



SOURDINE II

D3-1.2

Detailed definition of new noise abatement procedures

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1. INTRODUCTION

1.1. Purpose

The purpose of this document is to update the D3-1.1 deliverable with which a matrix of procedures were proposed NAPs and NADPs, which would result in delivering noise benefits to airports and their surrounding.

The purpose of this document is the proposal of the best NADPs and NAPs based only on the outcomes (most noise beneficial) of the SES (D5.3) analysis and the results of the third Brainstorm which took place in June 2003.

Therefore it must not be seen as a final project document, rather a necessary step towards the election of those procedures which will be further and thoroughly validated on other simulation test beds. It must be seen only as an update to D3-1.1 and at the same time as a report on the selection method.

Only the final document of the Sourdine II project will offer NADPs and NAPs which will be fully acceptable.

1.2. Structure

The document is meant as an update report of the D3-1.1 document and is divided into three parts, two of them are part of the selection process while the third a preliminary Safety case.

1. The first step towards the selection of the most recommended procedures was the evaluation of the SII D3-1.1 matrix with the SES (the results of the simulation can be found in D5.3). This section offers the criteria used to compare and obtain the most noise beneficial procedures.
2. The second step includes in the selection process loop, the information gathered from the third brainstorm and analysis in depth the resulting procedures.
3. Preliminary Safety case.

The chosen procedures which are still in the validation process will be used for both Real time and Fast time simulations.

1.3. Background

The document is based upon the work done in WP3 and WP5: the first designing and compiling a list (matrix) of procedures; while the second workpackage working on them, using Airbus performance software to compute operational trajectories and the Airbus NLCP to calculate noise impact per procedure. This enabled filtering out those procedures that were not flyable (from a pure aircraft performance point of view) and identify noise reduction potential of remaining procedures.

The results, specifically, of D5.3 take into account Airbus aircraft A340 and A320, migration of the results to other kind of aircraft should not be done with simplicity.

1.4. Glossary

Term	Description
4D	3D Position plus Time Parameter
ACARS	Aircraft Communications Addressing and Reporting System
ACDA	An Advanced CDA (ACDA) is a CDA that is enhanced with future infrastructure, ATC tools and crew tools in order to meet demands of capacity and safety. During an ACDA, the requirements for ATC speed control may be relaxed, or even removed, and additional constraints may be added; for example to execute a part of the approach with thrust idle or

	to follow a certain fixed vertical flight path.
Actor	An organisation or agency, formal or informal, or an individual involved in validation activity or any of its tasks
AEFMP	Algerie, España, France, Maroco, Portugal (Plan)
Air traffic	All aircraft in flight or operating within the manoeuvring area of an aerodrome
AIS	Aeronautical Information Service
AMAN	Arrival Manager
Analytical Technique	Validation technique in which the behaviour of a real-world element being validated is expressed in a mathematical model that defines the relationships between the input and output variables, enabling the performance of the real-world element to be assessed mathematically for a characteristic quality.
AOA	Angle Of Attack
APP	Approach Control Office/Service
APV	Approach procedures with vertical guidance
ARP	Aerodrome Reference Point
ATC	Air Traffic Control
ATCo	Air Traffic controller
ATM	Air Traffic Management, the equipment, manpower, and processes required to enable aircraft operators to meet their planned times of departure and arrival and adhere to their preferred flight profiles with minimum constraints, without compromising existing safety levels
ATS	Air Traffic Services
AVLC	Aviation VHF Link Control
CDA	Continuous Descent Approach. A noise abatement technique for arriving aircraft in which the pilot, when given descent clearance below the Transition Altitude by ATC, will descend at the rate he judges will be best suited to the achievement of continuous descent. Whilst meeting the ATC speed control requirements, the objective being to join the glide-path at the appropriate height for the distance without recourse to level flight. [ANMAC]
CFMU	Central Flight Management Unit
CRCO	Central Route Charges Office
CTR	Control Zone. An area of controlled airspace extending upwards from ground level to a specified upper limit.
DBA _{max}	Maximum A-weighted sound level (also denoted as L _{max})
DMAN	Departure Manager
EATCHIP	European Air Traffic Control Harmonisation & Integration Programme
EATMP	European ATM Program
EC	European Community
ECAC	European Civil Aviation Conference
ECIP	European Convergence and Implementation Plan
EFDP	European Flight Data Processing
EFMS, FMS	Electronic Flight Management System
ENAV	Ente Nazionale di Assistenza al Volo
EUROCAE	European Organisation for Civil Aviation Equipment
EUROCONTROL	European Organisation for the Safety of Air Navigation
Exercise runs	The set of individual time periods over which measurements are made in a validation exercise
FAA	Federal Aviation Administration
FAS	Final Approach Speed

