

   (a) the added value of action at Union level;

[1] COM/2011/0144 final http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2011:0144:FIN:EN:PDF
[2] COM(2011) 572 final http://ec.europa.eu/research/era/pdf/partnering_communication.pdf
[3] COM(2011) 809 final http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2011:0809:FIN:en:PDF

(b) the scale of impact on industrial competitiveness, sustainable growth and socio-economic issues;

(c) the long-term commitment from all partners based on a shared vision and clearly defined objectives;

(d) the scale of the resources involved and the ability to leverage additional investments in research and innovation;

(e) a clear definition of roles for each of the partners and agreed key performance indicators over the period chosen.

7. The Commission's proposal presents also a common set of rules for all initiatives supported under "Horizon 2020" in order to simplify participation, while leaving the necessary flexibility for individual initiatives to achieve their objectives, as well as ensure complementarity between the two Common Strategic Frameworks, for Research and Innovation and for Cohesion.

1.2. Organisation and timing

8. The present IA has been conducted including the following steps:

- Preparing a detailed roadmap and consultation plan.
- Setting up an inter-service Steering Group (ISG) in June 2012, to oversee the process (section 1.4).
- Setting up an independent expert panel in June 2012 to carry out an analysis of the current progress and assess the possible ways forward (section 1.5).
- Consulting interested parties through an open public consultation which ran from 11 July to 4 October 2012 (section 1.5).
- Setting up a hearing with the wider stakeholders' community on the proposal for the Clean Sky extension in September 2012.

1.3. Consultation of the Impact Assessment Board (IAB)

9. The Commission Impact Assessment Board was consulted in February 2013 and following its opinion the present IA report was revised as follows. First the problem definition text was shortened and focused on the lessons learned from the current initiative. Second, the objectives were revised and its reasoning explained better. Third, the options analysis section was strengthened and its comparison was supported better by quantitative analysis. The difference between the options in terms of timing, effectiveness and efficiency was better presented. Finally, critical opinions of different groups of stakeholders were analysed and addressed[4].

1.4. Impact Assessment Inter-service Steering Group (ISG)

10. This Impact Assessment was elaborated by DG RTD. In this context, a Commission Inter-Service Steering Group (ISG) has been created in June 2012. It included DG MOVE, DG ENV, DG ENTR, DG ENER, DG CLIMA, DG COMP, SG, DG BUDG and Legal Service. Meetings have been held for all major steps in the development of the initiative. In relation to this Impact Assessment, the ISG met on June 8th 2012, July 20th 2012, September 20th 2012 and November 22nd 2012. The last IASG meeting took place on December 12th 2012.

[4] Annex X provides more details about implementation of the IAB recommendations

1.5. Consultation and expertise

11. All stakeholders and enlarged community of industry actors were consulted through a public, web-based consultation conducted between July, 11th and October, 4th 2012 with 91 responses received (see Annex I for more detail). Additionally, individual position papers were issued by the main stakeholder associations (e.g. EREA of research organisations, EASN of universities, Member States and Associate States groups).

12. A hearing with the wider stakeholders' community on the proposal for the Clean Sky extension was organised at a seminar at the ILA Air show on 12th of September 2012 in Berlin. The seminar conclusions and different opinions voiced are included in the public consultation report.

13. In addition, an independent expert panel was established by the European Commission with the objective to review the current progress and assess the possible ways forward. The expert panel included 5 experts in aeronautics, large EU programme management, as well as experts with socio-economic background and their report has supported the drafting of this Impact Assessment[5].

1.6. Main stakeholder views on future policy options

14. The key messages received from the actors during the public consultation were[6]:

Stakeholders, in general, underline the relevance of the aeronautics industry in addressing societal challenges in transport and the importance of the Aeronautical R&D to Europe in an increasingly competitive global market. Strengthen R&D infrastructure and associated skill base is considered as the key factor to achieve required technology advances necessary to support the sector. They stress the fact that it is impossible for the EU aeronautics sector to rely solely on market mechanisms to achieve major innovations. They highlight that public support is essential at all levels and consider appropriate to set up a Public Private Partnership in aeronautics under Horizon 2020.

Member States and public authorities consider that the Clean Sky JTI is proving to be a very effective and efficient instrument to mature and demonstrate promising greening technologies and innovations and they are supportive of the preparation of a future JTI within the coming Framework Programme Horizon 2020 while improving further and increasing the openness of Clean Sky activities.

Research Establishments consider that the Clean Sky Joint Technology Initiative has proven to be an important and efficient instrument for demonstration and are supportive to its continuation under Horizon 2020.

Universities find positive the overall experience from the participation of academic institutions in Clean Sky and support its succession.

[5] see Annex IV

[6] see Annex I

2. PROBLEM DEFINITION

2.1. Policy background

2.1.1. Aviation in the EU context

15. The aviation sector is at the heart of the Europe 2020 strategy and its flagship initiatives including Innovation Union[7], an Industrial Policy for the Globalisation Era[8] and Resource Efficient Europe[9]. It has an important role to play in the further integration and growth of the enlarged EU and in the life of EU citizens being at the same time an important element in the reduction of the green-house emissions.

16. The White Paper "Roadmap to a Single European Transport Area – Towards a Competitive and Resource Efficient Transport System"[10] proposes concrete initiatives for the next decades aiming at, amongst others, increasing mobility and cutting carbon emissions. New technologies for vehicles and traffic management are recognized with high potential to lower transport emissions. At the same time, European Union launched the European Union Emissions Trading Scheme (ETS) with the objective to limit the amount of certain greenhouse gases and airlines will join the scheme. The aviation is also an important part of the EU Roadmap for moving to a competitive low carbon economy in 2050[11].

17. In parallel, recognising the evolving challenges facing the aviation sector, in 2011, the High Level Group on Aviation Research, established by the Commission, produced a new vision "Flightpath 2050"[12] for aviation following the objectives of Europe 2020 and of the Transport White Paper. This vision was developed in common agreement between major private and public players in the aviation sector in Europe in order to address the environmental and competitiveness challenges and proposes ambitious goals for a sustainable and competitive aviation sector for 2050. It is complemented by a new Strategic Research and Innovation Agenda (SRIA) of the ACARE (the Advisory Council for Aeronautics Research in Europe) and will guide and support future actions in public and private funding programmes along the common roadmap all over Europe.

2.1.2. Clean Sky Joint Undertaking

18. In 2008, the Clean Sky Joint Undertaking, a Public Private Partnership between the European Commission and the aeronautics industry, was established by Council Regulation (EC) 71/2008 for a period up to 31 December 2017. Its main objective is to develop environmental friendly technologies impacting all flying segments of commercial aviation, in order to contribute to the ACARE 2020 targets for reduction of emissions and noise in air transport in Europe. Clean Sky Joint Technology Initiative is a European research programme with a budget of € 1.6 billion, equally shared between the European Commission and the aeronautics industry, over the period 2008 – 2017[13].

19. In the Clean Sky programme 12 industry lekoaders, 74 associated members and more than 400 partners – out of which more than 40% are SMEs – are working together in

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7 COM(2010) 546 final http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2010:0546:FIN:EN:PDF
8 COM(2010) 614 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2010:0614:FIN:EN:PDF
9 COM(2011) 21 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2011:0021:FIN:EN:PDF
10 COM(2011) 144 final http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2011:0144:FIN:en:PDF
11 COM(2011) 112 final http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2011:0112:FIN:en:PDF
12 Flightpath 2050 – Europe's Vision for Aviation, European Commission 2011
13 EU contribution is maximum € 800 million. Industry contribution is at least equal to EU contribution.

a number of technology domains to address the common environmental objectives and to demonstrate and validate the required technology breakthroughs. All those technology domains have been integrated into 6 Integrated Technology Demonstrators (ITD) and a Technology Evaluator programme assessing the performance of the technologies developed under Clean Sky. Detailed description of the programme and the technical aspects is provided in Annex VI of this document.

2.1.3. Smart, Green and Integrated transport challenge under Horizon 2020

20. On 30 November 2011, the European Commission adopted the proposal for Horizon 2020, the new framework programme for research and innovation for 2014-2020[14]. The Societal Challenges pillar of the proposal includes the Smart, Green and Integrated Transport challenge which focusses mainly on three overarching objectives: resource efficiency, better mobility, global leadership for the European transport industry. These objectives are in line with the challenges the European aviation sector is facing.

21. The Commission proposal for Horizon 2020 underlines also the added value of achieving critical mass through partnering, and foresees greater impact of EU funding by combining Horizon 2020 and private sector funds within public-private partnerships in key areas. These partnerships, in particular in the form of Joint Technology Initiatives (JTIs), move away from the traditional case-by-case public funding of projects approach towards large scale research programmes dedicated to common strategic research targets. According to the proposal, JTIs launched under FP7 “may be continued using more fit-for-purpose structures”[15]. The Clean Sky JU is explicitly mentioned as one of the initiatives for which further support may be provided under Horizon 2020[16]. This added value is supported also by the Commission Communication "Partnering in Research and Innovation" which indicates that the partnering approach in PPP can help to address major societal challenges and strengthen Europe's competitive position.

2.2. What are the problems

2.2.1. Aviation's environmental impact is growing

22. Aviation[17] is an important sector for the European economy and society[18] but it contributes to climate change because aircraft release carbon dioxide (CO_2) and nitrogen oxides (NOx) through the burning of fuels. Aircraft noise is also an important environmental issue, in particular for population close to airport areas and under the main arrival and departure tracks.

23. In 2009, the CO_2 emissions from the aviation sector were about 7% of all the emissions produced by the transport sector and around 2% of total CO_2 emissions in the world[19]. Its share is growing rapidly (by 87% between 1990 and 2006[20]) and the

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[14] Proposal for a Council Decision establishing the Specific Programme Implementing Horizon 2020 - The Framework Programme for Research and Innovation (2014-2020)

[15] European Commission: Proposal for a Regulation of the European Parliament and of the Council establishing Horizon 2020 - The Framework Programme for Research and Innovation (2014-2020). COM(2011) 809 final

[16] European Commission: Proposal for a Council Decision establishing a Specific Programme Implementing Horizon 2020 - The Framework Programme for Research and Innovation (2014-2020). COM(2011) 811 final, p. 24

[17] For convenience in this document Aviation refers collectively to Aeronautics and air transport. Aeronautics and air transport comprises both: air vehicle and system technology, design and manufacture; and also the constituent parts of the overall air travel system (aircraft, airlines, general aviation, airports, air traffic management, and maintenance, repair and overhaul) as well as many non-transport applications of aircraft, such as search and rescue.

[18] See annex II

[19] International Energy Agency (2011), CO_2 emissions from fuel combustion 2011, OECD/IEA, Paris

overall impact of aviation is estimated to be greater than Figure 1 indicates. On the other hand, due to the electrification of road transport, the share of aviation is expected to increase to 20-30% from all transport CO_2 emissions in 2050[21].

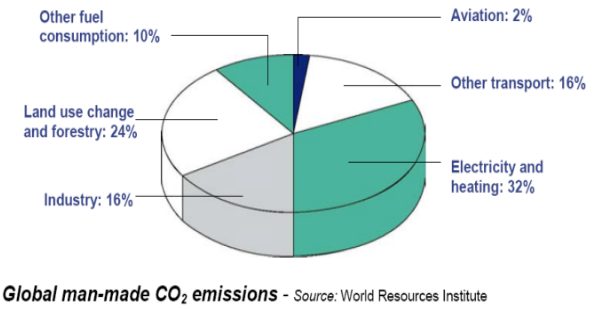

Figure 1: Global man-made CO_2 emissions

24. Over the last 30 years the aviation industry has reduced its environmental footprint threefold and is working actively to reduce it further (see ***Figure 2***). An aircraft today produces 70% less CO_2 than its equivalent 50 years ago and is 75% quieter than 30 years ago. This tendency is also kept for the future with International Civil Aviation Organisation (ICAO) targets including a global annual average fuel efficiency improvement of 2% until 2020 and an aspirational goal to continue improvement at this rate to 2050. Figure 2 shows the reduction of the aircraft energy intensity leading to reduction of CO_2 emissions for the different models over the last decades.

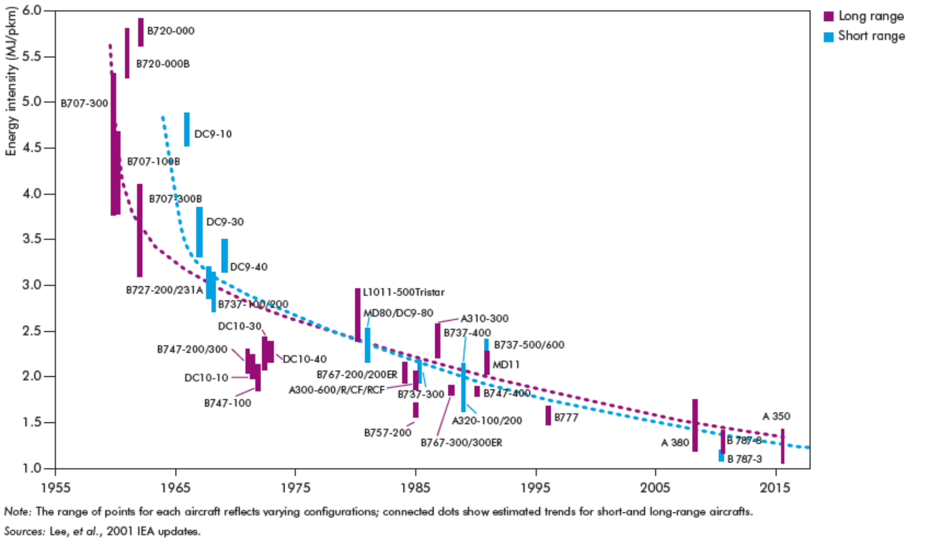

Figure 2: Energy intensity of aircraft. Source IEA (2009)

25. Aircraft noise technology has also significantly improved over the last 40 years[22]. Today, several techniques are used in order to reduce the aircraft noise and its impact including use of new technologies and improved flight procedures[23]. As an example, the "noise footprint[24]" of the Airbus A300, introduced in 1974 is 4.17 km², whereas

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20 "Climate change: Commission proposes bringing air transport into EU Emissions Trading Scheme" (Press release). EU press release 20 December 2006.

21 SEC(2011) 288 final - Impact Assessment – A roadmap for moving to a competitive low carbon economy in 2050

22 Vision 2050, IATA, 2011

23 In 2001, the International Civil Aviation Organisation (ICAO) Assembly endorsed the concept of a "balanced approach" to aircraft noise management. This consists of various measures to reduce noise through the exploration of four principal elements, namely reduction at source (quieter aircraft), land-use planning and management, noise abatement operational procedures and operating restrictions.

24 Noise footprint is the area which is exposed to noise levels in excess of 85dB

for the upcoming A350, it is anticipated to be in the 1-2 km² area. The next figure illustrates the technological advancement in terms of noise reduction over the last 50 years by plotting the cumulative aircraft noise relative to the ICAO Noise Standards[25] in effective perceived noise level expressed in decibels (EPNdB[26]) by year. The aircraft are grouped by engine bypass ratio (BPR), a key driver of overall aircraft noise.

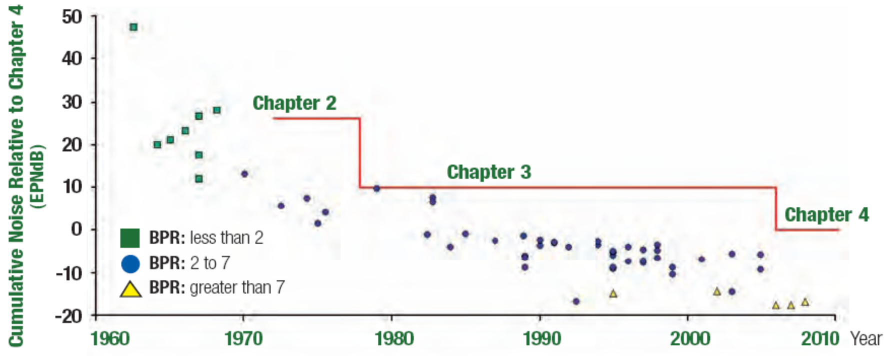

Figure 3: Progress made in noise reduction at source since implementation of aircraft noise Standards - by engine bypass ratio (source ICAO, ICCAIA 2008)

26. Despite all the improvements in reducing the environmental impact of aviation, it is still growing due to the growth of the air traffic. According to the EUROCONTROL forecast, flights in Europe in 2030 will be 1.8 times more than in 2009, with an average growth of 2.8% per year in the 'most-likely' scenario. This growth will be even stronger outside of Europe with the global expected traffic growth estimated to be 4.8% annually over the next 20 years[27]. The next figure shows the increase of the world air traffic in revenue passenger kilometres (RPK[28]) since 1970 and provides an estimate until 2030.

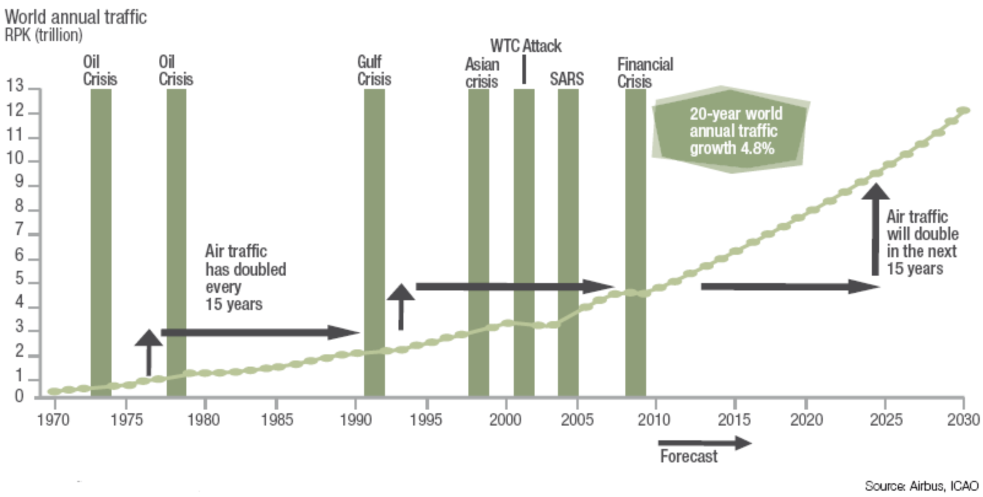

Figure 4: World annual air traffic, 1970-2030 (source Airbus, ICAO)

25 The standards for aircraft noise emissions are contained in Annex 16 of the ICAO Standards and Recommended Practices. The initial standards for jet-powered aircraft designed before 1977 were included in Chapter 2 of Annex 16. Subsequently, newer aircraft were required to meet the stricter standards contained in Chapter 3. Starting 1 January 2006, new, more stringent standard contained in Chapter 4 became applicable.

26 Effective Perceived Noise in dB (EPNdB) is a measure of human annoyance to aircraft noise which has special characteristics and persistence of sounds. It accounts for human response to spectral shape, intensity, tonal content and duration of noise from an aircraft.

27 Airbus' Global Market Forecast for 2011-2030

28 Revenue passenger kilometers (RPKs) are measures of traffic for an airline flight calculated by multiplying the number of revenue-paying passengers aboard the vehicle by the distance travelled.

2.2.2. EU Industrial leadership is threaten by increasing international competition

27. Today, the European aeronautics sector is one of the world leaders in terms of production, employment and exports. In 2010 Europe was the clear leader in terms of the number of transactions announced and Airbus, with revenues of US$36.6 billion in 2009, is the leader in the large commercial aircraft segment, closely followed by Boeing [29]. In the civil helicopter market, Europe is the global leader with players such as Eurocopter and Agusta Westland.

28. The world's fleet of passenger aircraft with more than 100 seats is expected to grow from 15,000 at the beginning of 2011 to nearly 31,500 by 2030[27] and the business jet deliveries will reach 24,000[30]. At the same time, the global market will require 149,000 engines to be delivered over the 20 year period from 2012-2031 worth around US$975 billion[31].

29. Despite this leadership, the European aeronautics sector evolves in a complex international environment and the EU aeronautics industry is increasingly confronted with strong international competition from traditional or emerging competitors.

30. The US aviation industry is one of the main global competitors and US government strongly invests in aeronautics R&D. Today, the large commercial aircraft segment is marked by fierce rivalry between two players, Airbus and Boeing.

31. In the longer term, this duopoly is bound to be challenged as other actors and new entrants invest in development programmes - most notably Bombardier (Canada), Embraer (Brazil), Commercial Aircraft Company of China (COMAC China), and Sukhoi Civil Aircraft Company (SCAC Russia) as well as new competitors from Japan.

32. Annex II provides more detailed description on the international competition on the aeronautics sector.

2.2.3. Current EU Public-Private Partnership in aeronautics needs improvements

33. Given the specificities of the aeronautics sector, new developments require a scale of effect and continuity of purpose and often depend on effective cooperation between the public and the private sector. Therefore the decision concerning the FP7 'Cooperation' specific programme identified certain aspects of the research agenda in aeronautics and air transport as requiring a Joint Technology Initiative[32] and resulted in establishing the Clean Sky Joint Undertaking (JU).

34. Since its establishment, the Clean Sky JU is successfully stimulating developments towards the strategic environmental targets as confirmed also by the expert panel of the interim evaluation of Clean Sky in 2010[33]. In 2010, the independent experts, performing the first Interim Evaluation, concluded that the concept of the JU is appropriate for its objectives and recognised a significant success and a number of achievements. These findings were furthermore confirmed by the Expert Panel

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29 Aerospace Global Report 2011, A Clearwater Industrials Team Report

30 Leading the way, Market forecast 2011-2030, Bombardier Business Aircraft, Bombardier

31 Rolls Royce Market Outlook 2009 - http://www.rolls-royce.com/civil/about/market_outlook/index.jsp

32 Council Decision of 19 December 2006 concerning the specific programme "Cooperation" implementing the Seventh Framework Programme of the European Community for research, technological development and demonstration activities (2007-2013). OJ L 54/30-80, 22.2.2007. pp. 61 and 78

33 http://ec.europa.eu/research/jti/pdf/clean_sky_interim_evaluation_15-12-2010.pdf

established by the European Commission to review the current progress and assess the possible ways forward[34].

35. Despite these achievements, the experts also identified a clear need for improved operational and legal framework. In addition, the JTI Sherpas' group recognised in its report[35] the need to streamline the legal framework to make it fit for the purpose of setting up and implementing JTIs and PPPs in research in general in the future. They provided several operational recommendations in order to improve the efficiency and the manner the JTIs function. Chapter 2.6.4 and chapter 2.6.5 present detailed analysis of the challenges and the improvements for the PPP.

2.3. What are the challenges

2.3.1. The aviation should reduce its future environmental impact

36. The expected increase of the aircraft fleet in the next 20 years would lead to more intensive energy (fuel) use and higher growth rate in CO_2 and NOx emissions. According to ICAO[36], estimated range of CO_2 emissions will grow between 2.5 and 3 times in 2036 compared to 2006 in the most realistic scenarios (assuming advanced technologies and operational improvements). At the same time, the NOx emissions emitted at less than 3 000 feet above ground level are expected to grow between 2 and 2.5 times by 2036 compared to 2006. In terms of noise, the population exposed to significant aircraft noise will grow from approximately 21.2 million people worldwide in 2006 to between 26.6 million and 34.1 million people, depending on the scenario.

37. With such a forecast, emissions will increase significantly if no further measures are taken to mitigate the environmental impact at a rate equal or outweighing the effects of growing traffic levels. To this end, the cut of air transport emissions, in particular CO_2 emissions, through drastic reduction of aircraft fuel consumption and innovation in green operations is essential to achieve reduction of this impact.

38. These environmental aspects are very important for the EU because the Union is at the forefront of international efforts in climate change mitigation actions, driving the strategic political agenda. The environmental aspects of aviation are also in the focus of international groups and organisations.

39. The public consultation related to the Impact Assessment also revealed that emission reduction and noise reduction are important challenges that European aeronautics sector will be confronted with in the following decades. It confirmed that reducing air transport environmental impact is a very important area where the EU level aeronautics research should be focused on.

2.3.2. European aeronautics' sector should remain a global leader

40. One of the challenges that EU industry is facing is to remain a global leader and keep the same market share in the frame of stronger competition and increased production. Europe is one of the leaders in the aeronautics sector today but in the current context of international competition this leadership is not guaranteed without sustained investment.

