EUROCONTROL Specification for Collaborative Environmental Management (CEM)

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This document is the EUROCONTROL Specification, developed under the EUROCONTROL Regulatory and Advisory Framework (ERAF), for Collaborative Environmental Management (CEM).

The CEM Specification formalises collaboration amongst the core operational stakeholders at and around airports. The objective is to minimise the environmental impact of their combined operations, by setting out generic, high level requirements and recommended practices necessary to either establish CEM working arrangements or, flexibly adapt existing ones in a pragmatic protocol to suit local needs and capabilities.

CEM benefits and supports core operational stakeholders’ common awareness and understanding of the interdependencies and constraints facing each other’s business. This in turn can facilitate the development of shared environmental solutions, on which they can then collaborate in joint planning and implementation. CEM may thus be used to facilitate enhanced relationships; for example, ANSPs assisting airports with capacity and airports and ANSPs assisting airlines with fuel savings, thus contributing to high performing airport operations.

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EXECUTIVE SUMMARY

Today, core operational stakeholders: Airport Operators, Aircraft Operators and Air Navigation Service Providers (ANSPs) are continuing to invest significant effort in minimising the environmental impacts of their combined operations at, and around airports. This investment is taking place in the context of continued passenger and cargo traffic growth of 7.4% across most of Europe in 2017 [11] and to accommodate the expected future increase in flights of 1.9% per year [16].

However, these impacts, primarily noise and emissions, remain a significant constraining factor to current operational efficiency and system capacity and, in the longer term sustainable growth of the aviation sector. A sustained collaborative focus on finding solutions to minimise these impacts is essential for improving European Air Traffic Management (ATM) capacity and flight efficiency as well as contributing to high performing airports. Reconciling these issues together with the fight against climate change are part of the key messages highlighted in the European Commission’s “An Aviation Strategy for Europe” [31].

The Collaborative Environmental Management (CEM) Specification, is a process promoted by EUROCONTROL, in line with legislative requirements, that formalises collaboration among the core operational stakeholders at airports, to minimise the environmental impact of their combined operations. This is facilitated by setting out generic, high level requirements and recommended practices necessary to either establish CEM working arrangements or flexibly adapt existing ones in a pragmatic protocol to suit local needs and capabilities.

CEM supports and benefits core operational stakeholders’ common awareness and understanding of the interdependencies and constraints facing each other’s business. This, in turn, can facilitate the assessment of environmental issues affecting the airport, airlines and ANSPs and identify common operational solutions, on which they can then collaborate in joint planning and implementation.

More strategically, CEM working arrangements can also address longer term operational and planning issues. Examples include the introduction of new airspace design, the implementation of different approach or departure procedures, de-icing procedures, planning scenarios for new airport infrastructure and adaptation actions to reduce the impacts of climate change.

Significantly, CEM can enhance relationships and, add value to those with customers such as ANSPs assisting airports with capacity, airports and ANSPs assisting airlines with fuel savings.

In addition, the CEM working arrangements may be used to facilitate a robust and transparent dialogue that benefits relations with National Regulators, local and regional authorities, land-use planning authorities, local communities (including Residents’ Associations) and local businesses¹.

CEM may support compliance both to regulatory and industry-led voluntary environmental impact reduction schemes. Additionally, CEM can support stakeholders to better understand the context of their organisations and identify data for international environmental certification and any relevant ISO Standards such as 14001 [35] and 26000 [36] that require evidence of continual improvement to reduce environmental impacts, including stakeholder consultation and engagement.

Furthermore, CEM may support stakeholders in respect of contributing to the realisation of

¹ Non-exhaustive list and depends on local culture and circumstances.
the Single European Sky (SES) [3]\(^2\) objective on the sustainable development of the air transport system and improving the overall performance of air traffic management and air navigation services for air traffic in Europe, with a view to meeting the requirements of all airspace users.

Voluntary in status, EUROCONTROL Specifications are developed to support Member States and interested parties. This EUROCONTROL CEM Specification has been developed and maintained together with our stakeholders, to accurately reflect the concerns and needs of each party.

1 INTRODUCTION

This EUROCONTROL Specification for Collaborative Environmental Management (CEM) at and around airports has been developed and maintained under the EUROCONTROL Regulatory and Advisory Framework (ERAF) in collaboration with stakeholders drawn from airport operators, aircraft operators, air navigation service providers (ANSPs), trade associations, regulators, business aviation, academia and interested parties. It acknowledges and builds upon the considerable actions already undertaken by the aviation sector to minimise its environmental impacts, in particular noise and emissions.

This CEM Specification sets out a high level protocol that will support and benefit core operational stakeholders in their continued actions to minimise environmental impacts at and around airports. More specifically, the CEM Protocol promotes a collaborative approach by formalising internal working arrangements between airport operators, aircraft operators, ANSPs (in particular, air traffic service providers (ATSPs)) and other stakeholders as required by local needs.

CEM can enhance relationships, and add value to customer relationships – e.g. ANSPs assisting airports with capacity, airports/ANSPs assisting airlines with fuel savings. For stakeholders wishing to either adapt existing or implement new CEM working arrangements, Section 7 in this Specification sets out the necessary requirements and recommended practices. The outcomes of a CEM Working Arrangement may also be used to facilitate compliance with certain requirements of:

- the Directive 2002/49/EC of 25th June 2002 relating to the assessment and management of environmental noise; and

In addition, it can support the Essential Requirements of the SES Interoperability Regulation, in particular the ‘sustainability and effectiveness of air navigation services’ and the ‘need to minimise environmental impact in accordance with Community legislation’.

Furthermore, the CEM protocol has been developed by EUROCONTROL in response to Implementation Objective ENV02, included in the Single European Sky Air Traffic Management (ATM) Research (SESAR) Master Plan Level 3 Implementation Plan and it is recognised as an enabler for minimising the environmental impact of ATM systems at airports thus contributing to high performing airport operations.

Note: See Annex B – Traceability to Regulatory Requirements

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3 See Annex E - Specification Update Procedures
4 Such as the Airport Regions Conference (ARC) representing local authorities that have a major international airport within or near their territory.
5 In the context of this Specification the term ATSP is used; ‘air traffic services’ means the various flight information services, alerting services, air traffic advisory services and ATC services (area, approach and aerodrome control services), including airspace design.
1.1 Maintenance of the Specification
This EUROCONTROL Specification has been developed under the EUROCONTROL ERAF and is maintained by EUROCONTROL in accordance with this Framework. Annex E - Specification Update Procedures and Annex F – Amendments to the Specification, give more information on update procedures and amendments to this particular Specification.

2 CONVENTIONS
EUROCONTROL Specifications are voluntary in status; however drafting conventions include 'normative' language to indicate which requirements must be complied with in order to claim compliance with the specification. Drafting conventions are used to indicate these requirements.

The following conventions are used in this EUROCONTROL Specification:

a. “Shall” – indicates a statement of specification, the compliance with which is mandatory to achieve the implementation of this EUROCONTROL Specification.

b. “Should” – indicates a recommendation or best practice, which may or may not be satisfied by all systems claiming conformity to this EUROCONTROL Specification.

c. “May” – indicates an optional element.

Numbers within square brackets are used to identify reference documents listed in Section 8 e.g. [1] identifies the first document referenced in Section 8.

3 APPLICABILITY
This CEM Specification is primarily targeted at the three core operational stakeholders at airports: Airport Operators, Aircraft Operators and ANSPs. The generic approach of a CEM Working Arrangement can be applied to both Commercial Air Transport and General Aviation operations.

In addition, the requirements of the CEM Specification also recognise that local working arrangements may include regulators or any other stakeholders such as ground handling agents that local circumstances require, as part of the core stakeholder group.

The outcomes of the CEM Working Arrangements can also enhance relationships with other external stakeholders such as local, regional and national authorities; engagement with local communities (including, for example, Residents’ Associations); local businesses; industry bodies; academia and the general public.

4 BACKGROUND
4.1 Social and Operational Constraints
Environmental sustainability is a pre-requisite for the aviation sector to maintain both current operations and enable future growth. The enhancement of European ATM capacity and increased flight efficiency can also be facilitated by the ability of aviation’s stakeholders to minimise the environmental impacts of their combined operations. There is, therefore, a much wider benefit available when minimising current environmental impacts whilst addressing any constraints affecting longer term sustainable airport development.

Many of these constraints relate to the environmental impacts arising from combined air traffic operations at, and around airports. These are the impact on the quality of life and
health of local people (noise, local air quality) and, the contribution to global climate change (greenhouse gas (GHG) emissions) [13][16].

Social, political and economic pressures on airports are increasing in importance. With or without the continued growth in air traffic, mounting public concern, environmental awareness and increasing legislation have made the management of these issues a critical priority for all airport stakeholders. Local communities have a natural interest in aviation projects that may impact them and increasingly expect to be informed and involved to some degree in the process of airport planning. In the future, physical risks on ATM operations arising from changes in the climate (e.g. more severe weather events) may provide additional significant challenges for the ATM system and its operation and development. Examples of these can be seen in delays, cancellations, higher risks of flooding and the expertise necessary to build resilience into the system.

Over many years, operational stakeholders at airports have made significant efforts to minimise the environmental impacts that are caused by air traffic operations. Some of the most visible examples of these efforts can be seen in the outcomes of engagement with local authorities and airport neighbours on securing their acceptance of an airport to operate and grow in a sustainable manner (see Annex C - Examples of Collaboration at Airports among Core Operational Stakeholders).

It is essential that addressing environmental impacts becomes a part of the normal operational process. Thus, when operational stakeholders are working together, for example to improve operational efficiency or capacity, they should also work in partnership to understand and minimise the environmental impact of their proposals and, if necessary, jointly identify robust mitigation solutions that are acceptable to all parties. The outcomes can then be captured in the management systems of each stakeholder.

The CEM protocol has been developed:

- to focus on identifying the root causes and risks (environmental, business and reputational) of combined environmental impacts;
- to identify opportunities that enhance performance, minimise impacts and provide business benefits;
- to further support awareness of business interdependencies among the core operational stakeholders; and
- to evaluate and manage the implementation of collaborative solutions, including conflict resolution.

Furthermore, adoption of the protocol can facilitate the inclusion of relevant external stakeholders in CEM working arrangements according to local needs and can ensure that the needs and concerns of local communities are taken into consideration.

4.2 Core Operational Stakeholders

4.2.1 Airport Operators

Significant numbers of medium to large airports across Europe are currently facing challenges to grow and or capacity constraints for environmental reasons [16]. Airports also continue to face a range of issues when changes to airspace design are required, capacity limits and operational practices. In addition, securing planning approval to extend or build new runways as a direct result of environmental concerns expressed both by local communities and court rulings attracts significant media and political attention. Many airports are also facing increasing social and regulatory pressure when renewing environmental permits, the contents of which may lead to further limitations on airport capacity. The challenges facing larger airports are increasingly applicable to smaller ones due in part:

- to increasing public awareness of environmental nuisance and potential health
concerns leading to organised opposition; and
  - to the significant growth of traffic during peak and off-peak hours.

Although numerous stakeholders operate at an airport, the public generally views the airport operator as the responsible entity for the environmental impacts. In many instances the airport operator also has legal responsibility for the airport’s environmental impact. The airport operator, in parallel, has to take into consideration the needs of general aviation that do not use its terminals. Ultimately an airport will aim to maximise its sustainable development and growth whilst minimising its environmental impact as a key value driver.

### 4.2.2 Aircraft Operators

Aircraft operators are subject to important performance, economic and political pressures. One of their key objectives is to reduce fuel consumption as it contributes to lowering operating costs and reducing emissions. It may, in addition, contribute to lowering compliance costs with emissions-related market-based measures such as the EU-ETS [37] and CORSIA [12].

