Final OSED for Madrid TMA (Annex Benefit Mechanisms) (Work Stream 1)

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Abstract

This document provides the Benefits Mechanisms of the project 05.07.04 – Full Implementation of P-RNAV in TMA as requested by 16.06.06 and following its guidelines and templates

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Table of Contents

List of tables

Executive summary

This document provides the Benefits Mechanisms of the project 05.07.04 – Full Implementation of P-RNAV in TMA as requested by 16.06.06 and following its guidelines and templates.

1 Project Info

1.1 Project Title

- 05.07.04 - Full Implementation of P-RNAV in TMA

1.2 Description

P05.07.04 shall address the current limitations in practical implementation of P-RNAV in TMA operations, enabling a move to integrated P-RNAV management in high-density traffic situations, throughout the day.

The project is focused in complex TMAs, taking Madrid, Milan and London as reference scenarios and extending the results to generic complex TMAs in Europe.

1.3 Aim

The aim of this project is:

- To determine how to maximise the benefits of P-RNAV in TMA operations, thereby enhancing the business justification of any such future implementation.
- To determine feasibility of concepts, such as Point Merge, that build upon P-RNAV procedures to solve safety, capacity, complexity, environment or efficiency limitations in complex TMA's, based upon current deployment in low complexity TMAs .
- To build upon Eurocontrol P-RNAV guidelines to enhance the potential benefits to air traffic.
- To determine feasibility & TMA design to address complex traffic management in multi-airport and mixed mode environments.
- To determine feasibility of concepts to address noise nuisance in transition from conventional to P-RNAV procedures.
- To optimise solutions for 2D P-RNAV operations to enable a solid foundation on which to build 3D and 4D RNAV operations to ATM Service Level 2 and beyond.
- To assess feasibility of implementing P-RNAV in complex TMAs focused on Point Merge and integrated with other advanced concepts like AMAN.

1.4 Focus

The project is focused on:

- Mixed Mode Operations – Integration of P-RNAV & conventional routes used by a mix of P-RNAV-compliant and conventional aircraft in high traffic density TMAs.
- High Terrain and bad weather – Use of P-RNAV procedures to improve safety of manoeuvres in TMA where high terrain and bad weather conditions cause limitations to use of airspace.
- Controller Mode of Operation – MOPS change for adapting ATCOs to new P-RNAV procedures.

- Route Spacing for P-RNAV – Investigation of solutions for optimum route spacing using P-RNAV.
- Maximum capacity of P-RNAV Arrivals/Transitions/SIDs/STARs
- Suitable descent slope for P-RNAV Arrivals in all meteorological conditions.
- P-RNAV CDAs in high density traffic
- Continuous Climb Departures enabled by the enhanced horizontal performance of P-RNAV
- Reducing noise emissions in scenarios where early turns are required in departures (Guidance for early turn departures)
- Impact on preferential noise routes upon transition from conventional to P-RNAV procedures, due to the turning performance linked to each respectively.
- Impact on departure sequencing due to aircraft performance mix (climb rates, turn capability, etc), which creates different departure routes for different performance levels.
- Feasibility of Point Merge.
- Optimization of airspace use and traffic management for complex TMAs through the use of Point Merge technique coupled with P-RNAV navigation capability.
- Integration of Point Merge with Arrival Management

The project will not consider (out of scope):

- The integration of Point Merge with advanced separation modes and spacing techniques such as ASAS.
- Any relationship with 5.7.3 Controller Team Organisation, Roles and Responsibilities in a Trajectory Based Operation (including Multi-Sector Planner).

1.5 Timeframe

- **Initiation phase: 18/09/09 – 26/05/10**
- **Execution phase: 17/06/10 – 13/06/12**

1.6 Environment

P-RNAV procedures implementation in complex airports:

1. Madrid TMA
2. London TMA
3. Milan TMA

1.7 Assumptions

- This new environment has to handle the current aircraft traffic capacity and forecasting traffic demand for 2030.

- Civil and military mixed mode usage of the airspace.
- Both conventional (Basic RNAV) and P-RNAV procedures in case of fleet non-capability. Not full-fleet technology capability.
- Hard crosswind and adverse meteorological situations

1.8 Associated projects

Transversal:

- 5.7 - TMA Trajectory and Separation Management
- 5.2 - Consolidation of Operational Concept Definition and Validation
- 5.3 - Integrated and Pre-Operational Validation & Cross Validation

Operational:

- 5.6.2 - QM-2 – Improving Vertical Profile
- 5.6.3 - QM-3 – Approach Procedure with Vertical Guidance (APV)
- 5.6.4 - QM-4 – Tactical TMA and En-route Queue Management
- 5.7.2 - Development of 4D Trajectory-Based Operations for separation management using RNAV/PRNAV
- 4.7.3 - Use of Performance Based Navigation (PBN) for En Route Separation Purposes

1.9 OIs

- AOM-0601 - Terminal Airspace Organisation Adapted through Use of Best practice, PRNAV and FUA (where suitable)
- AOM 0602 – Enhanced Terminal Airspace with Curved/Segmented Approaches and RNAV Approaches (where suitable)
- AUO-0501 - Visual Contact Approaches when Appropriate Visual Condition prevail
- AOM-0404 - Optimised Route Network using advanced RNP1
- AOM-0603 - Enhanced Terminal Airspace for RNP-based Operations
- AO-0703 - Aircraft Noise Management and Mitigation at and around Airports
- TS-0102 – Arrival Management Supporting TMA Improvements (incl. CDA, P-RNAV)

1.10 Operational Focus Area

- Optimized RNP structures (Enhanced Route Structures)
- Point Merge in Complex TMA (Enhanced Route Structures)

Indirectly is related to the following OFAs:

- Optimized RNP structures (Improved Vertical Profiles)
- Environmental Sustainability (Demand and Capcity Balancing En-Route)
- AMAN + Point Merge (Traffic Synchronization)

1.11 Alternative Scenarios

European TMAs with similar constraints or limitations. This will improve the efficiency of airspace management.

1.12 Anything else which is relevant

2 Benefit Mechanisms

2.1 Positive and Negative Impacts

Positive Impact	Primary or Secondary	Rank (1 = most important)	Order of Magnitude
Improve Arrival/Departure sequencing	Primary	1	N/A
Permits segregated arrival and departures streams	Primary	1	N/A
Reduce the need of radar vector usage	Primary	2	N/A
Reduce both pilot and controller workload	Primary	2	N/A
SAF11 O1: Ensure that the numbers of ATM induced accidents and serious or risk bearing incidents (includes those with direct and indirect ATM contribution) do not increase and, where possible, decrease.	Primary	1	≥ 1 (est. 2010)
SAF21 O1: All ANSPs and regulators are expected to achieve agreed maturity levels	Primary	2	N/A
ENV111 O1: Achieve emission improvements as an automatic consequence of the reduction of excess fuel consumption addressed in the KPA Efficiency[1]	Primary	1	
ENV112 O1: Minimize other adverse atmospheric effects (e.g. contrails) to the extent possible.	Secondary	2	
ENV211 O1: Improve the role of ATM in developing environmental rules (SESAR)	Secondary	3	
CEF2 O1: Reduce the cost of military training missions	Secondary	1	
CEF21 O1: Reduce the cost of mission transit time from the airbase to the training areas and back.	Secondary	2	
CEF111 O1: Limit Airspace User investments related to increased role in ATM	Secondary	4	

[1] This positive impact is as an automatic consequence of the reduction of fuel consumption at a local level that affects the reduction of G2G fuel consumption.

