

Doc 10031



Guidance on Environmental Assessment of Proposed Air Traffic Management Operational Changes

Approved by the Secretary General
and published under his authority

First Edition — 2014

International Civil Aviation Organization

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AMENDMENTS

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RECORD OF AMENDMENTS, CORRIGENDA AND ADDENDA

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FOREWORD

This manual covers an evolving area of knowledge and represents currently available information that is sufficiently well-established to warrant inclusion in international guidance. This first edition of the guidance manual includes chapters on purpose, context, scope and approach.

It is intended that the manual be kept up to date. Future editions will most likely be improved on the basis of experience gained and of comments and suggestions received from users of this manual. Therefore readers are invited to send their views, comments and suggestions on this edition, in writing to:

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TABLE OF CONTENTS

	<i>Page</i>
Glossary	(ix)
Definitions	(xiii)
References	(xv)
Chapter 1. Introduction	1-1
1.1 Purpose	1-1
1.2 Context	1-1
1.3 Scope of the document.....	1-1
Chapter 2. Preparation for Conducting an Environmental Assessment	2-1
2.1 Introduction.....	2-1
2.2 Criteria for triggering a formal assessment.....	2-3
2.3 Regulatory compliance	2-4
2.4 Environmental parameters and assessment methodologies	2-4
2.5 Documentation, communication and reporting	2-7
Chapter 3. Environmental Assessment Steps	3-1
3.1 Introduction.....	3-1
3.2 Describe proposed change, purpose and alternatives	3-1
3.3 Determine scope and extent of assessment required	3-3
3.4 Conduct an environmental assessment.....	3-6
3.5 Final documentation, communication and reporting	3-8
Chapter 4. Interdependencies and trade-offs	4-1
4.1 Introduction.....	4-1
4.2 Interdependency examples	4-2
4.3 Environmental interdependencies	4-2
4.4 Non-environmental interdependencies.....	4-3
4.5 Example approaches for managing trade-offs.....	4-3
Chapter 5. Conclusion	5-1
Appendix A. Examples of formal requirements and guidance for environmental assessments	App A-1
Appendix B. Assessment methodologies and key environmental parameters	App B-1
Appendix C. Avoiding common mistakes made in assessments	App C-1

	Page
Appendix D. Assessment examples	App D-1
Appendix E. Template for good practice examples of environmental assessment	App E-1

GLOSSARY

SYMBOLS AND UNITS

Distance:

ft	foot, or feet
nm	nautical mile
m	metre
µm	micrometre (1/1 000 000 of a metre)

Noise:

dB	decibel – see Appendix B for additional examples
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Mass:

g	gramme
kg	kilogramme (1 000 g)
t	tonne (1 000 000 g)

Volume:

l	litre
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Concentration:

ppb	parts per billion
ppm	parts per million
µg/m ³	microgramme per cubic metre

ABBREVIATIONS

AAL	Above Aerodrome Level
ACC	Area Control Centre
AEDT	Aviation Environmental Design Tool
AEM	Advanced Emissions Model
AGL	Above Ground Level
AIRE	Atlantic Interoperability Initiative to Reduce Emissions
ANAC	National Administration of Civil Aviation of Argentina
ANCON2	Aircraft Noise CONtour model, version 2 (UK CAA)
ANSP	Air Navigation Service Provider
ASPIRE	Asia & Pacific Initiative to Reduce Emissions
ATC	Air Traffic Control
ATM	Air Traffic Management
ATFM	Air Traffic Flow Management
CAA	Civil Aviation Authority
CAEP	Committee on Aviation Environmental Protection
CATEX	Categorical Exclusion