Operating restrictions and constraints to airport growth can have a negative impact on the competitiveness of aircraft operators. Such measures hinder connectivity, increase operating costs, can cause delay and eventually reduce operational flexibility. Ultimately, these impacts risk influencing the traveling public’s perception of the aviation sector and levels of customer loyalty.

Collaboration and partnership with other airport stakeholders can be instrumental in improving an aircraft operator’s performance, predictability and reducing operating costs in addition to emissions reduction initiatives. For example, avoiding track deviations after take-off can reduce the impact of operations - particularly on perceived noise levels equated with annoyance, maintain the engagement and trust of local communities and, obviate the need for more restrictive measures.

### 4.2.3 Air Navigation Service Providers

Air Navigation Service Providers (ANSPs) are responsible for the safe and expeditious movement of air traffic at and around airports. At the same time they can contribute to the redesign of improved arrival and departure routings, improvements to airport infrastructure and operational procedures. Their expertise can also contribute to understanding the need for possible compromise between reducing aircraft noise (which may require extensions of flight tracks) whilst at the same time reducing fuel burn/emissions (which would imply shortening the flight tracks). See Section 4.3 on Interdependencies for more detail.

Improving the performance of air traffic at the airport (e.g. reduction in taxi times) and in the airspace in its immediate vicinity can be best achieved through collaboration and partnership with the aircraft operators and the airport operator. Improved efficiencies can in turn contribute to a reduction in aircraft fuel usage and potentially noise, thereby achieving a more acceptable balance between environmental constraints and operational efficiency. In addition, this can contribute to meeting the needs and concerns of local communities and local, regional and national authorities.

### 4.3 Interdependencies

Operational changes are often made on the basis of a wide range of strategic, economic and operational reasons, which are interdependent. Such interdependencies can be positive (synergies) or negative (trade-offs).

Issues of capacity, efficiency, safety, spatial planning and environmental impacts are often intertwined such that the true impact of an operational change may not be understood unless the relevant stakeholders are able to collaborate together. However, safety considerations will always remain the priority in any operational change.
Typically, a compromise or balance is required to ensure that a negative impact in one area does not outweigh the value of a positive impact in another area. However, positive and negative impacts may also be found between different aspects of the same impact area. Examples include (but are not limited to):

- Noise versus fuel burn/CO₂ emissions: The development of Noise Preferential Routes (NPRs) may reduce the population affected by noise but may increase fuel burn and CO₂ due to the additional track miles to be flown. The use of Noise Abatement Departure Procedures (NADPs)\(^7\) [13][16] can have the potential for important improvement margins by optimising the operational use of NADP 1 which reduces noise close to the airport but increases fuel burn due to the late flap retraction, or NADP 2 which is more fuel efficient and reduces noise further from the airport, to deliver the best balance between community noise impact and fuel burn.

- Fuel burn/CO₂ emissions versus capacity: Optimizing the route structure to enable flights to fly closer to the user-preferred trajectory may result in a complicated route structure which has a negative impact upon capacity.

- Noise versus noise: The concentration of aircraft trajectories, in any area close or further out to the airport, due to advanced navigation performance (for example PBN) may result in a reduction in the total population exposed to noise but increase the noise impact on the population that will be exposed. Care should always be taken when describing noise impacts/reductions.

- Capacity versus fuel burn/CO₂ emissions: An increase in airport capacity may result in a more efficient operation when measured by reduced emissions per flight; however, such an increase in capacity may inevitably lead to an increase in total emissions.

- Fuel burn/CO₂ emissions versus fuel burn/CO₂ emissions: An optimisation of trajectories in the Terminal Manoeuvring Area (TMA) may result in reduced track miles to be flown in the TMA (reduced fuel burn) but not necessarily lead to a more efficient transition to en-route airspace outside of the TMA, which could result in an overall increase in trajectory inefficiency and consequently to increased fuel burn.

Consideration of the interdependencies and trade-offs between the different impacts of an operational change can only be truly determined at the local level. The priorities of the

\(^7\) ICAO Circular 317 gives comparison of NADP 1 and NADP 2 and their effects on noise and emissions from the eight types studied, can be determined:

**NADP 1 (with early cut-back) versus NADP 2 (with late cut-back)**

- The height profiles for the aircraft analysed indicate better climb performance for NADP 1 up to about 3 000 ft AGL, but better overall climb performance up to 10 000 ft for NADP 2.
- The results also indicate the “close-in” noise reduction obtained with NADP 1 compared to NADP 2. The peak values of noise difference in the “close-in” area before the crossover point for these aircraft vary from 3.5 to 8.1 dBA.
- In the “distant” area beyond the crossover point, noise differences are smaller, with peak differences between −0.2 and −3.7 dBA, and are spread out over a larger area.
- The crossover point ranges from 5.5 to 8.1 NM from brake release for all aircraft analysed except the business aircraft, which has its crossover point earlier at 3.3 NM.
- The emissions data show that, for these aircraft, NADP 2 produces up to 17.2 per cent more NOx through 1 000 ft and up to 19.8 per cent more NOx through 3 000 ft AGL. NADP 2 however leads to a reduction of CO₂ of as much as 2.7 per cent through the adjusted top of climb.

**NADP 1 (with early cut-back) versus NADP 2 (with early cut-back)**

- As with the preceding comparison, the comparison of NADP 1 and NADP 2 enables the noise and emissions differences between these procedures to be determined. NADP 2 features a cutback at the beginning of the acceleration and flap retraction phase. Although climbing out less steeply than NADP 1 in the initial phase, NADP 2 provides a steeper overall profile up to 10 000 ft AGL.
- The noise results indicate similar trends as in the preceding comparison. Compared to NADP 2, NADP 1 provides noise reduction in the “close-in” area, with peak differences ranging from 3.0 to 7.0 dBA.

**Note:** for more information and specific examples please refer to Section 8.6 of the ICAO Circular 317.
stakeholders will differ according to local requirements, conditions and expectations. An acceptable compromise for all parties can only thus be achieved through effective collaboration among all the relevant stakeholders.

The CEM working arrangement provides, therefore, a platform for discussion and allows core operational stakeholders to identify synergies, quantify impacts and reach compromises from an operational environmental perspective. In addition, the collaborative approach of the CEM working arrangement can support the search for solutions that ensure the maximum potential for current operations and the sustainable growth of the airport.

### 4.4 Environmental Management Systems

Stakeholders at airports may have their own approaches to environmental management, including formal Environmental Management Systems (EMS) or policies embedded in daily processes. These can influence many aspects of their operations. CEM should not be seen as a replacement for an EMS such as Eco-Management and Audit Scheme (EMAS)\(^6\) \([4]\) or other means of complying with international environmental and social responsibility certification standards such as ISO 14001 \([35]\) and ISO 26000 \([36]\). CEM is intended to build on existing working arrangements, facilitating stakeholder collaboration while improving the process of community engagement. Implementation of CEM type Working Arrangements supports Management Systems by facilitating engagement, developing clearer pictures of needs and expectations of interested parties, identifying risks and opportunities, as well as delivering continual improvement. Where multiple stakeholders operate their own management systems, CEM provides a platform where these can come together to deliver collective improvement.

### 5 SCOPE

The EUROCONTROL Specification for CEM covers all air transport operations both general aviation and commercial air transport and their environmental impacts at and around an airport (i.e. on the ground and in the air). It is not bound to a specific airport size or number of movements.

More specifically, the CEM Specification covers aircraft-related noise management (e.g. enhanced noise track adherence), introduction of new airspace design incorporating Performance Based Navigation (PBN) \([14]\)[17], the reduction in atmospheric emissions (both local air quality and GHG emissions), fuel conservation (as a scarce resource) and reduced engine running times.

CEM covers other locally determined air transport-related environmental issues such as water management, waste management, soil and groundwater contamination, energy conservation, the operational impact of de-icing solutions, third-party risk issues, bird hazard management, conservation of bio-diversity, and issues related to climate change adaptation.

CEM also covers topics ranging from simply responding to complaints to operational changes such as implementing major mitigation projects like Continuous Descent Operations (CDO) \([19]\)[29]. Longer term strategic projects, for example review of airspace design (PBN), new airport infrastructure, LED lighting projects or looking at increasing the usage of Fixed Electrical Ground Power (FEGP), can be facilitated and agreed solutions verified for regulatory compliance.

6 PURPOSE

The purpose of CEM is to support and facilitate internal collaboration among the core operational stakeholders and others, as local requirements demand, in order to minimise the environmental impacts resulting from their combined air traffic operations at and in the vicinity of an airport. In Section 7 CEM Protocol, the requirements and recommended practices to formalise new or adapt existing collaborative working arrangements are set out.

The working arrangements specified in the CEM Protocol can:

- facilitate operational stakeholders at airports meeting together in partnership to identify, develop and manage collaborative solutions and implementation strategies to tackle their common environmental challenges;
- facilitate an awareness and understanding of interdependencies when exploring and agreeing upon common solutions;
- ensure that there is an internal focus and understanding of all environmental impacts on operations and facilities and potential solutions before involving external stakeholders;
- facilitate commitment to, and provide evidence of compliance with, any voluntary or regulatory environmental impact reduction scheme or initiative that requires a collaborative approach;
- be used as a means of facilitating compliance with legislation that deals with current and future environmental challenges at and around airports associated with air traffic and airport operations;
- facilitate engagement and communication with external stakeholders e.g. with National Regulators, local and regional authorities, land-use planning authorities, local communities (Residents Associations) and local businesses.

Once implemented, a CEM Working Arrangement can also be used to identify which service partners (e.g. ground handling agents) and fixed based operators9 should become involved to inform, advise or take action.

CEM can therefore facilitate coordinated action to minimise the environmental impact of operational performance and contribute to the sustainable development and growth of the airport and the aviation industry as a whole.

In turn, this can support, if needed, individual compliance with local, national and European legislation relating to the environmental impact of air transport; SESAR operational improvements for airport operations; and the requirements of the ATM Master Plan Implementation Objective ENV02 [30]. Furthermore, it can contribute to the preparation of environment-related legislative deliverables as listed in Section 1 (see Annex A - Legislative Framework, Policy and Initiatives and Annex B – Traceability to Regulatory Requirements for more information).

The CEM protocol has been developed to facilitate the needs and obligations of stakeholders at airports as described in Regulation (EU) No 598/2014 that entered into force on 13 June 2016 [4], repealing Directive 2002/30/EC. In particular, Article 6 (Rules on Noise Assessment), paragraph 2, sub-paragraph (b), of that Regulation calls for technical cooperation amongst airport stakeholders to examine measures to mitigate noise.

In the longer-term, instigating such collaborative working arrangements can also help to manage more strategic issues such as identifying, understanding and building resilience to

the potential impacts of climate change on business and operations. The challenges of climate change will vary with time and geographical location. However, by working collaboratively and sharing best-practices and expertise, operational stakeholders can identify and implement cost-effective and efficient solutions [18][24].

7 CEM PROTOCOL

Figure 1: High level CEM overview

Figure 2 illustrates how a CEM working arrangement provides a platform for discussion and allows core operational stakeholders to identify synergies, quantify impacts and reach compromises from an operational environmental perspective. In addition, the collaborative approach of the CEM working arrangement can support the search for solutions that ensure the maximum potential for current operations and the sustainable growth of the airport.

7.1 Introduction

A number of critical factors influence the successful outcome of any collaborative process:

- Establishment of agreed working arrangements between the collaborating parties;
- Common recognition of issues, risks and opportunities, the contributing factors, including the involvement of each party;
- Common agreement on the environmental challenges and threats;
- Awareness of the goals and mission of each party;
- Awareness, acceptance and understanding of interdependencies and the benefits and costs that accrue to each stakeholder from different courses of action;
- Identification of the resources available to support the collaborative process;
An agreed common solution and implementation delivery.