CEF112 O1 Reduce the gate-to-gate air navigation cost (average cost per flight)	Primary	1	
CEF11221 O1: Reduce terminal ATM/CNS cost	Primary	2	
CEF11222 O1: Reduce terminal MET and regulatory costs	Primary	3	
CEF121 O1: Reduce cost of ATM inefficiencies to the level determined by the QoS targets	Secondary	5	
CEF1211 O1: Reduce indirect cost by meeting Flight Efficiency targets	Secondary	6	
CEF1212 O1: Reduce indirect cost by meeting Flexibility targets	Secondary	7	
CEF1213 O1: Reduce indirect cost by meeting Predictability targets	Secondary	8	
CAP11 O1: Increase the network capacity to support the annual flights	Secondary	2	
CAP12 O1: Increase the network capacity to support the daily flights	Secondary	3	
CAP2 O1: Increase local airspace capacity in line with growing traffic demand (Capacity x3 where required)	Primary	1	
EFF111 O1: Improve departure punctuality	Primary	1	
EFF112 O1: Improve adherence to planned gate-to-gate flight duration	Primary	3	
EFF112 O1: Improve adherence to planned gate-to-gate flight duration	Primary	4	
EFF11221 O1: Reduce airborne queuing (time spent in holding patterns)	Primary	2	
EFF12 O1: Improve Fuel Consumption	Secondary	9	
EFF1211 O1: Reduce fuel penalties resulting from non-optimum TMA and taxi operations	Secondary	10	
EFF1212 O1: Reduce Fuel Penalties resulting from route extensions (non-optimum route)	Primary	8	
EFF122 O1: Reduce Fuel Penalties resulting from non-optimum flight profile	Secondary	11	

EFF21 O1: improve the impact that SUA location and dimensions have on mission effectiveness	Secondary	12	
EFF3 O1: Improve the efficiency of airspace utilization for military training, both in terms of booking and actual usage	Secondary	13	
FLX111 O1: Accommodate more non-scheduled IFR flights can depart on time as requested	Secondary	3	
FLX112 O1: Accommodate more VFR-IFR change requests accommodated as requested	Secondary	4	
FLX121 O1: Accommodate more time/speed change requests without imposing penalties	Primary	1	
FLX122 O1: Accommodate more route/vertical profile change requests without imposing penalties	Primary	2	
FLX21 O1: Apply the FUA concept to a larger position of SUA	Secondary	5	
FLX22 O1: improve the release of airspace for civil use on cancellation of military use, at various time horizons prior to the scheduled start of training	Secondary	6	
FL3 O1: Improve ANSP ability to respond to the need of services in airspace at airports where previously no service was available	Secondary	7	
PRD1111 O1: Improve G2G Variability	Secondary	2	
PRD1112 O1: Improve arrival punctuality	Primary	1	
PRD1121 O1: Reduce Reactionary delays	Secondary	3	
PRD11212 O1: Reduce Reactionary cancellations	Secondary	4	
PRD112 O1: Reduce Degraded Conditions	Secondary	5	
PRD113 O1: Improve Disrupted Conditions	Secondary	6	
PRD11311 O1: Improve Service Disruption Delays	Secondary	7	
PRD11312 O1: Service Disruption Diversion	Secondary	8	
PRD11313 O1: Service Disruption cancellations	Secondary	9	

Table 1: Positive Impacts

Negative Impact [2]	Primary or Secondary	Rank (1 = most important)	Order of Magnitude
(Possible) Non-reduction of C02 emissions	Primary	1	N/A
(Possible) Non-reduction of fuel burning	Primary	1	N/A
(Possible) Longer and non-directly routes	Primary	2	N/A

Table 2: Negative Impacts

2.2 KPAs covered by Area

Here is listed all the KPAs covered by the Initial Baseline Performance framework (edition 0) until now (28th of February 2011). As a checklist the project has identified the KPAs that are going to affect indirectly or directly. Also, it has been identified the ones which are going to be measured and assess as so:

KPA	Main Focus Area	Qualitative Performance objectives	Affected	Assessed
SAF	ATM-related Safety Outcome	Ensure that the numbers of ATM induced accidents and serious or risk bearing incidents do not increase and, where possible, decrease (SESAR)	√	√[3]
	Safety Management Practices and Safety Culture	All ANSPs and regulators are expected to achieve agreed maturity levels	√	√
ENV	Environmental Sustainability Outcome	Climate Related Effects, Noise Emissions & Noise Impact	√	√
	Environmental Management Operations	Existing Environmental Constraints & Proposed New Environmental Constraints	√	√
CEF	ATM Effectiveness (Direct & Indirect Costs)	Limit Airspace User investments related to increased role in ATM; Flexibility & Predictability targets Reduce the gate-to-gate air navigation cost	√	√
	Mission Effectiveness	Mission transit time from the airbase to the training areas and back.	√	
CAP	Network Capacity	Increase European daily & annual IFR throughput in line with growing traffic demand	√	
	Local Airspace Capacity	Increase local airspace capacity in line with growing traffic demand	√	√
	Airport Best-In-Class Capacity	Single-runway airports, Parallel-dependent-runway airports & Parallel-independent-runway airports		

[2] IMPORTANT NOTE: Each of the positive impacts can turn into negative if the simulation results show unexpected results. Also, for peak periods of high traffic density it is not evident that reduction of CO2 emissions, fuel consumption and distance flown will be achieved. This has to be assessed after the simulation of the whole scenario with different traffic samples.

[3] This KPA is going to be assessed at a local level not at a Network level

EFF	Flight Efficiency	Improve departure punctuality, adherence to planned G2G flight duration & fuel consumption	√	√
	Mission Efficiency by Training inside SUA (TrS)	Improve the impact of SUA location and dimensions Improve the efficiency of airspace utilisation for military training	√	
FLX	Business Trajectory Flexibility	Late Filing, Air Filing, Time/Speed Changes & Route/Vertical Trajectory Changes	√	√
	Flexible Civil/Military Use of Airspace (FUA)	Apply the FUA concept to a larger portion of SUA; Improve the release of airspace for civil use on cancellation of military use, at various time horizons prior to the scheduled start of training	√	
	Service Location Flexibility	Improve ANSP ability to respond to the need for services in airspace and at airports where previously no service was available	√	
PRD	Business Trajectory Predictability	On-time Operation, Knock-on Effect, Reduce the occurrence of degraded conditions by reducing the impact of their causes on capacity & Prevent and mitigate service disruption to the greatest extent	√	
AEQ	Access	Shared used & Alternatives to Shared Use	√	√
	Equity	Under shared use conditions, improve management of access priority based on class of airspace user;	√	√
PRT	Stakeholders involved during Performance Management	Definition, Performance Review, Regulation, Assesment & Data Reporting for Objectives, Targets, Metrics & KPIs	√	√
	Stakeholders involved during Operations	Participation during Planning (Equal opportunity, @ the appropriate time) & Tactical Operations (Timely transfer, appropriate time frame & acceptable)limits of safety - cost effectiveness)	√	√
	Stakeholders involved during Deployment	Should take into account individual stakeholder needs (planning of deployment of new equipment, procedures or systems)	√	
	Stakeholders involved during Design	All stakeholders shall have the opportunity to be involved in the R&D process	√	√
	Stakeholders involved during Regulation	During development of new regulations, stakeholders shall be involved in the consultation phase avoiding conflicts of interest	√	√

Table 3: 5.7.4 KPAs affected and assessed.

