Aviation Noise Impact Management through Novel Approaches

D4.1 – Scenarios calculations for listening tests

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[1] Use one of the following codes: R=Document, report (excluding the periodic and final reports)
DEM=Demonstrator, pilot, prototype, plan designs
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OTHER=Software, technical diagram, etc.

[2] Use one of the following codes: PU=Public, fully open, e.g. web
CO=Confidential, restricted under conditions set out in Model Grant Agreement
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1 Introduction

One of the topics of research in ANIMA is the effectiveness of the use of a Virtual reality device for credible communication and engagement with people around airports. As input to this kind of device one needs realistic noise signatures.

For existing aircraft, experimental data (aircraft noise recordings) can be used. For novel aircraft however, only existing on the drawing board, such experimental data is obviously not available. To fill this gap, noise predictions will be made with the **Noise Reduction Solutions Simulator**, which is part of the Virtual Community Toolchain that is being developed in ANIMA WP4. This Simulator will be capable of predicting noise spectra of novel aircraft including noise reduction technology concepts, which, in turn, can be fed to noise synthesis tools (in this report also called auralization tools) to create realistic noise signatures. This combination of noise prediction and noise synthesis will be called auralization toolchain in the following.

At present the Noise Reduction Solutions Simulator is still under development and no reliable noise predictions can yet be made. However, an important aspect of the auralization toolchain can already be tested: the interface between the Simulator and noise synthesis tools. The goal is to have a noise prediction tool that can be plugged to any available noise synthesis tool.

This report describes the methodology used in the Simulator, comprised of two tools, FRIDA and SOPRANO, to get noise spectra from data characterizing an aircraft flight. Additionally, a representative sample datafile is described, with which this interface test can be performed, and which will allow for an early detection of any issues interfacing the components.

2 Methodology

The Noise Reduction Solutions Simulator, developed in ANIMA WP4, will be able to predict the noise of novel aircraft and noise reduction technology concepts for a fleet of aircraft, operating at an airport.

The core of this prediction tool is **SOPRANO, a single event aircraft noise prediction tool**, developed by Anotec in the Silencer project and since then continuously improved and used in a variety of research projects. SOPRANO is capable of predicting the noise of the various noise sources and installation effects for an aircraft/engine configuration. Changes to these noise sources and installation effects may be incorporated, simulating future noise reduction technologies. Their impact on noise will be assessed in ANIMA.

This capability of SOPRANO to adjust noise sources will also be used to predict the noise of novel aircraft concepts like blended wing bodies. In order to model novel aircraft, filters are used. Those are generated by a tool called FRIDA, developed by UoR. These filters will be provided as tables with changes to the source noise (ΔdB), with respect to a reference aircraft for which the noise sources are available in the Simulator. More information on FRIDA and SOPRANO are respectively given in chapters 2.1 and 2.2.

The noise spectra of the complete aircraft/engine combination, with applied filters, will be calculated for the user-defined time instants and an ASCII file with the 1/3 octave spectra and tonal components will be generated by SOPRANO. This text file will be used to feed the auralization tools. In a second branch of the tool chain (not considered hereafter), these spectra are used to generate the noise database required for airport noise predictions with the airport noise model SONDEO, which is a model compatible with ECAC Doc29 and is used in other tasks in the ANIMA project. For further details on SONDEO, references will be provided in forthcoming relevant documents (e.g. D4.3).