34 See Annex IV

35 JTI Sherpas' Group: Designing together the „ideal house“ for Public Private Partnerships in European research. Final report. January 2010

36 ICAO Environmental report, 2010 – Aviation Outlook

41. Break-through technologies will be required to secure future competitive advantage. In the current situation, technological capability and innovative potential of actors play a critical role and is becoming the major competitive differentiator, most notably in terms of energy and environmental performance.

42. In order to maintain its world leadership, EU aeronautics industry should provide competitive and high quality products and develop innovative fuel efficient technologies. In addition, high oil prices and economic measures, such as the inclusion of aviation in the EU Emission Trading Scheme, increase the necessity of a major leap in fuel efficiency.

43. The public consultation related to the Impact Assessment demonstrated that 79.1% of the respondents find that the strong international competition is a very relevant challenge that European aeronautics sector will be confronted in the following decades. It also indicated that 84.6% consider that EU level aeronautics research should be focused on the support of the industrial leadership of EU in the sector.

2.4. Improving the environmental performance of aeronautics technologies is an extremely complex and long process

44. The aeronautics industry is characterized by complex knowledge bases, and uncertainty in performance. A commercial aircraft comprises a wide range of components for propulsion, navigation, aviation, communication etc., that are already individually extremely complex but the interaction and integration of these systems is more complex and crucial to the performance of an aircraft. For this reason it is very difficult to predict the behaviour of a final product from design and engineering data, even with presently available computer-aided design techniques.

45. The development of new products in aeronautics is a complex, lengthy and costly process. The sector is characterised by extended lifecycles including long production complemented by long usage times of aircraft and consequently long maintenance periods[37]. The research, technology and product development phase from conception (TRL 1) to “fit-to-fly” (TRL 9)[38] is between 10 and 20 years presenting substantial financial investment and no incomes while the first positive cash-flow will come years after entry into service. Production and maintenance phases need also investment in new technologies because user requirements evolve during the prolonged lifetime of an aircraft design (Figure 5).

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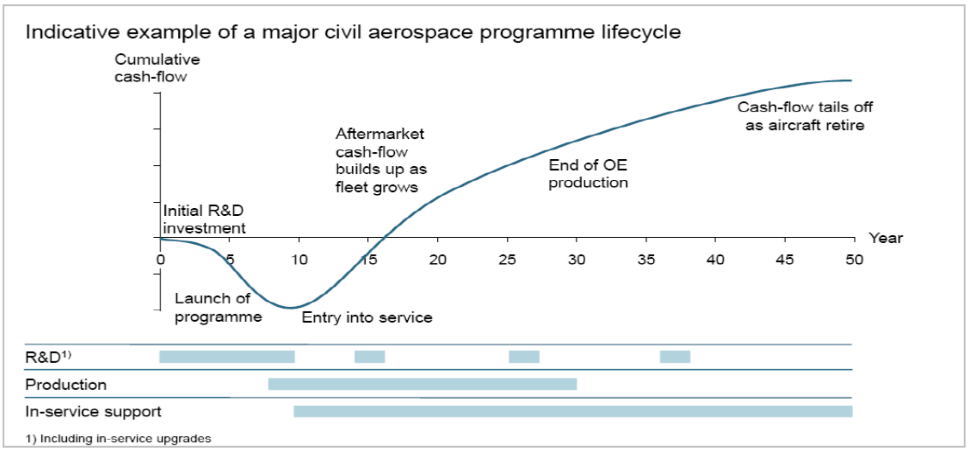
[37] As an example, the Airbus A300 was launched in 1969, entered into service in 1974 with the last aircraft being delivered after 33 years in July 2007. The Airbus A380 (a new model of aircraft put into service in 2007) has been subjected to tests covering 25 years of use

[38] See Annex V on Technology Readiness Levels description



Source:This slide is a courtesy of Roland Berger Strategy Consultants.

Figure 5: Indicative example of major civil aerospace programme lifecycle

46. The development requires a multidisciplinary approach and high level of cooperation between different partners with different expertise. It is characterised by very tight horizontal cooperation between actors with different expertise (materials, electronics, ICT, etc.) as well as between specific industry actors (design, manufacturing, maintenance and other service providers; academia and research institutes; end-users; public bodies such as certification agencies, air space management etc.). The research requires also important and expensive infrastructure for testing (e.g. wind tunnels, simulation tools, technology evaluators and test aircraft).

2.4.1. Regulatory measures alone are not sufficient

47. To incentivise the necessary development and introduction of green aircraft technologies, performance standards for aircraft emissions are set through regulations. There are already a number of regulations that constrain aviation emissions. Practically all aviation emission sources are independently regulated and legislation applies to products (i.e. environmental certification standards[39]), to local or regional fleet operation (e.g. noise dependent landing fees) or to a global fleet operation (e.g. ICAO, the International Civil Aviation Organization, imposes limitations on the aircraft noise and engine emissions through technical standards[40]).

48. The regulatory measures have proven to be a good incentive to reduce aviation environmental impact and EU has provided several regulations or certification rules ensuring mitigation of aviation environmental impacts[41]. In order to be effective, the regulatory framework should be streamlined to accelerate development and deployment of technologies that reduce environmental impact and to trigger new R&D efforts. Performance regulations should be flexible enough to avoid favouring a particular technology or particular market player and require research and determination of appropriate performance targets. At the same time they should be agreed and applied at international level in order to avoid distortion of competition.

39 for ex. Commission Regulation (EC) No 748/2012 laying down implementing rules for the airworthiness and environmental certification of aircraft and related products, parts and appliances, as well as for the certification of design and production organisations

40 ICAO Standards and Recommended Practices Annex 16

41 For example, the Single European Sky (SES) legislation reforms air traffic management organisation in Europe and aims at 10% emissions reduction per flight. Another example is the adoption in 2008 of the necessary legislation for bringing aviation into the EU Emission Trading Scheme (ETS) estimated to save 183 million tonnes of CO_2 per year on the flights covered.

Therefore, in order to allow reaching ambitious objectives, the regulatory framework should be supported by extensive R&D effort.

2.4.2. Aeronautics sector cannot rely solely on market mechanisms

49. From an economic point of view, the aeronautics industry cannot address alone the technological challenge to reduce the environmental impact because of the expenses and the risks involved. There are several sources of market failure discouraging aeronautics research in the reduction of fuel consumption, emission and noise of future aircraft. The step changes required to implement the goals for greening of aviation can only be met effectively if a number of investments are put in place as part of a co-ordinated and innovative integrated multidisciplinary approach. Major areas of work have to cover the broad range of R&D work: aircraft (fixed wing and rotorcraft), engines, systems, and eco-design concepts able to deliver more environment-friendly aircraft production and operation.

50. On the other hand the social benefits of cleaner air travel cannot all be appropriated by the investing firms. As with the rest of the transport sector, the full environmental costs to society are not paid by operators or manufacturers. This negative externality represents a market failure that results in sub-optimal investment in, and deployment of, new environmentally beneficial technologies. Support to technological innovation is a key measure to reduce the extent of this negative externality all over the world.

51. Due to the specific aspects of aeronautics research, private companies have difficulties to mobilise the human and financial resources necessary to develop radical, game-changing technological advances. This effect is amplified in times of economic crisis when the investment community is placing a much lower value on high-risk endeavours than it has before.

52. The public consultation also indicated that 79.1% of the respondents strongly disagree that the EU aeronautics sector can rely solely on market mechanisms to achieve major innovations without public support. Therefore, there is a crucial need to address the different sources of market failure discouraging aeronautics research in the reduction of fuel consumption, emission and noise of future aircraft.

2.5. EU level intervention brings added value

53. Member States support the aeronautics industry via national programmes that directly increase or aim to foster R&D and innovation. Different EU Member States put in place aeronautics research funding mechanisms in order to support the aeronautics industry. Grants are the most common form of support, although some countries also provide loans as supplementary funds. Other support mechanisms include fiscal incentives, venture capital funds, repayable launch investment, etc. The majority of programmes have annual public calls with fixed deadlines.

54. An important characteristic of the national programmes is that funding is allocated at national level and programmes address individual national technology developments. However, the scale and scope of the research agenda for greening of aircraft go beyond the borders and the capacity of individual Member States, both in terms of the financial commitment and of the research capacity involved. National programmes are not able to address in full the major technological advances because of the Pan-European nature of the aeronautics industry[42] (specialisation in the manufacturing, geographical distribution…). There is also some overlap of similar

[42] See Annex II

research activities, as most countries are willing to keep and improve their national competencies in key activities of this strategically relevant sector. This may imply the positive effect of some competitive pressure between European countries, but this effect may also imply a duplication of funding and may prevent fast technological progress[43].

55. On the other hand, studies[44] show that inter-firm collaboration is lower in the aerospace sector in comparison with other sectors of similar size. Fostering inter-firm collaboration, especially in R&D, is a way to sustain competitiveness of the EU aerospace sector. Therefore, it is important to ensure that all relevant European stakeholders cooperate in developing and maturing the most promising key technologies towards full industry application.

56. According to the results of the public consultation, 84.6% of the respondents find that the EU aeronautics sector should receive support at all levels (regional, MS and EU) to achieve major innovation. There are 13.2% considering that the sector should be supported only at EU level, 1.1% only on regional level and no one considers that the support should be done only at Member States level. At the same time 94.5% consider appropriate to set up a Public Private Partnership in aeronautics under Horizon 2020.

57. The right for the EU to act in this field is provided by article 187 TFEU, which specifically authorises to "set up joint undertakings or any other structure necessary for the efficient execution of Union research, technological development and demonstration programmes".

2.6. Clean Sky achievements and need for improved framework

58. The Clean Sky programme, as established in 2008, provides ground for radical new technological concepts that would otherwise be beyond the manageable risk of the private sector. It gives the necessary financial certainty and stability to the aviation sector and investors to develop and introduce game-changing innovations in timeframes otherwise unachievable. A major strength of the programme is that it brings together the key actors from across Europe in order to implement a common agenda; it allows them to work together in a united manner and it avoids the fragmented approach.

59. According to the public consultation performed in the frame of this Impact Assessment, the respondents find that there is very much added value provided by Clean Sky to its objectives. 95.6% of the respondents consider that Clean Sky Joint Technology Initiative is an appropriate way to address environmental targets in aeronautics. The respondents consider that Clean Sky succeeded in addressing the key environmental targets in aeronautics research (93.6% of the respondents), in

[43] FWC Sector Competitiveness Studies - Competitiveness of the EU Aerospace Industry with focus on: Aeronautics Industry, final report, Munich, 15 December 2009

[44] Inter-firm R&D partnerships: an overview of major trends and patterns since 1960, John Hagedoorn

increasing European competitiveness in this area (91.2%), in bringing together main relevant stakeholders (92.3%) and in aligning them towards collaboration in large scale demonstrators (85.8%). Most of the respondents agree also that Clean Sky has organised a sound and transparent proposal evaluation system (72.6%) and that it effectively engaged with SMEs (74.8%) and with Public Research Organisations and universities (78.1%).

2.6.1. Clean Sky attracts wide participation

60. The first Interim Evaluation report of Clean Sky acknowledged that the programme was highly successful in attracting a high level and wide participation from all EU key industries and a large number of SMEs.

61. The report underlined that Clean Sky has led to new collaborations and the participation of new organisations thus enhancing European integration. The statistics from the Clean Sky calls show that 37% of the budget[45] is dedicated to SMEs and 59% of these SMEs have not been beneficiaries of EU-level Collaborative Research before.

62. By mid-July 2012, Clean Sky has already published 13 Calls for Proposals. Based on the evaluation of the first 11 calls published between 2009 and 2012, there are 339 projects selected, 664 participations (winning proposals) among 1911 proposals received and 413 unique participants from 24 countries. This translates into a success rate of 35% for Call for Proposals. The breakdown of the participation by type of participant is 37.3% of SMEs, 23.6% of Universities, 17.5% of Research Centres and 21.5% of Industry[46].

63. The main reasons of higher SMEs involvement in Clean Sky are the lighter project management structure (consortia may have less than 3 participants), reasonable financial exposure (95% of projects coordinated by mono-beneficiary SMEs are below 300k€ of budget), short time duration (19 months on average for projects coordinated by mono-beneficiary SMEs) and direct contact with end-users (SMEs are in direct relation with large companies and have the opportunity to demonstrate their ability to become a future supplier of the supply chain).

2.6.2. Clean Sky provides already first technical results

64. Although half way through, the Clean Sky started to provide already first results. Two open rotor engine demonstrators, a concept providing lower environmental impact than the conventional engines, have been successfully gone through initial testing in the Sustainable and Green Engines ITD. Main critical components were tested at component level and the first build of the open rotor demonstrator will be ground tested in 2015 and flight tested in 2016 on an Airbus A340-600.

65. In the Smart Fixed Wing Aircraft ITD, the Advanced Lip Extended Acoustic Panel, the technology to reduce the Fan noise of large turbofan engine was flown and validated in operational conditions in 2010 with an Airbus A380-800 aircraft. This test campaign brought significant data to help reach the last step of technological maturity and enable design fine tuning for potential implementation in the next generation of large commercial aircraft. Once finalised, this noise absorbing panel will enhance the acoustic performances of the engines and reduce the noise levels.

[45] The indicated % share of funding for SMEs is calculated only using the part of funding foreseen for the open calls (€200 million foreseen for the calls while €600million is foreseen for the grants to the named beneficiaries).

[46] See Annex VIII

66. A flight test with Falcon F7X, which proved the technology to visualize laminar flow structure in flight by an infrared camera, was already performed in 2010. This was the first step to a low speed flight demonstrators of laminar flow wings planned on a Falcon test aircraft for 2014. This demonstrator should lead to a production wing design for a next-generation short- to medium range aircraft and will allow reducing the aircraft drag and consequently the fuel consumption.

67. A detailed list of Clean Sky Demonstrators per ITD is presented in Annex VII.

2.6.3. Clean Sky is on the track to achieve its environmental objectives

68. During the first Interim Evaluation the expert panel noted that although the gains achieved so far are difficult to quantify at this early stage of the programme, technical progress has been identified and the Clean Sky JU is successfully stimulating developments towards environmental targets.

69. In March 2012, the Technology Evaluator completed its first full-scale simulation and performed the evaluation of Clean Sky's progress at all three assessment levels (Aircraft, Airport, and Air Transport System). The Technology Evaluator is a simulation tool that allows estimating the environmental impact of the Clean Sky technologies aircraft compared to Year-2000 reference aircraft and identify the progress towards the defined targets. The two other assessment levels (Airport and ATS), address the cumulative environmental impact over airport-related geographical areas and communities, and the global fleet and air transport system respectively. Preliminary results show that with research that has been started within the programme, the objectives of Clean Sky will be achieved. The programme has a potential to reduce CO_2 and NO_x emission by 20-40% depending on the aircraft type and bring significant noise reduction.

2.6.4. Challenges with respect to operations and implementation

70. Clean Sky demonstrates the benefits of a public private partnership and its technical content has provided a good balance for the public and private interests. The first experience with the programme shows that it is a good instrument to achieve ambitious goals in greening of the aeronautics, bringing stakeholders together and achieving jointly agreed roadmaps. Despite this success, the interim evaluation[47] panel recommendations, experiences with the programme and stakeholders' views[48] also demonstrated that several points need to be better addressed in the future.

- <u>Improving the openness of CS activities</u> – The possibility to have limited number of named beneficiaries is identified in in the basic act of Clean Sky and a number of associates is identified at an earlier stage of the programme. Currently, 50% of the budget goes to 12 Clean Sky leaders - industrial organisations committed for the full duration of the CSJU to perform and complete the programme. 25% of the budget is allocated to 77 associated members - private or public organisations having applied for and been accepted through a selection process as permanent members of the Clean Sky JU. Finally, 25% of the budget is dedicated to partners, selected following open Calls for Proposals issued by the JU. In order to increase the accessibility to all potential beneficiaries, it is recommended that all members are selected through open and competitive procedure.

47 http://ec.europa.eu/research/jti/pdf/clean_sky_interim_evaluation_15-12-2010.pdf
48 See Annex I, chapter 2

- Increasing the share of funding through calls – Currently, 25% of EU funding for Clean Sky is dedicated for calls for proposals while the rest is distributed to the 'named beneficiaries'. This share needs to be increased compared to the current programme.

- Clear split of activities between the current and future programmes should be ensured in order to avoid allocation of additional budget to achieve the goals of the current programme. For this reason, the current programme should complete its activities and future initiative should implement a clear different technical programme.

- Strengthening the role of the Technology Evaluator. The Technology Evaluator (TE) should be kept and have a more independent role. Its governance structure should include a more balanced involvement of all stakeholders (Industry, Academia, Research Establishments). During the initial definitions of Clean Sky 2 the TE could be taken into account. The role of the TE should be expanded towards the whole aviation.

- Streamlining of activities – The Clean Sky activities should be streamlined towards achieving demonstrators and high TRL technologies.

2.6.5. Challenges with respect to complexity and cost-effectiveness

71. JTI JUs were set up as an innovative instrument under the 7th Research Framework Programme. The first experiences gathered with implementing the JTI instrument via the Joint Undertaking – own dedicated administrative structure – have highlighted a number of challenges with respect to complexity and cost-effectiveness, as noted by the Sherpa report[49], the JTI interim evaluation[50], and the CoA reports[51,52] on JTIs.

72. These challenges are mainly the lack of suitability of the general legal framework to the specificities of JTI JUs, the lack of options for tailoring in the JU establishment act, statutes, staff and financial rules and the delegation of the overall responsibility for the day-to-day management of the JU to the Executive Director. These identified shortcomings stem from the initial design and constitute a starting point for an improved design for the Horizon 2020 JTI JUs.

73. The notable examples of the abovementioned shortcomings are:

- Lack of tailoring of legal framework. The legal framework governing a JU is essentially composed of four elements: the Council Regulation, the Statutes, the JU's own Financial Regulation and the EU Staff Regulations. These are largely based on rules applicable to the European Institutions with little regard to the size of the JUs and nature of their activities. According to the interim evaluations of the JUs, this legal framework is not conducive to the efficient management of a small JU.

- Human resources. Due to the demanding legal and financial rules applying to the current JUs on the one hand, and the small overall size of the current JUs on the other hand, the structure of the JUs is one-sided when comparing administrative human resources with operational human resources: on average 50% of the JUs' staff is dedicated to work on administrative tasks. This

49 http://ec.europa.eu/research/jti/pdf/jti-sherpas-report-2010_en.pdf
50 See ref. 47
51 http://eca.europa.eu/portal/pls/portal/docs/1/22482779.PDF
52 OJ C 342, 16.12.2010; OJ C 368, 16.12.2011 and OJ C 6, 10.1.2013

percentage is high compared to the 22% ratio of the somewhat bigger European Agencies, also set up as union bodies.

- Recruitment rules. Under current regulation, due to the fact that JTI JUs are Union bodies, their staff recruitment rules follow the EU Staff Regulation. Accordingly, when planning recruitment, the grades and functions of new staff must be foreseen in the multi-annual staff policy plan and the annual budget. These require approval from the Governing Board and the European Commission as well as compliance with the multi-annual planning cycle starting at end of year N-2. Therefore, the recruitment procedures take a significant amount of time and lack flexibility.

- Public procurement rules. The public procurement rules applied by the JU are similar to those used by the European Institutions. Moreover, the financial regulation does not permit a JU to conclude a Service Level Agreement (SLA) with another JU. Consequently, this prohibits the sharing of services between JUs in order to reduce costs (for instance, sharing the internal auditor function between two or more JUs).

- Delegation rights to the Executive Directors. Under the statutes governing the JU, the Executive Director is responsible for the day-to-day management of the JTI JU. While the financial regulation perhaps should give the authorising officer, i.e. the Executive Director, the overall responsibility for the financial management of the JU, their regulations require also the approval of the Governing Board - this delays decision-making. As a consequence, recurrent administrative decisions are brought up to the level of the Governing board, thus hampering its focus on strategic issues.

- The funding and participation rules applied to/by JTI JUs as compared to mainstream FP7 legal and financial framework result in different and often lower funding rates for participants in JTI JU managed projects than collaborative research, which compromises the accessibility (new rules have to be learned) and attractiveness (funding rates are lower) of the JTIs.

- Availability of resources prior to start. The Interim Evaluation panel advised that for future JTI prior to the formal start of technical activities, the resources and administrative tools should be essentially available and that an in-depth review of the technical programme is carried out.

2.7. Baseline scenario

74. The baseline scenario is to implement the JTI in aeronautics renewing the current Clean Sky initiative with the necessary adaptations to comply with the context of Horizon 2020. This baseline scenario is based on a status quo where no specific improvements would be made to the initiatives, neither in scope nor in governance/operating rules.

75. The renewal of the current initiative would continue to address the need reducing Europe's greenhouse gas emissions in aviation in line with the new objectives by integrating, demonstrating and validating the most promising technologies. However, this scenario will not be able to achieve simplification in the administration and introduce additional flexibility as foreseen by the new Horizon 2020 rules. Moreover, it will not allow addressing integrated technology demonstrations at large system level. Together with the later start (new technologies will be developed once the

current programme is finalised), highly performing and mature enough technologies will not be ready for integration in next generation of aircraft by 2025-2030.

3. OBJECTIVES

76. The expected increase of the air traffic and the aircraft fleet in the next 20 years would lead to more intensive fuel use and therefore significant increase of emissions. In order to mitigate these environmental impacts at a rate equal or outweighing the effects of growing traffic levels additional measures are required to be taken allowing technological improvements of aircraft fuel efficiency.

77. Furthermore, these measures should allow the EU aeronautics industry to maintain its competitiveness and world leadership in the sector. The European Industry, which accounts today for c.a. 40% of the global civil aircraft market, must maintain its competitiveness to benefit from the global need for 70 000 new aircraft (40 000 fixed wing aircraft and 30 000 rotorcraft) in the next 20 years[53].

78. According to the current fleet replacement strategy, the replacement for 'single aisle' aircraft is likely to be in the 2025-2030 timeframe[54]. The research on new fuel-saving technologies and completion of technology demonstrators should be synchronised in time with the expected new fleet replacement and the results of the research phase should be completed by 2020-2025. The timely delivery of matured technologies is essential. Due to the long and costly development cycles in aeronautics the time between two generations of aircrafts is typically 10 to 15 years and the introduction of the technologies, which are not mature for the entry into service of the new aircrafts will be postponed.

79. In order to mitigate the traffic increase, the new technologies should provide better environmental performance than the usual pace. The typical improvement in fuel efficiency and therefore in emission reduction in the sector is 10-15% for a new generation of aircraft and all efforts should be made to accelerate this rate. A 20 to 30% improvement could result in 'skipping a generation' of nominal development and will have an important positive impact on environment.

3.1. Overall objective

80. Based on the assessment of the problem and its root causes, the general objective is to improve the environmental impact of European aeronautical technologies in order to:

- contribute to the achievement of the objective of reducing Europe's greenhouse gas emissions;
- secure the future international competitiveness of the European aeronautical industry.

81. The main rationale is to enhance the competitiveness and environmental performance of European aeronautics technologies in line with the objectives of Europe 2020, Transport White Paper and Horizon 2020 Smart, Green and Integrated transport challenge.

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53 Airbus, Alenia, Eurocopter market forecasts 2011-2030

54 See annex IX

3.2. Specific objectives

82. The aim of the proposed initiative is to integrate, demonstrate and validate the most promising technologies capable of:

- increasing aircraft fuel efficiency and reducing CO_2 emissions by 20 to 30% compared to "State-of-the-art" aircraft entering into service as from 2014[55]
- reducing aircraft NOx emissions by 20 to 30% compared to "State-of-the-art" aircraft entering into service as from 2014
- reducing aircraft noise emissions levels by up to 5 EPNdB[56] per operation[57] compared to "State-of-the-art" aircraft entering into service as from 2014

3.3. Operational objectives

83. The operational objectives of the initiative are:

- To establish a strategic innovation-driven agenda for industry aimed at tackling the problem identified
- To pool and coordinate R&D public and private investment bringing together the key actors from across Europe in order to implement this agenda
- To enhance the exchange of knowledge between actors and disciplines
- To gather the necessary critical mass of resources needed to set-up large scale system-level demonstrators to validate the research results
- To improve mechanisms and pathways for the more rapid commercial exploitation of results
- To ensure the efficient and flexible management of funds, including the systematic monitoring of progress and concrete results
- To ensure a high degree of SME participation

3.4. Objectives relation to the problem statement

84. Next figure shows how the objectives are mapped onto the problem statements and their drivers.

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55 State-of-the-art aircraft is a new baseline introduced for a future initiative. Currently, Clean sky results are compared to year 2000 aircraft reference. The state-of-the-art aircraft (e.g Airbus A320-NEO, Boeing 737-MAX, Boeing 787, Airbus A350 etc.) introduces already 15% decrease of CO_2 emissions compared to the Y2000 aircraft.