In the following sub-points it has been identified the KPAs that are going to be covered/affected and assessed by this project by shading its row in GREEN, the ones that are going to be covered/affected but not assessed in BLUE (out of the scope) and finally in RED the one that are not going to be covered/affected nor assessed by 5.7.4. The following figure representing a scope illustrates better this reasoning:

Benefit Mechanisms 5.7.4

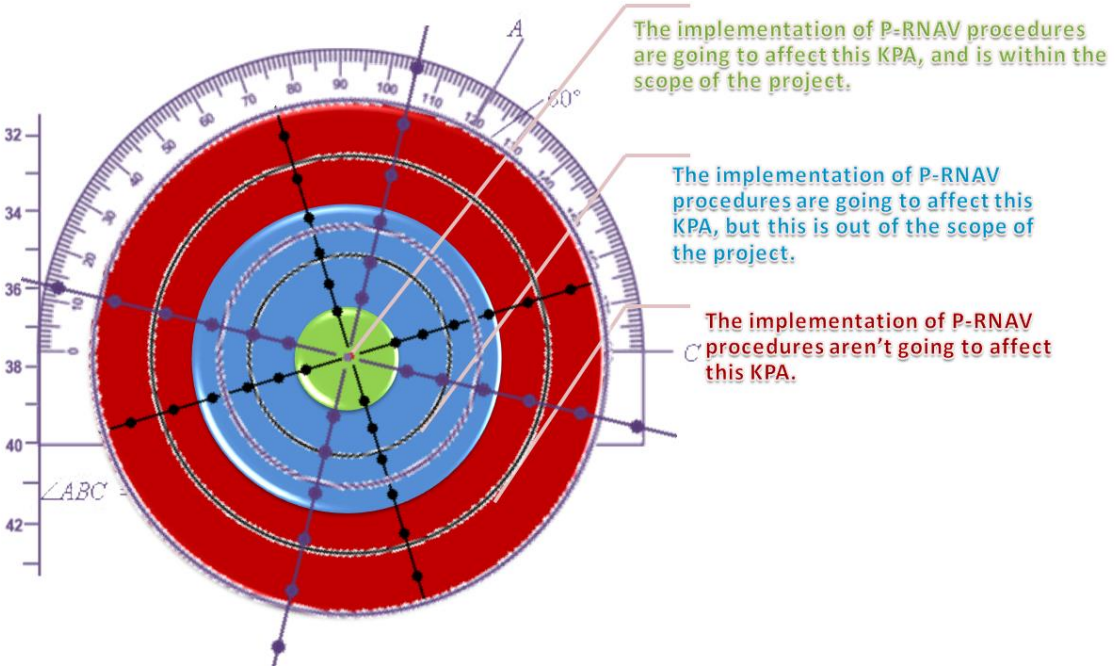


Figure 1: Benefits Mechanisms in 5.7.4

In this document is listed also a first approach to the KPIs that are going to be measured within this project and validation exercises. It has been shaded in LIGHT GREEN the ones who are going to be used as an input for the assessment. Shade in LIGH BLUE the ones that could be an input for the assessment but are out of the scope of the project. Finally, in LIGHT RED the ones that are not to be used nor assessed as an input. Adding up all the possibilities here is explained the main ones:

KPA	KPI	Explanation
GREEN	LIGH GREEN	The KPI is going to be produced, used and assessed affecting the associated KPA (e.g.: the new procedures increase the number of flight able to enter in the airspace increasing the capacity of the local airspace area)
GREEN	LIGH BLUE	KPI as an input from an external source and assessed affecting the associated KPA (e.g.: the number of accidents have been reduced in the local area so the safety has increased)
GREEN	LIGH RED	The KPI is not going to be used but the associated KPA is going to be assessed (e.g.: the traffic flows structure change in other countries are going to affect the capacity of the local airspace)
BLUE	LIGH GREEN	The KPI is going to be produced, used but not assessed (out of the scope); (e g. the number of incidents in the local area affects the safety at a network level)
BLUE	LIGH BLUE	KPI as an input from an external source but not assessed affecting the associated KPA (e.g.: the NOx emission are going to be reduced with the new procedures and affects the reduction of environmental impact)
BLUE	LIGH RED	The KPI is not going to be used but the associated KPA is not going to be assessed (e.g. the time spent in coordinate an unexpected SUA affects the capacity and flexibility of the use of airspace)
RED	LIGH GREEN	The KPI is going to be produced but the project do not affect the associated KPA (e.g.: the number of departures with the new procedures are not going to affect the runway throughput capacity)
RED	LIGH BLUE	KPI as an input from an external source but the project do not affect the associated KPA (e g. the reduction of en-route flight time do not affect the flight efficiency in the local area)
RED	LIGH RED	The KPI is not going to be used and the project do not affect the associated KPA (e.g. the departures punctuality do not affect the mission effectiveness)

Table 4: 5.7.4 KPAs vs. KPIs.

The target associated to each KPI are extracted from ATM Master Plan objectives and this project is contributing as a part of the whole target (e.g.: the new procedures have reduced the probability of an accident occurrence at a local area and this contributes to the whole probability of an accident occurrence in the European airspace).

2.2.1 Safety KPA

- Stakeholders: Community and States
- Grouping: High External Visibility - Effects are societal and of political nature

Main Focus Area	1st Lower Level Focus Area	2nd Lower Level Focus Area	3th Lower Level Focus Area	4th Lower Level Focus Area	KPI	Target
SAF1 - ATM-related Safety Outcome	SAF11 - ATM Induced Accidents and Incidents				SAF11 O1 I1 : Accident probability per operation (flight) relative to the 2005 baseline	SAF11 O1 I1 T1: Considering the anticipated increase in the European annual traffic volume, the implication of the initial safety performance objective is that the overall safety level would gradually have to improve, so as to reach an improvement factor of 3 in order to meet the safety objective in 2020 and a factor 10 for the design goal (based on the assumption that safety needs to improve with the square of traffic volume increase). This could be translated into a reduction of 66% in the ratio accidents/flight
SAF1 - ATM-related Safety Outcome	SAF11 - ATM Induced Accidents and Incidents				SAF11 O1 I2: Annual European wide absolute number of ATM induced accidents	SAF11 O1 I2 T1: No increase and if possible, a decrease. Taking as baseline 1997-2008: 7 accidents in 12 years (ratio accidents/year =0.58) (source: PRC) 2020 Target: no increase (ratio ≤ 0.58)
SAF1 - ATM-related Safety Outcome	SAF11 - ATM Induced Accidents and Incidents				SAF11 O1 I3: Annual European wide absolute number of ATM induced serious or risk bearing incidents	SAF11 O1 I3 T1: 2020: no increase
SAF2 - Safety Mgt Practices and Safety Culture	SAF21 - Maturity Level of Organizations					

Table 5: 5.7.4 Safety KPA.