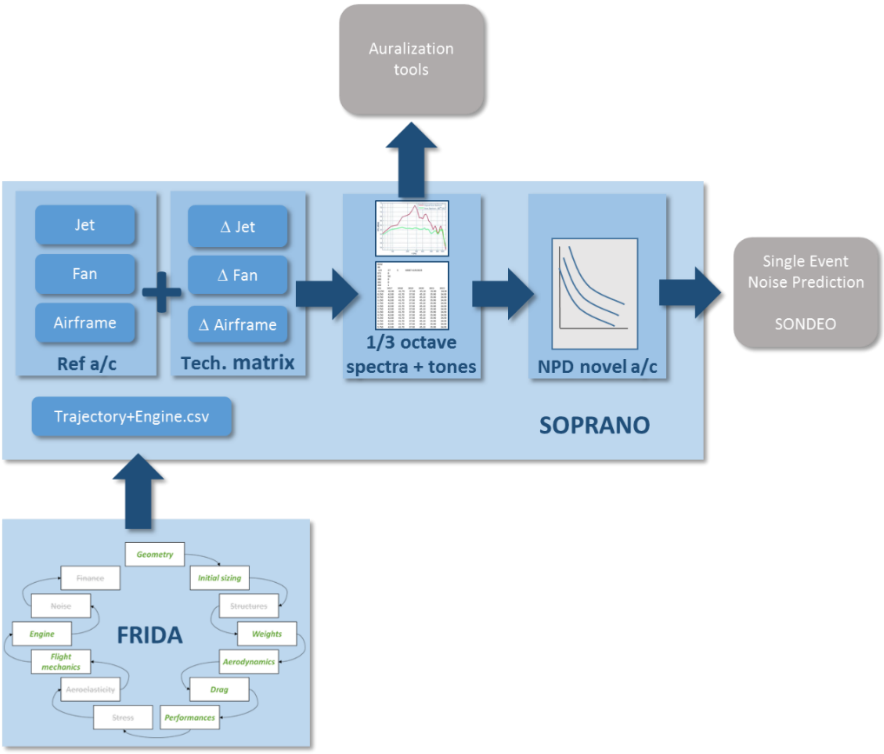

Figure 1: Schematic overview of toolchain

2.1 FRIDA

The Multidisciplinary Conceptual Robust Design Optimization (MCRDO) framework FRIDA (Framework for Innovative Design in Aeronautics) is outlined here. FRIDA can deeply describe the aircraft from a multidisciplinary point of view, so that it turns out to be suitable for all those applications that require the aircraft configuration definition, the environmental impact estimation (taking into account both the acoustical and chemical emissions) combined with financial metrics. It is worth noting that FRIDA, being developed to assess the conceptual design of both conventional and innovative aircraft (for which the designer cannot rely on past experience or literature data), the algorithms used in all the modules are, if possible, prime-principle based, simplified with specific assumptions to reduce the order of complexity.

Below, a schematic representation of the framework FRIDA is shown, with the modules used in ANIMA highlighted in green. A brief synthesis of the main characteristics of these modules follows.

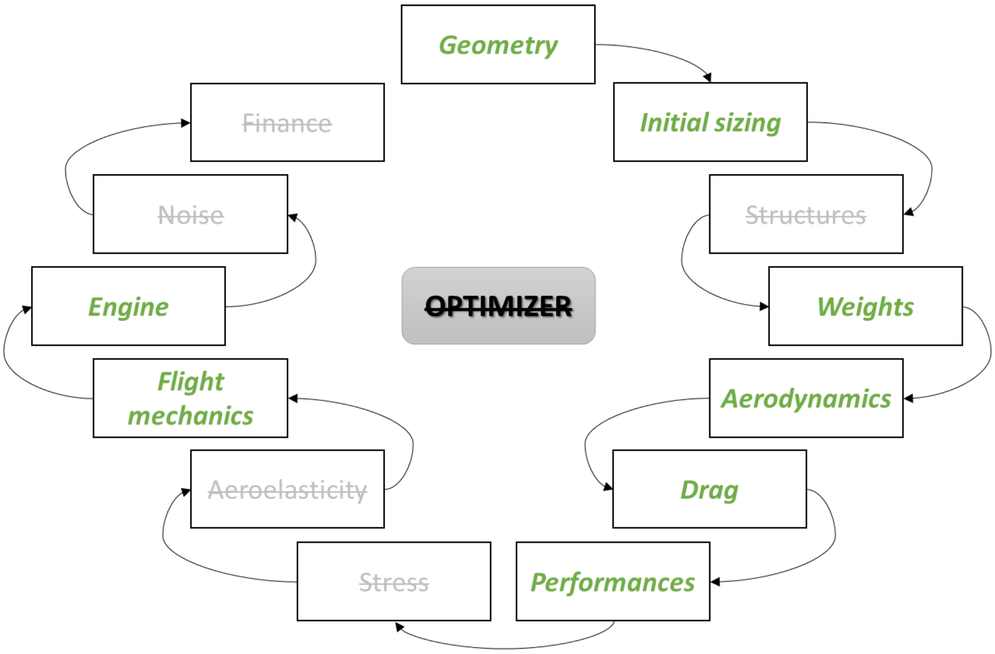

Figure 2 : Schematic representation of FRIDA

<u>Geometrical model build-up</u>

FRIDA makes use of a built-in geometrical processor for the generation of geometry nodes and structured mesh. The parametric half-geometry (the x-z plane of symmetry is considered) can be composed by several parts. Each part is characterised by "section properties" and "part properties", and suitable matching constraints ensure the geometry continuity.