56 Effective Perceived Noise in dB (EPNdB) is a measure of human annoyance to aircraft noise which has special characteristics and persistence of sounds. It accounts for human response to spectral shape, intensity, tonal content and duration of noise from an aircraft.

57 This represents around 30% of reduction of the noise emissions levels compared to "State-of-the-art" aircraft entering into service as from 2014.

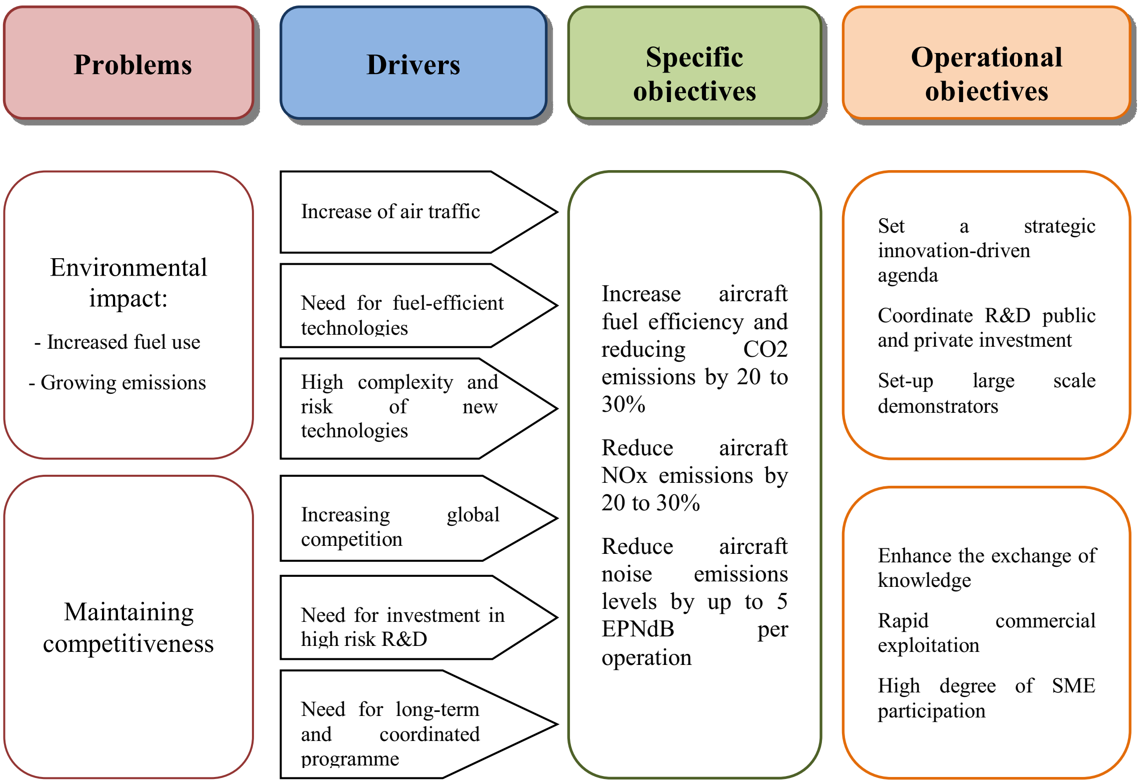

Figure 6: Schematic representation of the problem and objectives relationship

4. POLICY OPTIONS

85. Based on the problem definition and the objectives, the three main policy options are identified in line with the Horizon 2020 instruments, namely implementation via collaborative research projects complemented by the Public-Private Partnerships.

(a) Business as usual – current Clean Sky programme extended under Horizon 2020 (BAU)

(b) Establishing a contractual PPP to implement new programme (cPPP)

(c) Establishing a new Joint Technology Initiative (JTI) to implement, through an improved Joint Undertaking, a new programme (CS2)

4.1. Discarded options

4.1.1. No EU funding option

86. The No EU funding option consists of discontinuing public support for research and innovation in aeronautics at European level.

87. Horizon 2020 Impact Assessment tackles already the no-EU option[58] and recognises the need to continue with the research and innovation in transport. The proposal for Regulation establishing the Horizon 2020 Framework Programme proposes a Smart, Green and Integrated Transport challenge to be addressed. Therefore, this option is contradicting the provisions of Horizon 2020 recognizing the need to include EU level research and innovation in air transport in its framework and is not analysed further.

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[58] Bring to an end EU level R&D financing and re-nationalise R&D and innovation policies

4.1.2. Regulatory option

88. The regulatory option addresses the elaboration of regulations setting performance levels for aircraft emissions.

89. The regulatory measures to incentivise the necessary development and introduction of green aircraft technologies are discussed in chapter 2.4.1. Such measures are proven to be good encouragement in aviation but because of the need for global agreement before application and the need for ambitious but appropriate and competitive performance targets, it is considered that this option will not allow reaching ambitious objectives in the aviation sector in a given timeframe without extensive R&D support. Therefore the regulatory option is not addressed in details in this document.

4.1.3. No Public-Private Partnership

90. This option uses focussed (Level 1) and integrated (Level 2) collaborative projects[59] only. The current Clean Sky programme defined under FP7 ends its activities in 2017 and no new Public-Private Partnership in aeronautics is set up under Horizon 2020. All running projects will continue to be supported in the frame of the current JU between 2014 and 2017.

91. The traditional instruments of collaborative research effectively stimulate basic research and validation at the sub-system or system level and can provide a good progress in developing a wide range of new and greener technologies at lower TRL levels. However, in order to stimulate industry on long term and large multidisciplinary investment, with high risk and low profitability, it is important that the research programme should include the demonstrators needed to validate technologies at Technology Readiness Level 6 (TRL 6), which is the level preceding the system prototype demonstration in an operational environment.

92. Due to its fragmented approach and lack of synergies between research actors as well as its absence of long term commitment and defined research agenda, the collaborative research is not well suited for large-scale demonstrators integrating and combining several new technologies and systems. The sum of focussed research projects in the Framework programme will not guarantee maturation and validation of specific technologies on time and this would result in a significant delay in delivering all the research results needed including the large scale demonstrations.

93. Implementation through a set of smaller projects instead of with one large-scale integrated demonstrator programme may cause at least 10 years delay in reaching final technology maturity (TRL 6) allowing to launch new products. Such a delay will miss the opportunity to include these technologies in the next generation of aircrafts before their entry into service in 2025-2030. Because of this reason, the no Public Private Partnership option was assessed as sub-optimal to pursue the objective of accelerating the development of clean air transport technologies in the EU for earliest possible application and therefore excluded from further analysis.

4.2. Business-as-usual option

94. This option (BAU) considers the continuation of the current Clean Sky Joint Technology Initiative under Horizon 2020, managed by the Clean Sky Joint

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59 Collaborative projects are focused research projects with clearly defined scientific and technological objectives and specific expected results (such as developing new knowledge or technology to improve European competitiveness). They are carried out by consortia made up of participants from different countries, and from industry and academia.

Undertaking. The Clean Sky JU will extend its activities under the different ITDs to achieve the objectives set up in Chapter 3. The option will use the current allocated budget to finalise the current activities by 2017 and an overall budget from Horizon 2020 will be allocated for the period 2018-2020.

95. The business-as-usual scenario (BAU) relies on the continuing of the Clean Sky JU under Horizon 2020 as it currently exists under the 7th Framework Programme, i.e. retaining its implementation arrangements (governance, financial rules, funding rules, etc.), in particular:

- Regarding the governance structure – same division of powers and responsibilities between the Executive Director, the Governing Board, the Commission, and the private participants;
- Regarding the financial rules – same (updated) financial legal framework without additional flexibility for the needs of the JTI JUs;
- Regarding the funding rules – the funding and participation rules would continue to diverge from the mainstream rules under Horizon 2020
- Regarding the technical activities – the six Integrated Technology Demonstrators (ITDs) will be kept, together with the Technology Evaluator in order to deliver technology demonstrators in all segments of civil air transport. The programme will benefit from Horizon 2020 budget and extended timeframe (up to 2025) to mature further the initially identified technologies beyond the status achievable in the current Clean Sky timeframe (until 2017). Technologies developed are demonstrated at the best available integration level within Clean Sky ITDs i.e. at component (e.g. full engine, scale one structure, etc.) and not at aircraft level.

4.3. Contractual PPP option

96. This option (cPPP) aims to establish together with industry a common programme to achieve the objectives set up in Chapter 3. This programme is implemented through a contractual Public Private Partnership (contractual PPP) using the Framework Programme collaborative research and innovation projects managed by the Commission services or an Executive Agency. The current Clean Sky programme set under FP7 ends its activities in 2017 as initially programmed.

97. The contractual PPP is set-up via contractual agreements between the Commission and private partners, following a Commission Decision. Private partners develop the multi-annual roadmap and their own commitment is set out in the contractual agreement. The private partners have an advisory role and they cover their own costs of internal governance.

98. The implementation of the contractual PPP relies on annual budgets subject to an annual decision of the European Parliament and the European Council. An overall tentative budget for the period 2014-2020 is earmarked.

99. Annual or multi annual work programmes are proposed by the Commission and topics relevant to the objectives set-up in Chapter 3 are developed based on the advice by the private partners which can include proposals for the annual priorities. Member States are consulted. The industry and research stakeholders do not formally decide on the content of the work programmes.

4.4. Improved JTI JU option

100. Similar to cPPP, this option (CS2) establishes a new programme in the form of Joint Technology Initiative (JTI) implemented by a Joint Undertaking (JU) to achieve the

objectives set up in Chapter 3. An overall budget for the period 2014-2020 will be set by the Council Regulation establishing the Joint Undertaking. In establishing the new JTI, the current Clean Sky programme, set under FP7, will end its activities in 2017 and smooth transition of results and operations will be ensured.

101. The "improved JTI JU" option builds upon the past experience and the lessons learned and it further improves the design and suitability of the instrument to the new challenges under Horizon 2020 by simplifying the administration, introducing lighter financial procedures, exploring possibilities of establishing common services/functions, and increasing stakeholder commitment to the JTI. In technical terms, the option is centred on the continuation of Clean Sky efforts, addressing integrated technology demonstrations at large system level, and building upon Clean Sky achievements, including new configurations and new vehicle demonstrations at the integrated vehicle level. The new initiative enlarges the scope of demonstration to a wider set of technologies and introduces further integrated demonstrations and simulations of several aircraft systems at the aircraft platform level.

102. The "improved JTI JU" keeps the basic elements of an EU body: legal status, application of the Staff Regulations, application of the Protocol on Privileges and Immunities, liability, jurisdiction and applicable law, protection of the financial interests of the Members, rules on confidentiality and transparency; it also keeps basic elements of the Statutes such as the JU bodies and their responsibilities;

103. At the same time the "improved JTI JU" simplifies a series of other important elements: reference to the PPP-specific financial rules (new, tailor-made, simplified "model" financial regulation), harmonized provisions on control and audit, application of the Horizon 2020 rules subject to derogations where appropriate, set-up under the responsibility of the existing JTI JUs, no mandatory host agreement, streamlined financial and operational planning and reporting, and harmonized approach to internal audit.

104. In the future legal environment tailored-made for the JTI JUs, the "improved JTI" could contribute to: expanding the objective and activities of the JTI JUs in view of Horizon 2020, extending the current programmes, improving their shared governance, providing a stable long term perspective to the stakeholders and simplifying the administration and operations of the JTI JUs.

4.5. Analysis of the options

105. The three remaining policy options identified – BAU, cPPP, and CS2 – were compared along a range of key impacts and criteria selected for their relevance in assessing public intervention in aeronautics research and innovation. The comparison along these parameters was carried out in an evidence-based manner using a range of quantitative and qualitative evidence, including:

- ex-ante and interim evaluations,
- reviews of academic literature (e.g. on market and systemic failures, the impact of research and innovation, the impact of public funding for research and innovation)
- econometric modelling and sectorial competitiveness studies,
- vision papers and foresight studies,
- analyses of science, technology and innovation indicators,

- statistical analyses of FP implementation and participation data,
- public consultations and expert hearings.

4.5.1. Methodology

106. It is estimated that the Clean Sky 2 option will be able to achieve the objectives set in chapter 3 by 2025. The other two options will require longer time to achieve the same performance level. The BAU option will require 3 to 4 years more because of the later start (in 2017, only when the current programme finishes) and because of the need for system integration. The cPPP option will require at least 7 years more because of the nature of its implementation (more fragmented projects, annual budget adoptions) and because of the lower commitment from industry. However, in order to have some positive impact on environment and competitiveness, the developed technologies should be introduced in the next generation of aircraft.

107. The methodology to analyse and compare the impacts of the different options is based on the effect of the technologies introduced in the new generation of aircraft. Only mature technologies reaching TRL 6 at latest in 2025[60] will be introduced. Any other technology is considered to be delayed for later generations by 10 to 15 years and its effect will be minor for short terms.

108. Depending of the level of maturity and number of technologies introduced in new generation aircraft, every option will bring different emission reductions. The next table presents the improvement in performance levels for each option. These levels are computed based only on technologies developed and matured enough by 2025 and ready to be introduced in new generation aircraft. The estimations are based on the experts' view of technology development timescales and pragmatic current of new aircraft timing for each option.

	BAU	CS2	cPPP
CO_2 reduction	10-15%	20-30%	8-10%
Fuel reduction	10-15%	20-30%	8-10%
NOx reduction	15–30%	20-40%	10-30%
Noise reduction (in cumulative EPNdB)	-2dB	-8dB	-2dB

5. ANALYSING THE IMPACTS

5.1. Critical mass

109. The current Clean Sky programme has achieved critical mass bringing together all partners and complementary knowledge resources required to achieve its objectives. In total, more than 500 participants take part in the programme and more half of the beneficiaries are newcomers in European funded research programmes. At the programme level Clean Sky addresses a broad portfolio of relevant technologies and the programme covers the full scope of activities, required to accelerate the development and introduction of major technological advances.

60 Even though all options aim at achieving the objectives of up to 30% of CO_2 and NOx reduction and 5 dB noise reductions, only part of them will be ready at the end of programme period for introduction in the next generation. The other technologies will achieve lower maturity at the end of the programme and although they will not be introduced in the new generation of aircraft they will gear towards the ACARE Flightpath 2050 mid-term objectives.

110. Continuation of the current programme (option BAU) will have a positive impact in terms of critical mass. The contractual PPP option (option cPPP) has the advantages of the PPP to strengthen the synergies between researchers and industry but due to the annual decisions on budget and advisory nature of the multi-annual roadmap this option does not give necessary assurance for industrial investment and is considered less favourable than the JTI. The CS2 option, similarly to the BAU option, has the potential to assemble necessary critical mass because it offers long-term commitment for funding and for the scope of the programme. It presents also an advantage compared to BAU option because of the higher degree of integration and/or increased openness and therefore brings more actors together.

5.2. Small and Medium Size Enterprises

111. The aeronautics industry today is mainly dominated by large manufacturers but there are many smaller companies that support the big companies and can have an important impact. The SMEs have a significant involvement in the supply chain and may benefit from the all different options presented. All the proposed options are in line with the Rules of Participation for Horizon 2020 and do not introduce any distortions that impact disproportionately on the SMEs products.

112. Based on the experience with the current Clean Sky programme, the option BAU will have high positive impact on the SMEs. The natures of topics in the JTI (small enough, precisely defined, closer to market) and its specific rules (proposals may be submitted also by individual entities) make it easier and more attractive for SMEs to apply than the traditional Framework Programme collaborative projects in aeronautics requiring forming a larger consortia. As demonstrated in chapter 2.6.1, because of these particularities, the programme involves a high number of SMEs (ca. 40% of Call for Proposals beneficiaries are SMEs) and the budget from the open calls allocated to SMEs is significantly higher than in the FP7 aeronautics programme. Moreover, as more than half of these SMEs are new participants, it widens the participation, their know-how brings additional added value and improves the exchange of knowledge process.

113. The cPPP options will have also positive impact on the SME because the European Commission is paying special attention to the funding for SMEs under the Framework Programme collaborative projects. In average 15% funding was allocated to SMEs in Aeronautics and Air Transport topics during the FP7 and these options are expected to be even more beneficial for SMEs in Horizon 2020, building on the simplification of procedures.

114. The CS2 option is expected to have the same impact on the SMEs as the BAU option because of the nature of topics in the JTI and its specific rules.

5.3. Leverage effect

115. Public funding is generally expected to have a positive leveraging effect on private research budgets. This effect is two-fold. On one hand it links to additional research carried out by the private sector in parallel and on the other hand the additional research and development investment private carries out alone after the programme completion.

116. The BAU option produces strong leverage effects. The current Clean Sky Joint Technology Initiative mobilises about €800 million in private in-kind contributions which is 50% of the total budget of the initiative and roughly represents a leverage factor of 2 on top of the Framework Programme funding leverage effect. The total

effect is higher taking into account that the JTI triggers focused R&D activities at industrial level complementing its activities. It encourages also investment after its completion for technologies which are mature enough to be included in privately funded development programmes leading to new products. The ratio of investment between Research and Development programmes in aeronautics is estimated to be at least 1:10.

117. The contractual PPP option (cPPP option) will provide slightly lower effect than the BAU option because even if increased by the direct private participation the lack of long-term stability will affect negatively the private commitment. Moreover, due to the applicability of the Horizon 2020 rules, the funding rates the private contribution will be less than 50% and therefore the leverage effect will be lower than the BAU option.

118. The effect of the CS2 option is similar to the BAU option. The foreseen Clean Sky 2 budget is complemented by higher private investment in research and acts as the catalyst for substantial investment in new generations of green aircraft, engines, and systems by bringing high maturity level innovative and integrated technologies.

5.4. Coherence

5.4.1. Coherence with Member State Programmes

119. In terms of coherence with Member State programmes, all the proposed options will assure such coherence because of the participation of Member States in the activities. However, the options BAU and CS2 permit a more stable participation because of the long-term character of the Strategic Innovation and Research Agenda, strong industry commitment and as the Member States are directly involved through the advisory committee that serves as a relay for information exchange. In addition, the participation of industrial, national and regional representatives in the definition of the programme assures a maximum level of synergy through their contribution and through the feedback they will provide to their national and regional authorities.

5.5. Innovation Impact

120. The PPPs are better able to accommodate the various aspects of implementing sustained, large-scale and complex research and innovation activities and thus have better potential to achieve the expected innovation impacts and the specific objectives formulated. The unique contribution from PPPs is that they help transferring new technologies from lab into products. It enhances the productivity of public R&D investments and generates an increased number of lower-risk/higher-quality opportunities for the private sector investment.

121. The effectiveness of the current Clean Sky programme in terms of innovation impacts is confirmed by the results from the JTI Interim Evaluation which found that the CSJU is successfully stimulating developments towards environmental targets.

122. Taking into account these aspects, the BAU option will provide a number of technologies that will have achieved sufficient maturity to become available for inclusion in demonstration and development activities for future aeronautics products. The cPPP option will have positive impact but lower than the JTI options (BAU and CS2) due to the nature of the implementation of the objectives and because the progress on demonstration projects is bound to the availability of annual budgets. Finally, the CS2 option will have similar impact than the BAU option going even further by reaching quicker novel technological advancements.

5.6. Environmental Impacts

123. The environmental impact of the different options is computed based on the assumption of readiness of the developed technologies at the end of the programme and their maturity to be integrated in the next generation of aircrafts.

124. The continuation of current Clean Sky programme (option BAU) will have a positive impact on environment building on the achievements in its initial phase (until 2017). However, because of the later start of developing new technologies (after the finalisation of the current programme) and because these technologies will require further work on integration and maturation only some positive impacts will be additive to each other. The benefits achieved in terms of CO_2 emissions as a sum of different technologies are estimated to lead to maximum of 15% reduction of CO_2 compared to "State-of-the-art" aircraft.

125. Executing the new technological programme through a contractual PPP (option cPPP) will provide a good progress in terms of developed technologies. The necessary technological breakthrough will be more difficult and slower to achieve than for BAU and CS2 option. The main reason is that the possibilities to launch individual projects to implement the programme are subject to annual budget and work programmes decision of the Commission and Member States. Each year only a pre-defined number of projects can be launched and therefore the technological developments are expected to be slower than needed for reaching the objectives set in Chapter 3. In this sense, the benefits achieved in terms of emission are estimated to be 8 to 10% reduction of CO_2 compared to "State-of-the-art" aircraft.

126. The establishment of a new dedicated programme (option CS2) bears the highest potential to integrate and validate timely the novel technologies at higher, system level and therefore significantly contribute to the environmental and societal challenges. Building, where relevant, on Clean Sky technologies, increasing the maturity levels of technologies up to full TRL 6 and raising them to a higher level of integration, the expected achievements would allow to achieve at least 20% CO_2 reduction and enable substantial environmental savings in the next generation.

127. The following table presents the CO_2 saving potential by 2050 computed using the readiness of the developed technologies in each option at entry into service and based on experts estimations. The improvement of each option is compared to the estimated levels of emissions in 2050 resulting from the traffic increase and reduced only by the usual performance improvement.

Aviation emissions (in 2010)		**700 MtCO$_2$**		
Demand growth 2010-2050		4.5% per annum (p.a.)		
Assumed performance improvement	*Narrowbody*	0.6% p.a.		
	Widebody	0.56%		
Assumed % of fleet total fuel burn	*Narrowbody*	51%		
	Widebody	49%		
Normal fleet rollover period		25 years		
Options improvement		BAU	cPPP	CS2

	Narrowbody (EIS 2025)	14%	8%	20%
	Widebody (EIS 2030)	18%	10%	25%
CO_2 avoided (in tonnes)		**~3 bn**	**~1.5 bn**	**~4 bn**
NOx avoided (in tonnes)[61]		**~15 mln**	**~7.5 mln**	**~ 20 mln**

5.7. Economic Impacts

5.7.1. Macro-economic impact

128. On a macroeconomic scale Clean Sky (option "business as usual") will contribute to the economic growth of Europe as the European air transport industry generates 3.1% of the European GDP directly and supported 5.1 million jobs in 2010 in Europe[62]. In addition, due to the growth forecast in the air transport industry, this contribution is growing. Therefore this option will impact not only the aviation industry, but it will have a positive effect on the whole European economy. It also contributes to the generation of new jobs through the better performance of the industry with more successful products and resulting higher demand.

129. Establishing of a contractual PPP (option cPPP) will have a substantial economic impact, in particular for creation of new jobs and supporting the EU growth but it is expected to be in a lesser extent than for options CS2 and BAU. This is due to the delay in reaching the final technology maturity (TRL 6) for needed technologies caused by the implementation modalities of a contractual PPP – projects leading to demonstrators are implemented consecutively depending on the availability of annual budget and the full aircraft level demonstration is postponed.

130. The impact of the CS2 option is expected to generate more benefits for the European aeronautics industry than the BAU option as it will also address new technologies and will reach full system integration. Using methodology taking into account the forecast for aircraft sales, traffic growth expectations, the age of the existing fleet and the predicted technology improvements, the market opportunity related to these programmes is estimated to be around €2000 Bn. The direct economic benefit is estimated at around €350-€400bn and the associated spill-over is of the order of €400bn. These figures are additive with respect to the remaining (although slightly reduced) Economic Value Added still expected from Clean Sky.

5.7.2. Competitiveness

131. The competitiveness of the European aviation industry strongly depends on the quality of products it delivers and in particular on the fuel efficiency of the proposed technologies. Today, the fuel efficiency is the major competitive differentiator and the constant high fuel prices will drive the demand for more efficient aircraft in the future. On the other hand, the pressure to introduce new aircraft more frequently may rise with the increase of the competition and with other airframers entering the market. For these reasons, the timely introduction of new fuel efficient technologies is the main factor driving the competitive capacity in the sector.

132. For the purpose of this impact assessment and due to the lack of precise data, it is considered that the fuel efficiency and the maturity for introduction of the developed

[61] NOx emissions are computed as directly proportional to the CO2 reductions.
[62] Aviation: Benefits beyond borders –Air Transport Action Group, 2012

technologies in the new generation aircraft may be used as a measure for the impact on competitiveness.

133. Technologies developed in BAU option will contribute to the design of new cleaner aircraft providing around 15% of reduction of fuel consumption for the entering of service of the new aircraft generation. The cPPP option, on the other hand, because of the slower development, will provide only 8 to 10% increase in fuel efficiency and therefore its impact is expected to be lower than the BAU option. The 5 to 7 years delay in the maturation of the technologies is due to the implementation modalities of a contractual PPP – projects leading to demonstrators are implemented consecutively depending on the availability of annual budget and the full aircraft level demonstration may be postponed.