2.2.2 Environment KPA

- Stakeholders: Airlines, ANSPs, Community & States
- Grouping: High External Visibility - Effects are societal and of political nature

Main Focus Area	1st Lower Level Focus Area	2nd Lower Level Focus Area	3th Lower Level Focus Area	4th Lower Level Focus Area	KPI	Target
ENV1 - Environmental Sustainability Outcome	ENV11 - Atmospheric Effects	ENV111 - Gaseous Emissions			ENV111 O1 I1: Average fuel consumption per flight as a result of ATM improvements	ENV111 O1 I1 T1: -10%
ENV1 -	ENV11 -	ENV111 -			ENV111 O1 I2:	ENV111 O1 I2 T1: -10%

Environmental Sustainability Outcome	Atmospheric Effects	Gaseous Emissions			Average CO2 emission per flight as a result of ATM improvements	
ENV1 - Environmental Sustainability Outcome	ENV11 - Atmospheric Effects	ENV111 - Gaseous Emissions			ENV111 O1 I3:: Amount of NOx emissions which is attributable to inefficiencies in ATM service provision	No targets documented
ENV1 - Environmental Sustainability Outcome	ENV11 - Atmospheric Effects	ENV111 - Gaseous Emissions			ENV111 O1 I4: Amount of H2O emissions which is attributable to inefficiencies in ATM service provision	No targets documented
ENV1 - Environmental Sustainability Outcome	ENV11 - Atmospheric Effects	ENV111 - Gaseous Emissions			ENV111 O1 I5: Amount of particulate emissions which is attributable to inefficiencies in ATM service provision	No targets documented
ENV1 - Environmental Sustainability Outcome	ENV11 - Atmospheric Effects	ENV112 - Other Adverse Atmospheric Effects				
ENV1 - Environmental Sustainability Outcome	ENV12 - Noise Effects	ENV121 - Noise Emissions			ENV121 O1 I1: Total Area of the noise footprint	
ENV1 - Environmental Sustainability Outcome	ENV12 - Noise Effects	ENV122 - Noise Impact			ENV122 O1 I1: Impact Area of the particular noise level	
ENV2 - Environmental Management Operations	ENV21 - Environmental Constraint Management	ENV211 - Address Existing Constraints				
ENV2 - Environmental Management Operations	ENV21 - Environmental Constraint Management	ENV212 - Address Proposed New Constraints				

Table 6: 5.7.4 Environment KPA.

2.2.3 Cost-Effectiveness KPA

- Stakeholders: ANSPs, Military and Airlines
- Grouping: Medium External Visibility - Effects are business-level, on users and operators

Main Focus Area	1st Lower Level Focus Area	2nd Lower Level Focus Area	3th Lower Level Focus Area	4th Lower Level Focus Area	KPI	Target
CEF1 - ATM Cost Effectiveness	CEF11 - Direct cost of G2G ATM	CEF111 - Airspace User Costs				
CEF1 - ATM Cost Effectiveness	CEF11 - Direct cost of G2G ATM	CEF112 - G2G ANS costs			CEF112 O1 I1: Total annual en route and terminal ANS cost in Europe, €/flight	CEF112 O1 I1 T1: 2020: €400 (2005) / Flight
CEF1 - ATM Cost Effectiveness	CEF11 - Direct cost of G2G ATM	CEF112 - G2G ANS costs	CEF1121 En-route ANS Costs	CEF11211 En-route ATM/CNS		

				Costs	
CEF1 - ATM Cost Effectiveness	CEF11 - Direct cost of G2G ATM	CEF112 - G2G ANS costs	CEF1121 En-route ANS Costs	CEF11212 Other En-route Costs	
CEF1 - ATM Cost Effectiveness	CEF11 - Direct cost of G2G ATM	CEF112 - G2G ANS costs	CEF1122 Terminal ANS Costs	CEF11221 Terminal ATM/CNS Costs	
CEF1 - ATM Cost Effectiveness	CEF11 - Direct cost of G2G ATM	CEF112 - G2G ANS costs	CEF1122 Terminal ANS Costs	CEF11222 Other Terminal Costs	
CEF1 - ATM Cost Effectiveness	CEF12 - Indirect cost of G2G ATM	CEF121 - Airspace User Costs			
CEF1 - ATM Cost Effectiveness	CEF12 - Indirect cost of G2G ATM	CEF121 - Airspace User Costs	CEF1211 Flight Efficiency Impact		
CEF1 - ATM Cost Effectiveness	CEF12 - Indirect cost of G2G ATM	CEF121 - Airspace User Costs	CEF1212 Flexibility Impact		
CEF1 - ATM Cost Effectiveness	CEF12 - Indirect cost of G2G ATM	CEF121 - Airspace User Costs	CEF1213 Predictability Impact		
CEF2 - Mission Cost Effectiveness	CEF21 - Training Costs				
CEF2 - Mission Cost Effectiveness	CEF22 - Transit Costs				

Table 7: 5.7.4 Cost-Effectiveness KPA.

2.2.4 Capacity KPA

- Stakeholders: ANSPs, Military and Airlines
- Grouping: Medium External Visibility - Effects are business-level, on users and operators

Main Focus Area	1st Lower Level Focus Area	2nd Lower Level Focus Area	3th Lower Level Focus Area	4th Lower Level Focus Area	KPI	Target
CAP1 - Network Capacity	CAP11 - Annual IFR Throughput				CAP11 O1 I1: Flights/year	CAP11 O1 I1 T1: 16 Million flights/year
CAP1 - Network Capacity	CAP12 - Daily IFR Throughput				CAP12 O1 I1: Flights/day	CAP12 O1 I1 T1: 50000 flights/day
CAP2 - Local Airspace Capacity					CAP2 O1 I1: Hourly number of IFR flights able to enter the airspace volume	CAP2 O1 I1 T1: 2020 target: busiest en-route airspace volumes, typical busy hour demand would grow 70-80% between 2005 and 2020. For the busiest/largest terminal airspace volumes, typical busy hour demand would grow only 40-50% between 2005 and 2020
CAP2 - Local Airspace Capacity					CAP2 O1 I2: Annual number of IFR flights able to enter the airspace volume	CAP2 O1 I2 T1: Annual demand same growth rates as the typical busy hour requirement. For the busiest/largest terminal airspace volumes, annual demand grows somewhat more than the typical busy hour demand. For the smaller terminal airspace volumes, annual demand grows somewhat less than the typical busy hour demand.
CAP2 - Local Airspace Capacity	CAP21 - ACC/FIR Capacity				CAP2 O1 I1: Hourly number of IFR flights able to enter the airspace volume	CAP2 O1 I1 T1: 2020 target: busiest en-route airspace volumes, typical busy hour demand would grow 70-80% between 2005 and 2020. For the busiest/largest terminal airspace volumes, typical busy hour demand would grow only 40-50%