<u>Preliminary sketch and layout definition</u>

The initial gross-weight estimation is assessed using historical regressions [1] as function of the relevant mission requirements (modified to account for new aircraft concepts, such as BWB, Prandtl-Plane, Hybrid-electric power-plants, etc. [2]). The inner layout (cockpit, cabin, cargo and landing gears required volumes calculation) is also defined.

<u>Weight breakdown</u>

A revised procedure to compute the aircraft weight is implemented within the framework FRIDA. The iterative scheme for the weight breakdown has been enhanced to also account for innovative configurations such as the BWB. In this module, the geometry specs are loaded to estimate the contribution each part of the aircraft has with regard to the take-off weight. Total payload is a mission requirement and the weight corresponding to passengers and on-board operators is retrieved from the sketch module. Wing (and winglet) weight directly comes from the wing-box modelling: spar web, stringers' and panels' geometrical, elastic and inertial characteristics are given as input variables to the structural analysis module. The weight of the engines is an input parameter (a non-fixed design procedure is currently under development, aimed at evaluating the propulsion system weight starting from the mission requirements, also for electric engines). Landing gear weight is estimated using a formula found in literature. Fixed equipment weight is calculated as a function of the engine weight, payload, crew and staff weight in addition to the gross weight.

Aerodynamic analysis

The physical model used for aerodynamics is that of incompressible quasi-potential flows (the flow is potential everywhere except for the wake surface [3], [4]), with viscous correction valid for high Reynolds numbers. The wake geometry is fixed in a frame of reference connected with the wing and corresponds to the surface generated by the trailing edge during the motion. The model is coupled with a boundary-layer integral model that accounts for the viscosity effects and provides a suitable estimation of the viscous drag. The integral equation is completed by the non-permeability boundary condition on the body surface and the vorticity convection in terms of velocity potential jump at the trailing edge on the wake surface. Note that the boundary condition can include the effect of the boundary-layer in form of transpiration velocity [5]. The integral equation is solved in the frequency domain by Laplace-transforming and applying the BEM (Boundary Element Method) discretization. The calculation of induced drag is carried out by means of the Trefftz Plane: drag can be considered only dependent on the perturbation velocity induced in a plane infinitely far from the body surface.

Parasitic drag estimation

The parasitic drag coefficient (total non-induced) in clean configuration is calculated within FRIDA framework as superposition of the friction, compressible and pressure drag coefficients [1]. Each coefficient is strictly dependent on the geometrical properties of the wing (span, aspect ratio, taper ratio, relative thickness), fuselage and tail. The drag estimation also includes the Kroo correction to account for an estimate of the critical Mach number [6], with the aim of evaluating the wave drag contribution.

Performances evaluation

The FRIDA performance module allows the computation of the maximum lift coefficients and stall speeds at each mission phase. In addition, both the cruise performances (aerodynamic efficiencies and angles of incidence) and the ground performances (angles of attack as function of flap deflection, Balanced Field Length BFL, take-off and landing distances) are evaluated. At this stage, it is necessary to hypothesize the High-Lift Devices (HLD) geometry and settings, as the maximum lift coefficients are functions of the flap deflection in addition to the velocity. Plain flap, single- and double-slotted flap can be selected. Suitable corrections to the aerodynamic coefficients allow to compute the flapped lift coefficient [1], [7], [8]. The critical angle of attack is also output of the analysis. From the knowledge of the critical angle of attack, the stall speed is evaluated for take-off, cruise and landing conditions. Starting from the analysis of cruise performances, the aerodynamic efficiency and the characteristic angles of attack are computed for all the cruise phases (top of climb, mid-cruise and top of descent) considering the weight loss due to the fuel consumption.

Flight mechanics and flight simulation

Entire missions can be simulated with FRIDA [9]. Once the trajectory kinematics are known, the equilibrium of the forces is imposed (considering lift and drag of both wing and tail, drag of the fuselage and thrust): the reference angle of attack and the thrust are evaluated, in order to ensure the airworthiness. The static longitudinal stability is guaranteed by imposing the derivative of pitching moment with respect to the centre of gravity to be less than zero.