CH ₄	Methane
CO	Carbon monoxide
CO ₂	Carbon dioxide
CONOPS	Concept of Operations
DAP	Directorate of Airspace Policy (UK)
DGAC	Direction Générale de l'Aviation Civile (France)
DEFRA	Department for Environment, Food and Rural Affairs (UK)
DfT	Department for Transport (UK)
DME	Distance Measuring Equipment
EA	Environmental Assessment
EASA	European Aviation Safety Agency (Europe)
EC	European Commission
EIS	Environmental Impact Statement
FAA	Federal Aviation Administration (USA)
FAB	Functional Airspace Block
GDP	Gross Domestic Product
GHG	Greenhouse gas
GSA	Geographic Study Area
H ₂ O	Water vapour
HAP	Hazardous Air Pollutant
HC	hydrocarbons or unburned hydrocarbons
ICAO	International Civil Aviation Organization
IFR	Instrument Flight Rules
IFSET	ICAO Fuel Savings Estimation Tool
ILS	Instrument Landing System
INM	Integrated Noise Model (USA FAA)
INSPIRE	Indian Oceanic Strategic Partnership to Reduce Emissions
IPCC	Intergovernmental Panel on Climate Change
MASE	Midwest Airspace Enhancement
MCDM	Multi-Criteria Decision Making
NADP	Noise Abatement Departure Procedure
NEPA	National Environmental Policy Act
N ₂ O	Nitrous oxide
NO	Nitrogen oxide
NO ₂	Nitrogen dioxide
NO _x	Oxides of nitrogen (NO plus NO ₂)
NMHC	Non-methane hydrocarbons
NPR	Noise Preferential Route, or Routeing
PM	ultra-fine Particulate Matter (e.g. PM ₁₀ – ultra-fine particulate matter with mean aerodynamic diameter less than 10 µm; PM _{2.5} – mean aerodynamic diameter less than 2.5 µm)
RNAV	Area navigation
RTS	Real-time Simulation
SAAM	System for traffic Assignment and Analysis at a Macroscopic level
SAE	Society of Automotive Engineers
SES	Single European Sky
SESAR	Single European Sky ATM Research programme
SID	Standard Instrument Departure
SO _x	Oxides of sulphur
STAPES	SysTEM for AirPort noise Exposure Studies (Europe)
STAR	Standard Terminal Arrival
SVFR	Special Visual Flight Rules
TMA	Terminal Control Area

VFR	Visual Flight Rules
VOC	Volatile Organic Compounds
VOR	Very High Frequency Omnidirectional Range

DEFINITIONS

Action Plans:

Action Plans Action plans are a practical means for States to communicate to ICAO information on their activities to address CO₂ emissions from international civil aviation. The level of detail of the information contained in an action plan demonstrates the effectiveness of actions and will ultimately enable ICAO to measure global progress towards meeting the goals set by Assembly Resolution A37-19.

Airspace:

Class A Restricted airspace where all operations must be conducted under IFR or SVFR. All aircraft are subject to ATC clearance. All flights are separated from each other by ATC.

Class B Airspace where operations may be conducted under IFR or SVFR or VFR. All aircraft are subject to ATC clearance. All flights are separated from each other by ATC.

Class C Airspace where operations may be conducted under IFR or SVFR or VFR. Entering Class C airspace only requires radio contact with the controlling air traffic authority, though an ATC clearance will ultimately be required.

Assessments:

Absolute An assessment that evaluates all environmental parameters across all phases of flight and then compares the output to predefined acceptability criteria.

Relative An assessment that evaluates all environmental parameters across applicable phases of flight and then compares the output to the environmental parameters for an operation that is performed without the proposed change.

Fit for purpose In the context of this document, this relates to the fact that any assessment should be suitable for its intended purpose, i.e. it does what it was designed to do.

Emissions certification:

EI Emissions Index. Determined during the emissions certification of aircraft engines to ICAO Annex 16 — *Environmental Protection*, Volume II — *Aircraft Engine Emissions*, and expressed in terms of grammes of pollutant emitted per kilogramme of fuel burnt.

LTO Landing-Take-Off cycle. For emissions certification purposes, ICAO has defined a specific reference LTO cycle below a height of 3 000 ft (915 m) AGL, in conjunction with its internationally agreed certification test, measurement procedures and limits (see Annex 16, Volume II, for additional information). The departure and arrival phases of an actual operational flight cycle for a commercial aircraft are more complex than the four modal phases (i.e. approach, taxi/idle, take-off and climb) used for ICAO certification purposes. Actual cycles employ various aircraft engine thrust settings, and the times at those settings are affected by factors such as aircraft type, airport and runway layout characteristics, and local meteorological conditions.

Heights:

Height The distance above a defined datum, normally ground level.

Altitude The height above a datum defined by an atmospheric pressure of 1 013.25 mB.

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Chapter 1

INTRODUCTION

1.1 PURPOSE

The purpose of this document is to provide States, airport operators, air navigation service providers (ANSPs) and other stakeholders with environmental assessment guidance to support sound and informed decision making when analysing proposed air traffic management (ATM) operational changes. High-level principles related to the quantification of changes in aviation-related environmental impacts associated with air navigation service changes are collected in order to ensure a consistent approach to the analysis of the changes, while minimizing the risk of common assessment errors. This provides a framework within which specific, detailed assessment methodologies can be developed that meet local requirements, while facilitating global compatibility of results. It is also intended to assist with recognizing any environmental benefits associated with operational changes. While the guidance is intended to be applied broadly, it also highlights areas of priority that may need to be considered at the local level.

1.2 CONTEXT

This guidance manual was requested by ICAO Member States through the Committee on Aviation Environmental Protection (CAEP) in response to a growing need to measure in a globally harmonized and compatible way the environmental impacts associated with ATM operational changes. The high-level principles described in this document were extracted from the environmental assessment best practices of air navigation service providers, State governments and other advisory bodies. These high-level principles are not intended to override existing or future State-specific guidance, but can be used to support their development, or evolution.