FIR	Flight Information Region. UK airspace is divided into two FIRs, London and Scottish.
FUA	Flexible Use of Airspace
GAT	General Air Traffic
GBAS	Ground Based Augmentation System
GENOVA	Generic Overall Validation for ATM
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
HALS/DTOP	High Approach Landing System / Dual Threshold Operation
Hypothesis	In the context of a validation exercise, a proposition regarding the success of an operational concept in addressing a problem about operational concepts that is stated in statistical terms, based on the low-level validation objectives and constrained by the metrics that are available
IAC	Instrument Approach Chart
IATA	International Air Transport Association
ICAO/OACI	International Civil Aviation Organisation
IFS	Intermediate Flap Speed (advised)
ILS	Instrumental Landing System
Indicator	A metric that is indirectly related to the objective of interest (e.g, workload is an indicator of capacity)
JAA	Joint Aviation Authority
LVNL	Air Traffic Control the Netherlands
MAEVA	A Master ATM European Validation Plan
MAS	Measurement and Analysis Specification
MASPS	Minimum Aviation System Performance Standards
Metric	A system parameter measured in a validation exercise to provide the data used to derive conclusions
MFA	Minimum Flying Altitude
MLS	Microwave Landing System
Mode S	Mode Select Discrete Addressable Secondary Radar System with Data Link
MRVA	Minimum Radar Vectoring Altitude
MSA	Minimum Sector Altitude
MSSR	Monopulse Secondary Surveillance Radar
MTBO	Medium Time Between Occurrence
NADP	Noise Abatement Departure Procedure
NAP	Noise Abatement Procedure
NLCP	Noise Level Calculation Program (Airbus)
NOTAM	Notice to Airmen
NPA	Non-Precision Approach
OLDI	On-line Data Interchange panel
OPERATIONAL	Set of concepts which cover all 8 Invariant Processes and is described answering to the questions who, what, how, when, and where
P,B-RNAV	Precision, Basic Area Navigation
PANS-OPS	Procedures for Air Navigation Services Operations
PMP	Project Management Plan
RNAV	Area Navigation
RNP	Required Navigational Performance
SACTA	Automated ATC system
SEL	Sound Exposure Level

SID	Standard Instrument Departure
SMGCS	Surface movement Guidance and Control System
SOIA	Simultaneous Offset Instrument Approach
STAR	Standard Terminal Arrival Routes
TARA	Terminal Airspace RNAV Applications Task Force
TDZ	Touch Down Zone
TERPS	United States Standard for Terminal Instrument Procedures
TMA	Terminal Manoeuvring Area
TWR	Tower
Validation	The process through which a desired level of confidence in the ability of an operational concept to operate in a real-life environment may be demonstrated to the user, against the actual needs captured as a pre-defined level of functionality, operability and performance
Validation exercise	The set of one or several tests performed to determine whether an ATM configuration meets the validation requirements specified for it, which may range from a formal meeting of experts to the performance of empirical trials in validation environments and platforms.
Validation Scenario	Representation of an operational situation in which an ATM operational concept is validated within one or several validation exercises, to enable the measurement and characterisation of the operational concept's performance. Descriptions of validation scenarios should cover location, timeframe, events and ATM environment
Validation Technique	Method used to achieve the validation objectives of a specific validation exercise
VDL	VHF Data Link
VFR	Visual Flight Rules
VGH	Validation Guidance Handbook. A consolidated set of guidance materials to be produced by the MAEVA project
VMP	Validation Master Plan
VOR/DME	Very High Frequency Omnidirectional Range/Distance Measuring Equipment

1.5. Required Inputs

The analysis relies on the following documents:

1. Deliverable D5.3 for in depth evaluation of noise benefits and description of NADPs and NAPs, noise levels in terms of DBAmax and SEL.
2. D3-1.1 for the general concept description behind the procedure.
3. Minutes of Meeting Technical Management Board for proposed guidelines (SII_MoM_11FEB03_version 20030220.doc).
4. Brainstorm meeting number three results (D10-1-3)

1.6. Expected Outputs

The expected output is the included list of best noise performing NAAPs and NADPs and their selection for the next step in procedure validation, which is the FTS and RTS.

