Final Project Report

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Abstract

16.06.03 was responsible for providing SESAR Projects with the best practices/guidelines, tools and metrics for assessing the impact of SESAR operational improvements on the environment. 16.06.03 also supported some of those projects in conducting environmental impact assessments on aircraft noise, fuel efficiency, and local and global emissions. Finally, 16.06.03 was tasked with promoting the use of elements of the "Environment Reference Material" at ICAO CAEP level and in other European and International audiences and working groups

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Intellectual Property Rights (foreground)

This deliverable consists of SJU foreground.

Acronyms

Acronym	Definition
AEM	Advanced Emission Model
AIRE	Atlantic Interoperability Initiative to Reduce Emissions
ANP	Aircraft Noise and Performance database
ATM	Air Traffic Management
BADA	Base of Aircraft Data
CCO	Continuous Climb Operations
CDO	Continuous Descent Operations
CO2	Carbone Dioxide
ICAO	International Civil Aviation Organization
CAEP	Committee on Aviation Environmental Protection
EIA	Environmental Impact Assessment
ERM	Environment Reference Material
SESAR	Single European Sky ATM Research
V-PAT	Vertical Profile Assessment Tool
V&V	Validation and Verification

1 Project Overview

Project 16.06.03, the SESAR ENVIRONMENT SUPPORT AND COORDINATION FUNCTION, has developed a common approach to the conduct of environmental impact assessments in SESAR. This process, captured in a document called Environment Reference Material (ERM), was derived from mapping the process proposed by the ICAO Guidance document (Doc 10031) “Guidance on Environmental Assessment of Proposed Air Traffic Management Operational Changes” onto the SESAR validation framework. It provides guidance at each step of the validation process of a concept and addresses, among other topics, the types of environmental impact that should be assessed, when and how they should be assessed, and the tools available for conducting the assessment. The ERM also contains an appendix describing the assessment of fuel efficiency based on aircraft-derived data from flight trials, one of the main validation techniques used by the SESAR Research and Innovation programme.

The IMPACT tool was developed providing SESAR primary projects with the mean to conduct fuel efficiency, aircraft emissions and noise assessments simultaneously from a web based platform and using the same aircraft performance assumptions. IMPACT successfully passed the Verification & Validation process of the Modelling and Database group of the ICAO Committee on Aviation Environmental Protection. Project 16.06.03 has also ensured the continuous development/maintenance of the aircraft emissions modelling tool AEM for green-house-gas assessment, and the Open-ALAQS tools for local air quality issues. It should be noted that these tools have also been developed to be used in for the research and future deployment phase of SESAR

1.1 Project progress and contribution to the Master Plan

Project 16.06.03 has developed a common approach to the conduct of environmental impact assessments and built a robust suite of environmental impact assessment tools. Project 16.06.03 has contributed to the revision of the ATM Master Plan by providing inputs on the environmental elements that should be considered from the research phase through to the implementation phase of a new operational concept. It has in particular contributed to the reinclusion of local air quality and noise assessment concerns into the Master Plan. Complementary to this, Project 16.06.03 also contributed to the inclusion of noise and local air quality as part of the Performance Framework.

1.2 Project achievements

The main achievements of Project 16.06.03 are:

- Development of a methodology for assessing the potential impacts on the environment (in terms of noise contours, fuel efficiency, and local/global emissions) of SESAR solutions.
- Development of a set of assessments tools based on state-of-the-art environmental impact assessment methodologies: IMPACT (online integrated noise and fuel/emissions assessment); AEM (for local/ global fuel/emissions assessment); Open-ALAQS (for precise airport fuel/emissions estimation and dispersion assessment); and V-PAT (for vertical flight path analysis - CCO and CDO assessments).
- Provision of effective support to SESAR Primary projects in conducting environmental impact assessments.
- Contribution to SESAR 1 Business Case.
- Promotion of SESAR achievements towards more environmentally sustainable air transport.

It is expected that the methodology and tools will continue to be used for the duration of S2020.

1.3 Project Deliverables

The following table presents the relevant deliverables that have been produced by the project.