The objective of this section is to list the requirements and recommended practices to either identify existing suitable forums or establish a new internal CEM Working Arrangement at airports. Both scenarios involve core operational stakeholders taking a voluntary decision to implement collaborative working arrangements to minimise the environmental impacts at and in the vicinity of the airport.

Where similar arrangements already exist, the requirements in this section must be satisfied to claim compliance with this Specification.

### 7.2 General Requirements

The CEM working arrangements should build on existing collaborative arrangements – to the extent that it is helpful to the effort. These existing arrangements may include established technical advisory committees, noise working groups, community roundtables and any other relevant working arrangements.

7.2.1 A CEM type working arrangement **shall** be established, or an existing suitable forum identified, to minimise the environmental impacts of operations at and around an airport(s) comprising of personnel drawn from the following core operational stakeholders:

- Airport Operator;
- Aircraft Operators;
- Air Navigation Service Provider.

7.2.2 Depending on specific local circumstances, local, regional or national regulatory bodies **may** form part of the core CEM working arrangements and be included in the terms of reference.

7.2.3 Members of the CEM working arrangement **shall** possess the appropriate level of expertise and understanding of the issues to represent their organisations on operational environmental matters and to take decisions that commit their organisations to act.

*Note*: The CEM Specification’s requirements, if implemented, must work within the context of national legislation and measures.

7.2.4 The Airport Operator or any other relevant stakeholder leading the local implementation **should** initiate the establishment of the CEM working arrangement.

7.2.5 The CEM working arrangement **may** be convened by any one of the core operational stakeholders at any time.

7.2.6 The CEM working arrangement **should** have:

- Approved governance;
- Agreed roles and responsibilities of each participating stakeholder;
- Agreement on confidentiality – allowing for discussion amongst the CEM stakeholders of commercially sensitive information e.g. fuel burn;
- Agreed terms of reference focusing on minimising environmental impacts generated by air traffic operations at and in the vicinity of the airport;
- A minimum frequency of meetings – depending on the topics to be dealt with;
- Documented meeting reports (recording decisions and the status of actions).

7.2.7 Additional fixed base operators **should** be invited to the CEM working arrangement when required by local conditions.

7.2.8 The following topics **shall** be part of the terms of reference of the CEM working arrangements.
arrangement when relevant to local conditions:

- Noise;
- Local Air Quality (LAQ);
- Greenhouse gas emissions;
- Risks to ATM operations and structures arising from climate change such as sea level changes and severe weather events;
- Implementation of Continuous Descent Operations (CDO) [19]
- The review and coordination of the introduction of new concepts of operations to improve environmental performance;
- Identification of interdependencies between impacts, and between their potential solutions;
- Identification of trade-offs that would have to be made by each stakeholder when delivering solutions (in terms of issues such as capacity, operational flexibility, cost, customer service standards);
- Modifications to airport and CNS/ATM infrastructure;
- Interaction with external stakeholders;
- Communication;
- Identification of applicable local, national and European legislation;
- Alignment with state or local plans, such as air quality plans or climate action plans;
- Any other environmental issue that impact on the airport.

7.2.9 The following additional environmental topics\textsuperscript{10} should be part of the terms of reference of the local CEM working arrangement where relevant:

- De-icing;
- Waste management and refuse management in general;
- Wildlife hazard management;
- Conservation of biodiversity;
- Areas of Special Scientific Interest or their equivalent;
- Renewable energy possibilities such as:
  - wind turbines;
  - bio-mass;
  - solar panels, etc.

7.2.10 Given their potential impacts on operational and environmental performance, the following topics may also be part of the terms of reference of the CEM working arrangement where relevant:

- Land use in the vicinity of the airport;
- Third Party Risk.

7.2.11 Where local assessment and monitoring of performance indicators are required (using recognised tools and methodologies), in relation to the following topics, they shall be part of the terms and reference of the local CEM working arrangement:

- Noise;
- Local Air Quality:
  - NO\textsubscript{x} emissions;
  - Particulate Matter (PM) including Ultra-fine Particles (UFPs);
  - Black Carbon;
- Fuel burn;
- CO\textsubscript{2} emissions.

\textsuperscript{10} This list of topics is non-exhaustive – local conditions will determine what should be added or deleted at any one time
Note: Annex D lists a selection of models and tools currently available that may facilitate solutions to environmental impacts at and around airports.

7.2.12 Removed (see Annex F – Amendments to the Specification)

7.2.13 Operational stakeholders within the CEM working arrangement shall provide mutual support to each other to facilitate successful compliance with the environmental legislation to which each is subject.

7.2.14 The CEM working arrangement may identify and monitor compliance with environmental legislation applicable locally to the airport and those with the potential to influence air traffic operations.

7.2.15 Removed (see Annex F – Amendments to the Specification)

7.2.16 Removed (see Annex F – Amendments to the Specification)

7.2.17 The CEM working arrangement may propose the development of an Environmental Charter or similar document that describes the core operational stakeholders’ collective commitment to dealing with current and longer term environmental issues at and around the airport. This may include, for example, wider commitments to sustainable development and corporate social responsibility. This can serve to advance these stakeholders’ collaborative efforts to engage with the concerns of the airport’s neighbours and regulators.

7.2.18 Removed (see Annex F – Amendments to the Specification)

7.2.19 Removed (see Annex F – Amendments to the Specification)

7.2.20 Individual core operational stakeholders’ management systems should be modified to implement processes contributing to commonly agreed solutions that mitigate operational environmental impact(s).

7.3 Relationships with external stakeholders

7.3.1 The CEM working arrangement may support all of its external stakeholders concerned by the operational environmental impacts resulting from their combined operations at and around the airport. These may include:

- Airport neighbours and communities (e.g. Resident Associations, local businesses, schools, hospitals);
- Local, Regional and National Authorities;
- State-designated competent authorities and bodies responsible for environmental legislation;
- Non-Statutory bodies responsible for issues such as protection of wildlife, rural tranquillity, cultural/historical issues;
- Other airports (for example those in close proximity and/or in the same operating group if relevant).

7.3.2 If local circumstances require, the CEM working arrangement should establish a dialogue with representatives of external stakeholders. Prior to any formal dialogue the purpose, form and content of any subject matter to be communicated is to be agreed.

7.3.3 Removed (see Annex F – Amendments to the Specification)

7.3.4 Removed (see Annex F – Amendments to the Specification)
7.3.5 CEM working arrangement communication material, adapted to local needs and requirements, shall be clearly identified, whenever possible, as having been jointly prepared by the core stakeholders.

7.3.6 If relevant locally, the CEM working arrangement should nominate focal points to liaise with authorities\(^\text{11}\) and other designated bodies responsible for environmental legislation.

7.3.7 Removed (see Annex F – Amendments to the Specification)

7.4 Relations with Competent Authorities

Under some EU legislation, Member States have to designate their Competent Authorities on a variety of issues including air transport and the environment. Given the applicability of environmentally-related legislation to airports and air traffic operations, and the fact that different Competent Authorities may be involved, it is likely that a collaborative approach will facilitate working with them.

7.4.1 Depending on local circumstances, the CEM working arrangement may support the Competent Authorities designated by the Member States under Regulation (EU) No 598/2014 [4] in implementing the 'Balanced Approach' to assist in describing, compiling and/or assessing environmental information as needed to support compliance for the purposes of:

- evidence to support the requirement of establishing a technical cooperation to examine measures to mitigate noise;
- taking into account likely costs and benefits of the various measures available;
- contributing to the description of the environmental objectives of the airport;
- contributing to the description of measures already taken to reduce aircraft noise;
- contributing to the assessment of the cost/effectiveness or cost/benefit of specific measures taking into account the socio-economic effects on airport users and local communities;
- contributing to an overview of the possible environmental effects of the proposed measures on other airports etc.;
- taking into account the relationship of the Directive 2002/49/EC [8] on the regular assessment and management of environmental noise and any noise maps or action plans that may have been prepared.

7.4.2 The CEM working arrangement may support the Competent Authorities designated by the Member States under Directive 2002/49/EC [8] in describing, compiling and/or assessing environmental information as needed to support compliance for the purposes of:

- the preparation of the strategic noise map of the airport;
- the review every five years of the strategic noise map of the airport;
- the preparation of the noise action plan of the airport;
- the preparation of proposals for the noise action plan taking into account the concerns of external stakeholders;
- the review, every five years, of the noise action plan of the airport.

7.4.3 The CEM working arrangement may support the Competent Authorities designated under Directive 2008/50/EC [9] in describing, compiling and/or assessing environmental information/data as needed to support compliance for the purposes of:

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\(^{\text{11}}\) Concerned authorities will vary according to each State
o the monitoring and assessment of ambient air quality data;
o the preparation of the local, regional or national air quality plans for improvement in ambient air quality;
o Public Information made available by Member States to the general public on ambient concentrations of the pollutants covered by this directive.

7.5 Information sharing

7.5.1 Core operational stakeholders who, through existing collaborative working arrangements at airports, already meet or surpass the requirements of this Specification should contribute to pan-European harmonisation by sharing relevant case studies and practical information which may be documented in future editions of this Specification.
8 REFERENCES

EU Legislation

ICAO
15. NADPs Documents
• Sustainable Aviation. "Inter-dependencies between Emissions of CO2, NOX & Noise from Aviation", 2010.

EUROCONTROL
19. “Continuous Climb and Descent Operations”.
https://www.eurocontrol.int/articles/continuous-climb-and-descent-operations

Other
9 ABBREVIATIONS

AAT    Aircraft Assignment Tool
ACI    Airports Council International
ACA    Airport Carbon Accreditation
A-CDM  Airport – Collaborative Decision Making
ANS    Air Navigation Services
ANSP   Air Navigation Service Provider
ATAG   Air Transport Action Group
ATSP   Air Traffic Service Provider
AO     Aircraft Operator
APU    Auxiliary Power Unit
ARC    Airport Regions Conference
ATM    Air Traffic Management
ATC    Air Traffic Control
ATFCM  Air Traffic Flow and Capacity Management
CAA    Civil Aviation Authority
CAEP   Committee on Aviation Environmental Protection
CANSO  Civil Air Navigation Services Organisation
CCO    Continuous Climb Operations
CEM    Collaborative Environmental Management
CDA    Continuous Descent Approach
CDO    Continuous Descent Operations
CNS    Communications, Navigation and Surveillance
CO     Carbon Monoxide
CO₂    Carbon Dioxide
CORSIA Carbon Offsetting and Reduction Scheme for International Aviation
EASA   European Aviation Safety Agency
EATMN  European Air Traffic Management Network
EBAA   European Business Aviation Association
EC     European Commission
ECAA   European Common Aviation Area Agreement
ECAC   European Civil Aviation Conference
EEA    European Economic Area
EP     European Parliament
EMAS   Eco-Management and Audit Scheme
EMS    Environmental Management System
ERAF   EUROCONTROL Regulatory and Advisory Framework
ETS    Emission Trading System
ESSIP  European Single Sky Implementation Plan
EU     European Union
FEGP   Fixed Electrical Ground Power
GIS   Geographic Information System
GHG   Green House Gas(es)
HC    Hydrocarbon
ICAO  International Civil Aviation Organisation
IATA  International Air Transport Association
ISO   International Organization for Standardization
KPI   Key Performance Indicator
LAMP  London Airspace Management Plan
LAQ   Local Air Quality
MDG   Modelling and Database Group
NADP  Noise Abatement Departure Procedures
NATS  National Air Traffic Services
NGOs  Non-Governmental Organisations
NM    Nautical Miles
NOx   Nitrogen Oxides
NPR   Noise Preferential Route
OGs   Organic Gases
OI    Operational Improvement
PBN   Performance-Based Navigation
PM    Particulate Matter
PI    Performance Indicator
RNP   Required Navigation Performance
SDGs  Sustainable Development Goals
SEL   Sound Exposure Level
SES   Single European Sky
SESAR Single European Sky ATM Research
SID’s Standard Instrument Departures
SOx   Sulphur Oxides
SWIM  System Wide Information Management
TMA   Terminal Manoeuvring Area
UFPs  Ultra-Fine Particles
VOCs  Volatile Organic Compounds
VOR’s VHF Omnidirectional Range
V-PAT Vertical Profile Analysis Tool
ANNEX A - LEGISLATIVE FRAMEWORK, POLICY AND INITIATIVES

This annex contains a high level description of all key policies and initiatives relating to CEM.