2. BEST PROCEDURES (NOISE) STEP 1

2.1. Election method and criteria

In general in order to choose the best noise performing procedures, the results following from the D5.3 document were divided into Approach procedures and NADPs; including the subdivision by aircraft performing such procedure.

Hence the following criteria were applied:

APPROACH

1. Benefits below flight path in zones where noise levels are above 55dBA
2. Reduction of noise below track and of footprint area, compared to reference.
3. Trend from least beneficial to most beneficial

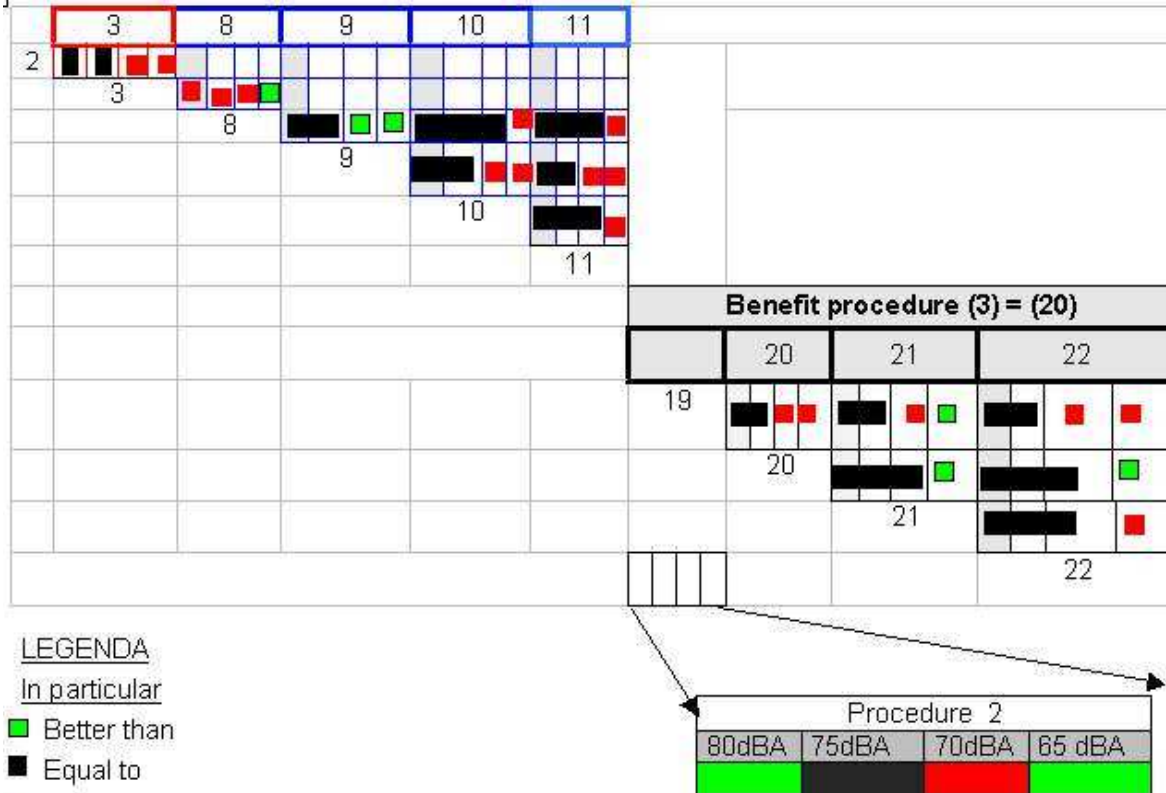
DEPARTURES

1. Best Localised Noise performance (Distant/Close-in)
2. Benefits below flight path in zones where noise levels are above 55dBA.

The idea to restrict the departure procedures outcomes to only 20 nm can be seen as not appropriate, as in many cases (D5.3 figure C3-6) the difference in noise between procedures can be as big as 5dBA. But the data we refer to for the procedure selection is not available further out and the noise value falls below the 55dB.