Engine operating point derivation

The prediction of the characteristic operational parameters of turbofan engines is not an easy task, due to the intrinsic complexity of the thermofluidynamic phenomena involved, and by the lack of useful data in the literature. To overcome these drawbacks, a simple but effective semi-empirical model, based on the fundamental physics and some additional data available to the authors, was developed. Such a model provides the percentage of throttle once both the flight condition and the engine features are known. Once the throttle is evaluated, it is easy to compute the rotational speeds N1 and N2 of respectively low–pressure and high–pressure spools, knowing the overspeed and idle conditions in terms of percentage with respect to the maximum value. Mass flows, temperatures, pressures and other thermodynamic variables are estimated as a function of the flight conditions and the rotational speeds.

Validation

The FRIDA module’s reliability has been verified during the last twenty years through a thorough validation against experimental data and high-fidelity simulations (see *e.g.*[2], [5], [10]–[20]). These assessments have been partially carried out within the framework of the EC-funded projects SEFA (Sound Engineering For Aircraft, FP6, 2004-2007), COSMA (Community Oriented Solutions to Minimise aircraft noise Annoyance, FP7, 2009-2012), and OPENAIR (OPtimisation for low Environmental Noise impact AIRcraft, FP7, 2009-2013). A few validation samples are reported in the following for the Structural Dynamics Module, the Aerodynamics Module, the Weight Estimate Module, and the Flight Mechanics Module.

As first example, the structural analysis module has been used to reproduce the results of two high-fidelity detailed FEM models (IGES and BDF), using the NASA CRM reference geometry as benchmark. In Figure 3, the first four eigenfrequencies obtained with both the methods are shown.

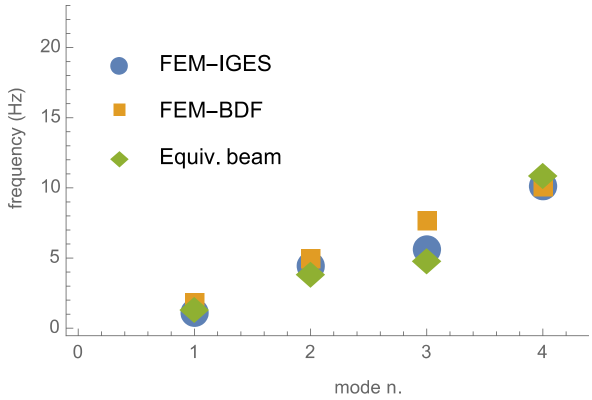

Figure 3 : Eigenfrequencies of the CRM wing obtained with the high-fidelity model (two CAD formats) and the equivalent beam.

The analysis of the figure highlights the good agreement of the FRIDA output.

The weight module outcomes are in excellent agreement with literature data (see Table 1).

Table 1 : A320 weights - available data vs. FRIDA calculation

	Reference	FRIDA	error
MTOW	78.0 t	77.0	1.3%
ZFW	59.0 t	58.2	1.4%
OEW	42.6	42.3	0.07%

The BEM results of the FRIDA aerodynamic module have been recently compared with the SACCON UCAV (NATO STO/AVT-161 Task Group). Some results are presented in Figure 4.

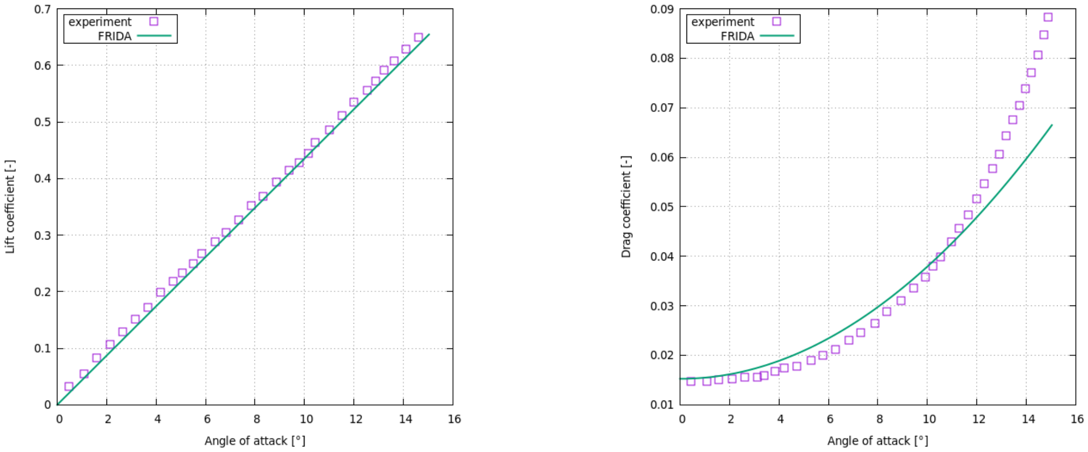

Figure 4 : Comparison between experimental campaign (data from [21]) and FRIDA simulation.