A.1 Overview

The following diagram and table illustrate and describe some of the different legislation and measures that affect core operational stakeholders at airports. Only key global and European legislation related to the environmental impact of airport operations is described. Different legislation will apply to individual airports depending on the local, regional and national contexts.

Figure 2: Overview of the levels of legislation

<table>
<thead>
<tr>
<th>SCALE OF APPLICABILITY</th>
<th>TYPE OF INSTRUMENT</th>
<th>LEGAL STANDING</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Guidance material</td>
<td>Advising/supporting States to achieve global harmonisation.</td>
</tr>
<tr>
<td>EUROPEAN</td>
<td>Regulations</td>
<td>Directly applicable, effective and binding in the EU Member States.</td>
</tr>
<tr>
<td></td>
<td>Directives</td>
<td>Binding as to the result to be achieved; must be transposed into EU Member States’ national legislation.</td>
</tr>
<tr>
<td>NATIONAL</td>
<td>Legislation</td>
<td>Directly applicable, effective and binding. In the EU, most national laws stem from EU law. Non-EU States adopt or transpose EU law in application of the EEA\textsuperscript{12} or ECAA\textsuperscript{13} agreements.</td>
</tr>
<tr>
<td>LOCAL</td>
<td>Airport-specific rules and local planning law requirements etc.</td>
<td>Often mandatory</td>
</tr>
</tbody>
</table>

\textsuperscript{12} EEA - European Economic Area Agreement, which entered into force on 1 January 1994.

\textsuperscript{13} ECAA - European Common Aviation Area.
A.2 European Regulation

Following the adoption of ICAO’s ‘Balanced Approach’ the European Union adopted Directive 2002/30/EC on the introduction of noise-related operating restrictions at European Union airports. Since then, the European Union recognising the need to address the growing environmental issues surrounding aircraft noise, has repealed this directive with the publication of Regulation (EU) No 598/2014 that came into force on the 13 June 2016 [4]. The requirements of this Regulation will have implications on how competent authorities manage noise and consult with external stakeholders. In addition, Directive 2008/50/EC [9] implementing a common approach to ambient air quality and cleaner air for Europe, applies to the management of local air quality at and around airports.

The objective of the SES, as stated in - Regulation (EU) No 549/2004 (the framework Regulation) [1], sets out to “contribute to the sustainable development of the air transport system”. Furthermore, Annex II, Part A, paragraph 5, to Regulation (EU) No 552/2004 [2], states ‘that systems and operations of the EATMN shall take into account the need to minimise the environmental impact in accordance with Community legislation’.

A.3 SESAR

The SESAR programme is the technological pillar of the SES initiative. Within this technological pillar is the European ATM Master Plan (The Master Plan) [30], which sets out the agreed roadmap connecting research and development with deployment. The Master Plan has three levels that combine high level planning, research and practical implementation objectives. The level three view (implementation) is represented by the Plan that enables stakeholders to achieve their performance targets.

CEM is part of the Implementation Objective ENV02 that supports the following three SESAR Operational Improvement Steps (OIs):

AO-0703 Aircraft Environmental Impact Management and Mitigation at and around Airports
AO-0705 Reduced Water Pollution
AO-0706 (Local) Monitoring of Environmental Performance

CEM is described in the Implementation Objective ENV02 [30]

“Formal working partnership arrangements between ANSP, Airport and Aircraft Operators will be established at individual airports to enable:

- the minimisation of noise and atmospheric emissions (including fuel burn); and
- the management of aircraft and airfield de-icing resulting from combined aircraft operations at the terminal airspace and ground.

These formal working arrangements will enable understanding and awareness of interdependencies and facilitate jointly agreed solutions for environmental improvements.”

Note: As from the Master Plan Level 3 Plan 2018 edition, ENV02 is considered to be a Local Objective. These are a specific kind of Objective that have no determined applicability area or an expected achievement date. This change was made in order to better capture the nature of CEM and its expected implementation throughout European airports.

CDO is part of the Implementation Objective ENV01 [30] and supports SESAR OI AOM-0701 Continuous Decent Approach (CDA). CDO is described as:
“Continuous Descent Operations (CDO) is an aircraft operating technique enabled by airspace design, procedure design and facilitated by ATC in which an arriving aircraft descends continuously, to the greatest extent possible, using minimum engine thrust and low drag. CDO does not adversely affect safety and capacity and will produce environmental and cost benefits including reductions to fuel burn, gaseous emissions and noise impact.”

A.4 Industry Collaboration

Industry partners and trade associations in related policy documents and position papers (e.g. IATA [34], CANSO [25] [26] [27], ACI [20], ATAG [22]) have recognised that a collaborative approach will facilitate the sustainable development of airports and ensure that the associated environmental impacts are understood and addressed by their members and external partners.

Both ACI-Europe, ACI-World and CANSO recognise CEM Working Arrangements as best practise for the management of noise at and around airports [28]. In addition, CEM Working Arrangements can support airports in achieving ACI Airport Carbon Accredited (ACA) status at Level 3 Optimisation and Level 3+ Neutrality, as stakeholder engagement is one of the requirements at both these levels. The ACI-ACA programme [21] accepts evidence of complying with the CEM specification’s requirements as adequate proof of a Stakeholder Engagement Plan.

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**ATAG FLYING IN FORMATION: AIR TRANSPORT AND THE SUSTAINABLE DEVELOPMENT GOALS [23]**

The SDGs are not going to be achieved without collaborative efforts by governments, with businesses and civil society all working together. Luckily, aviation is very experienced in working in partnership to set and achieve system-wide goals. In safety and security, and most recently climate change, air transport at a global level has followed the day-to-day operational philosophy of working together for the benefit of all, including with a well-connected network of suppliers.

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The economic importance of air transport to regions and countries as generators of business and employment is widely recognised. It has been estimated that globally air transport supports 62.7 million jobs (direct, indirect, induced, and catalytic impacts); as identified by ATAG [23], 2.7 million people work for airlines or handling agents, 450,000 people directly for airport operators, while 5.5 million work on-site at airports for government agencies such as customs and security, or provide services in retail outlets, restaurants, hotels, etc.

To maintain these economic benefits through airports being allowed to grow sustainably (whilst complying with regulations), collaboration and partnership of operational stakeholders needs to follow a widely accepted and robust process that local authorities, regulators and local businesses and communities can trust and engage with.
ANNEX B – TRACEABILITY TO REGULATORY REQUIREMENTS

This annex contains traceability to regulatory requirements tables between relevant European legislation and the CEM Protocol requirements with regard to EU environment-related legislative provisions affecting operational activities at and around airports. The collaborative working arrangement set out in the CEM Protocol can also be adopted by any group of stakeholders to support and/or facilitate coordinated action to fulfil current or future legislative requirements:

- The first column identifies the individual legislation;
- The second column identifies legislative requirements that the CEM working arrangement can facilitate compliance with;
- The third column identifies requirements in section 7: CEM Protocol that can facilitate compliance with legislation.

<table>
<thead>
<tr>
<th>Legislation</th>
<th>Legislative Requirements</th>
<th>CEM Specification requirement N°</th>
</tr>
</thead>
</table>
| DIRECTIVE 2002/49/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 25 June 2002 relating to the assessment and management of environmental noise | **Article 4**<br>Implementation and responsibilities<br>1. Member States shall designate at the appropriate levels the competent authorities and bodies responsible for implementing this Directive, including the authorities responsible for:<br>(a) making and, where relevant, approving noise maps and action plans for agglomerations, major roads, major railways and major airports;<br>(b) collecting noise maps and action plans. | • 7.3.6  
• 7.4.2 |
| Article 7<br>Strategic noise mapping<br>3. The strategic noise maps shall satisfy the minimum requirements laid down in Annex IV.  
5. The strategic noise maps shall be reviewed, and revised if necessary, at least every five years after the date of their |                                                                                          | • 7.4.2 |
<table>
<thead>
<tr>
<th>Article 8</th>
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<tbody>
<tr>
<td><strong>Action plans</strong></td>
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</tbody>
</table>
| 1. Member States shall ensure that no later than 18 July 2008 the competent authorities have drawn up action plans designed to manage, within their territories, noise issues and effects, including noise reduction if necessary for: | • 7.4.2  
| (a) places near the major roads which have more than six million vehicle passages a year, major railways which have more than 60 000 train passages per year and major airports; |  
| 5. The action plans shall be reviewed, and revised if necessary, when a major development occurs affecting the existing noise situation, and at least every five years after the date of their approval. | • 7.4.2  
| 7. Member States shall ensure that the public is consulted about proposals for action plans, given early and effective opportunities to participate in the preparation and review of the action plans, that the results of that participation are taken into account and that the public is informed on the decisions taken. Reasonable time-frames shall be provided allowing sufficient time for each stage of public participation. | • 7.3.1  
| • 7.4.2 |  
|  
| **ANNEX IV** |  
| **MINIMUM REQUIREMENTS FOR STRATEGIC NOISE MAPPING** | • 7.4.2 |
3. Strategic noise maps for agglomerations shall put a special emphasis on the noise emitted by:
   — road traffic,
   — rail traffic,
   — airports,
   — industrial activity sites, including ports.

REGULATION (EU) No 598/2014 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL
of 16 April 2014
on the establishment of rules and procedures with regard to the introduction of noise-related operating restrictions at Union airports within a Balanced Approach and repealing Directive 2002/30/EC

Article 1

Subject matter, objectives and scope

1. This Regulation lays down, where a noise problem has been identified, rules on the process to be followed for the introduction of noise-related operating restrictions in a consistent manner on an airport-by-airport basis, so as to help improve the noise climate and to limit or reduce the number of people significantly affected by potentially harmful effects of aircraft noise, in accordance with the Balanced Approach.

2. The objectives of this Regulation are:
   (a) to facilitate the achievement of specific noise abatement objectives, including health aspects, at the level of individual airports, while respecting relevant Union rules, in particular those laid down in Directive 2002/49/EC, and the legislation within each Member State;
   (b) to enable the use of operating restrictions in accordance with the Balanced Approach so as to achieve the sustainable development of the airport and air traffic management network capacity from a gate-to-gate perspective.

Article 5
## General rules on aircraft noise management

1. Member States shall ensure that the noise situation at an individual airport as referred to in point (2) of Article 2 is assessed in accordance with Directive 2002/49/EC. EN 12.6.2014 Official Journal of the European Union L 173/69

2. Member States shall ensure that the Balanced Approach is adopted in respect of aircraft noise management at those airports where a noise problem has been identified. To that end, they shall ensure that:

   (a) the noise abatement objective for that airport, taking into account, as appropriate, Article 8 of, and Annex V to, Directive 2002/49/EC, is defined;
   (b) measures available to reduce the noise impact are identified;
   (c) the likely cost-effectiveness of the noise mitigation measures is thoroughly evaluated;
   (d) the measures, taking into account public interest in the field of air transport as regards the development prospects of their airports, are selected without detriment to safety;
   (e) the stakeholders are consulted in a transparent way on the intended actions;
   (f) the measures are adopted and sufficient notification is provided for;
   (g) the measures are implemented; and
   (h) dispute resolution is provided for.