2.2. Chosen procedures

2.2.1. Approach procedures evaluated for A340-313



LEGENDA

In particular

- Better than
- Equal to
- Worse than

Please refer to Deliverable 5.3 for procedure numbering and in detail information

Fig. 1. A340-313 approach procedures analysis matrix.

In general

RED area procedures: CDA Standard Glideslope;
 BLU area procedures: CDA increased Glideslope;
 BLACK area procedures CDA Variable Path Segment.

From the table we can see which are the best performing NAPs compared one to the other: the outcome is a hierarchy of best noise performing procedures:

- Section 1 (in RED)
 (3) performs better than (2) which is higher than the reference baseline procedure.
- Section 2 (BLU)
 Procedure (11) is the best followed in order by (10) ,(8) and (9) which has an increase in the 65 dBA zone just inside the 10nm distance from the threshold.
- Section 3 (BLACK)
 Procedure (20) performs best, followed in order by (22), (21) and (19).

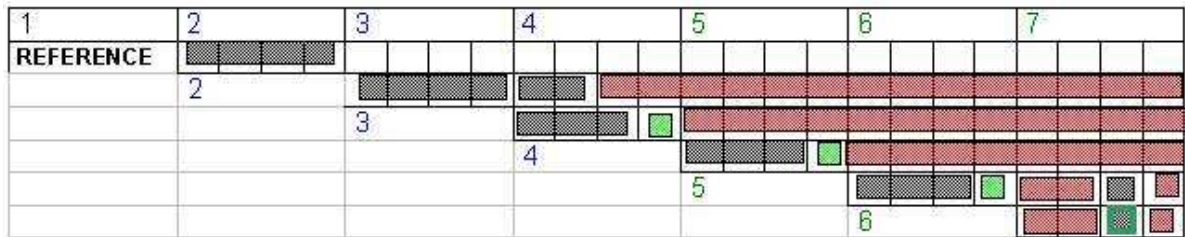
Conclusions

Since procedures number (3) and (20) have the same footprint benefits relatively to the reference procedure, while procedure number (8) is better than number (3). Hence resuming, in order from most beneficial to less beneficial procedure (in terms of noise footprint) we have:

Most noise beneficial					Less Noise beneficial				
Procedure	11	10	8	3-20	22	21	9	2	19

2.2.2. Approach procedures evaluated with A320-211

The same use of colours is used to identify benefits in comparing the noise footprints.



“—”: procedure (4) and (5) increase noise above the reference procedure (1).

Please refer to Deliverable 5.3 for procedure numbering and in detail information

In particular

- Better than
- Equal to
- Worse than

- 2,3,4 (BLU): Standard CDA procedure;
- 5,6,7 (Green): CDA procedure with Increased GS.

Fig. 2. A320-211 approach procedures analysis matrix.

Conclusions

For the A320-211 the noise footprint comparison is straight forward, the best noise performing procedures in order of (%) benefit are:

Most noise beneficial			Less Noise Beneficial		
Procedure	7	5	6	3	2

Noise procedure number 4 was taken out of the table as it does not give any noise benefit, on the other hand 2 is very similar in beneficial noise gain to procedure number 1 which is the reference procedure.

2.2.3. Departure procedures

As done by D5.3 the NADPs were divided into Close-in and Distant procedures, the first giving noise relief closer to the airport while the second noise relief further away.

The amount and location of noise relief depends on the procedures themselves and the aircraft type and weight.

On the other hand the zone where noise relief is required and therefore the need for a Close-in or Distant procedure is rather dependent on the necessities of the airport (i.e. the location of noise sensitive zones relative to the departure runways).

Bearing in mind this first division into two categories, we may notice that it is not possible, to distinguish a procedure, which relieves noise on all areas and with the same gain.

It is therefore more helpful to refer to the conclusions given by the D5.3 (par 5.2-“Departure Procedures”) which covers the general question.

3. PROCEDURE SELECTION STEP 2

The following sub sections continue the selection work of section 2, where only the noise abatement characteristics were weighed.

In this second step in fact the results from step one will indicate which aspects among the various procedures are the most noise beneficial, meaning that it is not the specific aircraft procedure we are aiming for, rather from which characteristics do we obtain the most benefits.

In the following subsections the analysis goes more in detail on certain results obtained for certain procedures which are numbered following the aircraft the SES was simulating on.