1.3 SCOPE OF THE DOCUMENT

1.3.1 This guidance identifies high-level principles that facilitate the robust definition and application of specific assessment approaches, methodologies and their respective metrics. The focus of these principles is on changes that relate to aircraft and ATM operational initiatives and may involve all phases of flight (e.g. Gate-to-Gate). The general principles of this guidance can be applicable to air navigation aspects arising from infrastructure proposals and major changes to airspace capacity or throughput, as well as operational changes. While the boundaries of an air navigation services environmental analysis are based on the needs of the study, for the purposes of this guidance material “air navigation services environmental assessment” is to be interpreted in the broadest possible sense and refers to impacts arising from changes to where, when, and how aircraft are operated.

1.3.2 These principles could support the development of environmental “Action Plans”, which can be used to report the environmental benefits expected from the implementation of the elements or modules outlined: in the ICAO Global Air Navigation Plan, States action plans on emissions reduction, or be used to further support changes that allow aviation to become more sustainable. They can also apply to the assessment of specific operational changes.

1.3.3 This guidance material has been developed to be applicable worldwide with no specific geographic restrictions. It is focused on assessments of environmental impacts related to operational procedural changes, airspace redesigns and other similar operational aspects. Therefore, additional guidance should be consulted for the assessment of other types of changes that do not deliver operational change, such as those related to aircraft technologies and fuels. Similarly, these principles do not cover the direct environmental impacts from facility development or operation (e.g. terminal buildings, airport access). This material is applicable for the assessment of aircraft emissions, fuel consumption and noise.

1.3.4 The principles in this document are high level and intended to be flexible enough to account for State-specific requirements with respect to methodologies and metrics. The information in this document can be used to populate metrics and to support the validation and application of assessment methodologies. This includes helping to determine the types of changes that could be subject to an environmental assessment, criteria for triggering an assessment, and the environmental parameters to be assessed. The principles can also guide the definition of the geographical boundaries of an assessment and the prioritization of environmental aspects that should be assessed based on geographic area and the relative significance of the impacts being considered. The main types of environmental effects of air navigation service changes are listed, and their assessment is described at a high level.

1.3.5 The consideration of trade-offs between various environmental impacts and non-environmental effects is a typical analysis and policy challenge. This high-level material provides guidance on how to recognize these trade-offs, but does not provide detailed recommendations on the in-depth assessment of interdependencies.

1.3.6 This assessment guidance is intended to be used in the planning phase of air navigation service or other operational changes. While many of the principles described could be useful for performance measurement or environmental steering after implementation of changes, these activities are outside the scope of this document.

1.3.7 Many States and organizations have developed detailed descriptions of environmental assessment methods and issues. As this document is limited to the identification of high-level principles, Appendix D provides some examples of related, detailed, assessments.

Chapter 2

PREPARATION FOR CONDUCTING AN ENVIRONMENTAL ASSESSMENT

2.1 INTRODUCTION

2.1.1 When beginning to formulate an environmental assessment plan for a proposal, one of the first important tasks is to determine what environmental regulations apply both in terms of the assessment itself (e.g. consultation obligations) and in terms of the impacts to be assessed (e.g. limit values). In cases where environmental regulations may apply, one should become familiar with their application and compliance requirements. The regulations could range from broad overarching regional/national regulation to very specific city/county/municipal requirements. These regulations may also have specific criteria for the types of documentation required and for the review period for information submitted. These requirements need to be included in planning to avoid the risk of regulation breach or project delay. This initial regulation review may need to be revisited once the scope of the environmental assessment is determined to check for new regulation risks and requirements.

2.1.2 In addition to the above, in many circumstances it may be good practice to conduct an environmental assessment where there is no legislative or regulatory requirement to do so. In particular, while formal legislated triggers may indicate the impacts from a proposal will not be significant, it may be prudent to be conservative and engage with stakeholders even when apparently small impacts are expected. Note that in doing so, it should be recognized that “stakeholders” are not only represented by official bodies or organizations but potentially by environmental groups and political opposition as well.

2.1.3 Assessment preparation typically begins by gathering information on the present situation and the proposal itself, addressing core information such as the following non-exhaustive list of examples:

- a description of the proposal including any options/alternatives to be assessed, with suitable information on any aspects that may change environmental impacts;
- a description of the “do nothing” scenario, which usually provides the “base case” against which the proposal will be compared in order to derive the net¹ impacts of the proposal;
- the core context assumptions for the proposal such as:
 - the proposed date of implementation;
 - the estimated life expectancy for the proposal;
 - the agreed milestone dates at which assessments are required;

1. In the context of this document, “net” refers to the difference in system performance in the base case and the performance of the system after the change has taken effect.