3. Member States shall ensure that, when noise-related action is taken, the following combination of available measures is considered, with a view to determining the most cost-effective measure or combination of measures:

   (a) the foreseeable effect of a reduction of aircraft noise at source;
   (b) land-use planning and management;

- 7.3.1
- 7.4.1
- 7.4.2
(c) noise abatement operational procedures;
(d) not applying operating restrictions as a first resort, but only after consideration of the other measures of the Balanced Approach.

**Article 6**

**Rules on assessment**

1. The competent authorities shall ensure that the noise situation at airports for which they are responsible is assessed on a regular basis, in accordance with Directive 2002/49/EC and the legislation applicable within each Member State. The competent authorities may call on the support of the Performance Review Body referred to in Article 3 of Commission Regulation (EU) No 691/2010

2. If the assessment referred to in paragraph 1 indicates that new operating restriction measures may be required to address a noise problem at an airport, the competent authorities shall ensure that:

(a) the method, indicators and information in Annex I are applied in such a way as to take due account of the contribution of each type of measure under the Balanced Approach, before operating restrictions are introduced;

(b) at the appropriate level, technical cooperation is established between the airport operators, aircraft operators and air navigation service providers to examine measures to mitigate noise. The competent authorities shall also ensure that local residents, or their representatives, and relevant local authorities are consulted, and that technical information on noise mitigation measures is provided to them;

| 7.4.1 |
| 7.2.1 |
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| 7.2.5 |
| 7.2.6 |
(c) the cost-effectiveness of any new operating restriction is assessed, in accordance with Annex II. Minor technical amendments to measures without substantive implications on capacity or operations shall not be considered new operating restrictions;

(d) the process of consultation with interested parties, which may take the form of a mediation process, is organised in a timely and substantive manner, ensuring openness and transparency as regards data and computation methodologies. Interested parties shall have at least three months prior to the adoption of the new operating restrictions to submit comments. The interested parties shall include at least:

(i) local residents living in the vicinity of the airport and affected

| 7.2.7 |
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| 7.2.13 |
| 7.2.14 |
| 7.2.17 |
| 7.2.20 |
| 7.3.1 |
| 7.3.2 |
| 7.3.5 |
| 7.3.6 |
| 7.4.1 |
| 7.4.2 |
| 7.4.3 |
| 7.5.1 |
| 7.3.1 |
| 7.4.1 |
| 7.4.2 |
by air traffic noise, or their representatives, and the relevant local authorities;
(ii) representatives of local businesses based in the vicinity of the airport, whose activities are affected by air traffic and the operation of the airport;
(iii) relevant airport operators;
(iv) representatives of those aircraft operators which may be affected by noise-related actions;
(v) the relevant air navigation service providers;
4. The relevant information may include:
(a) while respecting national law, information on alleged infringements due to changes in flight procedures, in terms of their impact and the reasons why such changes were made;
(b) the general criteria applied when distributing and managing traffic in each airport, to the extent that those criteria may have an environmental or noise impact; and
(c) data collected by noise measuring systems, if available.

ANNEX I
ASSESSMENT OF THE NOISE SITUATION AT AN AIRPORT
Indicators:
1. Air traffic noise impact will be described, at least, in terms of noise indicators L den and L night which are defined and calculated in accordance with Annex I to Directive 2002/49/EC.
2. Additional noise indicators which have an objective basis may be used.
Noise management information:
• 7.2.13
• 7.2.14
• 7.4.1
• 7.4.2
## 1. Current inventory

### 1.2. A description of the environmental objectives for the airport and the national context.

### 1.3. Details of noise contours for the relevant previous years — including an assessment of the number of people affected by aircraft noise, carried out in accordance with Annex II to Directive 2002/49/EC.

### 1.4. A description of the existing and planned measures to manage aircraft noise already implemented in the framework of the Balanced Approach and their impact on and contribution to the noise situation, by reference to:

#### 1.4.1. For reduction at source:

(a) information on the current aircraft fleet and any expected technology improvements;

(b) specific fleet renewal plans.

#### 1.4.2. For land-use planning and management:

(a) planning instruments in place, such as comprehensive planning or noise zoning;

(b) mitigating measures in place, such as building codes, noise insulation programmes or measures to reduce areas of sensitive land use;

(c) consultation process in respect of the land-use measures;

(d) monitoring of encroachment.

#### 1.4.3. For noise abatement operational measures, to the extent that those measures do not restrict the capacity of an airport:

- 7.2.11
- 7.2.13
- 7.2.14
- 7.3.1
- 7.4.1

### 7.2.9

### 7.2.10
1.4.4. For operating restrictions:

(a) use of global restrictions, such as a cap on movements or noise quotas;
(b) use of aircraft-specific restrictions, such as the withdrawal of marginally compliant aircraft;
(c) use of partial restrictions, drawing a distinction between daytime measures and night-time measures.

2. Forecast without new measures

2.1. Descriptions of airport developments, if any, already approved and in the pipeline, for example, increased capacity, runway and/or terminal expansion, approach and take-off forecasts, projected future traffic mix and estimated growth and a detailed study of the noise impact on the surrounding area caused by expanding the capacity, runways and terminals and by modifying flight paths and approach and take-off routes.

2.2. In the case of airport capacity extension, the benefits of making that additional capacity available within the wider aviation network and the region.

2.3. A description of the effect on noise climate without further measures, and of those measures already planned to ameliorate the noise impact over the same period.

2.4. Forecast noise contours — including an assessment of the

| 7.2.8 |
| 7.2.10 |
| 7.2.11 |
| 7.2.13 |
| 7.2.14 |
| 7.3.1 |
| 7.4.1 |
number of people likely to be affected by aircraft noise —
distinguishing between established residential areas, newly
constructed or planned residential areas and planned future
residential areas that have already been granted authorisation
by the competent authorities.
2.5. Evaluation of the consequences and possible costs of not
taking action to reduce the impact of increased noise, if it is
expected to occur.

<table>
<thead>
<tr>
<th>3. Assessment of additional measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1. Outline of the additional measures available and an indication of the main reasons for their selection. Description of those measures chosen for further analysis and information on the outcome of the cost-efficiency analysis, in particular the cost of introducing those measures; the number of people expected to benefit and the timeframe; and a ranking of the overall effectiveness of particular measures.</td>
</tr>
<tr>
<td>• 7.2.11</td>
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<tr>
<td>• 7.2.13</td>
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<tr>
<td>• 7.2.17</td>
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<td>• 7.3.1</td>
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<td>• 7.3.2</td>
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<tr>
<td>• 7.3.6</td>
</tr>
<tr>
<td>• 7.4.1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3.2. An overview of the possible environmental and competitive effects of the proposed measures on other airports, operators and other interested parties.</th>
</tr>
</thead>
<tbody>
<tr>
<td>• 7.2.11</td>
</tr>
<tr>
<td>• 7.3.1</td>
</tr>
<tr>
<td>• 7.3.2</td>
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<tr>
<td>• 7.4.1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ANNEX II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment of the cost-effectiveness of noise-related operating restrictions</td>
</tr>
<tr>
<td>• 7.4.1</td>
</tr>
<tr>
<td>• 7.2.8</td>
</tr>
<tr>
<td>• 7.2.13</td>
</tr>
</tbody>
</table>

The cost-effectiveness of envisaged noise-related operating restrictions will be assessed taking due account of the following  • 7.3.1
elements, to the extent possible, in quantifiable terms:

| (1) the anticipated noise benefit of the envisaged measures, now and in the future; | • 7.2.8  
|                                                                             | • 7.2.11  |
| (2) the safety of aviation operations, including third-party risks;            | • 7.2.10  |
| (3) the capacity of the airport;                                             | • 7.2.8   |
| (4) any effects on the European aviation network.                            |           |

In addition, competent authorities may take due account of the following factors:

(1) the health and safety of local residents living in the vicinity of the airport;

(2) environmental sustainability, including interdependencies between noise and emissions;
(3) any direct, indirect or catalytic employment and economic effects.

**DIRECTIVE 2008/50/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 21 May 2008 on ambient air quality and cleaner air for Europe**

*N.B. The air quality standards do not refer specifically to air traffic. However, as air traffic and any other traffic on the TMA can be considered as a contributing source to LAQ depending on the local requirements – CEM outputs can contribute to air quality plans.*

| • 7.2.8  
| • 7.2.11  
| • 7.2.13  |
REGULATION (EC) No 549/2004 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 10 March 2004 laying down the framework for the creation of the single European sky (the framework Regulation)

Article 1
Objective and scope

1. The objective of the single European sky initiative is to enhance current air traffic safety standards, to contribute to the sustainable development of the air transport system and to improve the overall performance of air traffic management (ATM) and air navigation services (ANS) for general air traffic in Europe, with a view to meeting the requirements of all airspace users. This single European sky shall comprise a coherent pan-European network of routes, network management and air traffic management systems based only on safety, efficiency and technical considerations, for the benefit of all airspace users. In pursuit of this objective, this Regulation establishes a harmonised regulatory framework for the creation of the single European sky.


ANNEX II - ESSENTIAL REQUIREMENTS

Part A: General requirements

2. Support for New concepts of operations

‘The EATMN, its systems and their constituents shall support, on a coordinated basis, new agreed and validated concepts of operation that improve the quality, sustainability and effectiveness of air navigation services, in particular in terms of safety and capacity…'

5. Environmental constraints

• 7.2.8
Systems and operations of the EATMN shall take into account the need to minimise environmental impact in accordance with Community legislation.

<table>
<thead>
<tr>
<th>Clause</th>
<th>Description</th>
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**DIRECTIVE 2001/81/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 October 2001 on national emission ceilings for certain atmospheric pollutants**

**Article 2**

**Scope**

This Directive covers emissions in the territory of the Member States and their exclusive economic zones from all sources of the pollutants referred to in Article 4 which arise as a result of human activities.

**Article 3**

**Definitions**

For the purposes of this Directive:

(g) landing and take-off cycle. means a cycle represented by the following time in each operating mode: approach 4.0 minutes; taxi/ground idle 26.0 minutes, take-off 0.7 minutes; climb 2.2 minutes; Emission inventories and projections

1. Member States shall prepare and annually update national emission inventories and emission projections for 2010 for the pollutants referred to in Article 4.

**Article 8**

**Reports by the Member States**

1. Member States shall each year, by 31 December at the latest, report their national emission inventories and their emission projections for 2010 established in accordance with Article 7 to the Commission and the European Environment

**N.B.** CEM can help to support stakeholders at airports with their reporting obligations under this directive

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<td><strong>Whereas:</strong> (9) EMAS should be made available to all organisations, in and outside the Community, whose activities have an environmental impact. EMAS should provide a means for those organisations to manage that impact and to improve their overall environmental performance</td>
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<td>N.B. CEM formalises working arrangements that could support an airport which is already part of the EMAS scheme or wishes to become registered. A CEM working arrangement can facilitate the involvement of the relevant stakeholders in order for the airport to fulfil its obligations and contribute to its continual environmental performance improvements and reporting requirements.</td>
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<td>A Community eco-management and audit scheme, hereinafter referred to as 'EMAS', is hereby established, allowing voluntary participation by organisations located inside or outside the Community.</td>
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<td>The objective of EMAS, as an important instrument of the Sustainable Consumption and Production and Sustainable Industrial Policy Action Plan, is to promote continuous improvements in the environmental performance of organisations by the establishment and implementation of environmental management systems by organisations, the systematic, objective and periodic evaluation of the performance of such systems, the provision of information on environmental performance, an open dialogue with the public and other interested parties and the active involvement of employees in</td>
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organisations and appropriate training

**Article 2**

**Definitions**

For the purposes of this Regulation the following definitions shall apply:

2. ‘environmental performance’ means the measurable results of an organisation’s management of its environmental aspects;
ANNEX C - EXAMPLES OF COLLABORATION AT AIRPORTS AMONG CORE OPERATIONAL STAKEHOLDERS

The following case studies demonstrate real life active collaboration between the core operational stakeholders at airports in tackling their environmental challenges. These examples clearly show the feasibility and benefits of implementing collaborative working arrangements. In addition, sharing experience and good practise between airports can enhance existing working arrangements and/or provide practical guidance for establishing new ones. These and future case studies will be made available online.