Reference	Title	Description
16.06.03 - D27	Environment Assessment Process	D27 describes a common approach to the assessment of environmental impacts in SESAR. This approach was derived from mapping the process proposed by the ICAO Guidance document (Doc 10031) "Guidance on Environmental Assessment of Proposed Air Traffic Management Operational Changes" onto the SESAR validation framework. It provides guidance at each step of the validation process of a particular concept and addresses, among other topics, the types of environmental impact that should be assessed, when and how they should be assessed, and the tools available for conducting the assessment. It also contains an appendix dedicated to the assessment of fuel efficiency based on aircraft-derived data from flight trials, one of the main validation techniques used by the SESAR Research and Innovation programme.
16.06.03 - D59	IMPACT v2.1 - Release document	IMPACT is a single modelling platform supporting both aircraft noise and emissions assessments. It is developed by EUROCONTROL in the context of the SESAR Research and Innovation programme and is available through a secure web portal. IMPACT can support studies ranging in size from a single airport up to an entire continent. Based on an extensive reference-data warehouse, it enables consistent trade-off analyses between fuel burn/emissions and noise. IMPACT is already being used for assessments of ICAO environmental policy options and is one of the environmental reference tools in SESAR. For more information or request for accessing IMPACT please contact: impact@eurocontrol.int.
16.06.03 - D63	Open-ALAQ (new PM + 1st Dispersion) - Release document	Open-ALAQS was developed in the context of the SESAR Programme to allow SESAR partners to perform local air quality assessments. This version fully implements the functionalities of the EUROCONTROL local air quality model ALAQS-AV which is one of the models approved for use by the ICAO Committee on Aviation Environmental Protection (CAEP). This new version is based on QGIS v2.12 "Lyon" 64 bits version, and provides improved performances, additional functionalities, and most of all the combination of Open-ALAQS with the German Federal Environmental Agency dispersion model AUSTAL2000. For more information or request for accessing Open-ALAQS please contact: open-alaqs@eurocontrol.int.

16.06.03 - D68	GHG KPIs and metrics Final Set	D68 provides a selection of indicators and metrics to be used in the analysis of fuel burn and GHG emissions from simulations and flight-test trials.
16.06.03 - D69	Noise KPIs and metrics	D69 provides a selection of established and innovative KPIs and metrics to be used in the analysis of noise and annoyance.
16.06.03 - D70	Airport emission KPIs and metrics	D70 provides a selection of KPIs and metrics to be used in the analysis of airport emissions.
16.06.03 - D71	Environmental Trade-Offs and Interdependencies	D71 describes the nature of trade-offs and interdependencies between the two main environmental impacts of aviation - CO2 emissions and noise - and evaluates, through three relevant examples, existing trade-off methods with regard to the context of Air Traffic Management and the SESAR Research and Innovation programme.
16.06.03 - D72	Environmental Regulatory Baseline	D72 provides an overview of European legislation with aviation-environmental relevance. It assesses the potential need for regulatory measures to support the implementation of SESAR operational improvements.
16.06.03 - D73	Reporting and Analysis of Environment-Related Risks	D73 provides an update on the environmental risks which were identified in 16.03.07 D4 “Regulatory and Risk Scenarios” as presenting either knowledge gaps or uncertainties and thus required further monitoring, research or analysis.
16.06.03 - D 76	3D Fuel Consumption Formula	In order to assess fuel impact of airspace designs, D76 provides a methodology that makes intensive use of a 3D fuel consumption formula. It depends on distance, altitude, and also aircraft type if required. The methodology is easy, efficient and less error prone when design modifications mainly consist in modifying routing in 3 dimensions: 2D path and vertical profile. It can be used in combination with more detailed simulations.

1.4 Contribution to Standardisation

Fuel Burn modelling:

An advanced fuel flow calculation method has been developed that combines the ECAC Doc 29 aircraft performance calculation method and Aircraft Noise and Performance (ANP) data to calculate the aircraft trajectory and the BADA 4 Fuel Flow equation and coefficients to calculate fuel flow along the trajectory. Such a modelling method enables robust noise/emissions interdependency assessments. As of June 2016, it is still being presented to different working groups in charge of developing and maintaining modelling standards in the field of aviation environment, and is already considered as a significant modelling improvement.

Noise modelling:

ECAC Doc.29 3rd Edition (and its Doc 9911 equivalent at the ICAO level) is the international standard to model aircraft noise around airports. The noise calculation method described in this document allows producing noise contours for both arrival and departure operations in a consistent manner, notably as it relies on the use of aircraft noise and performance (ANP) data which are available for a large range of commercial aircraft types and are generally derived by manufacturers from aircraft noise certification data.

However, a well-known limitation of the Doc.29 calculation method is related to the noise modelling of approach operations, where airframe noise becomes a major noise source (as opposed to departure operations, where engine noise constitutes the main source): even though the ANP database includes approach-specific reference noise data which include a specific airframe noise component, the Doc.29 calculation method does not allow to account for the variation of the airframe noise component, as a function of the aircraft approach configuration (flaps, gear) and speed.