134. The CS2 option provides the highest performance and market potential of the validated technologies – 20 to 30% fuel efficiency – compared to 15% in BAU and 10% in cPPP. The development of technologies integrated at system level addressing environmental goals will greatly enhance EU industry competitiveness, since greater energy efficiency will imply reducing operating costs and result in higher demand.

5.8. Social Impact

135. The development of new less polluting air transport has important social impacts such as positive influence on quality of life, public health, mobility, creation of new jobs and contributes to economic prosperity. The World Health Organisation (WHO) and the Joint Research Centre of the Commission a report[63] published in 2011 estimating the healthy life years lost in Europe due to environmental noise. It shows that traffic-related noise may account for over 1 million healthy years of life lost annually in the EU Member States and other Western European countries. It depicts the link between exposure to aircraft noise and hypertension, ischaemic heart disease and the risk of high blood pressure. Another report from the WHO indicates that transport-related air pollution, affects a number of health outcomes, including mortality, non-allergic respiratory morbidity, allergic illness and symptoms (such as asthma), cardiovascular morbidity, cancer, pregnancy, birth outcomes and male fertility. Transport related air pollution increases the risk of death, particularly from cardiopulmonary causes, and of non-allergic respiratory symptoms and disease.

136. It is difficult to quantify exactly the impact of the different options on public health because the accuracy of the proportion of diseases attributable to aircraft emissions and noise is hard to specify. However, it is clear that reduction of CO_2 emissions and noise levels will provide a direct positive effect on public health. In this sense, the reduction of those emissions may be adopted as a measure to understand the effect of the options on public health.

137. As assessed earlier, BAU option is expected to provide 10 to 15% reduction of CO_2 emissions, the cPPP option 8 to 10% less CO_2 and CS2 option 20% less. Regarding the noise level reduction the BAU and the cPPP options will bring 2 dB noise reductions while the CS2 option will provide 8 dB. In this regard, the CS2 option may be considered as the most favourable in terms of effect on public health.

138. In terms of number of jobs, the CS2 option is estimated to provide in the order of 600 000 (direct and indirect jobs) supported by the development, manufacture and support of Clean Sky 2 technology taking into account the accessible market

[63] WHO-JRC, 2011; Report on "Burden of disease from environmental noise, http://www.euro.who.int/en/what-we-do/health-topics/environmental-health/noise

opportunity. This estimate is based on a jobs per unit of economic activity ratio developed by the UK aerospace industry and used with the British Government. The BAU option and the cPPP option will provide both about 100 000 to 150 000 jobs less.

5.9. Cost effectiveness

5.9.1. Cost neutrality and JTI JUs as effective means to achieve goals

139. The first experiences with the JTI JUs indicate that they constitute a highly effective means of implementing the 7th Research Framework Programme.

140. The use of a JU to implement the JTI has the following main benefits compared to using the standard means of implementation of a framework programme:

- a clear commitment of the stakeholders;
- visible legal, contractual and organisational framework to structure the specific joint commitments to which stakeholders are ready to sign up;
- firm governance structure for the JU, including shared decision-making powers and management by the public and private partners, is visible to all stakeholders;
- budgetary certainty via the budget ceiling for EU contribution to cost of the operations and the private partners' financial commitment;
- efficient use of public resources as the Commission passes operational roles to the JU while retaining focus on regulation and supervision.

141. Furthermore, the use of a JU to implement the JTI with the current small-sized body is already at least cost neutral and probably more cost effective for the Commission because the private partner pays 50% of the running costs of the JU. This is shown by the cost-benefit analysis performed in-house DG RTD, by comparing JU to collaborative research initiatives and contractual PPPs in terms of administrative, supervision, establishment and winding up costs. Increasing the size of operations of the JTI JUs and simplifying their functioning on the basis of common participation rules for Horizon 2020 will make the JU a cost-effective means of implementation (see Annex III).

5.9.2. Possible improvements - efficiency

142. The "business as usual" scenario relies on the continuing of the JTI JUs under Horizon 2020 as they currently exist under the 7th Framework Programme. In contrast, the CS2 option simplifies and improves the legal framework, governance, and operational modalities of the current JUs.

143. In particular, in order to ensure a good balance between cost-neutrality of the JTI JUs under Horizon 2020 and increase their cost-effectiveness, the following simplification measures are being considered:

- Foreseeing a single set of Rules for Participation and Dissemination that will, subject to derogations where appropriate, render participation easier and ensure a single and sufficiently flexible regulatory framework, will create a more coherent set of instruments covering both research and innovation, enhance programme accessibility and attractiveness, and increase the scientific and economic impact while avoiding duplication and fragmentation.

- Introducing lighter financial procedures, which in particular will provide simplified procedures for the establishment and the adoption of the budget and corresponding reporting. This is due to the new Financial Regulation which permits bodies like JTIs adopt lighter financial rules based on a new, tailor-made, simplified "model" Financial Regulation
- Using common IT systems, including the proposal evaluation system for Horizon 2020 which increases harmonisation, reduces the costs for such services and allows JU staff members to better adapt to the common software management programme. Moreover, by using the "commons" of the programme, the JUs coordinate better their internal processes regarding portfolio management, as well as monitoring and reporting towards the legislator and the Commission regarding management of programmes and projects.
- Exploring different options regarding establishing common services/functions (IT, Audit, Legal issues) for PPP/JTIs. These options are:

  (a) Commission provides common services to JTIs JUs and requests from them the payment of a proportional contribution;

  (b) JTIs JUs set up their own common functions, which are specific and shared among them;

  (c) Each JTI JU organises itself individually.

- Sharing functions in the context of the internal audit or for the accounting officer (the latter case being explicitly provided for by the Rules of Application (RAP), Service Level Agreements, common service and supply contracts and exchange of information among JU colleagues.
- Continuity of staff between the current and future JUs for the period when the current project portfolio is closed down and the future portfolio is built up.

5.9.3. Possible improvements - effectiveness

144. At the same time, the above simplifications envisaged for the new JTI JUs to be set up under Horizon 2020 will also allow them to become more effective by:

- Clear stakeholder commitment to the JTI through (1) a definition, in a dedicated annex to the regulation, of the contribution to the JTI of industrial members, rendering their contribution more visible, (2) improved representation of the public and private partners in governing bodies, (3) a balance of influence between the Commission and Industry in the appointment of the Executive Director, etc.).
- Introducing more flexible budgetary and procurement procedures through adjusted legislative framework building on the new Financial Regulation.
- Increasing the accessibility and attractiveness of the programmes. The Horizon 2020 JTI JUs shall apply the common set of rules of the Horizon 2020 Rules for Participation, thus providing a coherent legal framework. Any derogation requested by the JU would have to be duly justified for specific needs and should be cost-effective for the implementation of Horizon 2020.

6. COMPARING THE OPTIONS

6.1. Comparison of the options

145. The following table presents the assessment of the different policy options compared to the option Business as Usual. This option is chosen as reference because it

presents the current situation and has proven to be efficient means for R&D in the aeronautics sector.

-	=	+
Disadvantage compared to reference	Same impact as reference	Benefit compared to reference

Option Criteria	Business as Usual BAU	Contractual PPP cPPP	Renewed JTI CS2
Effectiveness			
Critical mass	=	-	+
Impact on SMEs	=	-	=
Leverage effect	=	-	=
Innovation impact	=	=	+
Environmental impacts	=	=	+
Economic impact	=	=	+
Social Impact	=	-	+
Efficiency			
Administrative costs	=	-	+
Administrative simplicity	=	=	+
Coherence			
Coherence with programmes of MSs	=	-	=

6.2. Preferred option

146. Based on the assessment, the CS2 option provides the best means to achieve the defined objectives. In addition, it has very good synergy with the currently implemented research programme and can be built up upon technologies and demonstrators developed under Clean Sky following a smooth transition.

147. CS2 option allows timely execution of the full research programme and offers a higher level of integration with full aircraft demonstrators so as to understand the full impact, including risks and synergies of the combination of innovative technologies. This would allow maximising technological innovation which will help to address more ambitious objectives for air transport regarding environmental impact and passenger mobility, following the Europe 2020 strategy, the Transport White Paper, Flightpath 2050 and is in line with the Horizon 2020 objectives.

148. It helps the most to overcome the so-called "market failure" by using public support to reduce the development risk of non-conventional technologies to a level that is considered to be financially viable by industry.

149. It aims also to move the pre-competitive research closer to market for accelerating market introduction of new technologies keeping Europe competitive especially under the current economic and financial situation which makes investment in technology even more necessary for growth and competitiveness.

150. In addition, a JTI with an improved Joint Undertaking:

(a) Provides a stable mid to long term framework enabling strong commitment of the participants for developing innovative design solutions;

(b) Ensures focus of participants towards commonly defined environmental and societal goals;

(c) Steers activities towards integration and validation of new technologies into new aircraft configurations;

(d) Stimulates and enforces cooperation among major aeronautical companies and other research stakeholders;

(e) Offers improved governance and legal framework compared to the current programme;

(f) Enables a substantial participation of SMEs and academia through flexible and open Call for Proposal procedures.

151. This option is also preferred according to the results of the public consultation. 95% of the answers consider appropriate to set up a Public Private Partnership in aeronautics under Horizon 2020. Most of the participants agree (39%) or strongly agree (50%) with the fact that the PPP in aeronautics research should focus on large-scale demonstration of new promising technologies. In addition, the majority of the answers (41% favourable and 33% very favourable) are in support of setting up a dedicated legal structure with a lighter approach.

152. In addition, this option is supported by the industry, which has indicated its commitment for the continuation of the activities and has signed a Letter of Intent in September 2012.

153. Therefore it is recommended to implement this option as the most adapted to achieve the defined objectives in Chapter 3.

6.2.1. Scope

154. The CS2 will address the most promising aircraft technologies capable of improving the environmental performance and the EU industry competitiveness. These technology developments will fully take into account the compatibility with potential alternative fuels under development.

155. CS2 will build on the successful features of Clean Sky such as project-like character with a relatively small number of well-focussed demonstrators and clearly set deadlines. In addition to the development of new technologies, CS2 is also building upon technologies and demonstrators developed under Clean Sky, FP7 and national research programmes. The next figure demonstrates the links between Clean Sky and Clean Sky2.

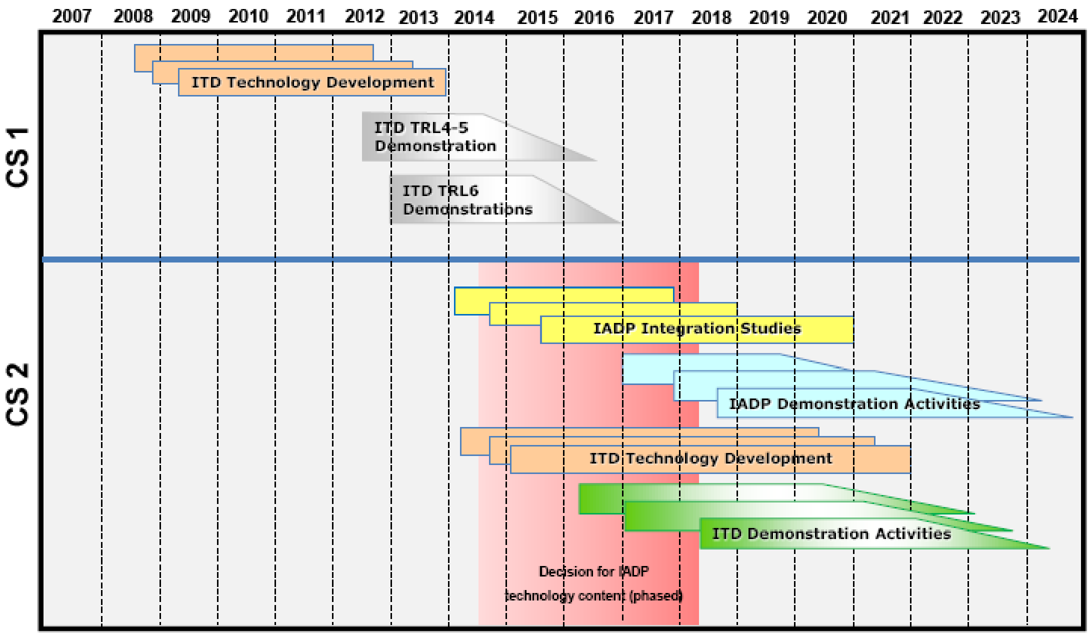


Figure 7: Linkages between Clean Sky and Clean Sky 2

156. Most Clean Sky activities will continue after the possible start of CS2 in 2014 and key results from demonstrators will become available in the 2015-2016 period. Transition from Clean Sky to CS2 is, therefore, expected to be progressive and the technical and managerial continuity between Clean Sky and CS2 will be ensured for a seamless transition of activities.

6.2.2. Structure

157. Two complementary types of demonstrator activities are proposed for CS2:

(a) Three demonstrators (Innovative Aircraft Demonstrator Platforms - IADP) at the higher level of integration of full vehicle platforms to carry out final testing of aircraft systems in all flying segments (large aircraft, regional aircraft, rotorcraft) at the highest research level (TRL6) in view of future certification.

(b) Three transversal Integrated Technology Demonstrators (ITD) focussing on airframe, engine and systems and including electrical taxing and sustainable life-cycle.

158. In addition, a Technology Evaluator will assess routinely technological progress and impact while promising knowledge spill-overs to other modes of transport.

159. Close coordination will be ensured with the Single Sky technology development under SESAR and also with EC research activities on sustainable alternative fuels.

6.2.3. Budget

160. The current industry estimation is that the cost of the CS2 programme is €4.05 billion. The EU will contribute with €1.8 billion from the Horizon 2020 programme budget. The industrial partners will contribute with €2.25 billion. €1 billion of the industrial commitment will be through additional activities that are not included in the work plan of the JTI but contribute to the programme objectives. The significant increase compared to the previous programme is due to the higher level of integration and its in-flight demonstration at full-scale level requiring complete aircraft architectures. The private members will contribute on a 50/50 basis to all CS2 administrative cost.

161. The indicative split between different activities (ITDs, IADPs and Technology evaluator), based on the assessment of the draft technical programme, is as follows:

Clean Sky 2	**100%**
IADPs	
Large passenger aircraft	32%
Regional aircraft	6%
Rotorcraft	12%
ITDs	
Airframes	19%
Engines	17%
Systems	14%
Transverse activities	
Technology Evaluator	1% of the above IADP/ITD values
Eco-DESIGN Transverse Activity	2% of the above IADP/ITD values
Small Air Transport Transverse Activity	3% of the above IADP/ITD values

6.2.4. Governance and organisation

162. Based on the lessons learnt from Clean Sky, it is proposed to use the current Joint Undertaking structure as a baseline. In particular, the Governing Board, ITD Steering Committees, National States Representative Group, Scientific and Technology Advisory Board and the General Stakeholders Forum will be maintained.

163. The proposed CS2 membership, including the Commission, Leaders and Core Partners, is also similar to that of Clean Sky.

164. To address the challenges with respect to complexity and cost-effectiveness, as highlighted by the expert reports, the JU interim evaluation and the Court of Auditors reports on JUs, the following key elements will simplify and improve the legal framework, governance, and operational modalities:

(a) A *single set of Horizon 2020 Rules for Participation and Dissemination* also applicable to JTIs will, subject to derogations where appropriate, render participation easier and more attractive and ensure a single and sufficiently flexible regulatory framework for the entire Horizon 2020.

(b) Introducing *lighter financial procedures* will provide more flexibility and lower administrative costs for JUs. It is more trust-based implying the adoption of financial rules closer to private sector practice and contains in particular much needed simplified procedures for the establishment and adoption of the budget and for corresponding reporting. As an example this approach would not require any longer a separate decision of the budgetary authority on the staff establishment plan of the JUs with the corresponding distribution of posts and budgets, giving the Executive Director more flexibility in organising the staff composition.

(c) Usage of *common IT systems*, including the full integration of the JUs in the Research and Innovation Participant Portal, which provides for Horizon 2020 all services for documentation and guidance, call publication, proposal submission and evaluation, grant preparation, grant management and reporting as well as management of experts will be proposed. This will increase harmonisation of IT systems, reduce the costs for such services and allow JU staff members to better adapt to the common software management programme. It improves the programme monitoring, statistics, communication, dissemination and reporting towards the legislator and the Commission will be simplified once all project data are integrated in the common Horizon 2020 data bases.

(d) *Use of common services/functions*. JUs set up their common functions, which are shared among themselves or use services provided by the Commission. This will be done allowing the use of Service Level Agreements, common service and supply contracts and of exchange of information leading to enhanced coordination among JUs.

(e) *Delegation of routine administrative, financial and management decisions to the Executive Director* to make the Governing Board a more strategy-oriented body.

(f) *Increase openness of the activities* by enlarging the participation through open calls. For this reason the share of budget for dedicated to open selection will be increased to 60% - calls for proposals will be increased to 30% compare to 25% today and additional 30% will be dedicated to selection of core partners through open calls. Finally, the leaders will be identified in a transparent manner, ensuring that all industrial stakeholders will be able to join.

7. Evaluation and Monitoring

165. The monitoring and evaluation of the progress within the Clean Sky Joint Undertaking will be carried out both by external and internal bodies.

166. The internal monitoring is first executed by the Project Officers who monitor the implementation of the ITDs, participate in the ITD Steering Committees, review the quarterly ITD reports and follow the annual review of ITDs. They monitor the progress in both the budget implementation and advancements in the technical work according to the work plans submitted by ITDs and suggest corrective actions, where appropriate.

167. The ITD annual reviews are carried out in the presence of independent external experts and the implementation of recommendations is checked at an interim annual ITD meeting. In addition, the Scientific and Technology Advisory Board (STAB) of Clean Sky analyses the review results across all ITDs and gives its assessment to the JU Executive Team. Based on these assessments an Annual Activity Report is prepared for the adoption by the Governing Board and is published.

168. The external evaluation for the whole programme is organized by the European Commission and carried out by the independent experts in different steps according to the phase of the programme: evaluation before the programme starts *(ex ante)*, interim assessments and evaluation after the programme completed *(ex post)*.

169. In addition, assessment studies like the present one contribute to the effort made in order to prepare the project to satisfy all the expectation and criteria. In the preparatory phase, but also during the programme implementation, special meetings with the representatives of Member States, Associated States and ACARE technology platform ensures that the Clean Sky 2 technical programme is satisfactory to all stakeholders.

7.1. Measurement of progress

7.1.1. Evaluation levels

170. Three different kinds of measurement will be maintained during the programme:

- evaluation and forecast on whether the programme produces the required results in terms of the benefit for the environment and for the competitive position of the industry;
- continuously checking that public money invested is well spent by following the project work plans and advancement of the deliverables;
- monitoring that the selection process for additional partners is transparent and fair.

171. The evaluation of the progress against the criteria above will be executed at technical, managerial and financial levels using a limited set of headline indicators.

7.1.2. Technical monitoring and evaluation

172. The measurement of the technical impact evaluates to what extent the technologies developed in the projects reach the technical objectives and assesses their impact.

173. As for the current Clean Sky programme, the most important instrument for impact assessment in CS2 will be the Technology Evaluator (TE). As pointed out by the Expert Panel, the Technology Evaluator should be maintained as an essential element within Clean Sky 2 and its role should be strengthened. The assessments of environmental impacts could be expanded and they can include other impacts, such as the mobility benefits of Clean Sky 2 concepts, where applicable.

174. The progress of each demonstration platform (ITDs and IADPs) will be monitored against well-defined environmental and socio-economic benefits and targets. For full vehicle-level demonstrations in the IADPs, the core aircraft performance characteristics will be reported and for ITDs, the TE will enable an aircraft-level synthesis of results (via ‘concept aircraft’) allowing the ITD results be shown at aircraft level and evaluated within the Air Transport System alongside IADP results.

175. The management structure will also take part in the technical monitoring. Detailed technical sub-objectives as stated in the ITD work plans will be monitored at the level of the ITD Steering Committees and by the JU Project Officers. Results of higher level analysis of progress will be included in the Annual Activity Report adopted at the Governing Board level and will be shared with the external bodies and general public.

176. Before the start of the programme, based on the detailed technical proposal from Industry, an in-depth technical assessment will be carried out. It will aim at identifying the main work packages in detail and to set detailed performance indicators addressing environmental (such as reducing noise and NOx emissions) and operational (project milestones) objectives in addition to the following ones:

(a) **Indicator 1 to 3 (environment)** measures the contribution to reaching -30% in CO_2, -30% in NOx emissions levels and -5 dB in noise emissions compared to 2014 baseline.

7.1.3. Managerial monitoring

177. The managerial monitoring is executed by the governing bodies of Clean Sky. A clear management and communication structure ensures the appropriate day-to-day management of the project and helps in the strategic planning process. These bodies

are also responsible for the administrative, managerial monitoring of the project by analysing the reports from lower management levels and measuring the progress against the detailed project plan.

178. The Executive Director is the legal representative of the JU. The JU collects all the relevant information and prepares the reports on the basis of the information received. The Executive Director reports directly to the Governing Board.

179. One important element is to ensure that a fair and transparent evaluation and selection process of additional partners through the Calls for Proposals is in place. A well-established selection process can guarantee that companies not yet part of the supply chain will have equal possibilities if they have useful capabilities for the project. In addition, continuous monitoring of involvement of SMEs and academia is carried out and communication and dissemination events are organized to inform and attract broad range of new partners.

180. The present governance structure ensures that each important stakeholder group is informed on progress. In addition to different kind of information events, a General Annual Forum is organized to report on the progress made.

181. The following indicators are used to assess the achievement of the managerial objectives:

(b) **Indicator 4 (programme management)** measures time-to-contract against 180 days benchmark.

(c) **Indicator 5 (SMEs)** measures the SME participation rate in Calls for Proposals against the 20% target of Horizon 2020.

7.1.4. Financial monitoring

182. Besides the technical and managerial aspects, sound financial management is equally important to continuously monitor that the financial and administrative Clean Sky targets are maintained. To guarantee that funding received from the European Commission is spent according to public interest, the European Commission has a de facto veto right in the Governing Board.

183. Ex-post audits to the beneficiaries are conducted by the JU according to the common rules.

184. The following indicator is used to assess the achievement of the financial objectives:

(d) **Indicator 6 (financial management)** measures time-to-pay against 90 days target of the Financial Regulation.

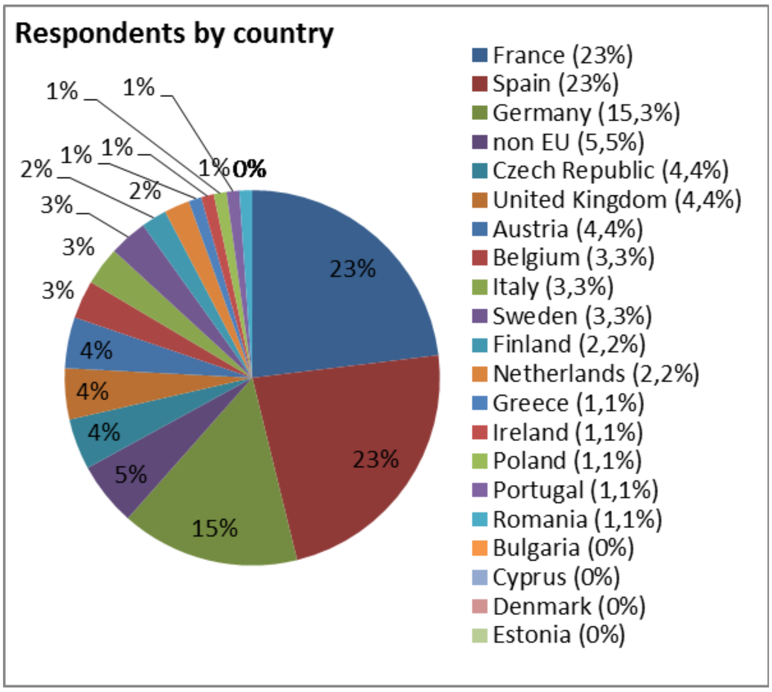
Annex I: Results from the public consultation on the preparation of the Clean Sky Joint Technology Initiative under Horizon 2020

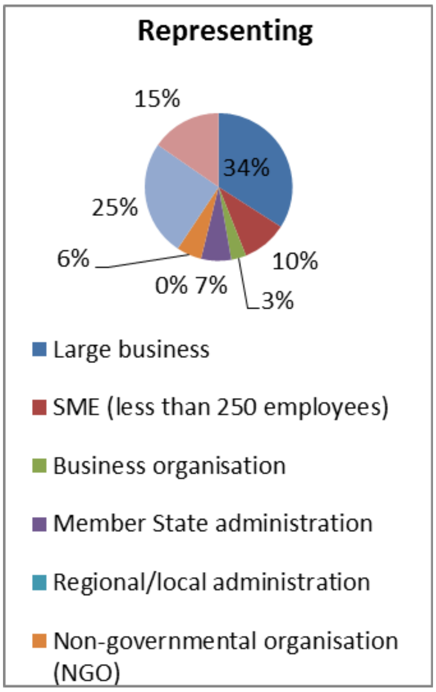
1. Public consultation

The public consultation was opened on the 11th of July 2012 and closed on the 4th of October 2012 (12 weeks). 91 responses were received.