The conclusion will highlight which best concepts will be brought forward to the further steps of validation.

3.1. Further general remarks on best noise performing procedures

3.1.1. Approach procedures A340-313

Comparison between procedures 3 and 20:

The initial height for procedure 20 corresponds to 7000ft whereas procedure 3 is initiated at 6000ft therefore enabling the aircraft to fly at a higher altitude and then generating less disturbances to the airport vicinity at this distance from the runway threshold (5.4 dBA less than reference for procedure 20 and 2.4 dBA less for procedure 3).
(see graphs in deliverable D5.3).

In the case of procedure 20, the aircraft then descends at constant speed after having decelerated in level flight for slats and flaps deployment and reached the reference speed. The noise level gain is then conserved while the aircraft following procedure 3 decelerates on a -2° flight path to reach reference speed at a height of about 3500ft.

Advantage for procedure 20 is therefore maintained until a distance of about 8NM from the runway threshold when noise levels become equivalent, corresponding to the flight idle/constant speed segment for procedure 3.

Procedure 20 would then be more beneficial than procedure 3 in terms of noise.

3.1.2. Approach procedures A320-211

Comparison between procedures 5 and 6:

Noise profiles show noise levels corresponding to procedures 5 and 6 and are very close (see deliverable 5.3).

These two procedures describe a similar descent from an altitude of 7000ft with an initial speed of 250kt on a -2° flight path to reach CONF3 and Landing Gear Down position. The difference comes from the fact that configuration changes for procedure 5 are achieved slightly earlier by selecting higher speeds for CONF 3 and gear deployment (CONF 3 selected at maximum speed authorised to change to CONF3). This enables a faster deceleration, and therefore allows flying slightly higher than procedure 6 before the 4° glide slope intercept.

Nevertheless, this fast deceleration by configuration and gear deployment at higher speeds results in an important noise level increase, being slightly higher than for procedure 6. At this point, it is possible to notice that procedure 5 generates more noise than reference for about 3.5NM whereas the noise peak for procedure 6 lasts less than 1NM.

It therefore appears procedure 6 would be more beneficial than procedure 5 since the corresponding noise levels remain smaller than reference longer.

Procedure number 7

This procedure is the best performing noise procedure when simulated for the A320 as shown in section 2.2.2. And is very similar to procedures n°10 for the A340 achieving there also good values for noise decrease.

3.2. Procedures with more than 3° GS general analysis base on BSIII [BSIII]

During the Sourdine II third brainstorm, the best noise performing procedures were proposed to the Expert Panel in order to have a further support for there selection, mostly based on the different background and know-how of the Panel's components.

Following is one of the most discussed points which have influenced the selection process at this stage:

Procedures with more than 3° GS

The remarked problem of procedures with more than 3 degree GS was that with extreme weather conditions like strong wind, pilots should have margin of error, which probably they do not have with more than 3 degrees. In particular, only a limited number of aircraft seems likely to perform approach with steeper descent angles- the issue being deceleration and flare. Certainly not all the aircraft in 2015 fleet mix will be able to perform increase glide slope angles.

As a consequence, two ILS should be available at each airport (i.e. the usual 3°ILS should be kept operational). On the other hand the tendency for future technology is the non-precision approach and an ILS is not present at all airports.

Another point was that the noise benefit of steeper angles (as obtained for the A320 and A340 under theoretical conditions) might not be as good when the procedures are applied to a fleet mix under operational conditions. For example, a number of aircraft will require to be at lower speed and higher flap/slat angles (possibly with landing gear extended) prior to intercepting a steeper glide slope. In this case higher airframe noise may eliminate part of the steep approach noise reduction.

For these reasons, for short and medium term concepts applicable to the overall fleet and majority of airports, we should focus our attention on the intermediate approach instead of the final approach phase.

Further other points came up in the brainstorm which were included in deciding the procedures, the above being one of the most important. Further arguments can be found in the D10-1-3.

Another point was that the noise benefit of steeper angles (as obtained for the A320 and A340 under theoretical conditions) might not be as good when the procedures are applied to a fleet mix under operational conditions.