					between 2005 and 2020
CAP2 - Local Airspace Capacity	CAP21 - ACC/FIR Capacity			CAP2 O1 I2: Annual number of IFR flights able to enter the airspace volume	CAP2 O1 I2 T1: Annual demand same growth rates as the typical busy hour requirement. For the busiest/largest terminal airspace volumes, annual demand grows somewhat more than the typical busy hour demand. For the smaller terminal airspace volumes, annual demand grows somewhat less than the typical busy hour demand.
CAP2 - Local Airspace Capacity	CAP22 - APP/TMA capacity			CAP2 O1 I1: Hourly number of IFR flights able to enter the airspace volume	CAP2 O1 I1 T1: 2020 target: busiest en-route airspace volumes, typical busy hour demand would grow 70-80% between 2005 and 2020. For the busiest/largest terminal airspace volumes, typical busy hour demand would grow only 40-50% between 2005 and 2020
CAP2 - Local Airspace Capacity	CAP22 - APP/TMA capacity			CAP2 O1 I2: Annual number of IFR flights able to enter the airspace volume	CAP2 O1 I2 T1: Annual demand same growth rates as the typical busy hour requirement. For the busiest/largest terminal airspace volumes, annual demand grows somewhat more than the typical busy hour demand. For the smaller terminal airspace volumes, annual demand grows somewhat less than the typical busy hour demand.
CAP2 - Local Airspace Capacity	CAP23 - Sector capacity			CAP2 O1 I1: Hourly number of IFR flights able to enter the airspace volume	CAP2 O1 I1 T1: 2020 target: busiest en-route airspace volumes, typical busy hour demand would grow 70-80% between 2005 and 2020. For the busiest/largest terminal airspace volumes, typical busy hour demand would grow only 40-50% between 2005 and 2020
CAP2 - Local Airspace Capacity	CAP23 - Sector capacity			CAP2 O1 I2: Annual number of IFR flights able to enter the airspace volume	CAP2 O1 I2 T1: Annual demand same growth rates as the typical busy hour requirement. For the busiest/largest terminal airspace volumes, annual demand grows somewhat more than the typical busy hour demand. For the smaller terminal airspace volumes, annual demand grows somewhat less than the typical busy hour demand.
CAP2 - Local Airspace Capacity	CAP24 - SUA capacity	CAP241 - Designed SUA capacity (DSC)			
CAP2 - Local Airspace Capacity	CAP24 - SUA capacity	CAP242 - Utilized SUA capacity (USC)			
CAP2 - Local Airspace Capacity	CAP24 - SUA capacity	CAP243 - Utilized FIR/UIR Capacity			
CAP3 - Airport capacity				CAP3 O1 I1: Hourly number of IFR movements (departures plus arrivals)	
CAP3 - Airport capacity				CAP3 O1 I2: Daily number of IFR movements (departures plus arrivals)	
CAP3 - Airport capacity	CAP31 - BIC capacity in VMC	CAP 311 - Single RWY Airport capacity in VMC		CAP311 O1 I1: Best In Class (BIC) declared airport capacity in VMC (1 RWY), mov/hr	CAP311 O1 I1 T1: 2020: 60 mov/h
CAP3 - Airport capacity	CAP31 - BIC capacity in VMC	CAP 312 - Parallel dependent RWY Airport capacity in VMC		CAP312 O1 I1: Best In Class (BIC) declared airport capacity in VMC (2 parallel dependent RWYs), mov/h	CAP312 O1 I1 T1: 2020:90 mov/h
CAP3 - Airport capacity	CAP31 - BIC capacity in VMC	CAP 313 - Parallel independent RWY Airport capacity in VMC		CAP313 O1 I1: Best In Class (BIC) declared airport capacity in VMC (2 parallel independent RWYs), mov/h	CAP313 O1 I1 T1: 2020: 120 mov/h
CAP3 - Airport	CAP32 - BIC capacity in	CAP 321 - Single RWY Airport		CAP321 O1 I1: Best In Class (BIC) declared	CAP321 O1 I1 T1: 2020:48 mov/h

capacity	IMC	capacity in IMC		airport capacity in IMC (1 RWY), mov/hr	
CAP3 - Airport capacity	CAP32 - BIC capacity in IMC	CAP 322 - Parallel dependent RWY Airport capacity in IMC		CAP322 O1 I1: Best In Class (BIC) declared airport capacity in IMC (2 parallel dependent RWYs), mov/h	CAP322 O1 I1 T1: 2020:72 mov/h
CAP3 - Airport capacity	CAP32 - BIC capacity in IMC	CAP 323 - Parallel independent RWY Airport capacity in IMC		CAP323 O1 I1: Best In Class (BIC) declared airport capacity in IMC (2 parallel independent RWYs), mov/h	CAP323 O1 I1 T1: 2020: 96 mov/h

Table 8: 5.7.4 Capacity KPA.

2.2.5 Efficiency KPA

- Stakeholders: ANSPs, Military and Airlines
- Grouping: Medium External Visibility - Effects are business-level, on users and operators

Main Focus Area	1st Lower Level Focus Area	2nd Lower Level Focus Area	3th Lower Level Focus Area	4th Lower Level Focus Area	KPI	Target
EFF1 - Flight Efficiency	EFF11 - Temporal efficiency	EFF111 - Departure Punctuality			EFF111 O1 I1:Number of scheduled flights departing on time (as planned);	EFF111 O1 I1 T1: 2020: 98% flights on time
EFF1 - Flight Efficiency	EFF11 - Temporal efficiency	EFF111 - Departure Punctuality			EFF111 O1 I2:Average delay of delayed scheduled flights (departing not as planned)	EFF111 O1 I2 T1: 2020: Average departure delay<10 min
EFF1 - Flight Efficiency	EFF11 - Temporal efficiency	EFF112 - G2G Flight Duration			EFF112 O1 I1:Number of flights with block to block time as planned;	EFF112 O1 I1 T1:2020: 95% flights as planned
EFF1 - Flight Efficiency	EFF11 - Temporal efficiency	EFF112 - G2G Flight Duration			EFF112 O1 I2: Average block to block time extension of the flights with time longer than planned	EFF112 O1 I2 T1: 2020: average block-to-block time extension <10 minutes
EFF1 - Flight Efficiency	EFF11 - Temporal efficiency	EFF112 - G2G Flight Duration	EFF1121 - Taxi Time		No KPIs or Targets defined by SESAR	No KPIs or Targets defined by SESAR
EFF1 - Flight Efficiency	EFF11 - Temporal efficiency	EFF112 - G2G Flight Duration	EFF1122 - Airborne Time		No KPIs or Targets defined by SESAR	No KPIs or Targets defined by SESAR
EFF1 - Flight Efficiency	EFF11 - Temporal efficiency	EFF112 - G2G Flight Duration	EFF1122 - Airborne Time		EFF11222 O1 I1: Horizontal en-route efficiency (excess distance flown per flight)	EFF11222 O1 I1 T1: annual reduction of route extension by 2 km/flight/year; PC target valid until 2013
EFF1 - Flight Efficiency	EFF12 - G2G Fuel Efficiency				EFF12 O1 I1: Number of flights have fuel consumption as planned	EFF12 O1 I1 T1: 2020: 95% flights as planned
EFF1 - Flight Efficiency	EFF12 - G2G Fuel Efficiency	EFF121 - Impact of G2G Flight Duration	EFF1211 - TMA + Taxi efficiency			
EFF1 - Flight Efficiency	EFF12 - G2G Fuel Efficiency	EFF121 - Impact of G2G Flight Duration	EFF1212 - Horizontal En-Route Efficiency			
EFF1 - Flight Efficiency	EFF12 - G2G Fuel Efficiency	EFF122 - Vertical Efficiency				
EFF2 - Mission	EFF21 - Training					

Effectiveness (Military)	inside SUA	

Table 9: 5.7.4 Efficiency KPA.