16.06.03 has developed and implemented in IMPACT an advanced calculation method which fully removes the above-mentioned limitation, based on the use of Multi-Configuration Multi-Speed (MCMS) approach noise data. This method allows robust noise assessments of new approach procedures, especially when speed and flap setting schedules significantly differ from the baseline procedures.

A major advantage of this method is to remain fully compatible with the overall calculation method of Doc. 29. It is already recognized as the best modelling practice by the different working groups in charge of maintaining the airport noise modelling standards. The method requires however the availability of more detailed noise data, which can only be developed and supplied by manufacturers. The main issues are that these are technically complex to generate and are considered by manufacturers as sensitive and therefore confidential information. So far, IMPACT only includes MCMS noise data which have been developed and supplied by Airbus for a set of (representative) Airbus aircraft types.

These constraints currently prevent the inclusion of the method in updated standards.

Standardisation: Input to standardisation activities/standardisation roadmap was provided in 2012 although it did not identify any specific OFAs for standardisation on environment grounds.

1.5 Project Conclusion and Recommendations

Guidance provided by the Environment Reference Material (ERM) should be followed. Along with other SESAR guidance documents, this ERM provides extensive guidance for how to conduct live trials, which require even more rigorous preparation in order that the environmental assessment can be conducted reliably.

Consequently, any analyst can conduct an environmental impact assessment, as long as adequate training and support for applying the environment tools is provided.

Fuel burnt and emissions can always be calculated and therefore should always be, although for some concepts no differences might be observed.

Noise and Local/Airport Air Quality should be systematically considered during an environmental impact assessment and addressed when appropriate.

The maintenance of IMPACT, and even, its development, should continue to take some SESAR concepts e.g. change in speed in the cruise phase, into account.

V-PAT is the recommended tool to assess vertical path efficiency and CCO/CDO operations in particular.

Project 16.06.03 also recommends maintaining in SESAR 2020 a watch activity of the European environmental legislation and an activity related to the update of evaluation of the environment-related risks at least on an annual basis.

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2 References

[1] SESAR Programme Management Plan, Edition 03.00.01

[2] European ATM Master Plan

[3] Multilateral Framework Agreement ("MFA") signed between the SJU, EUROCONTROL and its 15 selected members on August 11, 2009, amended on 14 June 2010, 19 October 2010 and 2 July 2012

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[5] Project 16.06.03, SESAR ENV Assessment Process 4 (ERM methodology update), D27, V1.0, May 2016

[6] Project 16.06.03, Report on ENV Assessment Release 5, D33, V1.0, May 2016

[7] Project 16.06.03, IMPACT Technical Documentation - Ex 16.03.01 D02 - GHG requirements, D54, V1.0, May 2016

[8] Project 16.06.03, IMPACT Technical Documentation - Ex 16.03.01 D03 - Noise requirements, D55, May 2015

[9] Project 16.06.03, IMPACT Technical Documentation - Ex 16.03.01 D05 - Acft Performance requirements, D56, V1.0, May 2016

[10] Project 16.06.03, IMPACT Technical Documentation - Ex 16.03.01 D06 - Data Warehouse requirements, D57, V1.0, March 2015

[11] Project 16.06.03, IMPACT V2. (Noise + Emissions + BADA 3 & 4) - Release document, D58, V1.0, April 2015

[12] Project 16.06.03, IMPACT V2.1 (multi conf NPDs + New 16.03.02 metrics) - Release document, D59, V1.0, March 2015

[13] Project 16.06.03, IMPACT V3. (improved Emissions) - Release document, D60, V1.0, May 2016

[14] Project 16.06.03, Open-ALAQS V2.1 (new PM + 1st Dispersion) - Release document, D63, V1.0, May 2016

[15] Project 16.06.03, V-PAT (Update and Documentation) - Release document, D65, V1.0, Nov. 2014

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[19] Project 16.06.03, Metrics Final deliverable - Ex 16.03.02 D13 - Airport emissions metrics, D70, V1.0, July 2014

[20] Project 16.06.03, Trade-off final report - Ex 16.03.03 D05, D71, V1.0, July 2014

[21] Project 16.06.03, Second Analysis of Environmental Regulatory Requirements - Report - Ex 16.03.07 D10, D72, V1.0, April 2016

[22] Project 16.06.03, Second Reporting and Analysis of Environment-Related Risks - Ex 16.03.07 D11, D73, V1.0, May 2016

[23] Project 16.06.03, 3D Fuel Comsumption Formula, D76, V1.0, December 2015

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