- a description of the key impact influences for the milestone years (movement forecasts, predicted fleet mixes, operational assumptions, etc.) as these will apply to both the base case and proposal case(s); and
- what legislation, regulations or agreements apply.

2.1.4 The scope of the environmental assessment may cover a known geographical area for anticipated local impacts and may also include issues with a wider scope (e.g. comparison to national policy or global greenhouse gas emissions). Typically for the local impacts, surveys of the area of potential impact would be conducted to identify important assets and sites that are relevant to the impacts being assessed including, but not limited, to:

- population distribution;
- tranquil areas;
- schools and hospitals;
- touristic or leisure areas;
- areas of special ecological or historical value; and
- coastal zones.

2.1.5 It will be important to assess the present baseline situation (e.g. level of pre-proposal impacts) for any such areas of interest that are considered to be important for the assessment (e.g. where a significant positive or negative change to impact may be expected). These present-day baseline assessments will often form the basis for the predictive modelling or extrapolation of any “future do-nothing” base cases, against which the proposal may be assessed to determine its net impact.

2.1.6 It is also important to note any existing environmental conditions in order to avoid double counting and to identify areas of special interest, for example, where noise and/or pollution levels are already close to breach of regulation. It is also a good idea at this stage in planning to determine if there are other projects occurring in the same timeframe and geographical or project area. The environmental impacts of other actions may need to be considered, especially if there is a regulatory requirement to look at all actions in a specific area from a cumulative perspective. Some airspace projects may give rise to cross-border impacts (e.g. a proposal in a State may have impacts on a neighbouring State). These projects may require special handling, such as initiating early consultation with affected parties or responsible State authorities.

2.1.7 Gathering this baseline information is beneficial in several different ways. The first is that it aids in planning. For example, if the project area contains a noise-sensitive area, then planning can take that into consideration and it may be possible to avoid the noise-sensitive area during the design of the project. Ultimately determining the net impact of a proposal may require a combination of comparisons, for example:

- where impacts will arise in areas that would otherwise remain free of such impacts, the comparison to the present case will be important. This can allow risk analysis of the likelihood of any possible breaches of environmental regulations or limits;
- where environmental impacts are expected to change significantly with or without the proposal (for example, where growth in movements will be accommodated in the base case), then the true comparison to derive the impact may be between a “future do-nothing case” which represents the base case and a “future with the proposal case”;

- sometimes the comparison of impacts between the base case and the proposal case will be required for a number of milestone years to show the change in the impact differential over time;
- sometimes a combination of the above comparisons will be needed to accurately describe the proposal's change to impacts.

2.1.8 All of this information (assumptions, methodologies used, etc.) should be adequately documented so that it can be substantiated and reproduced by another party, if necessary, to confirm the findings.

2.1.9 Not all environmental assessments are driven by legal requirements. For example, an operationally driven proposal may reduce environmental impacts, enhancing its business case. In addition, some environmental assessments may be performed based on agreements set up with local bodies or neighbourhoods, or as part of flight trials, etc.

2.2 CRITERIA FOR TRIGGERING A FORMAL ASSESSMENT

2.2.1 Operational changes that are expected to result in significant or long-term impacts may be subject to a formal environmental assessment. If the proposed change is likely to result in modification to how, where, when or how many aircraft transit the airspace or airport surface, then an environmental assessment may be required.

2.2.2 The list below contains some examples of significant or long-term changes (which affect the routine practice of operations) that may require environmental assessment:

- new or changed standard instrument departures or arrivals;
- new or changed existing flight paths or routes or use of them due to, for example, implementation of operational assistance tools or equipment that affect the way routes or flight paths are used;
- reclassification of airspace (e.g. from class A to class C);
- a change in normal use of runways (e.g. preferred usage);
- change to aircraft movements by time of day (e.g. changes to curfews or other changes based on ATM service);
- changes to airport infrastructure (e.g. new runways or changes to taxiway configurations);
- development of new airports and associated airspace infrastructure;
- changes that allow different aircraft types or operators to use current procedures/routes/processes.

2.2.3 In addition to specific operational changes that affect the way aircraft are operated, significant changes to traffic numbers will generally also require an environmental assessment.

2.2.4 Short-term changes resulting in temporary modifications to the way aircraft fly or move around may not require a formal environmental assessment. However, consultation with affected parties normally proves to be extremely beneficial in the long term and should include the reasons for the changes and the options for managing the changes. Examples of short-term changes may include runway closures for maintenance, emergency response actions, special single-day events or demonstration flights.