C.1 Vienna: Relations with External Partners

Vienna Airport has had a Mediation Forum since 2000. The Mediation Forum was one of the outcomes of the Master Plan 2015 published in 1998 calling for the development of Vienna Airport to meet increasing future traffic needs. One of the needs identified was the addition of a third runway.

In the Forum the following parties take part in discussions about possible improvements to the environmental situation and the future development of the airport and its surroundings.

- ATC
- Austrian Airlines
- Vienna Airport
- Mayors of the surrounding communities
- Politicians from different parties
- Association of NGOs

In addition to this, ATC-OPS meetings are held on a regular basis with ATC, Airlines, Airport and the Ministry of Transport where mainly practical operational questions are discussed. These meetings can also be used to negotiate environmental matters. Other meetings are held with airlines as customers of the airport.

Vienna Airport founded its Dialog Forum in 2005 as an outcome of the Mediation Forum created in 2000. Within this Forum there is the opportunity to discuss issues of concern with neighbouring communities, political parties and NGOs together with ATC and Airlines. Other issues such as possible improvements of the environmental situation and the future development of the airport are also raised. For example, the construction of the third runway and its aftermath will be on the agenda.

Benefits from the Dialog Forum can be seen in the acceptance of the airport and its future development plans by the surrounding communities and local authorities. Each complaint from residents is now brought forward to the relevant working group in such a way that the complainant gets an answer to his/her concerns. Mitigation is possible, as the relevant stakeholders are at the table and decide on measures which can be taken to improve the situation.

In Austria land use planning authorities are not obliged to take aircraft noise zones into account. However, Vienna Airport has been proactive in making contacts with this authority thus avoiding development of populated areas in the surroundings of the airport. In addition, there is now a contract with the surrounding authorities that they do not create new housing areas within certain noise contours.
C.2 Manchester: Operational Improvements facilitated by Collaborative Environmental Management

Manchester is the UK’s third largest airport, in 2017 it handled 27.6 million passengers travelling on nearly 204,000 flights. Over 23,000 people are employed on site, contributing over £1.4bn GVA to the UK economy. Manchester is the only UK airport to have both two full length runways and significant spare capacity, with the ability to match the demand for aviation growth in the UK. For its size, Manchester is unique in that it has no single dominant airline customer – instead, over seventy airlines operate to more than 210 destinations – meaning the airport hosts an incredibly diverse range of aircraft types, from small regional aircraft to Emirates’ six daily A380 movements.

Manchester Airport has a long history of collaborative approaches to environmental management and stakeholder engagement, predating even the development of their second runway which opened in 2001. Manchester was therefore a natural partner to EUROCONTROL in developing the initial Specification for Collaborative Environmental Management (CEM), and the first UK airport to implement a CEM working arrangement.

The airport implemented CEM through the creation of its CEM Group in 2010. The Group meets four times a year and includes representatives from airlines, air traffic control providers, the airport company and other organisations relevant to the meeting agenda – for example handling agents. The CEM Group works successfully alongside a range of pre-existing platforms, with which it exchanges information, views and opinions, including the:

- Airport Consultative Committee, and Technical Advisory Group
- Flight Operations Safety Committee
- Airline Operators Committee
- Environmental Health Officer’s Working Group

CEM has, alongside Manchester’s other collaboration platforms, supported the development and implementation of mitigation programmes included in the airport’s Sustainable Development Plan, Noise Action Plan and Night Noise Policy. Examples include:

- Improvements to aircraft track keeping by departing aircraft and the implementation of continuous descent approaches for arriving aircraft, reducing noise impacts and emissions;
- The development of procedures and type approvals for reduced engine taxiing, including live runway crossings, reducing taxi emissions by up to 40%;
- Enabling and promoting the use of zero-carbon renewable electricity to cut noise and emissions from parked aircraft through us use of ‘FEGP’.

The CEM working arrangement at Manchester provides value to both the airport and its customer airlines. In doing this, and supported by other engagement forums, the airport has a thorough understanding of the context of its organisation and the needs and expectations of its stakeholders thus underpinning the airport’s Environmental Management System and fulfilling the requirements of ISO14001 [35].

CEM also supports continual improvement, another key requirement of Environmental Management Systems, both in terms of improved performance and the introduction of innovative solutions. To illustrate, topics covered within CEM have been as diverse as to support the introduction of the UK’s first LED runway and high-mast apron lighting, confirming the safety benefits of new types of lighting which reduced energy use by over 70%. By maintaining this fresh outlook, Manchester is currently enjoying significant growth – and investing £1bn in a Transformation Programme that will support the business as a high performing airport in the years to come.
C.3 Stockholm: Arlanda – Bromma - Green Approaches & Noise Reduction Initiatives

Stockholm Arlanda: Curved Approaches and reduced charges for quieter aircraft

Sweden’s largest airport Stockholm Arlanda has been working internally in partnership with its core operational stakeholders to look at various ways to reduce aircraft noise; and with local communities to ensure that the least amount of people are disturbed by it. Internally the Swedavia (the airport), airlines and LFV (ANSP) cooperated together in the ‘Green Flights’ project initiated in 2007.

Additionally Stockholm Arlanda also worked using the “Stenvändarprocessen” (Swedish for “the stone turning process”) – an extensive project in which the airport was “turning every stone” to find new ways of reducing noise disturbances from air traffic. Although this project is now closed many measures that were identified are now in use. One example is the yearly updating of the Airports Noise Management Plan.

Lower take-off charges for aircraft with cleaner and quieter engines and the use of green approaches are examples of some of the measures Swedavia and its partners are working with in order to reduce the environmental impact of air traffic. Sweden was one of the first countries in the world to introduce this type of charging. The purpose is to persuade airlines with older planes or old aircraft engines to replace them with more environmentally friendly alternatives. The introduction of green approaches reduces noise, fuel consumption and thus atmospheric emissions.

At the end of March 2010 SAS became the first airline to be granted formal permission by the Swedish Transport Agency to use “curved approaches” with the SAS Boeing 737NG at Stockholm Arlanda’s third runway, 01R. Since early 2006 more than 40,000 Green Approaches have been made and the results show that each approach can save up to 100-150 kg of fuel.

Open dialogue and heightened environmental awareness

In addition to measures aimed at limiting noise, the airport also carries out measurements and test flights as well as programmes aimed at helping air traffic controllers and pilots further increase their environmental awareness. An open dialogue with Stockholm Arlanda’s neighbours is another important element of the process. The airport endeavours to locate its flight paths where the noise will cause the least disturbance to the fewest people possible. The homes most heavily exposed to noise are noise-proofed.

Cooperation with noise abatement associations

Stockholm Arlanda Airport meets representatives of the noise abatement associations in nearby communities such as Upplands Väsby, Sollentuna and Rosersberg several times per year. Outcomes of these meetings have resulted in a number of suggestions for noise-reduction measures, some of which have been implemented or are in the process of being implemented.

Stockholm Bromma – Noise reduction initiatives

Stockholm Bromma Airport works together with the City of Stockholm, County Administration, and the Swedish Transport Administration to define areas where houses can be built with regard to the airport's future noise curves and height restrictions. This work contributes to a better understanding of the needs of the airport and the City of Stockholm. It is expected that the resulting reports which will include information on height restrictions of buildings and the influence of noise will be used by all parties over the coming years to secure both the functioning of the airport and the City of Stockholm’s requirements to build new housing.

The City of Stockholm and the airport are also working together on a specific project, close to the airport; the objective in the first instance is to lower ground noise levels by looking at
the planning of non-residential buildings as shields against noise. Also evaluated will be the effect that the buildings will have on shielding against take-off noise.

Stockholm Bromma Airport is a city airport with a high focus on noise issues. The airport has an approach angle of 3.5 degrees. To evaluate which effect a steeper angle could have on the noise levels a project was introduced including the main airline operators and the ANSP (LFV) at the airport. One part of the project included test flights with an angle of 4.25 degrees. The results were evaluated. However, due to some airlines indicating problems with a steeper approach it was not possible to introduce this at the airport. Nevertheless the project entailed a close and valuable collaboration that involved discussions on other noise reduction activities.

C.4 CDO: ANSP Case Study for CDO Implementation @ EBLG (Liège Airport)

Continuous Descent Operations (CDO) based on vectoring were implemented at Liège Airport on the 7th December of 2017 after almost two years of intensive collaboration between the main stakeholders that were involved in and or impacted by potential operations. The need to put in place a working group based on a CEM model was identified during the CDO kick-off meeting in November 2015 due to the number of stakeholders that are required to coordinate and collaborate in such complex airspace. The EBLG TMA (Terminal Manoeuvring Area) is surrounded by military and low-flying areas. Operations at EBLG are close to Liège City, there are substantial night cargo operations and the Dutch frontier is located nearby making this project even more sensitive.

- The working group based on the CEM model included:
  - Representatives from Liège Airport, (from both the operations and environment domains);
  - Belgocontrol (Belgian ANSP), including Air Traffic Controllers;
  - Airlines flying to/from EBLG (TNT/FEDEX, TUIFly, etc.);
  - SOWAER Environment (responsible for the sustainable growth of both Liège and Charleroi airports);
  - Walloon Public Service (regional authority competent for noise); and
  - ACNAW (authority controlling noise traffic due to operations at Walloon airports) as observers only.

The aim of this collaboration was to identify potential operational benefits of CDO implementation at EBLG airport and to assess the feasibility of CDO operations together with any environmental risks associated to the project and the identification of any appropriate mitigations. Moreover, it aimed to:

- define and validate the CDO implementation plan;
- organise, plan and monitor the CDO implementation trials;
- organise and share training best practices for both ATCOs and pilots;
- discuss and decide any applicable phraseology; and
- approve each key milestone of the CDO implementation process.

Thanks to this collaborative working group and its quarterly meetings, CDO implementation at EBLG is a success. The discussions held within this group have ensured that that the needs and concerns of all involved parties were taken into account throughout the life cycle of the project. For instance, noise aspects were thoroughly discussed during the meetings.
whilst the outcomes of analysis based on modelling or measurements were also shared within the group. Discussions are currently ongoing to formalise this working group into a CEM working arrangement to facilitate further collaborative discussions on sustainable operational improvements.

C.5 Stansted Airport: Collaborative Implementation of Performance Based Navigation (PBN)

Early engagement with local communities and keeping them informed played a key part in the successful implementation and delivery of PBN at Stanstead Airport, as well as strong collaborative support from Airlines, NATS, CAA and its Consultative Committee.

Context

The airspace infrastructure in the United Kingdom (UK) is based on near obsolete ground navigational aids, such as VOR's (VHF Omnidirectional Range). The UK airspace network, which utilises these VOR's, is more than forty years old, meaning that in a significant number of cases the capabilities of the avionics aboard almost all of the modern aircraft operating at London Stansted are not optimised. In the 1950's, the UK air transport network handled 195,000 air traffic movements, 2.1 million passengers and 31,000 tonnes of freight. More recent 2010 data confirmed an exponential growth of 2.002 million air traffic movements carrying 214 million passengers and 2.3 million tonnes of freight. With 2014 data confirming continued growth in excess of 241 million passengers in the UK and no sign of this growth slowing, especially at London Stansted, there is evidence of this aging airspace network being restricted at the busiest times of the day.