3.3. Conclusion

Taking into account both the noise performance of the procedures plus the comments from the third Brainstorm meeting (mostly in the case of increased GS on ILS) the following procedures were proposed for their preliminary sound abatement benefits. To notice that the basic idea is not the creation of aircraft specific procedures: as such the A320 and A340 were used as test beds to obtain a first filtering out in order to obtain the most noise beneficial features of the procedures.

Approach Procedures

Procedure 10

From section 3.1.1 both in terms of noise and pilot workload procedure 11 looks better than 10, on the other hand 11's glideslope angle, which is higher than 4° was understood to be a big constraint for many aircraft (see section 3.2). In the end procedure 10 was chosen as a good representative of a increased GS CDA with good noise abatement performance.

Procedure 10 and 7

A good example of this stepped analysis are the good results obtained for both aircrafts with a high GS procedure, in fact procedure (10) A340 and (7) A320 are very similar and indicate that the general characteristics or concept behind the specific aircraft outcome during the SES, deliver noise abatement benefits.

The general procedure based upon the (10-7) can be found described further on in section 4.

Procedure 2

Was chosen as the standard basic CDA procedure.

Procedure 20 & 21

Both represent a Variable path CDA procedure and behaved quite well for the A340 resulting in good noise relief.

On the other hand no procedure of this type was simulated on the SES for the A320 at the beginning, although the basic concept is thought to be of great aid in decreasing noise. Therefore in a second moment the two procedures were simulated for the A320, in order to see if the basic concept would work on another aircraft and the results were fairly good (REF:B.3 page 63, D5.3).

The two procedures have been chosen in order to keep supporting the research on Variable path concept and the construction of a general Variable Flight Path CDA.

General

The results from all the previous steps has shown that certain procedure concepts pursued during the design process do result in noise benefits.

This achievement not only makes the procedures general but overall gives the possibility of adapting the concept the specific necessities (fleetmix, airport, etc..) as far as possible.

The procedures have proven beneficial for A340 and A320 and the same results are expected for the same type of aircrafts.

Departure Procedures

The selection for the departure procedures fell on the Sourdine I optimised and the NADP1 and NADP2 procedures. The SI procedures have proven beneficial for four engine aircraft, but for aircraft who cannot perform this procedure since their normal Climb rating is already very low another less advanced but compatible procedure is required such as the basic NADP 1 and NADP 2 procedures.

The study conducted in D5.3 confirms that noise reductions obtained with identical procedures depend much on aircraft type and weight [Ref. D5.3, page 33]

The departure procedures should be selected depending on the airport environment (sec.2.2.3).

Selected Procedures

Approach Procedures	
2 CDA standard GS and 10 (7) increased GS CDA	20 and 21 type Variable path CDAs
Departure Procedures	
4, 5 Sourdine I optimised Close-in/Distant (four engine aircraft)	NADP1 and NADP2

The above procedures will be tested in both FTS and RTS towards a baseline procedure NAP (ICAO-A).

4. GENERAL SOURDINE II PROCEDURE DESCRIPTION

The following is the general description of the procedures, were the speed and vertical profile are defined together with thrust and configuration changes. Due to its nature customisation (i.e. choice of lateral track) needs to be done to adapt them to the specific environment in which they will be tested.

The specific part of the following procedures will be found in the operation of concept section related to each simulation platform document.

4.1. Approach procedures

Overall assumptions:

- Aircraft at 90% MLW when starting approach (standard MLW per aircraft)
- Standard ISA atmospheric conditions
- Airport/runway elevation: Sea Level

4.2. Approach procedure I: Reference with level deceleration at 3000ft

Condition	Parameter values
7000 ft (Fixed height)	- Speed 250 KTS CAS
	- Level flight
3000 ft (Fixed height)	- Clean configuration
	- Landing Gear up
	- Idle thrust
	- Constant CAS descent
Landing configuration and speed reached (Resulting height, minimum 1000ft)	- Level flight
	- Decelerate to intermediate flap speed (IFS) and change to intermediate configuration
	- Fixed descent angle of 3°
	- Landing gear down
	- Decelerate and change to landing configuration
Landing configuration and speed reached (Resulting height, minimum 1000ft)	- Decelerate to final approach speed (FAS)
	- Adapted Thrust for descent at 3°
Landing configuration and speed reached (Resulting height, minimum 1000ft)	- Constant speed (FAS) descent to 50ft