1.1. Respondents profile

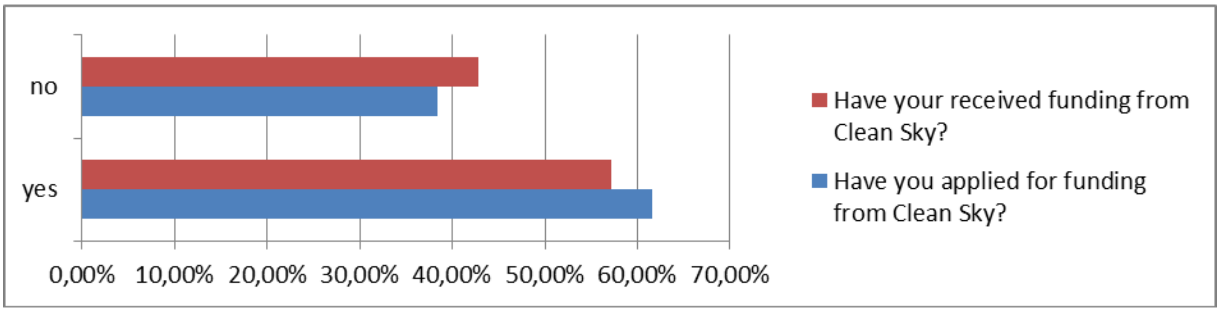
Respondents originate from at least 17 different countries, including 5 from associated countries. France and Spain are the most represented (23.1 % each), followed by Germany (approx. 15.4%) and other countries (e.g. Austria, Czech Republic, UK, Belgium, Italy and Sweden). Most respondents are representative of the large business (34.1%), followed by individual citizens (25.3%) and other (15.4% each). The number of SMSs answers is 9.9% from the total and of the Member Stares administration is 5.5%. No regional administration has answered the consultation.



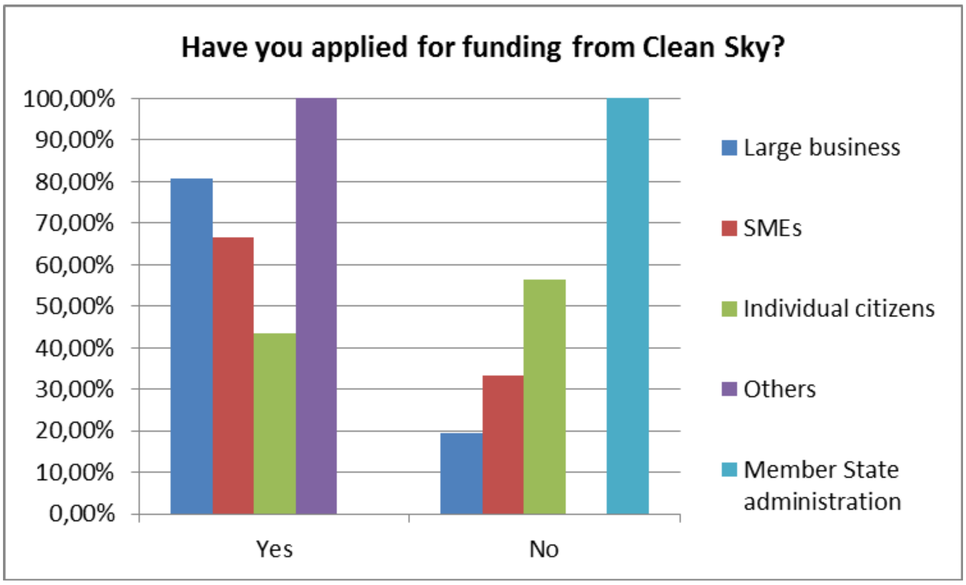


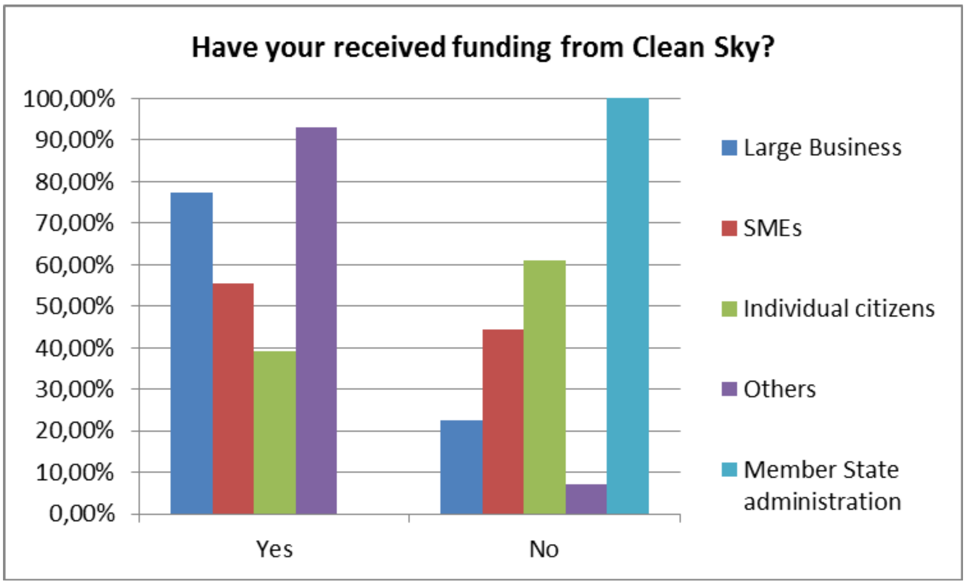
There are 31 answers from the large companies including the main manufacturers such as Airbus (aircraft manufacturer), Eurocopter (helicopter manufacturing and support company), Rolls-Royce (engine manufacturer), Safran (engine manufacturer), Liebherr, Volvo as well as other companies such as Aernova (aerostructures), Constellium (manufacturer of aluminium products) and others. Six of the answers are provided by companies that have not applied for Clean Sky funding. On the other hand, a number of the individual responses come from working or worked in the large industries. The SMEs representatives who answered the questionnaire are from different European countries, mainly from Spain, Germany, Italy, Austria and Belgium. One third of them have not applied for Clean Sky funding. The opinions of the Research organisations and the Universities are represented in the "Others" category. It includes research centres such as ONERA (the French Aerospace research centre), DLR (the German Aerospace Center), NLR (research institute based in the Netherlands) and Fraunhofer (German research organisation) as well as other centres and universities from Spain, Sweden, Poland, Czech Republic and Romania. The Member states representatives include answers from ministries in Czech Republic, Netherlands, UK, Austria and Finland as well as from the French civil aviation authority.

Most of the respondents were familiar (~92%) with the Clean Sky Joint Undertaking and the majority has applied for funding (61.5%) or have received already funding (57.1%) from the JU. It is worth to note that from those that applied for funding the majority is large organisations (44.6%) or other (25%) including Academia, followed by SMEs (10.7%). The order is the same and the ratio is very similar for received funding.



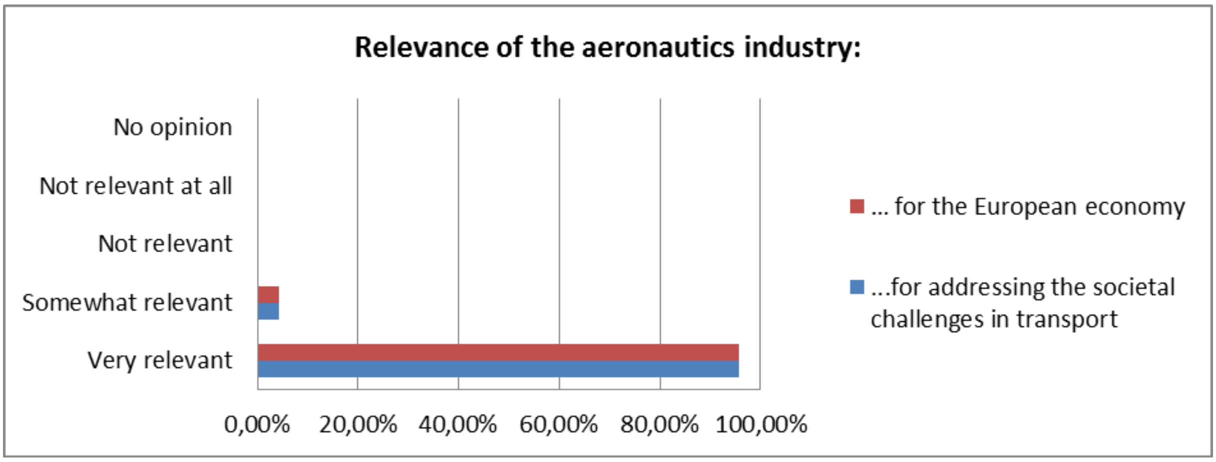
From the stakeholders' answers for application and participation in Clean Sky it can be seen that the most participation is from others, followed by large industry and SMEs. It is worth to note that 39% of the individual citizens have received funding from Clean Sky. This is mainly due to the fact that those persons are working for industry companies.





1.2. Relevance of the sector

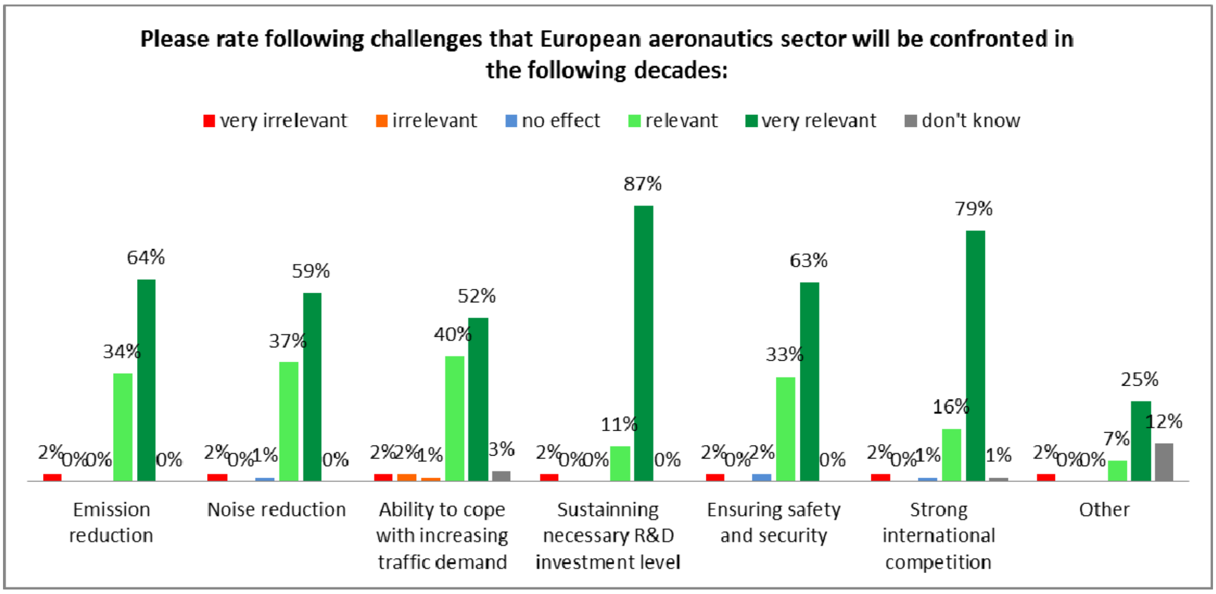
All respondents supported the relevance of the aeronautical industry in addressing societal challenges in transport (emissions, mobility, fuel consumption, congestion, etc). The majority considers also aeronautics industry as very relevant for the European economy.



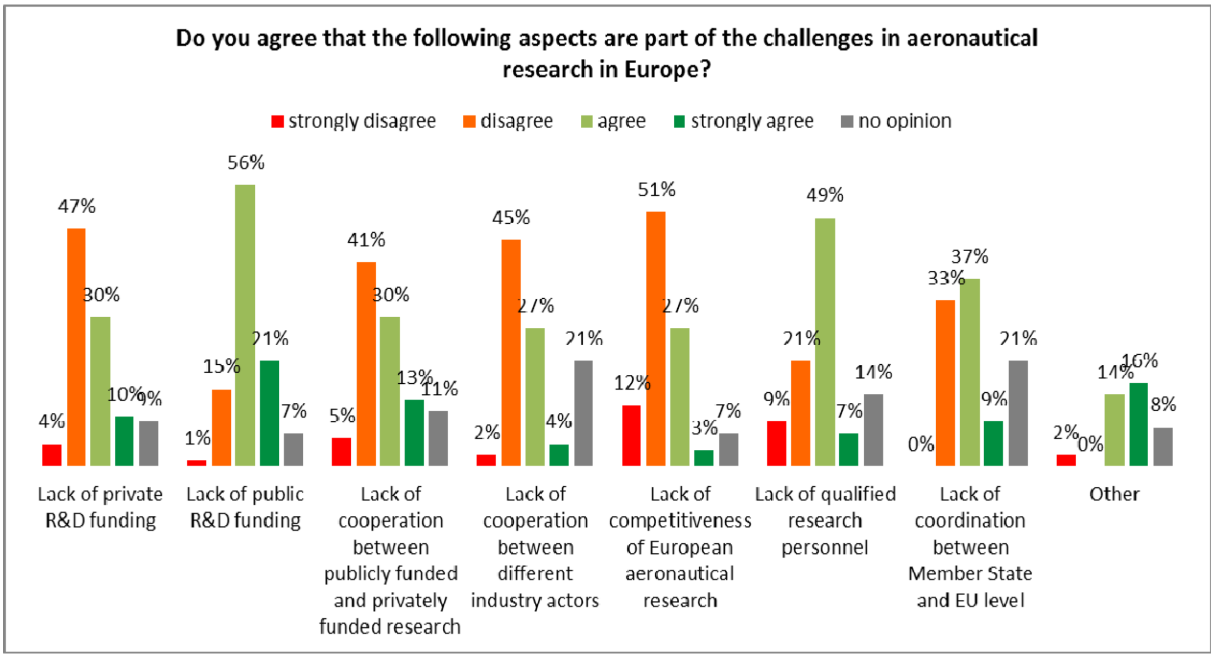
1.3. Identification of the problem

Assessment of the most relevant challenges facing the Aeronautical sector showed strong support for all topics. "Sustaining necessary R&D investment" and "Strong international competition" were rated as the two most relevant challenges followed by "Emission reduction", "Ensuring safety and security", "Noise reduction" and finally the "Ability to cope with increasing traffic demand". Specific comments included:

- management of the risk of materials availability and use (REACH legislation)
- step changes in aircraft fuel efficiency, optimised on board energy and economic efficiency
- maintain sufficient and efficient up to date research and test infrastructure (e.g. wind tunnels, simulators, flying test beds,…) and to educate the necessary work force at all levels



Analysing the aspects of the challenges in aeronautical research in Europe, the majority of respondents clearly consider the lack of public R&D funding and the lack of qualified research personnel as an important aspect while they regard European Aeronautical research as competitive.

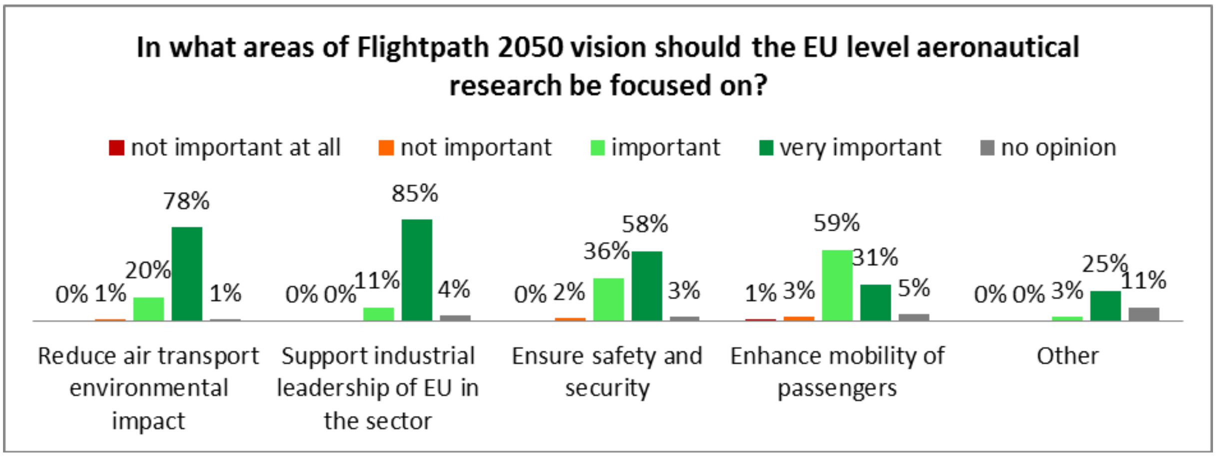


1.4. European added value

When assessing European added value, the majority of the respondents (79.1%) disagree that it is possible for the EU aeronautics sector to rely solely on market mechanisms to achieve major innovations without public support. Responses supported the requirement that it is essential that public support is provided at all levels (84.6% for all levels – regional, Member State and EU) to achieve major innovations. Comments recognised that industry alone could not maintain Europe's strong global position but programmes like Clean Sky can significantly balance industries investment to successfully mature technologies through effective demonstration.

1.5. Objectives

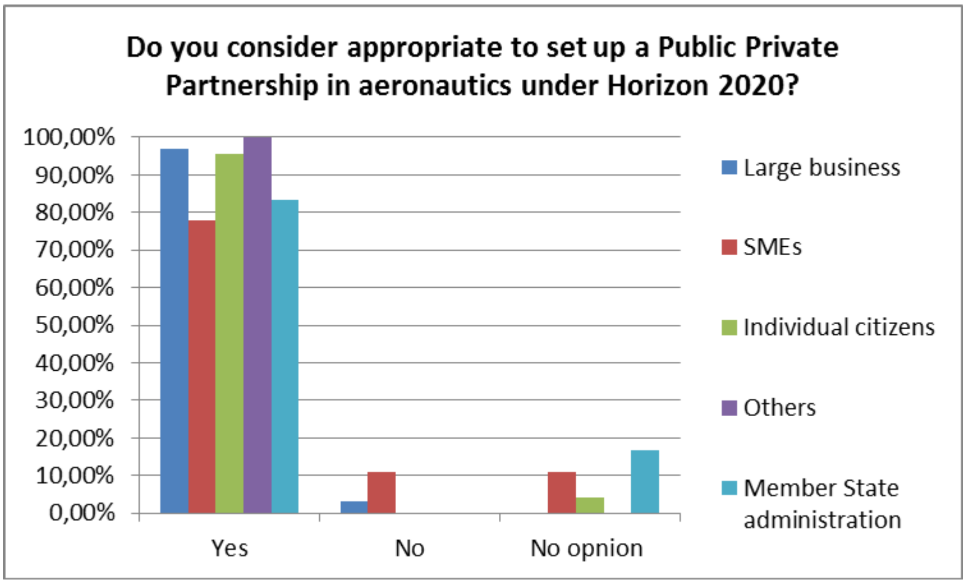
There was strong (88%) agreement that Europe's new vision for aviation, Flightpath 2050, is an adequate point of departure for the research agenda in the aeronautical sector at EU level. In addition, all vision's areas (Reduce air transport environmental impact, Support industrial leadership of EU in the sector, Ensure safety and security, Enhance mobility of passengers) are regarded as important. Comments indicated that innovative energy supply is also an important aspect, which has to be done partly outside the aviation area.



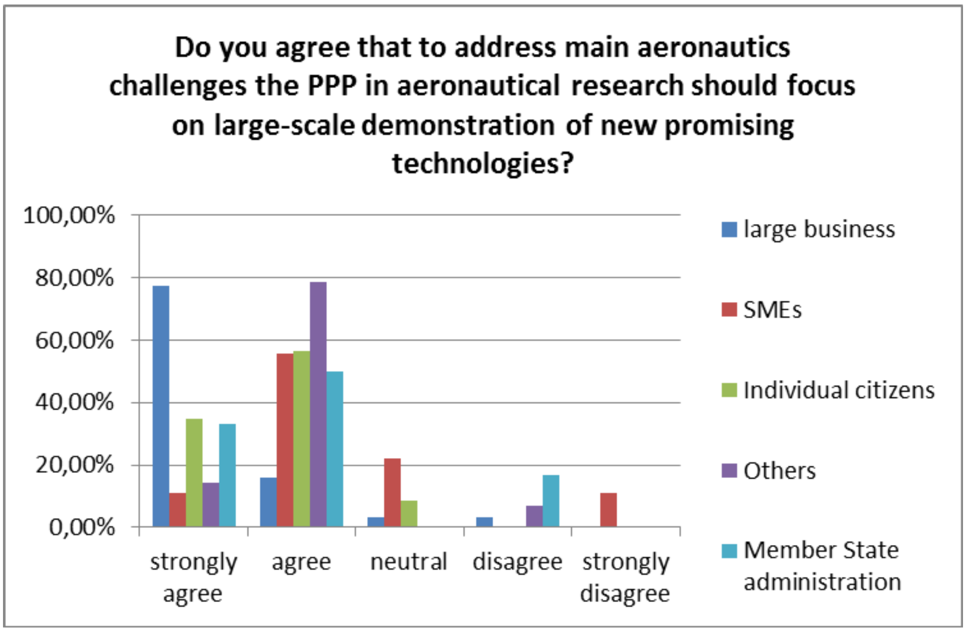
1.6. Options and Impact

The majority of the respondents (94.5%) considers appropriate to set up a Public Private Partnership in aeronautics under Horizon 2020 capable to improve the competitiveness of Europe in the aeronautics sector for both short (by 2020) and medium term (by 2035). There are only 2 participants out of 91 that do not consider appropriate setting up a Public Private Partnership. They represent one large business company and one SME. The first proposes to integrate research projects in existing PPP's (Clean Sky I, SESAR) thus in practice contradicting the original comment; The second suggests maintaining the current scheme of FP7 with collaborative research only capability.