The London Airspace Management Plan (LAMP) seeks to address these issues through a redesign of UK airspace into a Performance Based Navigation (PBN) environment. The benefits of this approach allows for increased airspace capacity, safety and performance whilst reducing the overall environmental impacts of aviation. This can be achieved through utilising the navigational capabilities on-board modern aircraft (allowing reduced separation and increasing throughput), direct routing, and time-based separation to name but a few.

At London Stansted this collaborative process is already underway, the Civil Aviation Authority (CAA) recently announced approval for changes proposed by the National Air Traffic Services (NATS) after a consultation in 2014, called LAMP phase1A. Daytime departures that head towards Dover were usually held level at under 7,000ft until they crossed the Thames estuary, to maintain vertical separation from Heathrow and London City arrivals. Now they will depart on the Clacton route to the east, to join a new air route from Clacton to Dover. This is indeed 8 nautical miles further, however, the initial climb rate when departing to Clacton and then turning to Dover reduces fuel burn by 130+kgs and CO₂ emissions by nearly .5 tonne per departure.

Summer 2015 also saw Stanstead Airport conduct a twelve week public consultation to implement two Required Navigation Performance of 1 Nautical Mile (RNP1) departure routes. These RNP1 Standard Instrument Departures (SID's) replicated existing routes to within 340 metres. These two RNP1 SID's trialled since May 2013 have been welcomed by the local communities, the airport consultative committee and local, parish and district councils as they significantly reduce the numbers of people overflown and exposed to aircraft noise.

Collaborative Solutions

This project was originally developed following community concerns from residents living directly beneath the runway 22 Clacton departure route in Hatfield Heath and in response to growing community annoyance that was making regional news channels. Although well within the departure swathe, this location was to the south of the conventional SID. The traditional SID's, based on old ground navigational aids such as VOR's, were interpreted by
database encoders who each programed an aircraft’s flight management system. This caused a wide spread of departure tracks, especially around the tight turns at Stansted Airport, as each aircraft type has limitations relating to bank angle, speed and the effects of wind speed and direction. Results were aircraft drifting across and over this location as it was mid-way through a low-level turn. The request of the local residents was “We will be happy if aircraft follow the centre line of the SID as closely as possible” and this would then avoid the direct overflight of this community.

The CAA was approached by a member of Stanstead Airport's Consultative Committee, to request their support in “resolving” the problem.

The RNP1 trial developed from this initial meeting in 2012 where the CAA suggested designing an RNP1 SID. RNP1 concentrates the aircraft much nearer the designed route, reducing the numbers of people overflown, by utilising the latest navigational capabilities of modern aircraft which auto corrects the aircraft back onto the desired track irrespective of aircraft type or wind speed and direction.

This trial introduced new technology to both Stanstead Airport and the CAA. Previously, there were no RNP1 SIDs in the UK, therefore the approach was cautious, keeping the local community informed of progress and managing their expectations in terms of timescales. The Airport requested that the CAA design RNP1 “to really test it” on their runway 04 Detling departure route as this was most problematic for departing aircraft with an initial turn point at 0.8DME and a tight wrap around turn.

The trial started with a single operator to test the design and was gradually expanded to other operators who had RNP1 equipped fleets. In parallel the Stanstead Consultative Committee and local communities were kept informed.

Subsequently a formal request was submitted for a formal airspace change proposal to make the RNP1 SIDs a permanent option in 2016; this was fully published in August 2017. The percentage of RNP1 utilisation is now over 90% and continues to grow.

This technology has proved very successful at London Stansted, the trial data so far and the consultation material can be found at: [http://www.stanstedairport.com/community/local-environmental-impacts/performance-based-navigation/](http://www.stanstedairport.com/community/local-environmental-impacts/performance-based-navigation/)

**Key messages**

Over the next few years, Stanstead Airport intends to implement this technology on the other four out of six departure routes. This will ensure that they are well ahead of EU obligations relating to the Single European Sky initiative - Pilot Common Project [6].

In addition, the Airport has also developed, with its Consultative Committee a reporting metric that exceeds the design criteria of RNP1, monitoring the aircraft departure tracks within a +/- 500m swathe rather than the traditional +/- 1,500m swathe. The community of Hatfield Heath, as demonstrated in the maps below, is no longer underneath the new reporting swathe.

![Figure 3: Runway 04 DETLING conventional and RNP1 SID performance](image)
Figure 4: Runway 22 CLACTON conventional and RNP1 SID performance

Figure 5: Reduction in population numbers overflown following the implementation of PBN

Figure 5 Up to 4,000ft, where aircraft can be vectored onto a more direct heading by ATC, the number of people overflown reduces from 5,000 to just 700 on these two RNP1 SID’s alone.

The RNP1 SID design allows Stansted to ‘thread the needle’ when thinking about future development of this technology, providing the ability to avoid the overflight of the larger communities surrounding the airport whilst enabling the further reduction of noise impact. Early engagement with local communities and keeping them informed played a key part of delivery as well as well as strong collaborative support from Airlines, NATS, CAA and Stanstead’s Consultative Committee.
C.6 Thomas Cook Airlines: Operational Improvements

One of the earliest outcomes emanating from a CEM Working Arrangement, at Manchester Airport, was the Thomas Cook Airline’s “Optimum Flight” project in conjunction with the UK Sustainable Aviation Group. This project was implemented in April 2013, when the first benchmark and optimised flights were flown from EGCC (MAN) to GCRR (ACE) using an A320. The project’s objectives were:

- to measure the operational efficiency of the airline and the environment that it operates in;
- to ensure operations are achieving the optimum level of performance possible; and
- to investigate potential avenues for greater operational efficiencies for routine operations.

The “Optimum Flight” project involved close collaboration and communication between Thomas Cook Airlines, Airbus, NATS, MAG and French, Spanish, Portuguese and Moroccan ANSPs, EUROCONTROL’s Single Sky and Network Manager Directorates and the UK’s Sustainable Aviation Group.

One of the most significant outcomes from the “Optimum Flight” project was the relationships established and, a working arrangement that allowed Thomas Cook Airlines to discuss with all the relevant parties issues such as the use of airspace that has an impact upon the most efficient flight paths. Although Thomas Cook Airlines does not have the ability to directly influence airspace changes, CEM has provided a framework and relationship gateway to draw stakeholders’ attention to what kind of changes, at a local level, could make a difference to operators and authorities and, in the end benefit air transport consumers and the environment.

More specifically Thomas Cook Airlines has had success when working with a National Authority in redesigning an approach into an airport with significant terrain and safety concerns. The new approach funded by the authority gave a safer approach course with a lower decision height that has more certainty about making a successful approach. The safety and environmental impact of this new airport approach means there is a reduced probability of having to make a go-around due to low cloud, it is on a safer trajectory and there is a reduced fuel burn and associated noise burden due to more safer and successful approaches.

The aviation sector should be embracing current navigation technology; the system accuracy is much greater than before making it possible to design safer and more efficient approaches than in the past. In addition, there are other secondary benefits such as being able to avoid overflying certain areas if they are noise sensitive.

Participating in CEM allows participants to create a different type of discussion with stakeholders as it encompasses all areas. CEM also allows everyone to think a little more outside of the box on what the future of aviation will look like and address emerging issues.

When Thomas Cook Airlines talks about the future, it views CEM as a process that can help to refine vision to what is feasible and acceptable. In terms of improving flight efficiency, CEM provides a forum, a multi-discipline team across industry, bringing people to the table who may not have been considered as having a contribution because their areas of responsibility or influence are unknown.

Sharing information, understanding and creating awareness whilst passing on knowledge are one of the keystones of the CEM approach. In this context, Thomas Cook Airlines was the first airline in the UK to have a Required Navigation Performance approach (RNP AR) capability, giving it the opportunity to fly curved descending approaches to a tolerance of 0.1 Nautical Miles (NM). The first curved descent approach into Innsbruck has already taken place. This is the future for Thomas Cook Airlines, the ability to fly more safely and more
efficiently because of changes in technology and training.

Thomas Cook Airlines have made these changes to meet internal imperatives and are happy to share these improved operational practises with other stakeholders. An additional benefit is seen as having someone else at the table bringing their experiences of topics not yet on the agenda, sharing the challenges, solutions and potential performance improvements.

C.7 European Business Aviation Association (EBAA) and CEM

The publication of the Business Aviation Commitment on Climate Change (BACCC) [32] in 2009 highlighted the seriousness with which Business Aviation takes its environmental responsibilities. The three goals are:

- to achieve carbon neutral growth by 2020;
- to reduce total CO₂ emissions of 50% by 2050 relative to 2005; and
- an improvement in fuel efficiency of an average of 2% per year from 2009 until 2020.

These goals will be achieved through four key pillars: technology, infrastructure and operational improvements, alternative fuels, and market-based measures.

Business Aviation considers the EUROCONTROL Collaborative Environmental Management (CEM) approach, through providing a facilitative platform for discussion, whereby all relevant stakeholders can support the search for solutions that ensure the maximum potential for operations, as particularly helpful in achieving its goals within the BACCC in two of its four pillars: operations and infrastructure.

The business community thus recognises the value of CEM in achieving its goals and as another valuable mechanism that will contribute to reducing the sectors overall environmental impact.
ANNEX D - IMPLEMENTATION SUPPORT

D.1 Models, Tools, Concepts & Training
There are many private, industry and regulatory initiatives available that can support operational stakeholders in their efforts to deal with environmental challenges in and around their airport(s). The most appropriate mitigation solution or joint initiative will vary depending on local imperatives.

The following section offers an overview and descriptive of several EUROCONTROL models and tools that can be used to support and facilitate CEM Working Arrangement initiatives and outcomes.

To further support our stakeholders, information on these models, tools, training and access rights is available on EUROCONTROL’s environment webpage:

http://www.eurocontrol.int/environment

D.2 CEM Online
An implementation tool for airport stakeholders who may need more structured support. This web-based tool, tested and validated by a users’ group, provides a platform that facilitates Airport Operators, ANSPs and Aircraft Operators in establishing a CEM working arrangement.

CEM Online guides users through the process of setting up a CEM working arrangement. Each stakeholder can access a secure workspace to share information as well as document needs and actions under the Specification’s requirements. Functionalities include a dashboard option that indicates compliance levels and monitors progress. Request for access is available here: http://www.eurocontrol.int/collaborative-environmental-management-cem

CEM Online can support users’ needs to provide evidence for example to fulfil voluntary carbon-reduction programme criteria, or comply with environmental certification and environmental reporting requirements by the downloading of reports.

Note: CEM Online can be used to assess to what extent the current working arrangement at an airport already maps to the requirements as set out in Section 7: CEM Protocol Alternatively it can be used to make a gap analysis or serve as a blueprint for setting up CEM working arrangements.

D.3 Environmental Impact Assessment Models
The EURCONTROL website http://www.eurocontrol.int/environment should be consulted for up-to-date details of the environmental impact modelling capabilities that EUROCONTROL offers. At the time of publication, this covered:

D.3.1 Aircraft Assignment Tool (AAT)
The Aircraft Assignment Tool (AAT) is a fleet and operations forecasting model jointly developed by EUROCONTROL, the European Commission and the European Aviation Safety Agency (EASA). The tool converts an aggregated demand forecast into detailed operations by aircraft type and airport pair for a given future year and scenario.

D.3.2 Open-ALAQS
Open-ALAQS is an application that provides the functionality to build a four-dimensional airport emissions inventory in which emissions from various fixed and mobile sources are
aggregated and then displayed for analysis. Once the emissions inventory is established, the
dispersion model, AUSTAL2000, can be used to calculate pollutant concentrations at and
around the airport throughout a day. Open-ALAQS is compatible with legislative
requirements for estimating 8-hour, 24-hour and annual average pollutant concentration
values.