4.2.1. Procedure II: Basic CDA with 2° initial FPA

Condition	Parameter values
7000 ft (Fixed height)	<ul style="list-style-type: none"> - Speed 250 KTS CAS - Level flight - Clean configuration - Landing Gear up
	<ul style="list-style-type: none"> - Idle thrust - Fixed 2° Flight Path Angle (FPA) - Decelerate to intermediate flap speed (IFS) and change to intermediate configuration
3000 ft (Fixed height)	<ul style="list-style-type: none"> - Fixed descent angle of 3°. - Landing gear down - Decelerate and change to landing configuration (+) - Decelerate to final approach speed (FAS)
Landing configuration and speed reached (Resulting height, minimum 1000ft)	<ul style="list-style-type: none"> - Adapted thrust for descent at 3° - Constant speed (FAS) descent to 50ft

4.2.2. Procedure III: CDA with 2° initial FPA and increased final glide slope

Condition	Parameter values
7000 ft (Fixed height)	<ul style="list-style-type: none"> - Speed 250 KTS CAS - Level flight - Clean configuration - Landing Gear up
	<ul style="list-style-type: none"> - Idle thrust - Fixed 2° Flight Path Angle (FPA) - Delay flap deployment as late as possible - Decelerate and change to intermediate configuration - Decelerate to intermediate flap speed (IFS)
3000 ft (Fixed height)	<ul style="list-style-type: none"> - Fixed descent angle of 4°. - Landing gear down - Decelerate and change to landing configuration (+) - Decelerate to final approach speed (FAS)
Landing configuration and speed reached (Resulting height, minimum 1000ft)	<ul style="list-style-type: none"> - Adapted thrust for descent at 4° - Constant speed (FAS) descent to 50ft

4.2.3. Procedure IV: CDA with constant speed, variable FPA segment at landing configuration

Condition	Parameter values
7000 ft (Fixed height)	<ul style="list-style-type: none"> - Speed 250 KTS CAS - Level flight - Clean configuration - Landing Gear up
	<ul style="list-style-type: none"> - Idle thrust - Decelerate, landing gear down and change to landing configuration (+), - Decelerate to final approach speed (FAS)
Landing configuration reached (Resulting FPA)	<ul style="list-style-type: none"> - Descend at constant speed (FAS) to 2000ft - Idle thrust
2000 ft (Fixed height)	<ul style="list-style-type: none"> - Adapted thrust for descent at 3° - Constant speed (FAS) descent to 50 ft.

4.2.4. Procedure V: CDA with constant speed, variable FPA segment at intermediate configuration

Condition	Parameter values
7000 ft (Fixed height)	<ul style="list-style-type: none"> - Speed 250 KTS CAS - Level flight - Clean configuration - Landing Gear up
	<ul style="list-style-type: none"> - Idle thrust - Decelerate and change to intermediate configuration - Decelerate to intermediate flap speed (IFS)
Intermediate configuration reached (Resulting FPA)	<ul style="list-style-type: none"> - Descend at constant speed (IFS) to 3000ft - Idle thrust
3000 ft (Fixed height)	<ul style="list-style-type: none"> - Fixed descent angle of 3°. - Landing gear down - Decelerate and change to landing configuration (+) - Decelerate to final approach speed (FAS)
Landing configuration and speed reached (Resulting height, minimum 1000ft)	<ul style="list-style-type: none"> - Adapted thrust for descent at 3° - Constant speed (FAS) descent to 50ft

(+) Minimum allowable flap deployment

(++) Depending on aircraft type and weight, this segment may be steeper than the final approach (3°G/S angle) and therefore result in a G/S intercept from above

4.3. Departure procedures

4.3.1. Assumptions

Atmospheric

- Standard ISA atmosphere
- Airport/runway elevation: Sea Level

Takeoff weights

Two weight options:

- TOW = 85% MTOW
- TOW = 100% MTOW

4.3.2. THRUST Operation Definitions

CUTBACK Thrust definition

In this study, *CUTBACK THRUST* is defined as that thrust level (value of N1 or EPR) that in case of one engine inoperative, using the remaining engines, ensures a climb gradient of 1.2% for twinjet, 1.5% for 3 engines aircraft and 1.7% for 4 engines aircraft.

GRADUAL THRUST INCREASE definition

GRADUAL THRUST INCREASE means a gradual increase of thrust from the CUTBACK THRUST to Max Climb thrust. It can only be applied in case CUTBACK THRUST is smaller than Max Climb thrust.