2.2.6 Flexibility KPA

- Stakeholders: ANSPs, Military and Airlines
- Grouping: Medium External Visibility - Effects are business-level, on users and operators

Main Focus Area	1st Lower Level Focus Area	2nd Lower Level Focus Area	3th Lower Level Focus Area	4th Lower Level Focus Area	KPI	Target
FLX1 - Business trajectory Flexibility	FLX11 - Unscheduled Traffic	FLX111 - Late Filing			FLX111 O1 I1: Number of accommodated non-scheduled IFR flights departed on time as requested	FLX111 O1 I1 T1: 2020: 98% of non-scheduled IFR flights departed on time as requested
FLX1 - Business trajectory Flexibility	FLX11 - Unscheduled Traffic	FLX112 - Air Filing			FLX112 O1 I1: number of accommodated VFR-IFR change requests as requested	FLX112 O1 I1 T1: 2020: 98% of the VFR-IFR change requests as requested
FLX1 - Business trajectory Flexibility	FLX12 - Trajectory Modifications	FLX121 - Time/Speed Changes			FLX121 O1 I1: Number of scheduled flights with departure time as requested (after change request)	FLX121 O1 I1 T1: 2020: 98% of departure change requests accommodated as requested
FLX1 - Business trajectory Flexibility	FLX12 - Trajectory Modifications	FLX121 - Time/Speed Changes			FLX121 O1 I2: (Average delay of delayed scheduled flights (after change request))	FLX121 O1 I2 T1: 2020: average delay< 5 min
FLX1 - Business trajectory Flexibility	FLX12 - Trajectory Modifications	FLX121 - Time/Speed Changes			FLX121 O1 I3: Flexibility demand: % Flights requesting time translation from initial Reference Business Trajectory (FLX.1.OBJ1.IND3)	No target defined by SESAR
FLX1 - Business trajectory Flexibility	FLX12 - Trajectory Modifications	FLX122 - Route/Vertical Changes			FLX122 O1 I1: Percentage of route/vertical change requests accommodated	FLX122 O1 I1 T1: 2020: 95% of route/vertical profile change requests accommodated
FLX1 - Business trajectory Flexibility	FLX12 - Trajectory Modifications	FLX122 - Route/Vertical Changes			FLX122 O1 I2: Percentage of route/vertical change requests accommodated without imposing delay	FLX122 O1 I2 T1: 2020: 90% of route/vertical profile/change requests accommodated as requested
FLX1 - Business trajectory Flexibility	FLX12 - Trajectory Modifications	FLX122 - Route/Vertical Changes			FLX122 O1 I3: Average delay of flights delayed as a consequence of route / vertical change request	FLX122 O1 I3 T1: 2020: <5 minutes per flight
FLX2 - Flexible Use of Airspace	FLX21 - FUA Application					
FLX2 - Flexible Use of Airspace	FLX22 - SUA Management					
FLX3 - Service Local Flexibility						

Table 10: 5.7.4 Flexibility KPA.

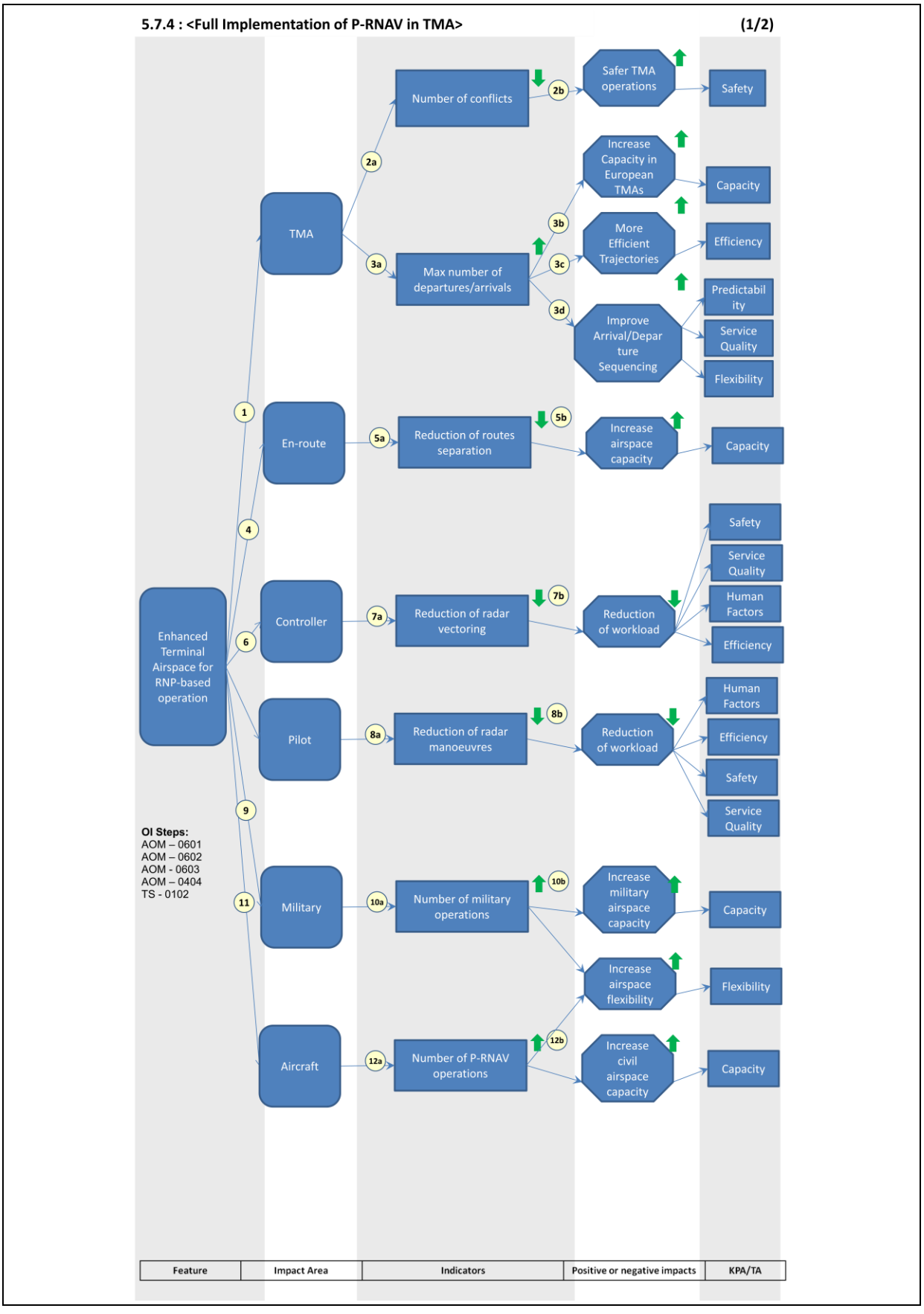
2.2.7 Predictability KPA

- Stakeholders: ANSPs, Military and Airlines
- Grouping: Medium External Visibility - Effects are business-level, on users and operators