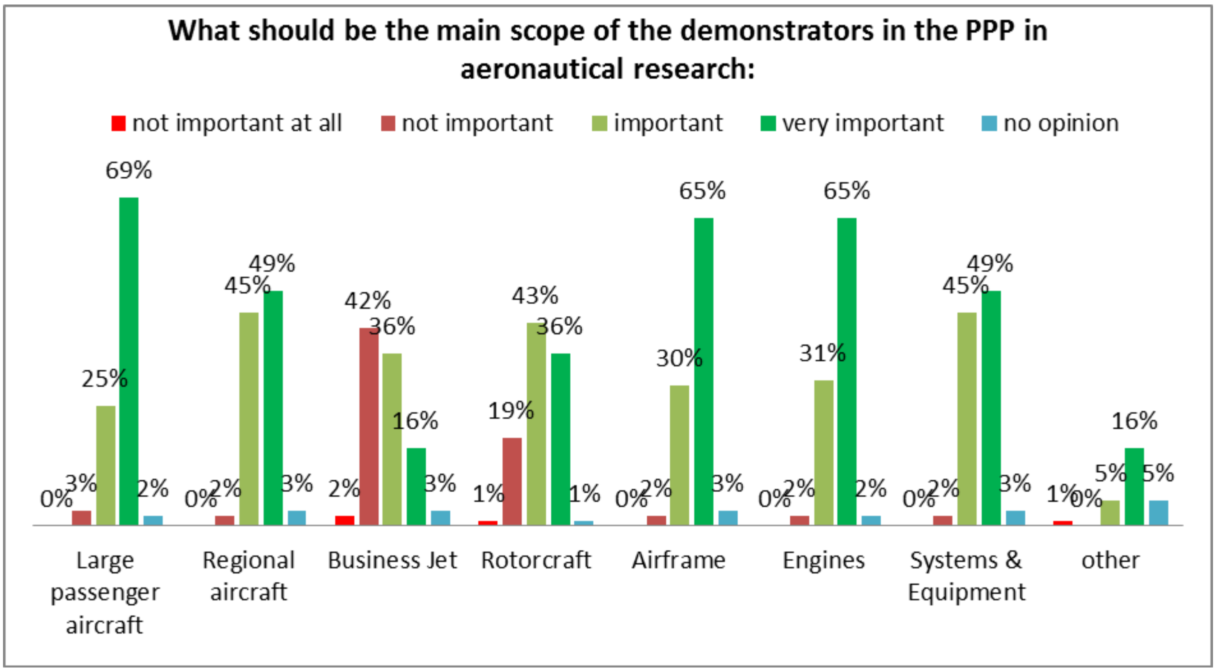
In terms of types of stakeholders, all agree on this subject with large industry, individual citizens and more than 95%. This ratio is slightly lower with SMEs (75% agree) and member states administration (83% agree)



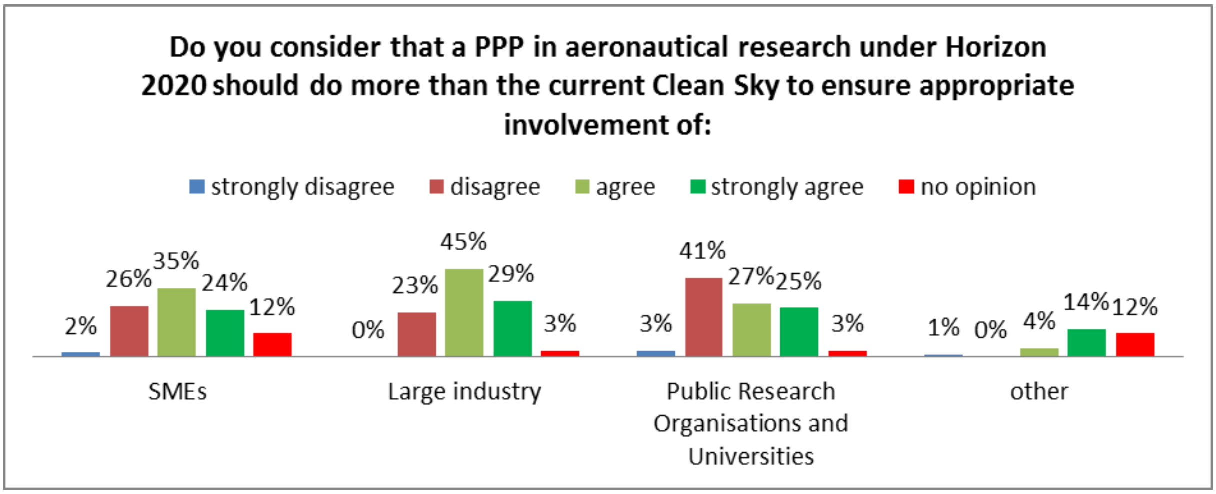
Concerning the focus of the established PPP in aeronautical research most of the respondents agree (47.3% strongly agree and 41.8% agree) that it should be on large-scale demonstration of new promising technologies in order to address main aeronautics challenges. In terms of results per stakeholder type, the strongest support comes from large industry followed by SMEs, individual citizens and others. There is one large industry representative; one SME, one of the member states and one other that disagree with the focus on large scale demonstrators. According to them it should focus on alternative and new fuels, small transport aircraft and demonstrators for unmanned aircraft.



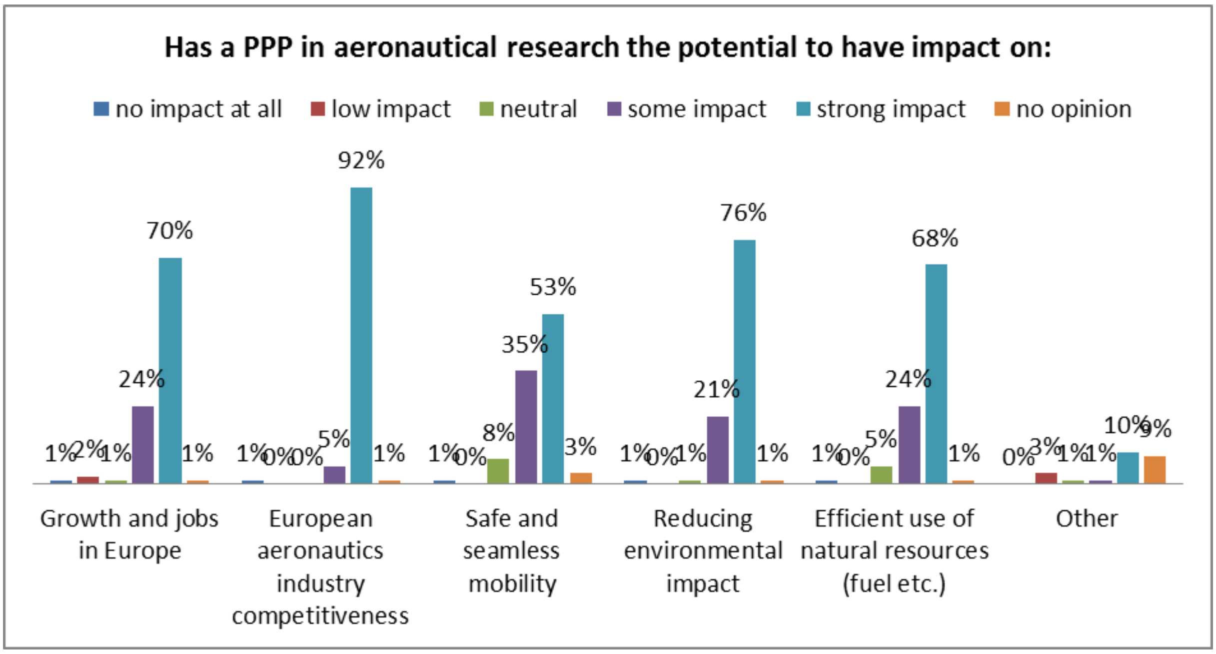
Assessing the main thrust for demonstration revealed engines, large passenger aircraft, regional aircraft, systems & equipment and the airframe being important (95%), rotorcraft achieved 80% support and business jets are considered important by ~50% of respondents. Comments included the potential use of unmanned air systems to assess lower TRL technologies in small scale earlier in the demonstration cycle. Small transport aircraft is also considered as important to be in the scope of the new programme.



Respondents also considered that a PPP in aeronautical research under Horizon 2020 should do more than the current Clean Sky to ensure appropriate involvement and should be more focussed on large industry before SME's or Public Research Organisations and Universities. This may have been a direct reflection of the participant profile. The comments indicated that more flexibility is required for companies to engage at a later stage of the programme and that medium sized industry should be better involved.

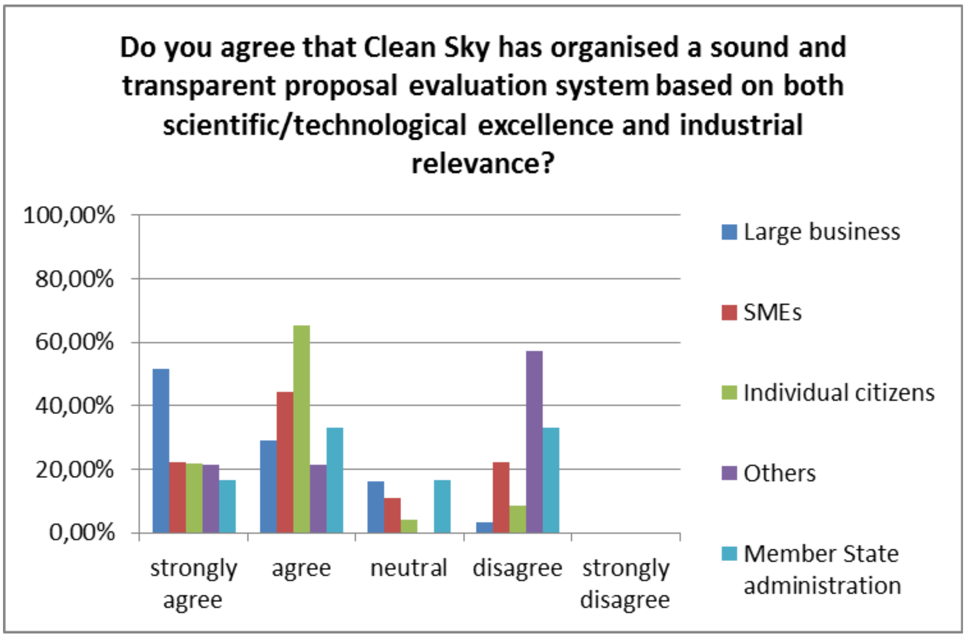


Major benefits of the PPP would impact favourably on "European aeronautics industry competitiveness" and "reducing environmental impact" with "growth and jobs in Europe" and "efficient use of natural resources (fuel, etc) just behind. Comments reflect significant support for the role Clean Sky has delivered to date in maturing and de-risking promising technologies. Clean Sky 2 objectives need to align with Flightpath 2050 and SRIA topics and continue to develop the strong participant "supply chain" achieved in Clean Sky.



1.7. Achievements of the current Clean Sky initiative

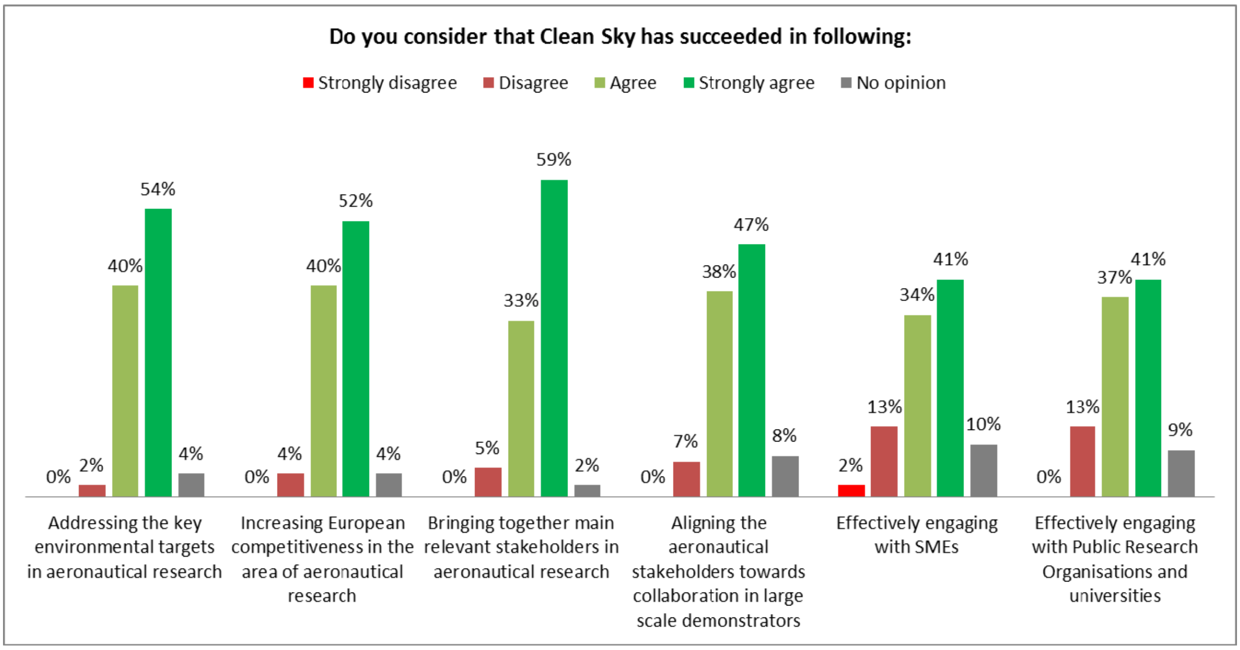
Most of the respondents consider that Clean Sky provided very much value added on each of its objectives together with the proposal evaluation system that is considered sound and transparent based on both scientific/technological excellence and industrial relevance. There are 16 responses that disagree or strongly disagree with that representing 17% of the total opinions. For them the Clean Sky proposal evaluation process is considered sound, however it is less transparent than the one used for the regular EU calls for proposal.



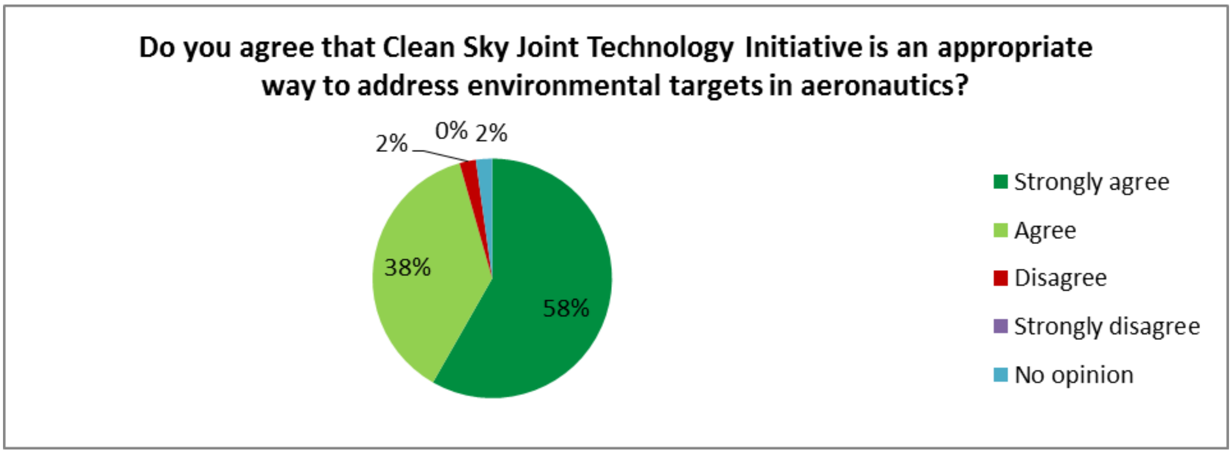
Areas of success of Clean Sky include,

- addressing key environmental targets in aeronautical research
- increasing European competitiveness in the areas of aeronautical research
- bringing together main stakeholders in aeronautical research
- aligning the aeronautical stakeholders towards collaboration in large scale demonstrators
- effectively engaging with SME's
- effectively engaging with Public Research Organisations and universities

Comments indicated that Clean Sky succeeded in attracting partners (~ 500 partners) integrating further European aeronautics players on solid grounds for many years.



Importantly, majority of the respondents (95.6%) agree that Clean Sky Joint Technology Initiative is an appropriate way to address environmental targets in aeronautics and most of them (93.4%) are aware of technological successes of Clean Sky.

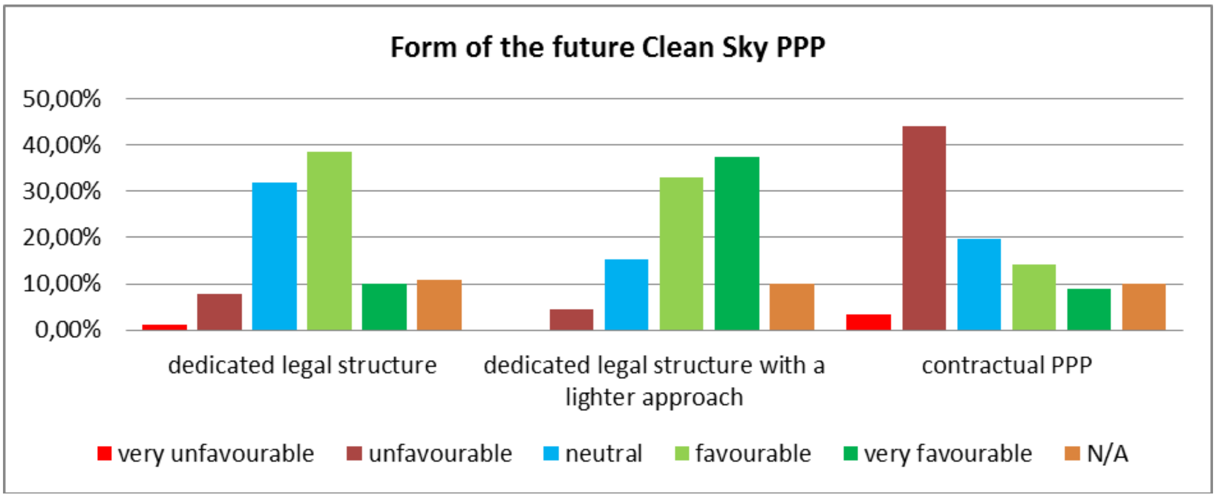


Further comments on achievements show that Clean Sky has provided an excellent focus for aeronautical research in Europe, providing strategic research leadership, ensuring that research is closely aligned to the research agenda, and providing a mechanism to encourage cooperation between competitors and across national boundaries. However, some areas in which improvements can be made are mentioned. It is considered that a big part of the activities in Clean Sky are focused on administration and therefore for Clean Sky 2, to become a truly effective public private partnership, the rules must be relaxed with an increased focus on risk management and much less attention to form filling correctly.

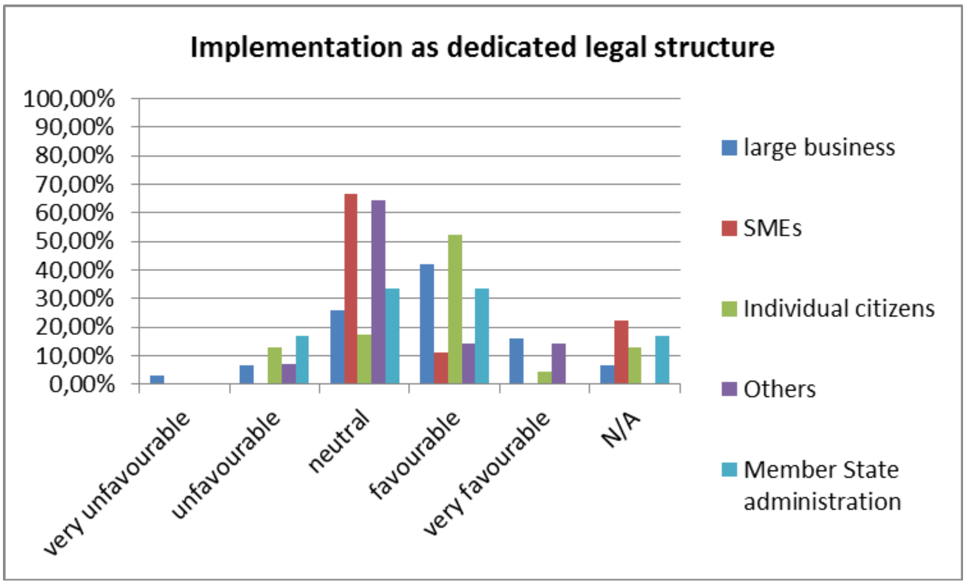
A particular concern is raised about the openness and the limited possibility for participation. In this sense Clean Sky 2 needs more open and transparent system of selecting members. Measures should be taken to ensure the possibility of new interested and committed (industry & research) stakeholders to join the new initiative openly and transparently, be it as from the very beginning or even at a later stage.

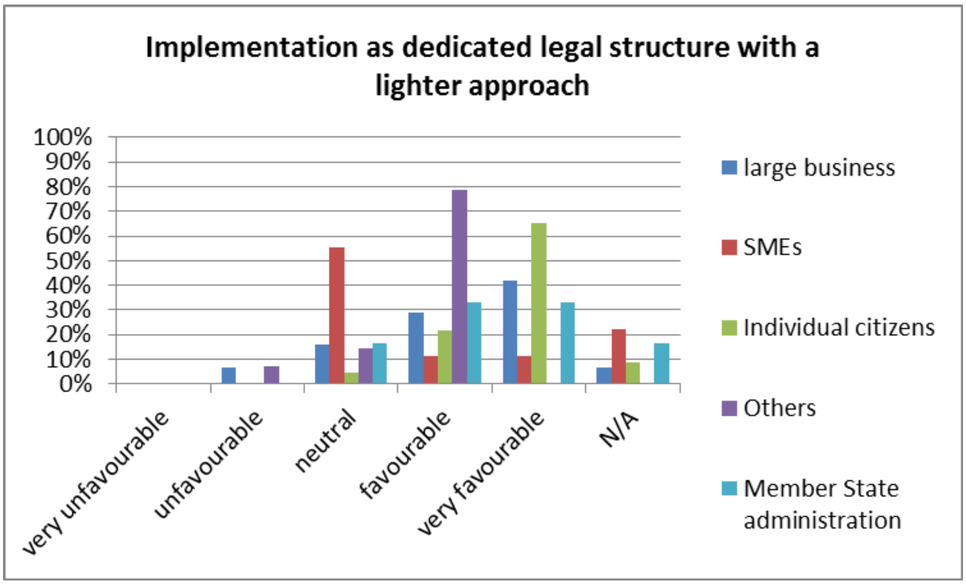
1.8. Possibilities for set-up of a PPP in the area of aeronautics under Horizon 2020

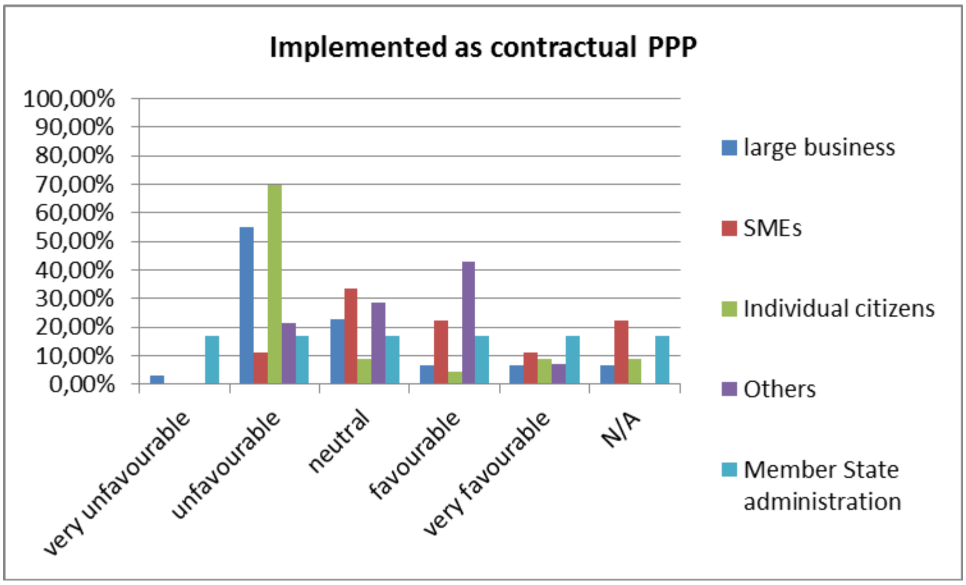
Nearly 80% of respondents indicated that they have sufficient experience with Clean Sky to be able to comment on PPP options. Opinion was positive or neutral with the preferred option being a dedicated legal structure similar to the current JTI but with a lighter approach.



In terms of stakeholder's type, the results are as follows:







Opinions on whether activities not primarily R&D but contributing to achievement of goals should be supported was divided equally.

1.9. Summary

This consultation has given a clear view that the Clean Sky JTI has been successful and should be continued under Horizon 2020 to meet the Europe 2020 and Flightpath 2050 goals. Comments reflect the importance of Aeronautical R&D to Europe in an increasingly competitive global market. To support this it will be necessary to strengthen research and development infrastructure and associated skill base to achieve required technology advances. It will be vital to maintain and grow the SME and technology supply chains to deliver required integrated technology solutions for demonstration under the leadership of industry.

2. Stakeholder's view

During the consultation period three consolidated stakeholders' position papers were received:

- Informal Position[64] of Member States and Associate States based on discussion of representatives in the ACARE Member States Group and the Clean Sky National States Representatives Group;
- Association of European Research Establishments in Aeronautics (EREA) Position paper on the successor to Clean Sky in Horizon 2020;
- European Aeronautics Science Network (EASN) Position on a successor to Clean Sky in Horizon 2020.

2.1. Member States informal position

The Member States consider that since its inception, the Clean Sky JTI is proving to be a very effective and efficient instrument to mature and demonstrate promising greening technologies and innovations. While improving further and increasing the openness of Clean Sky activities, they are supportive of the preparation of a future JTI "Clean Sky 2" within the coming Framework Programme Horizon 2020. In the preparation of this future JTI the successes and lessons learned of the current Clean Sky programme should be taken into account in order to improve the JTI instrument further.