The GRADUAL THRUST INCREASE is designed to avoid noise increase below track during the transition from CUTBACK THRUST to Max Climb thrust. This is accomplished (automatically, requiring adapted engine control systems) using an optimised rate of increase of thrust per unit height increase or unit time.

4.3.3. Departure procedure 1 Reference (ICAO-A):

Altitude (ft)	
0 ft	- TOGA (Take-Off Go Around) Thrust - Conf 1+F - Climb out at V2 + 10 kt
1500 ft	- Reduce to Climb Thrust - Maintain V2 + 10 kt
3000 ft	- Acceleration to 250 kt, retracting flaps/slats on schedule - Climb to 15000 f

4.3.4. Departure procedure 2 (Sourdine optimised close-in):

Condition (altitude ft)	Parameter values
0 ft	<ul style="list-style-type: none"> - TOGA (Take-off Go Around) thrust - Brake release and acceleration to rotation speed (*) - Rotation and lift-off
	<ul style="list-style-type: none"> - Retraction of undercarriage - Climb out at a speed of V2 + 10-20 KTS IAS (**)
At 800ft [1]	<ul style="list-style-type: none"> - Reduce thrust to <i>CUTBACK</i> (***) or Max Climb, whichever is lowest - Maintain V2 + 10-20 KTS IAS
3000 ft	<ul style="list-style-type: none"> - If <i>CUTBACK</i> thrust was selected: perform <i>GRADUAL THRUST INCREASE</i> (****) to Max Climb thrust - Maintain V2 + 10-20 KTS IAS
Upon achieving Max Climb	<ul style="list-style-type: none"> - Accelerate and retract flaps/slats on schedule to clean configuration - Continue acceleration to 250KTS - Climb to 15000ft

4.3.5. Departure procedure 3 (Sourdine optimised distant):

Condition (altitude ft)	Parameter values
0 ft	<ul style="list-style-type: none"> - TOGA (Take-off Go Around) thrust - Brake release and acceleration to rotation speed (*) - Rotation and lift-off
	<ul style="list-style-type: none"> - Retraction of undercarriage - Climb out at a speed of V2 + 10-20 KTS IAS (**)
At 800ft [1]	<ul style="list-style-type: none"> - Accelerate to zero-flap speed (Vzf) - Retract flaps/slats on schedule to intermediate configuration
Upon reaching Vzf	<ul style="list-style-type: none"> - Complete flaps/slats retraction to clean configuration - Reduce thrust to <i>CUTBACK</i> (***) thrust or Max Climb, whichever is lowest - Maintain speed (Vzf)
5000 ft	<ul style="list-style-type: none"> - If <i>CUTBACK</i> thrust was selected: perform <i>GRADUAL THRUST INCREASE</i> (****) to Max Climb thrust - Maintain speed (Vzf)
Upon achieving Max Climb	<ul style="list-style-type: none"> - Accelerate to 250 KTS IAS - Climb to 15000 ft

(*) Cleanest possible takeoff configuration

(**) V2+10 where possible

(***) Defined in section 4.3.2.

(****) Defined in section 4.3.2.

[1] Dependent on local airport

5. CONCLUSION

The objective of the D3-1.2 update was twofold: first the procedure selection based on the single event noise calculation (D5.3) study and the input from the expert panel; second the preliminary safety analysis in which the identification of safety critical areas was conducted.

The process has been conducted in order to pick the best noise beneficial procedures, by comparison of the theoretical vertical noise abatement benefits.

Among the criteria used we may underline the 4^o aspect of the GS which was refused for short/medium term general application by the expert panel, by which only one procedure was endorsed for further trials.

The four NAAPs proposed are not specific but general procedures and most important they are not the final SII recommended procedures, at least not at this stage were no FTS and RTS have being conducted.

Various aspects influence departure procedures, going from the aircraft to the environment we apply them too. At this stage, the four NADPs proposed both SI and NADP1&2 still need to be simulated on FTS and RTS. But have given good results in the Single Event Simulation noise calculations, indicating on the one hand good noise benefits while on the other that again the influence in the aircraft used dictates the use of one or the other solution.

The choice between close-in or distant departure is totally dependent on the airport situation.