Main Focus Area	1st Lower Level Focus Area	2nd Lower Level Focus Area	3th Lower Level Focus Area	4th Lower Level Focus Area	KPI	Target
PRD1 - Business Trajectory Predictability	PRD11 - Nominal conditions	PRD111 - On-Time Operations	PRD1111 - G2G Variability		PRD1112 O1 I1: Coefficient of flight duration variation	PRD1111 O1 I1 T1: 2020: At the regional level, the variability of flight duration (off-block to on-block) shall have a coefficient of variation of maximum 0.015 (standard deviation divided by the mean value)
PRD1 - Business Trajectory Predictability	PRD11 - Nominal conditions	PRD111 - On-Time Operations	PRD1112 - Arrival Punctuality		PRD1112 O1 I1: Number of flights arriving on time (as planned)	PRD1112 O1 I1 T1: 95% of flights arriving on time (as planned)
PRD1 - Business Trajectory Predictability	PRD11 - Nominal conditions	PRD111 - On-Time Operations	PRD1112 - Arrival Punctuality		PRD1112 O1 I2: Average arrival delay of the flights with delayed arrival	PRD1112 O1 I1 T1: 2020: 95% avg arrival delay<10 minutes
PRD1 - Business Trajectory Predictability	PRD11 - Nominal conditions	PRD112 - Knock-on effect	PRD1121 - Reactionary delays		PRD1121 O1 I1: Reactionary delay	PRD1121 O1 I1 T1: 2020: 50% reduction of total reactionary delay compared to 2010
PRD1 - Business Trajectory Predictability	PRD11 - Nominal conditions	PRD112 - Knock-on effect	PRD11212 - Reactionary cancellations		PRD1122 O1 I1: Reactionary flight cancellation rate	PRD1122 O1 I1 T1: 2020: 50% reduction of reactionary flight cancellation rate compared to 2010
PRD1 - Business Trajectory Predictability	PRD112 - Degraded Conditions					
PRD1 - Business Trajectory Predictability	PRD113 - Disrupted Conditions					
PRD1 - Business Trajectory Predictability	PRD113 - Disrupted Conditions	PRD1131 - Service Disruption Effect	PRD11311 - Service Disruption Delays		PRD11311 O1 I1: Delay (min) due to the service disruption	PRD11311 O1 I1 T1: 2020: 50% reduction of total service disruption delay compared to 2010
PRD1 - Business Trajectory Predictability	PRD113 - Disrupted Conditions	PRD1131 - Service Disruption Effect	PRD1132 - Service Disruption Diversion		PRD11312 O1 I1: Flight diversion rate due to service disruption compared to 2010	PRD11312 O1 I1 T1: 2020: 50% reduction of service disruption flight diversion rate compared to 2010
PRD1 - Business Trajectory Predictability	PRD113 - Disrupted Conditions	PRD1131 - Service Disruption Effect	PRD11313 - Service Disruption cancellations		PRD11313 O1 I1: Flight cancellation rate due to the service disruption	PRD11313 O1 I1 T1: 2020: 50% reduction of service disruption flight cancellation rate compared to 2010

Table 11: 5.7.4 Predictability KPA.

2.3 Benefit Mechanisms



Feature Description: *<fuller description of the feature>*

Mechanisms

(1) *<how the feature will bring changes in the 'impact area'>*

(2a) *<how the 'impact area' will bring about changes in the 'indicator'>*
+ *<how the indicator will be measured – metric description>*

(2b) *<what change is seen in the 'positive' or 'negative impacts' when the indicator(s) change and which KPA[4](s) this links to>*

(..) *<continues for other numbered mechanisms>*

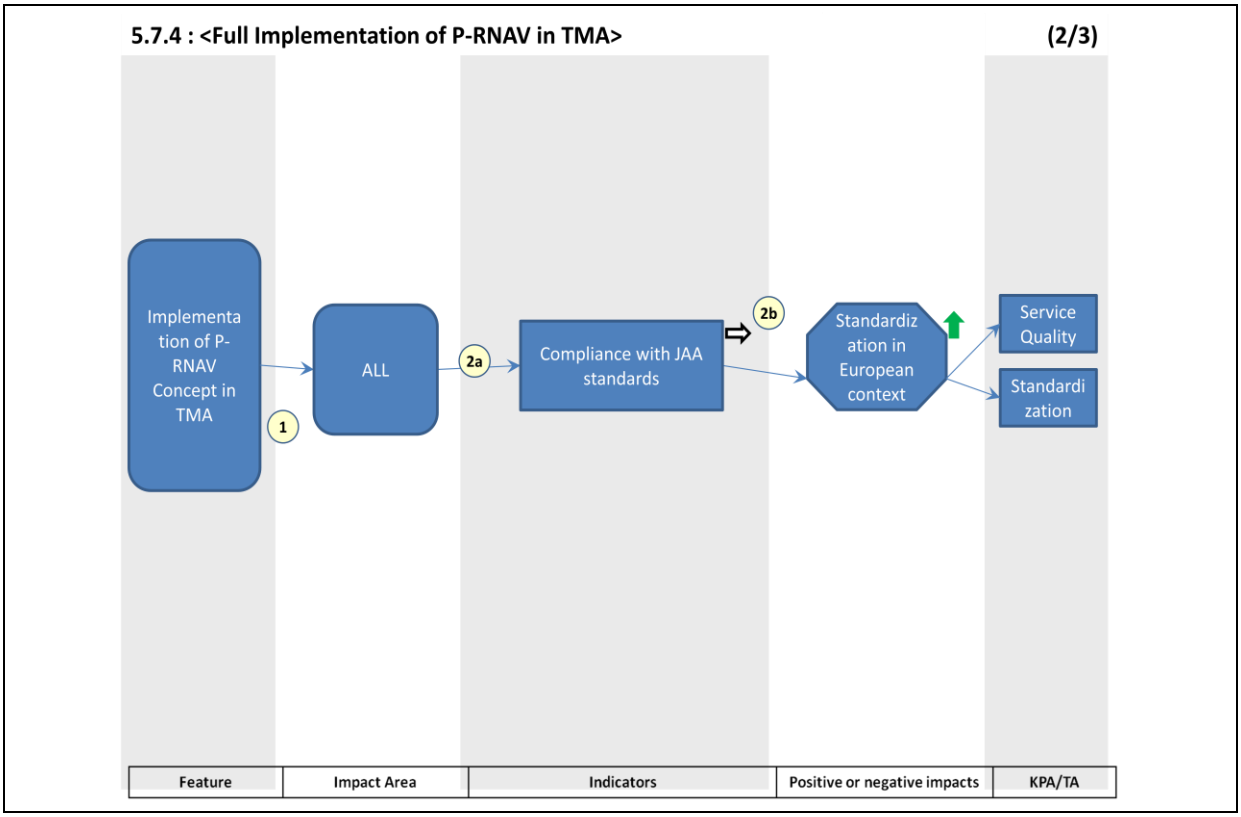
Impacted Stakeholders

Positive Impact 1	*<which stakeholders will be impacted>*
Negative Impact …	*<which stakeholders will be impacted>*

Data Sources

Indicator A	*<where can the data to measure the indicator come from>*
Indicator …	*<where can the data to measure the indicator come from>*

Table 12: Benefit Mechanism 001



[4] In the next version of the guidelines, projects will be asked to link to Strategic Targets and Influencing Factors, see Ref **Error! Reference source not found.**, which are at a lower level than PAs. If projects are already familiar with these then they are encouraged to use them.