The specific recommendations cover governance, content, initiation / set up, and processes. Summarising key points for governance the legal framework should be in place prior to the start of Clean Sky 2. Clusters should be promoted and accepted as viable programme entities. The National States Representative Group (NSRG) should become more involved. It should be given earlier insight into activity plans and should respond with recommendations. The number of ITD's should be increased with ITD duration periods less than full Clean Sky 2 programme period. Higher TRL topics should remain the main focus for calls, with one partner proposals being accepted. Clarity on the end of Clean Sky and start of Clean Sky 2 with clear separation of the programmes is required. The bipartite funding model (50% EC / 50% private funding) should be considered and current JU programme management approaches and IP rules continued. Work programmes and calls for topics should be developed in a comparable but more interactive way. The number of associates should be increased and a clear selection process put in place. Tier 1 and 2 companies should be allowed to drive technology demonstration in a non-prescriptive way. With regard to costs the structure should allow for at least 50% funding of full costs in line with Horizon 2020 rates.

2.2. European Research Establishments in Aeronautics (EREA) position

64 This position should not be considered as a formal opinion of any of the Member States. The Member States will draft their positions in the formal decision process through their national structures and this position does not therefore preclude that process in any way.

EREA members consider that the Clean Sky Joint Technology Initiative has proven to be an important and efficient instrument for demonstration and are supportive of its continuation under Horizon 2020. The successor of Clean Sky should be foreseen reinforcing the demonstration activities for innovative technologies and radically new configurations, reducing the risks of new product development.

EREA supports the idea of continuing with five main topics within the current programme and considers that the focus of the Clean Sky JTI under Horizon 2020 should be on developing, integrating and demonstrating high TRL technologies and considering radical (X-plane) configurations.

The current structure is estimated as appropriate and could continue. Regarding funding they would like the same funding rules applied as in Horizon 2020. They suggest that having institutionalised EREA seats in the governing board would reinforce the development of the partnership between EREA and industry. Use of research and test facilities and associated hardware should attract 100% (full cost) funding and treated as a service for industry.

2.3. European Aeronautics Science Network (EASN) position

EASN carried out a questionnaire campaign asking its members for their views and positions regarding a successor to Clean Sky in Horizon 2020. The overall experience from the participation of Academic institutions in Clean Sky is positive and a successor of Clean Sky is supported.

Some recommendations are issued concerning the future successor of the Clean Sky JTI under Horizon 2020.

It is stated that current budgets appear too low for tasks offered, which may result in insufficient innovation to project outcomes. With respect to the funding rules, it is recommended to coincide with the Horizon 2020 rules used as a common EC funding model. In addition, level 1 and level 2 projects should remain separate from Clean Sky 2.

EASN also requested representation on the governing board to provide an academic view on issues. They would also like to contribute to implementing lessons learnt and have an active role in dissemination.

With respect to the submission, evaluation and negotiation process the existing deviations from the FP rules should be examined whether necessary and all project titles and successful abstracts should be published.

Annex II: European aviation key figures

Aviation[65] is an important sector for our society and helps to meet society needs by ensuring suitable and sustainable mobility of passengers and freight and significantly contributing to the European economy and to the competitiveness of Europe as a region[66]. Aviation has strong social impacts as it facilitates the European integration and contributes to sustainable development by providing essential transport links. It impacts also business operations efficiency by stimulating development, opening new markets, boosting international trade, encouraging investment and allowing effective communication between regions and companies.

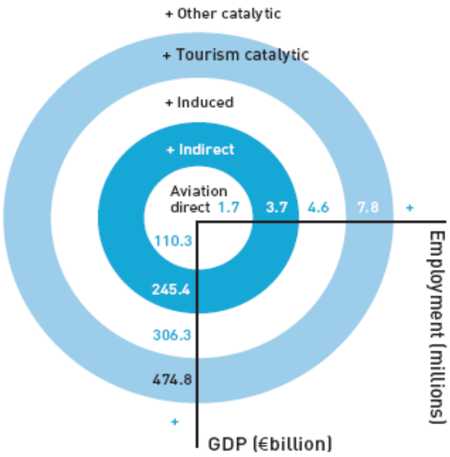


Figure 8: EU jobs and GDP generated by aviation, 2010 (source: ATAG)

In economic terms, in 2010, the EU aviation sector contributed €475 billion to the EU GDP or 3.9% of it including direct, indirect, induced and tourism catalytic impact. €245 billion of this contribution or ca. 2% of the GDP are from aviation direct and indirect only impact[67]. The sector is also a catalyst for growth and skilled employment. The number of jobs created directly by the industry is estimated to have reached 1.7 million in 2010. In total (direct, indirect and induced impact), aviation supported 4.6 million jobs in EU and represented around 20% of the jobs in the sector worldwide[67]. For comparison, the automotive sector in EU represented 12 million direct and indirect jobs and 4% of GDP in 2011[68].

The aeronautics sector itself generated in 2011 a turnover of €70 billion[69], and approximately 60% is exported outside the European Union[70]. It creates a trade surplus of €2.2 billion a year[71]. The sector is characterised by a large positive trade balance and high R&D intensity

65 Aviation refers collectively to Aeronautics and air transport. Aeronautics and air transport comprises both: air vehicle and system technology, design and manufacture; and also the constituent parts of the overall air travel system (aircraft, airlines, general aviation, airports, air traffic management, and maintenance, repair and overhaul) as well as many non-transport applications of aircraft, such as search and rescue.

66 The vital importance of Aviation for the European economy and our societies was highlighted in 2010 during the Icelandic volcanic eruption in April. 5 days of European airspace closed, involving 100,000 flights cancelled, 2 million passengers stranded and billions of losses for the economy show to what extent Europe depends on an efficient and well-functioning air transport sector.

67 Aviation: Benefits beyond borders, European Union 27 nations – Air Transport Action Group, October 2012

68 European Commission Press release - IP/12/1187 - CARS 2020: for a strong, competitive and sustainable European car industry, 8th of November 2012

69 ASD, Aerospace and Defence Industries Association of Europe – Key facts and figures, 2011

70 Flightpath 2050 Europe's Vision for Aviation, p.5

71 European Commission (2006), "Flying high, Aeronautics Research in the Seventh Framework Programme"

(14% of their annual turnover reinvested in Research and Development[72]), with a particular focus on lower carbon technology solutions[73]. The European aeronautics sector alone numbers around 2 000 aeronautics companies and 80 000 subcontractors including significant share of small and medium sized enterprises[74]. It is an important employer of highly educated personnel. Around 1/3 of the employees are university graduates[73]. In 2009, the sector supported 468 300 highly skilled and sustainable jobs[74]. The current forecast for the sector is to grow by 4.8% average annual growth rate from 2010 to 2030[75], thus providing a stable source of job creation (1.6 million jobs in 20 years corresponding to the growth forecast) and societal stability.

In terms of passengers, in 2010, the total number of passengers travelling by air in the European Union was 777 million, an increase with 3.4% compared to 2009. 41% of these travels were intra-EU and 21% were national[76]. In terms of cargo, in 2010 more than 13 million tons of cargo was transported in EU Member states where international extra-EU transport represents 80% of this total[76]. While this represents less than 1% of the tonnage of EU trade with the rest of the world, in terms of value-density[77] of freight the aviation cargo transport has a significant share – nearly 23% of the value of that trade [78].

Today, the European aeronautics sector is one of the world leaders in terms of production, employment and exports. In 2007, the aerospace sector including aeronautics had a trade surplus with Extra-EU exports valued ad €41,450 million and trade balance of €11,183 million[79]. In 2010 Europe was the clear leader in terms of the number of transactions announced and Airbus, with revenues of US$36.6 billion in 2009, is the leader in the large commercial aircraft segment, closely followed by Boeing [80]. In the civil helicopter market, Europe is the global leader with players such as Eurocopter and Agusta Westland.

Between 2000 and 2006, EU-27 companies applied at the European Patent Office in total for 1240 patents in the space and aeronautics sectors. Germany and France have the highest shares, followed at some distance by the United Kingdom. Germany and France also have the highest share in the patents granted by USPTO in the period 1997-2003. It is worth noting that the sector performed well in terms of innovation and scientific performance during the global recession in 2008. In 2009 the "Aircraft; Aviation; Cosmonautics" was one of the top technical fields by number of publications in the European Patent Office with 573 applications (6.9% growth compared to the previous year[81]).

By its nature the European aeronautics industry is a cross-border industry. It is distributed geographically in several EU Member States. The main aeronautics countries are France, the United Kingdom, Germany, Italy and Spain that account over three quarters of the production and 89% of value-added. Other countries such as Sweden, The Netherlands, Poland, Belgium and Czech Republic are also established players in the sector and there is a certain specialization within these Member States in the manufacturing of parts and components.

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72 ASD Facts and Figures 2011

73 Competitiveness Studies - Competitiveness of the EU Aerospace Industry with focus on: Aeronautics Industry. EC (ENTR/06/054) - http://ec.europa.eu/enterprise/sectors/aerospace/files/aerospace_studies/aerospace_study_en.pdf

74 Strategic Research and Innovation Agenda Volume 1- Draft 4.0, ACARE, June 2012

75 Airbus GMF 2011-2030 delivering the future - http://www.airbus.com/company/market/forecast/passenger-aircraft-market-forecast/?eID=dam_frontend_push&docID=18803

76 Air transport recovers in 2010 - Statistics in focus 21/2012

77 Value density is the ratio of a product’s value to its weight

78 Aviation: Benefits beyond borders, European Union 27 nations – Air Transport Action Group, October 2012

79 Eurostat (2009a) European Business: Fact and Figures, Edition 2009, Luxembourg: Office for Official Publications of the European Commission

80 Aerospace Global Report 2011, A Clearwater Industrials Team Report

81 European Patent Office – Annual Report 2009

These manufacturers are spread equally in the supply chain and, given that 75% of the cost of aircraft is going to suppliers, there is significant budget distributed to companies that are outside of the five main aeronautics countries. One example could be Poland, which is not considered as aeronautics country but there are roughly 55 aviation companies operating in Poland which employ a total of 16 000 people. A significant share of their output is exported. Moreover, in the current Clean Sky programme there are stakeholders from 24 Member states and associated states. At the same time the impact from the programme goes beyond the aeronautics companies but also to airlines, airports and therefore to all Member States, not to mention the impact of emission and noise reduction which applies globally.

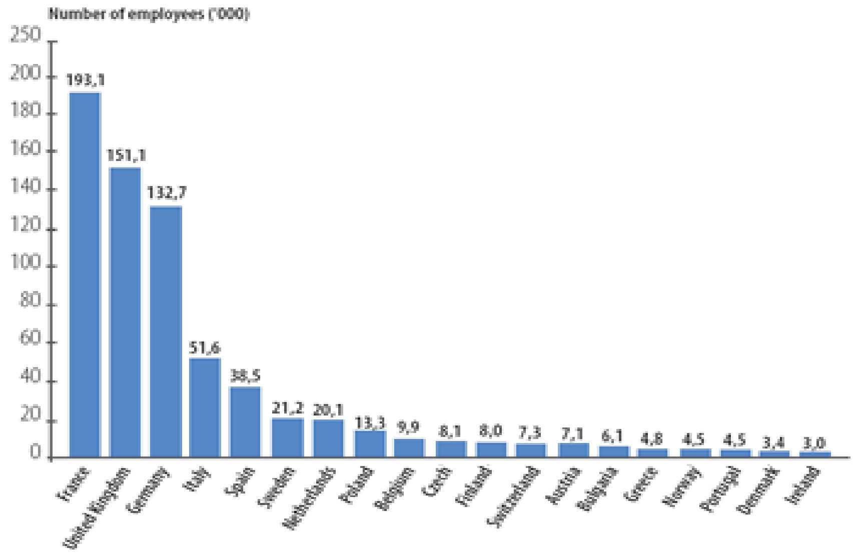

Figure 9: Distribution of European Aerospace and Defence Industry employment (source ASD[82])

European aeronautics sector in the international context

Today, the European aeronautics sector is one of the world leaders in terms of production, employment and exports. Despite this leadership, the European aeronautics sector evolves in a complex international environment and the EU aeronautics industry is increasingly confronted with strong international competition from traditional or emerging competitors.

The US aviation industry is one of the main global competitors and US government strongly invests in aeronautics R&D. NASA conducts and administers the Aeronautics and Space Program which accounted for 2011 $18.5 billion. It represents 0.5% of the $3.4 trillion USA federal budget or 35% of total spending on academic scientific research in the United States. Space gets around 54% ($10 billion), while science $ 4.5 billion, followed by maintenance of old and construction of new facilities $3.5 billion, technology demonstrators $650 million, the Aeronautics Research Programme $590 million and education $146 million. More than 18,000 people work for NASA. Many more work with the agency as government contractors.

Canada is also investing in research in aeronautics. The statistics of 2011 state of the Canadian Aerospace Industry show that $2.0 billion are invested in R&D. Currently, Bombardier, the third-largest airplane manufacturer based in Canada, is developing the CSeries family of airliners, capable of carrying 110 to 130 passengers and competing directly with the smallest airliners from Airbus and Boeing. The first deliveries are expected at the end of 2013.

The Russian Federation is also one of the players in the market with a significant potential to challenge the current players and expects to become the world's third largest aircraft

82 ASD Facts and Figures 2010

manufacturer by 2015. In 2006, the Russian aircraft industry was consolidated under the state owned joint stock company Obyedinyonnaya Aviasroitelnaya Korporatsiya ("UAC"). The government is currently supporting the aerospace industry through the Federal Targeted Programme "Development of Civil Aviation Technology of Russia in 2002-2010 and up to the year 2015" with a budget estimated around 4 billion Euro[83].

Similarly, Brazil is a leader in the aeronautics sector with the "Embraer" company producing regional aircraft. Embraer was significantly impacted by the financial crisis and saw reductions in orders, revenues, and employment but is gradually improving. Public sector organisations played a critical role in creating Embraer through direct funding, tax breaks, and other forms of support but currently there is a reduction in direct government funding. A federally-owned bank does, however, provide interest rates rebates for loan purchasers of exported Embraer aircraft[84].

China's ambition to become a force in the industry is clearly indicated by aerospace being targeted in the 12th Five Year Plan (2011-2015) as a Priority Industry[85]. As an example, the Chinese state-owned company COMAC is expected to become the strongest of all the newcomers "because they have more financial firepower than anybody else".[86] COMAC may eventually hold a monopoly on the production of jet aircraft of over 70 seats what is projected to be the world's second largest aviation market by 2025[84]. COMAC will also benefit from a large domestic market, since over the next twenty years China is expected to be the most valuable aircraft market. The increasing role of Chinese banks in aircraft financing may also strengthen COMAC position.

Japan is also becoming an important airliner player with the development of the Mitsubishi Regional Jet passenger aircraft. The project is in manufacturing with its maiden flight scheduled for 2013 and first delivery in 2015.

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83 ERAWATCH http://erawatch.jrc.ec.europa.eu/erawatch/opencms/information/country_pages/ru/supportmeasure/support_mig_0007

84 Deloitt, AIAC – Global Aerospace Market Outlook and Forecast, 2010

85 China's 12th Five-Year Plan: Overview March 2011, KPMG China

86 Parker, A., A dogfight for the duopoly, Financial Times, August 7, 2012.

Annex III : Summary of the cost-benefit analysis of JU

The cost-benefit analysis is provided as input to and forms an integral part of the Impact Assessment carried out by the Commission Services on the Public Private Partnerships (PPPs) set up on the basis of Article 187 TFEU planned under Horizon 2020.

The cost-benefit analysis focuses on those costs and benefits of the implementation means of the PPP - the Joint Undertaking - that can be easily quantified and monetised. As such, it covers exclusively the costs and benefits of the dedicated administrative structures set up to implement the strategic research agendas of the JTIs, the Joint Undertakings (JUs). A comprehensive analysis of the benefits and costs associated with different policy choices, such as opting for a PPP or not, are outside the scope of this analysis.

JUs are currently the preferred administrative structure used to implement the JTI instrument. Five JTI JUs are currently in operation, 3 under the responsibility of DG RTD (IMI, CLEANSKY and FCH) and two under the responsibility of DG CNECT (ARTEMIS and ENIAC). While JUs remain complex from a legal and administrative point of view, they have become the instrument of choice to implement JTIs, mainly because they address the need for visible legal, contractual and organizational structures within which to implement joint commitments between public and private partners, as well as for reasons that they leverage private investment in key research areas. Therefore, Art. 187 initiatives are an important element of the Commission's Work Program 2013.

Our comparative analysis focuses on the administrative costs of the year 2011 of the DG RTD's JUs, the ERC-EA executive agency and the operational/thematic directorates in DG RTD, thus covering all three programme implementation management modes currently in use.

Costs of setting up, monitoring and winding down a JU are explored as well. Some of the costs estimated are limited to an order of magnitude assessment because of lack of a more appropriate detailed input data.

Our analysis will lead us to conclude that the use of a JU to implement a JTI of the current size is about cost neutral for the European Commission, both in respect of the JU's creation, operation and winding down procedure and in respect of managing any FP7 legacy, as long as 50% of the administrative costs of the operation of the JU is being covered by the private partner. To secure cost-neutrality for Horizon 2020, the size of the JTI programmes has to increase, cost-reducing simplifications should be implemented and cost-increasing derogations from Horizon 2020 provisions have to be avoided.

The full report of the Cost-Benefits analysis can be found at http://intranet-rtd.rtd.cec.eu.int/int_com/docs/CBA_JU.pdf

Annex IV: Executive summary of the preliminary report of the Impact Assessment Expert Group

This summary presents the main conclusions and recommendations of the group of experts for the Clean Sky 2 (CS2) Impact Assessment study performed in July-August 2012.

The Expert Group has been established by the Commission in June 2012 in order to "Provide an expert opinion on the content and the relevance for the establishment of the Clean Sky 2 and assess the different scenarios for the way forward of the current Clean Sky programme."

The Expert Group fully supports the CS2 initiative.

- The Expert Group agrees that the CS2 initiative is justified and necessary for a full integration of Clean Sky demonstrators and for further technology innovation towards Flightpath 2050 goals.
- The Expert Group supports the general objectives as ambitious but realistic and consistent with Horizon 2020 guidelines and current technological requirements.
- The Expert Group considers that the Clean Sky type of organisation gives a project-like character to the programme. Activities are focused and awareness of objectives and deadlines is high. In view of the satisfactory operation of the Clean Sky JU, the Expert Group supports the establishment of a similar structure for CS2.
- Whilst the general objectives are endorsed, the Expert Group recommends quantifying the environmental targets and identifying and justifying the societal and economic objectives.
- The Expert Group considers that the detailed technical content of CS2 should be available well before the official start of CS2. This involves preparing a work plan with project milestones including decision gates, such as for launching demonstrations.
- The Expert Group stresses that CS2 should not become a broad development programme constituted by the sum of all desirable research activities. In most IADPs and ITDs, there is a need to streamline the programme and to focus on key high priority topics. High priority topics should be those required for IADP demonstrators or the most promising ones in terms of environmental and socio-economic impact. The streamlining process must be an integral and essential objective of the project definition.

The Expert Group notes the special requirements and constraints regarding the establishment of CS2, the overlap between Clean Sky and CS2 and recognizes the need for technical and managerial continuity to ensure a seamless transition of activities.

- The Expert Group considers that these requirements are best achieved by considering CS2 as an extension of Clean Sky, and not just as a new project. This scheme has been used successfully in a previous Joint Undertaking. This approach would be consistent not only with the rationale and objectives of Horizon 2020 but also with the longer term objectives of Flightpath 2050.
- With regards to the governance, the Expert Group supports the approach to maintain all Clean Sky instruments with a single management structure for Clean Sky and CS2 during the transition period from 2014 to 2017. This will provide technical and managerial continuity.

- In order to clarify the management and reporting chain, the Expert Group considers that Governing Board members and their alternates from industry should be selected among senior aeronautical industry technical representatives but who are not directly involved in IADP and ITD activities.
- The role and responsibilities of the JU and its management need to be strengthened.
- The Executive Team staff and budget resources should be substantially increased because of the parallel management of Clean Sky and CS2 and also because the estimated budget for CS2, 3.6b€, far exceeds the 1.6b€ of the Clean Sky budget thus implying more extended and demanding activities.

The Expert Group recommends maintaining the Technology Evaluator (TE) as an essential element within CS2, with its role being strengthened.

- TE should develop independent simulation capabilities in order to monitor results with the TE team coming from highly qualified independent research / academic institutes.
- The TE budget should be raised according to the extended scope.

In conclusion, the Experts' Panel agrees that CS2 has the potential to play a vital role in addressing Horizon 2020 societal challenges and in moving towards the targets set by Flightpath 2050.

Annex V: Technology Readiness Levels (TRL)

Technology Readiness Level		Description
1	Basic principles observed and reported	Lowest level of technology readiness. Scientific research begins with, to be translated into applied research and development. Example might include paper studies of a technology's basic properties.
2	Technology concept and/or application formulated	Invention begins. Once basic principles are observed, practical applications can be invented. The application is speculative and there is no proof or detailed analysis to support the assumption. Examples are still limited to paper studies.
3	Analytical and experimental critical function and/or characteristic	Active research and development is initiated. This includes analytical studies and laboratory studies to physically validate analytical predictions of separate elements of the technology. Examples include components that are not yet integrated or representative.
4	Component and/or breadboard validation in laboratory environment	Basic technological components are integrated to establish that the pieces will work together. This is relatively "low fidelity" compared to the eventual system. Examples include integration of 'ad hoc' hardware in a laboratory.
5	Component and/or breadboard validation in relevant environment	Fidelity of breadboard technology increases significantly. The basic technological components are integrated with reasonably realistic supporting elements so that the technology can be tested in a simulated environment. Examples include 'high fidelity' laboratory integration of components.
6	System/subsystem model or prototype demonstration in a relevant environment	Representative model or prototype system, which is well beyond the breadboard tested for TRL 5, is tested in a relevant environment. Represents a major step up in a technology's demonstrated readiness. Examples include testing a prototype in a high fidelity laboratory environment or in simulated operational environment.
7	System prototype demonstration in a operational environment	Prototype near or at planned operational system. Represents a major step up from TRL 6, requiring the demonstration of an actual system prototype in an operational environment, such as in an aircraft, vehicle or space. Examples include testing the prototype in a test bed aircraft.

8	Actual system completed and 'flight qualified' through test and demonstration	Technology has been proven to work in its final form and under expected conditions. In almost all cases, this TRL represents the end of true system development. Examples include developmental test and evaluation of the system in its intended weapon system to determine if it meets design specifications.
9	Actual system 'flight proven' through successful mission operations	Actual application of the technology in its final form and under mission conditions, such as those encountered in operational test and evaluation. In almost all cases, this is the end of the last "bug fixing" aspects of true system development. Examples include using the system under operational mission conditions.

The following table presents graphically the TRLs and their link with the R&D process as well as the coverage of each TRL by type of project inside the EU framework programme.