Open-ALAQS is based on Quantum GIS (QGIS), a user-friendly open-source geographic
information system (GIS). This technical choice offers future Open-ALAQS users the
possibility of conducting local air quality studies without having to invest first in a proprietary
GIS solution. By making Open-ALAQS openly available, EUROCONTROL wishes to foster
the development of a community of experts around airport local air quality issues for the
benefit of the entire aviation community and the European citizens.

D.3.3 IMPACT
IMPACT is a web application for assessing the impact of civil aviation on the environment in
terms of noise and gaseous/particulate emissions. IMPACT is one of the approved models
for conducting assessments for the Modelling and Database Group (MDG) of the ICAO
Committee on Aviation Environmental Protection (CAEP), both for fuel/emissions and noise.

It is compliant with the ECAC Doc 29 [33] method for computing noise contours around
airports and relies on the EUROCONTROL Advanced Emission Model, which is also an
approved CAEP MDG model, for calculating emissions from fuel burn. IMPACT can be used
to generate noise maps according to widely-recognised metrics such as $L_{eq}$, $L_{den}$, $L_{max}$,
and $SEL$, and offers the user the possibility to derive his own noise metrics from these. It
also calculates the area of each noise contour and the population exposed to the associated
noise level.

IMPACT can be used also to estimate the amount of fuel burn and the masses of 25
gaseous and particulate emissions produced when burning that fuel on each segment of the
aircraft trajectory, among which carbon dioxide ($CO_2$), water vapour ($H_2O$), the oxides of
nitrogen ($NO_x$) and sulphur ($SO_x$), unburnt hydrocarbons ($HC$), carbon monoxide ($CO$),
volatile organic compounds ($VOCs$), and other organic gases ($OGs$).

D.4 Environmental Impact Assessment Tools

V-PAT (Vertical Profile Analysis Tool)

V-PAT) is a tool, developed under SESAR, for analysing flight efficiency. V-PAT is able to
analyse radar data but is specifically designed to process different sources of real-time and
historical ADS-B data at a European / Global level.

V-PAT has been used to pre-process ADS-B data to support ICAO analyses on horizontal
flight efficiency however the primary intention of V-PAT is to support vertical flight efficiency
analyses - the methodology within V-PAT allows the user to define the parameters for which
vertical flight efficiency is measured whilst allowing analysis down to the individual route,
airline, aircraft type or airport level.

In addition, V-PAT is used to conduct the specific measurement of CCO / CDO undertaking
in accordance with the harmonised definitions, metrics and parameters identified by the
European CCO / CDO Taskforce (see http://www.eurocontrol.int/articles/continuous-climb-
and-descent-operations).

D.5 Training

The following training gives a high level broad overview of the general issues associated
with the environmental impact of aviation from a unique multi-stakeholder approach; and the
measures that can be taken to improve the sustainability of the aviation business.
**D.5.1 E-learning Modules**

*Introduction to the Environment (ENV-INTRO) – module of 1 hour - under revision and currently not available*

This short ‘Introduction to Environment’ e-learning package aims to give regulatory, operational and non-operational staff a good understanding of the general issues associated with environment and aviation. In addition, specific indications of what actions they can take in their daily work to help mitigate the impact of aviation on the environment are addressed.

*Environment Co-ordinators Training (NMO-E-ENV) – package of various e-learning courses*

Provides an easy to access repository of available ATFCM related online Web Based Training packages suitable for Environment Co-ordinators.

**D.5.2 Classroom Taught Course**

*Environment in Air Traffic Management (ENV-ENV)*

The aim of this taught course is to introduce the environmental implications of air transport and their potential to constrain current operations and future growth.

The role of stakeholders and in particular the ATM community in mitigating these issues are discussed in the context of safety, capacity, costs and performance. Aviation’s future sustainability can only be achieved if these elements are properly balanced both strategically and operationally.

The four-day course is delivered through lectures, workshops, interactive learning, debates and case studies of good practice. The key issues of climate change, noise, greenhouse gas and local air quality emissions are introduced along with methods of measurement, management and mitigation.

Participants who have attended this course will be able to understand:

- the consequences of their day-to-day decisions on the environment;
- the interdependencies with other stakeholders; and
- the measures they can take to minimise (mitigate) environmental impacts whilst ensuring the safe and expeditious handling of air-traffic.

**Access and restrictions:**

All stakeholders and interested parties.

**Further information:**

[https://trainingzone.eurocontrol.int/env-catalogue.htm](https://trainingzone.eurocontrol.int/env-catalogue.htm)
D.6 Concepts and Information Management

D.6.1 SWIM

Description and scope

The goal of SWIM (System Wide Information Management) is to foster the interoperability between European ATM Stakeholders in a networked environment. SWIM consists of standards, infrastructure and governance enabling the management of ATM information and its exchange between qualified parties via interoperable services. SWIM is based on open standards and mainstream technologies. The key building blocks of SWIM are information, information services, service orientation practice and, technical infrastructure.

What does it do?

SWIM is an enabler for the digitalisation of the ATM network. Based on SWIM interoperable information sharing is achieved, which transforms the ATM network into a digital collaborative environment.

Ensuring that an airport’s information, communications and technology infrastructure is SWIM-compliant will enable the core operational stakeholders (airport operators, aircraft operators and air navigation service providers) and, potentially other organisations such as ground handling agents to share relevant information by providing and consuming online standardised ATM information services.

SWIM as an enabler of operational improvements, contributes to improved situational awareness and collaborative decision-making (e.g. through more efficient sharing of aircraft and vehicle movement information). Outcomes can, for example, facilitate a more predictable and optimal use of taxiways, gates, stands and the delivery of service vehicles to aircraft in the right place at the right time.

SWIM, although not a direct contributor to reducing the environmental impact of combined operations at an airport can however improve performance for a given number of air traffic movements. These performance improvements can potentially lead to substantial fuel and emission savings thus reducing the airport’s impact on the environment.

SWIM Specifications

Three EUROCONTROL specifications, for the description of information services, the definition of the exchanged information, and the technical infrastructure technologies are available for SWIM implementers. The specifications form the foundation of SWIM’s information services.

The specifications are available for download at:

https://eurocontrol.int/publications/eurocontrol-specifications-system-wide-information-management-swim

D.6.2 A-CDM

Description and scope

The Airport Collaborative Decision Making (A-CDM) activity integrates procedures, processes and systems aiming at improving the overall efficiency of operations at European airports, particularly focusing on the aircraft turn-round and pre-departure sequencing process. A-CDM means a step forward from “first come, first served” to “best planned, best served”. Any airport regardless of size can implement A-CDM.

What does it do?

A-CDM is about partners - airport operators, aircraft operators, ground handlers, air traffic control, local flow management cells and the Network Manager - working together more efficiently and transparently by sharing information beneficial to each other.
Working in this way allows for better decision making, based on more accurate and timely information, with all airport partners having the same operational picture. This enables more efficient use of resources at airports.

Better predictability in the departure process can lead to less congestion on the apron and taxiways, resulting in reduced taxi times and queues at the runway. This translates into reduced fuel burn during taxi and runway holding, which has both economic and environmental benefits. It also helps to unlock capacity in the en-route network as better predictability has the potential of reducing buffers.

The benefits are visible at a network level, with more accurate take-off information feeding into the air traffic flow and capacity management system run by EUROCONTROL’s Network Manager, allowing the ATM Network to run more fluently. The Network Manager is able to manage the available Network capacity more efficiently, meaning more effective use of ATFM slots resulting in reduced delays. Airports also benefit from more accurate arrival information improving their efficiency in the resource allocation.

Further information on A-CDM and related support by the EUROCONTROL Network Manager can be found on:
http://www.eurocontrol.int/articles/airport-collaborative-decision-making-cdm or by contacting the EUROCONTROL A-CDM team at airport-cdm@eurocontrol.int
ANNEX E - SPECIFICATION UPDATE PROCEDURES

It is necessary to periodically check this EUROCONTROL Specification for consistency with referenced material, notably relevant Regulations. The Specification is also expected to evolve following real project and field experience.

The main objectives of a regular review are:

a) to improve the quality of the requirements (e.g. clarity, testability, etc.);
b) to verify that the level of detail published is adequate;
c) to ensure that the regulatory framework is properly reflected; and
d) to make all stakeholders aware of the latest developments.

The update process for this EUROCONTROL Specification may be summarised as follows:

Stakeholders may provide change proposals either through existing working arrangements (e.g. established working groups) or by sending a formal Change Request (CR) to the generic email address: standardisation@eurocontrol.int

The CR needs to provide following minimum elements:

- Originator information (name, Organisation, contact details);
- Specification title, number and edition date;
- Page, chapter, section (sub-section) where the issue appears;
- Description of the issue and reason for change; and
- Specific change proposal text (incl. potential alternatives, if any).

Main steps towards a revised version:

- Agency (Standardisation Unit) will assess each CR in coordination with content owners, classify the urgency and establish the CR impact category (major, minor or editorial);
- Agency will then prepare resolution proposal(s) and, if needed, discuss those with the originator and/or relevant working arrangements. Note: CR will be grouped into “change packages” to consider reasonable update cycles;
- Agreed changes will be integrated into a revised version “Proposed Issue” including a summarised list of changes; and
- Consultation will be performed in accordance with the CR impact category identified:
  - Major changes require full formal stakeholder consultation;
  - Minor changes need consultation at working layers (e.g. working group or Team); and
  - Editorial changes may be implemented directly at any stage though grouped with change packages.

Note: Identified errors which may cause potential problems when implementing, may be corrected directly via separate “Corrigendum”.

The Agency will apply this process in an objective and impartial way and will consult stakeholders as needed and in line with the formal Standards Development Process.
### ANNEX F – AMENDMENTS TO THE SPECIFICATION

Amendments applied in comparison to Edition 1.0.

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
<th>Change proposal</th>
<th>Reason, Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>all</td>
<td>Revised document configuration pages incl. headers and footers</td>
<td>-</td>
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<tr>
<td>General</td>
<td>13, 17, 21</td>
<td>Added recognition of existing working arrangements</td>
<td>Request from operational stakeholders to take into account existing working arrangement which could serve as a basis for CEM implementation</td>
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<tr>
<td>General</td>
<td>13, 18</td>
<td>Included other external stakeholders as part of core operational stakeholders and airspace design</td>
<td>Depending on local circumstances, other external stakeholders may be part of a CEM Working arrangement</td>
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<td>10, 18, 21</td>
<td>Included climate change related issues</td>
<td>This topic has now been recognised as having a significant operational and financial impact on the aviation sector</td>
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<td>4.3</td>
<td>16</td>
<td>Added NADPs</td>
<td>The benefit of optimising NADPs in the trade-offs between fuel and noise is of significant relevance both to the airport and surrounding communities.</td>
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<td>7.2.6</td>
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<td>Changed to recommended practise</td>
<td>Previous wording was considered too prescriptive especially if suitable working arrangements already exist</td>
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<td>7.2.12</td>
<td>23</td>
<td>Removed and replaced by note and reference to Annex D</td>
<td>Annex D provides a selection of models and tools that may facilitate solutions to environmental impacts</td>
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<tr>
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<td>This topic is already covered under 7.2.17</td>
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<td>This topic is already covered under 7.2.8</td>
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<td>Change</td>
<td>Reason</td>
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<td>Changed to optional element</td>
<td>Previous wording was considered too prescriptive changed to reflect local needs context</td>
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<td>Reflects removal of 7.3.3</td>
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<td>Annex D</td>
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<td>Annex E</td>
<td>Added Annex on Specification Update procedure</td>
<td>Revised Specification Update Procedure</td>
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<td>Annex F</td>
<td>Added Annex on Specification Amendments listing changes from edition 1.0 to edition 1.1</td>
<td>To communicate latest main specification amendments</td>
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