Feature Description: *<fuller description of the feature>*

Mechanisms

(1) *<how the feature will bring changes in the 'impact area'>*

(2a) *<how the 'impact area' will bring about changes in the 'indicator'>*
+ *<how the indicator will be measured – metric description>*

(2b) *<what change is seen in the 'positive' or 'negative impacts' when the indicator(s) change and which KPA[5](s) this links to>*

(..) *<continues for other numbered mechanisms>*

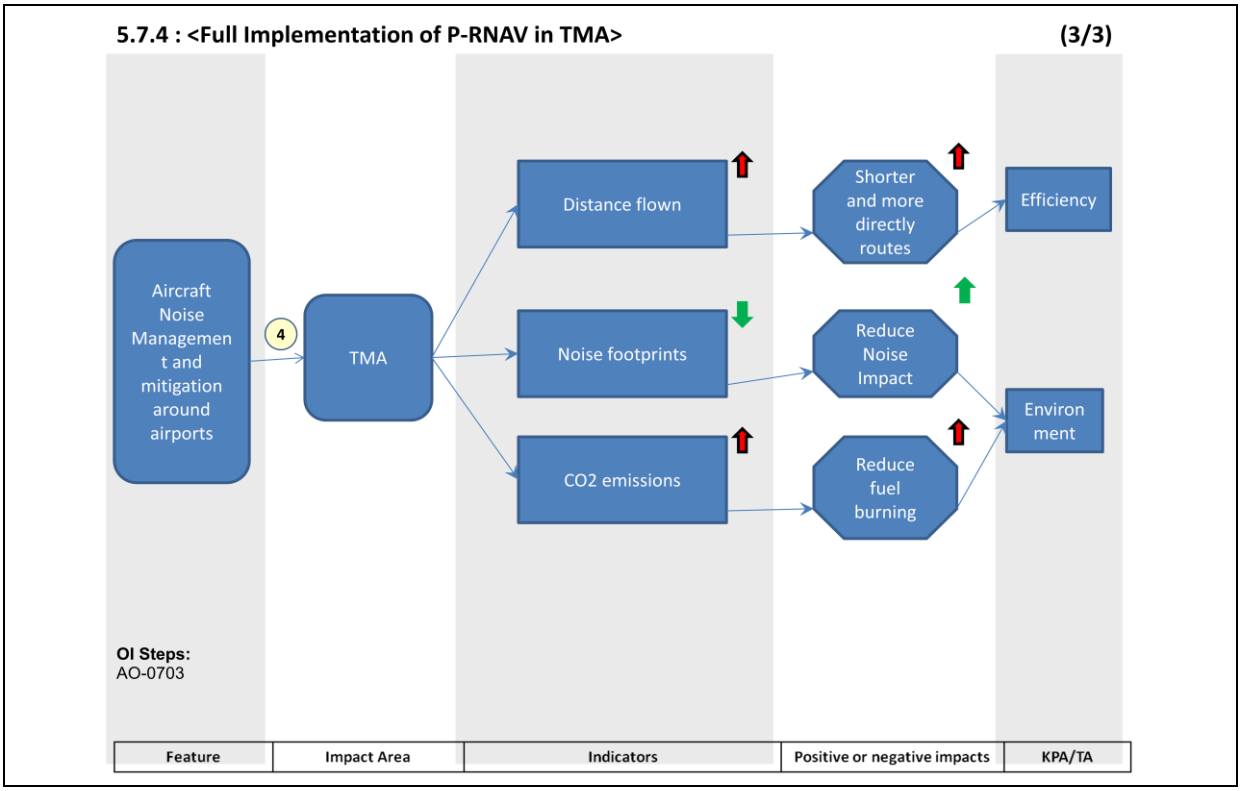
Impacted Stakeholders

Positive Impact 1	*<which stakeholders will be impacted>*
Negative Impact …	*<which stakeholders will be impacted>*

Data Sources

Indicator A	*<where can the data to measure the indicator come from>*
Indicator …	*<where can the data to measure the indicator come from>*

Table 13: Benefit Mechanism 002



[5] In the next version of the guidelines, projects will be asked to link to Strategic Targets and Influencing Factors, which are at a lower level than KPAs. If projects are already familiar with these then they are encouraged to use them.

Feature Description: *<fuller description of the feature>* **Mechanisms** (1) *<how the feature will bring changes in the 'impact area'>* (2a) *<how the 'impact area' will bring about changes in the 'indicator'>* + *<how the indicator will be measured – metric description>* (2b) *<what change is seen in the 'positive' or 'negative impacts' when the indicator(s) change and which KPA[6](s) this links to>* (..) *<continues for other numbered mechanisms>*

Impacted Stakeholders

Positive Impact 1	*<which stakeholders will be impacted>*
Negative Impact …	*<which stakeholders will be impacted>*

Data Sources

Indicator A	*<where can the data to measure the indicator come from>*
Indicator …	*<where can the data to measure the indicator come from>*

Table 14: Benefit Mechanism 003

2.4 Legend

Column Title	Box Shape	Column Description
Feature	Feature	Introduces one of the new features that the project is bringing to the world of ATM
Impact Area	Impact Area A	Sub categories used to group indicators and positive/negative impacts to help orient the reader (may not always be necessary)
Indicators	Indicator A	Aspects which can be measured (or calculated from other metrics) to identify if the expected positive and negative impacts are actually realised. These need to be measured in the validation exercises
Positive or Negative Impacts	Impact 1	Describes the expected positive or negative impacts
KPA	KPA 1	KPAs linked to the positive or negative impacts

Table 15: Benefit Mechanism Syntax - Columns

[6] In the next version of the guidelines, projects will be asked to link to Strategic Targets and Influencing Factors, see Ref **Error! Reference source not found.**, which are at a lower level than PAs. If projects are already familiar with these then they are encouraged to use them.

The boxes in these columns are linked by numbered arrows which represent the mechanisms.

1	The numbers provide links to the mechanism descriptions in the text.

Table 16: Benefit Mechanism Syntax - Mechanisms

The arrows associated with the Indicators and the Positive or Negative Impacts are:

	A beneficial decrease e.g. a reduction in CO_2 emissions (indicator) or a reduction in controller workload (positive impact)
	A detrimental increase e.g. an increase in CO_2 emissions (indicator) or an increase in controller workload (negative impact)
	A beneficial increase e.g. an increase in no. of movements (indicator) or an increase in safety (positive impact)
	A detrimental decrease e.g. a reduction in no. of movements (indicator) or a reduction in safety (negative impact)
	A change in the indicator, a positive or negative impact is expected but with current knowledge the direction is still not clear. Can be coloured to show the main expectation. It is preferable to use a direction arrow, however this is provided as a 'last resort', for example where input from a TA expert is required.

Table 17: Benefit Mechanism Syntax – Coloured Arrows

Appendix A: Benefit Mechanisms


Benefit Mechanism Template v0.1


Project BM.pptx

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