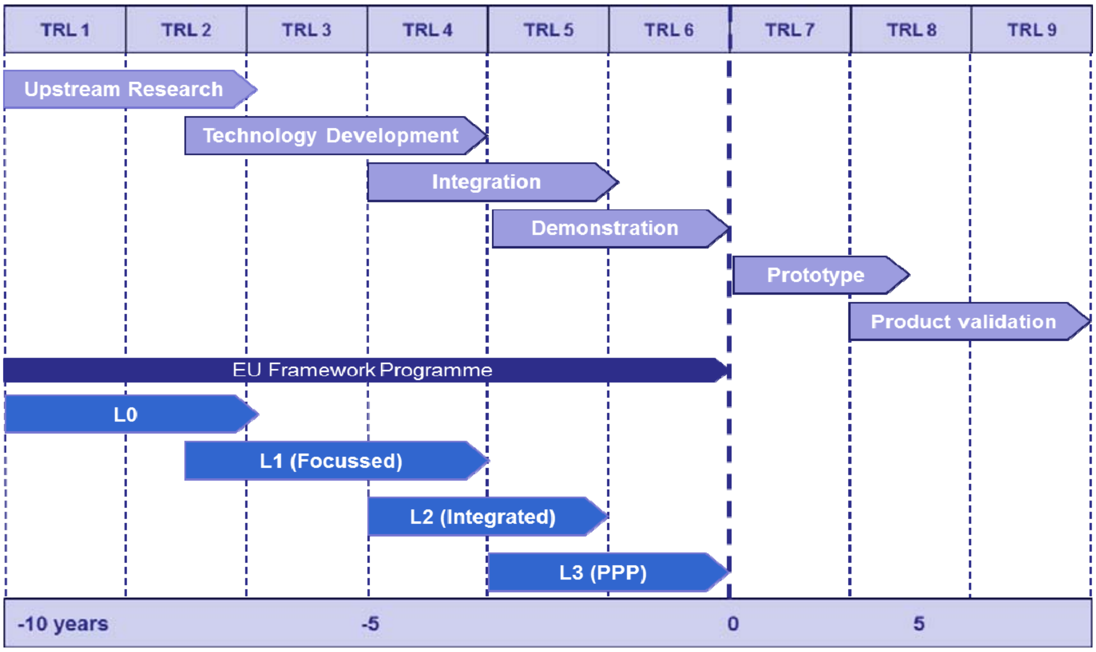


Figure 10: Research, Technology and Product Development. (Source EREA, EC)

Annex VI: Clean Sky

In the Clean Sky programme 12 industry leaders, 74 associated members and more than 400 partners are working together in a number of technology domains to address the common environmental objectives and to demonstrate and validate the required technology breakthroughs in a commonly defined programme. All those technology domains have been integrated into 6 Integrated Technology Demonstrators (ITD), that cover the broad range of R&D work and able to deliver together more environmental friendly aircraft manufacturing and operations:

- Smart Fixed Wing Aircraft, delivering active wing technologies and new aircraft configuration
- Green Regional Aircraft, delivering low-weight aircraft
- Green Rotorcraft delivering, innovative rotor blades, engine installation and advanced electrical systems.
- Sustainable and Green Engines, designing and building innovative engine demonstrators
- Systems for Green Operations, focused on new equipment and systems architectures to fully exploit the benefits of Single European Sky
- Eco-Design focused on green design and production, withdrawal, and recycling of aircraft

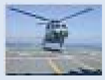
In addition, the Technology Evaluator programme, a set of models to predict the local and global ecological impact of the technologies developed, allows independent analysis of the projects as they unfold and assesses the performance of the technologies developed under Clean Sky.

Figure 11: Structure of the Clean Sky programme

Part of the Clean Sky programme is performed by partners selected through open calls for proposals to address specific tasks which fit into the overall technical Work Programme and time schedule.

Clean Sky objectives for the whole programme at the aircraft level are to reduce CO_2 aircraft emission by around 20-40%, NOx by around 60% and noise by up to 10dB compared to year

2000 aircraft. These objectives have been identified as a sum of different objectives by aircraft type:

	Widebody 2020	**Narrowbody 2015**	**Regional 2020**	**Corporate 2020**	**Rotorcraft 2020**
					
CO_2	-30%	-20%	-40%	-30%	-30%
NO_x	-60%	-60%	-60%	-30%	-60%
Noise[87]	-5 to -7 dB	-4 to -7 dB	-2 to -9 dB	-2.5 to -10 dB	-3.3 dB

During the Clean Sky JU lifecycle some changes in aircraft fleet replacement strategy were introduced in the sector. In 2007, when the CS objectives, key demonstrators and relevant schedules were defined, the fleet replacement for 'single aisle' aircraft was scheduled for 2018-2020. Due to the steep increase of oil prices, the introduction of new generation of single aisle aircraft was postponed to 2025 and beyond and a new intermediate generation of aircraft is introduced bringing ca 15% fuel efficiency over the current year 2000 generation[88]. The future R&D investment in the sector will be benchmarked against the performance of this new generation. This market change has also led to slight modifications in the Clean Sky technical programme without changing the overall objectives.

Since its establishment, the Clean Sky JU is successfully stimulating developments towards the strategic environmental targets. The programme provides ground for radical new technological concepts that would otherwise be beyond the manageable risk of the private sector and gives the necessary financial certainty and stability to the aviation sector and investors to develop and introduce game-changing innovations in timeframes otherwise unachievable. Clean Sky has established also links with the SESAR Joint Undertaking[89] which develops Air Traffic Management (ATM) technologies in line with the "Single European Sky" initiative of the Commission[90].

87 These objectives were normalized in 2011 against the Y2000 aircraft baseline and expressed in EPNdB noise reduction per average single operation. All previous values expressed in dBcum (cumulative noise defined as the arithmetic sum of noise levels measured at 3 certification points) were divided by 3 for the commercial aircraft.

88 Airbus introduced the Airbus A320neo family as a series of enhanced versions of the A320 family. The A320neo is planned to enter service in 2015. Boeing introduced the Boeing 737 MAX - a new family of aircraft based on the Boeing 737 Next Generation family. The 737 MAX is scheduled for first delivery in 2017.

89 SESAR programme is the European air traffic control infrastructure modernisation programme. One of the targets is to contribute to the environmental objectives as a result of ATM improvements alone. For more information www.sesarju.eu

90 In order to achieve the environmental targets, both aspects should be addressed - more efficient aircraft and engines, as well as better operational and flight management procedures. These aspects are complementary and are addressed by Clean Sky and SESAR programmes respectively.

Annex VII: List of Clean Sky Demonstrators per ITD

ITD	Demonstrator	Ground demonstrator	Flying demonstrator
SFWA	High Speed Smart Wing Flight Demonstrator	several ground-based 'feature' demonstrators from 2010 to 2013	An Airbus A340-300 test aircraft will be used to demonstrate the laminar wing **mid-2015**
SFWA	Low Speed Smart Wing Flight Demonstrator	two innovative technologies will be ground-tested: "smart flap" concept and an active vibration control system	If the ground test is successful a flight test on a Falcon F7X of the active vibration control is intended to be engaged in **2014**
SFWA	Innovative Engine Demonstrator Flying Test Bed ('CROR engine - demo FTB')	the CROR SAGE2 engine will be developed with the target to be ground and flight tested within Clean Sky in SFWA.	The first ground demonstrator engine in SAGE2 is now planned for demonstration in **2015** and will be flight tested in **2016** on an Airbus A340-600
SFWA	Long Term Technology Flight Demonstrator	Demonstrations will be performed on ground for down selected candidate technologies contributing to the smart wing.	Dedicated flight test activities will be prepared and conducted when only very light modifications on the aircraft are necessary.
SFWA	Innovative Empennage Demonstrator	a full scale afterbody mock up will be tested on-ground, integrating an existing turbofan	No testing activities
SFWA	Advanced Lip Extended Acoustic Panel	No dedicated activities	flight tested with A380-800
GRA	Low weight configuration	Testing of Coupon Testing of Large Stiffened Panels Full Scale Ground Demo	No testing activities
GRA	Low Noise configuration	Low Noise & High Efficiency High Lift Devices Natural Laminar Flow Wing HLD	No testing activities
GRA	All electrical Aircraft	Ground Laboratory Test (copper bird and other) of main critical components.	In-flight demonstration (ATR-72)of some critical sub-systems (E-ECS, E-WIPS, EMA, etc.)
GRA	Trajectory & mission management	Flight Simulator on ground including FMS with optimised trajectories (in relation with SGO)	No testing activities

GRC	Innovative Rotor blades on Ground / in Flight	component testing (sub-systems & wind tunnel), full scale ground testing (whirl tower)	limited flight testing
	Drag reduction on Ground / in Flight	14 active demonstrators will be tested	Flight testing performed on 6 out of 14 demonstrators
	Medium helicopter electrical system demonstrator including electromechanical actuation for flight controls	the demonstration will be carried out on the copper bird test bench (EDA)	No testing activities
	Lightweight helicopter electromechanical actuation	Ground tests performed on an SW-4 helicopter	No testing activities
	Electric Tail Rotor Prototype	Ground-test performed on an in-house test bench	No testing activities
	Diesel powered flight worthy helicopter Demonstrator	Ground tests planed in **2013/ early 2014** on an engine test bench and on EC120 helicopter	Flight testing activities planned **mid 2014 - 2015** on an EC120 helicopter (but w/o Clean Sky funding)
	Flight paths operational Demonstrations	Flight path demonstrator and cockpit simulation tool	Flight tests planed on EC155, EC145, SW-4, AW139 and Tilt-rotor AW609
	Rotorcraft Eco Design Demonstrators	4 technology demonstrators	No testing activities
SGO	COPPER BIRD	Techno for BusiJet, Regional or Helicopter Applications will be ground tested on the EDS test bench (Copper Bird)	No testing activities in SGO
	PROVEN (Ground test rig at Airbus Toulouse)	All major electrical equipment for Short Range Aircraft applications will be ground tested on PROVEN test bench as regards their electrical characteristics	Part of critical electrical technologies will be flight tested
	AVANT (Thermal test rig at Airbus Hamburg)	All major electrical equipment for Short Range Aircraft applications will be ground tested on PROVEN test bench as regards their electrical characteristics	Some electrical technologies will be flight tested
	In house electrical technologies demonstrators	All major electrical for Short Range Aircraft applications will be ground tested on PROVEN test bench as regards their thermal characteristics	No testing activities

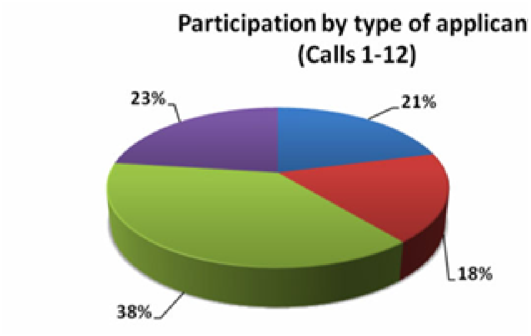
	AIR LAB, MOSAR & GRACE simulations	New innovative flight path trajectories will be ground tested on different trajectory simulation tools (Airlab, Mosar and GRACE) with various level of representiveness	No testing activities
SAGE	Geared Open Rotor Demonstrator 1	Main critical engine parts tested at component level and the feasibility of the engine concept itself on the Rig 145 CROR Blade Testing	No testing activities within the timeframe of Clean Sky (forecast in 2018)
	Geared Open Rotor Demonstrator 2	Main critical components tested at component level and the first build of the open rotor demonstrator will be ground tested in **2015**	Testing activities planned in SFWA
	Advanced Low Pressure System (ALPS) Demonstrator	The engine test vehicle will be a Rolls-Royce Trent 1000 engine	Flying test bed tests will be performed
	Geared Turbofan Demonstrator	Components and modules with new technologies will be developed and validated through rig testing as required before implemented into a GTF donor engine	No testing activities
	Turboshaft Demonstrator	Both main critical components and the engine itself	No testing activities
	Lean Burn Demonstrator	Both main critical components and the engine itself	No testing activities
ECO	COPPER BIRD	Techno for BusiJet, Regional or Helicopter Applications will be ground tested on the EDS test bench (Copper Bird)	No testing activities in ED
	Thermal Bench	Techno for BusiJet, Regional or Helicopter Applications will be ground tested on the EDS test bench	No testing activities in ED
	'Clustered technologies' parts Demonstrators	Demonstrators are developed for different technologies	No testing activities in ED

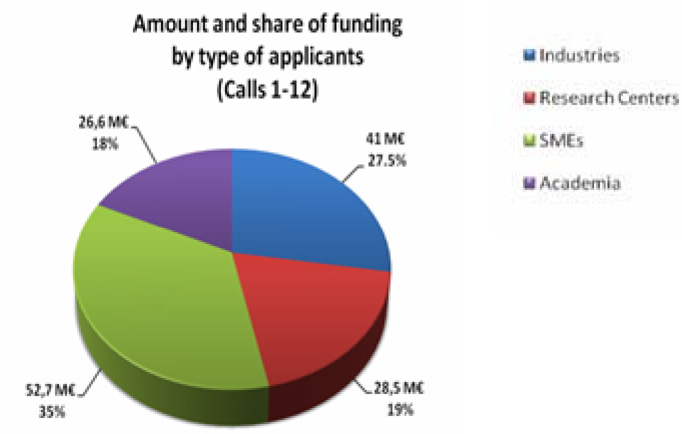
Annex VIII: Statistics on Clean Sky calls

Clean Sky Calls for Proposals results between 2009 and 2012 (from Call 1 to Call 12), at a glance:

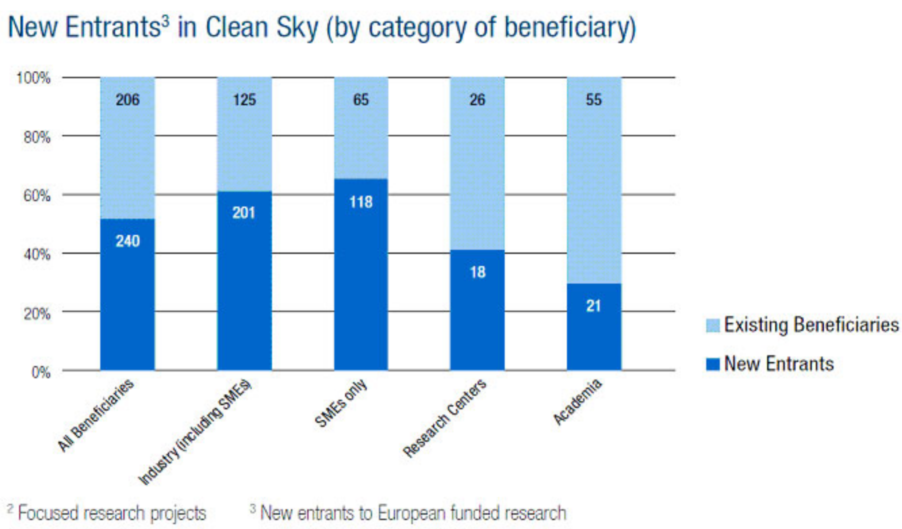
Total cost	227 M€
Total funding	149 M€
Number of partners	446
Number of topics	525
Average funding rate	65.6 %
Applicants success rate	35%
Average number of participants per topic	1.96
Average SME share	35 % in funding
Average Academia share	18 % in funding
Average Research organisations' share	19 % in funding

The following pie charts present the distribution of the applicants by type and by share of funding.

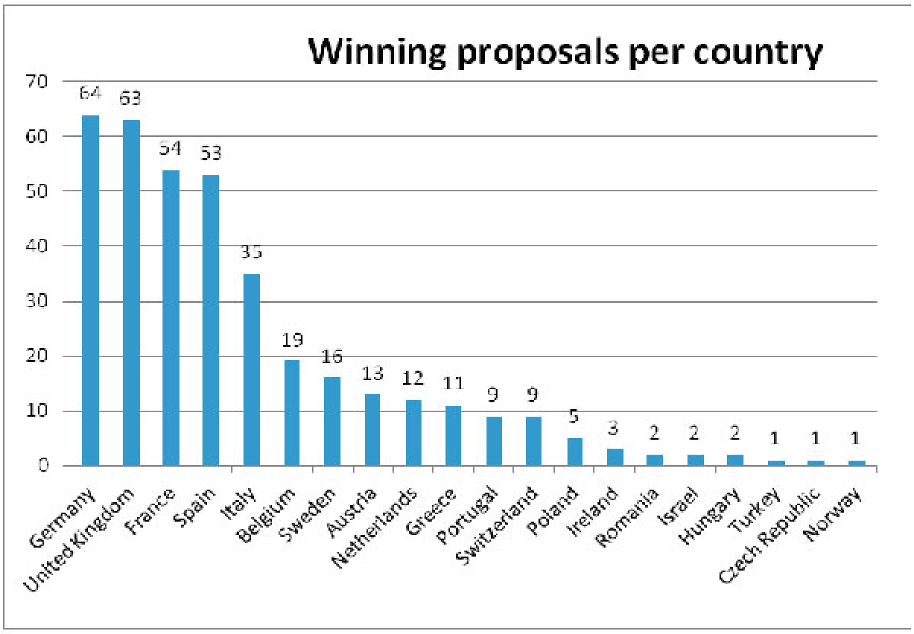




In total – Members included – around 500 Participants take part in the Clean Sky programme. More than 50% of Clean Sky's beneficiaries are newcomers in the European funded research programmes.



The following graph presents a breakdown of Clean Sky Call for Proposals "winning organisations", per country (as Coordinators of the consortium).



The following tables present the distribution of the beneficiaries in the calls for proposals.

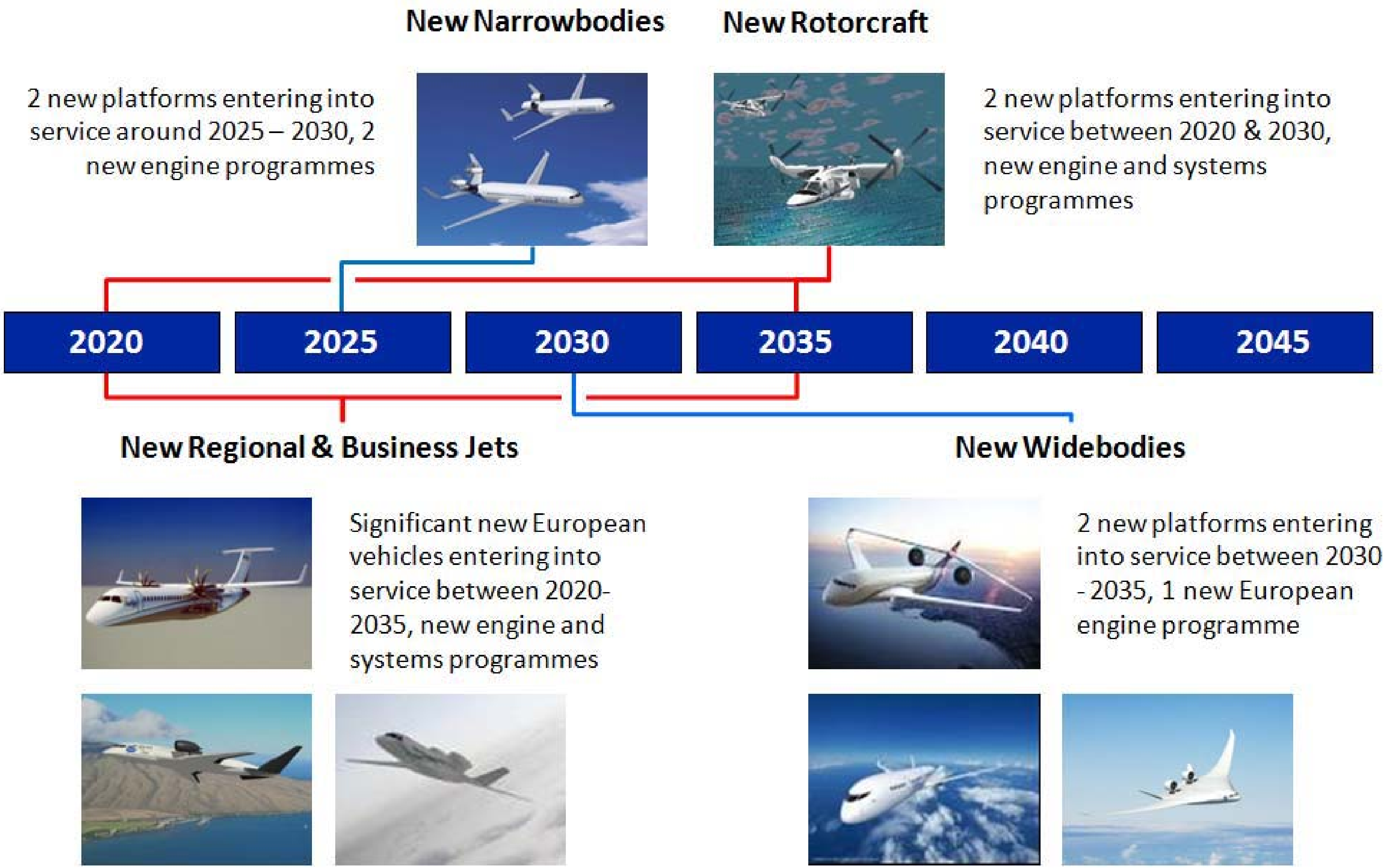
Total winning Projects up to call 13		**405**
Mono-beneficiary	173	**43%**
Bi-beneficiaries	125	**31%**
3 beneficiaries	72	**18%**
4 beneficiaries	23	6%
5 beneficiaries	7	2%

Mono beneficiary projects	**Projects**	**% out of total 173 mono-beneficiaries projects**
SME	58	**34%**
Research Centre (RC)	43	**25%**
High Education (HE)	69	**40%**
Total	**173**	

Bi-beneficiaries projects	**Projects**	**% out of total 125 Bi-beneficiaries projects**
1 SME and HE/RC	57	**47%**
Team of 2 SMEs	15	**12%**
Team of RC & HE or RC&RC or HE&HE	23	**19%**
Total	**125**	

This demonstrates that the mono and bi-beneficiaries projects are the majority with a high participation of SMEs and Academia.

Annex IX: Product Timeline Assumptions



Annex X: Impact Assessment board opinion

Implementation of the IAB's comments

Comment	Answer
Align the problem analysis to the remaining policy choices.	
Given that key parameters have been already set in the "Horizon 2020" proposal the report should concentrate in its problem description on the actual scope of the intervention, i.e. finding the most suitable governance option for a joint research and development programme.	The report focuses now on the three options of Joint Initiative looking for the most suitable between them. (ch. 4)
The overview of market and technology developments should be reduced to a short policy context section.	Reduced. Information moved to annexes.
Instead the problem definition should build much stronger on the lessons learned from the evaluations that have been completed, including where relevant evaluations of similar projects in other policy areas, and corresponding Court of Auditor Reports.	Lessons learned section strengthened (ch. 2.6)
It should show on the basis of evidence what aspects of the current programme have been effective, with regards to achieving the objectives and regional effects.	ch. 2.6
It should clearly identify who has benefited from the existing programme, including an explanation that a considerable part of the benefits actually go to suppliers to the aircraft industry that are much more evenly distributed over EU Member States than the aircraft manufactures.	Ch. 2.6.1 indicates that there are 413 participants from 24 countries in Clean Sky. Explanation that a significant budget is distributed to companies outside of the five main aeronautics countries is added in Annex II
It should present the results of monitoring with the Technology Evaluator and better describe the benefits of demonstrators, using for example the	Ch. 2.6.2 and ch. 2.6.3

technical results from the Sustainable and Green Engines, and the Smart Fixed Wing Aircraft demonstrators.	
The report should explain the importance of stimulating the development of new higher risk technologies to ensure their availability in time for the next expected fleet renewal of 2025/2030, and clarify why (emissions) legislation is not enough to ensure that this technology will be developed sufficiently quickly.	Ch. 2.7
The report should also strengthen its arguments concerning the threat of international competition, and give a fair indication of public funding awarded to the aeronautics sector in competing countries.	Annex II
The baseline scenario (current Option 1) should be set out in sufficient detail in the problem section, with an explanation that the autonomous 1.5% p.a. reduction in CO_2 emissions that is assumed for this scenario is based on expert consensus.	Baseline scenario explained in ch. 2.7. The assumption of 1.5% p.a. reduction in CO_2 is for a scenario where no support is provided. The baseline scenario, if selected, will provide better reduction that the 1.5% p.a. but still not sufficient and not in time for the next generation of aircraft.
Better explain the objectives	
The objectives section should clarify on what analytical and/or practical basis the CO_2 and market share targets have been set.	Para. **Error! Reference source not found.**
It should also explain why setting concrete objectives for NOx or noise levels is complicated because of the trade-offs between the two.	Specific objectives for NOx and noise are introduced. Ch. 3.2 based on trade-offs and realistic estimations.
The reviewed report should include the targets for these two items, with a discussion of the trade-offs.	Specific objectives for NOx and noise are introduced. Ch. 3.2
The discussion of targets for C02 reduction should clearly explain that the aim to reach 30% reductions is consistent with the proposed development	Para. **Error! Reference source not found.**

of this technology in time for the next fleet renewal.	
Better assess and compare options	
The report should explain clearly that although the options may all entail roughly the same costs, they are expected to differ in their effectiveness in stimulating and speeding up the high risk technological development, that is considered indispensable to benefit from the next round of fleet renewal to deliver on the key objectives.	Ch. 4.5.1
It should provide clearer evidence, for example based on comparative analysis with the EU's main competitors, how this type of funding can actually improve the competitiveness of the European aerospace industry.	Annex II
The Report should provide a more detailed account of the social impact of the programme, as well of its benefit across Member States.	Social impact section strengthened.
Procedure and presentation	
The report should incorporate the results of available interim and ex-post evaluations, and relevant Court of Auditors reports in a more transparent way, preferably in a separate chapter in the problem description.	Results presented in ch. 2.6.4 and 2.6.5
Some issues, such as the benefits of demonstrators should be explained in less technical terms.	Ch. 2.6.2
The report should identify stakeholders (or categories thereof) rather than report percentages and incorporate and discuss where relevant critical input received.	Annex I presents stakeholders and critical inputs.