As last example, in Figure 5 the time history of the total thrust for a commercial aircraft is depicted: FRIDA makes use of inverse flight mechanics to evaluate the forces for a generic mission segment.

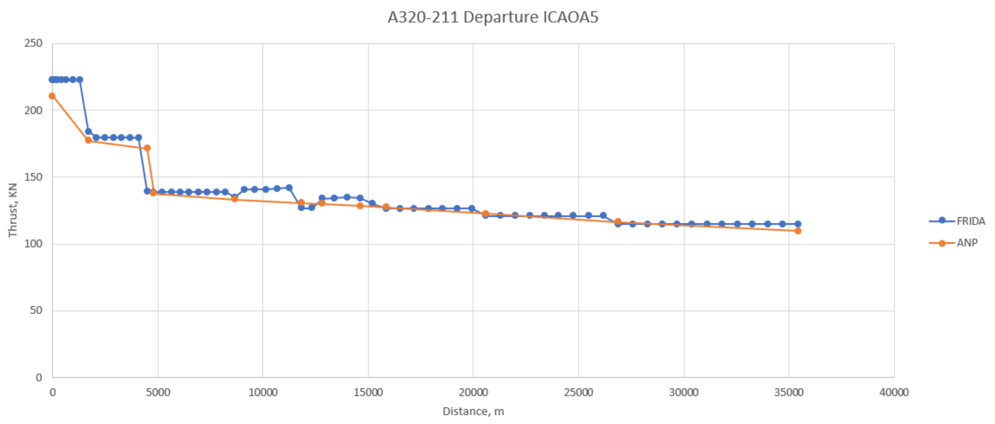

Figure 5 : A320-211 departure operation (ICAO-A5): ANP vs. FRIDA.

Flight mechanics and engine modules provide outcomes in good agreement with available databases.

2.2 SOPRANO

SOPRANO (Silencer cOmmon PlatfoRm for Aircraft NOise calculations) is a single event aircraft noise simulation model. Originally developed in the EU SILENCER project as a technology evaluator, SOPRANO has been used and extended in a variety of other EU projects. SOPRANO contains a collection of semi-empirical source noise models for all main sources of a conventional jet and propeller aircraft. New methods, sources or engine/aircraft parameters can be easily added. Source noise can also be provided in the form of look-up tables. This allows SOPRANO to take advantage of the results from high-fidelity CFD/CAA tools and measurements to make accurate predictions and to extend its use to e.g. rotorcraft and Open Rotors. Filters can be applied to each noise source, so as to simulate noise reduction technologies or to simulate other aircraft configurations.

In order to predict overall aircraft noise levels, the program can perform several different types of calculation. These can be broadly classified as follows:

- Individual noise sources
- Thermodynamic effects on noise sources (atmospheric conditions, altitude)
- Flight effects on noise sources
- Changes (‘deltas’) on noise sources
- Propagation effects
- Noise unit calculations

Noise sources

The semi-empirical noise source prediction methods and propagation methods included in the current version of the program are given in the following table.

*Table 2 : M*ethods included in SOPRANO

Item	Ref.	Title
Jet noise	SAE ARP 876D	Gas turbine jet exhaust noise prediction
	Stone	J.R. Stone, D.E. Groesbeck, C.L. Zola: Conventional profile coaxial jet noise prediction, AIAA Journal (1983)
Core noise	SAE ARP 876D#	
Fan noise	Heidmann 1979#	M.F. Heidmann: Interim prediction method for fan and compressor source noise, NASA Technical Report TMX-71763, 1979
	Heidmann 1996#	K. B. Kontos, B. A. Janardan and P.R. Gliebe NASA Contractor Report 195480, 1996
Turbine noise	NASA TM X-73566#	E.A. Krejsa: Interim prediction method for turbine noise
	AIAA 75-449	S. B. Kazin and R. K. Matta: Turbine Noise Generation, Reduction and Prediction, 1975
Propeller noise	SAE AIR 1407#	Prediction procedure for near-field and far-field propeller noise
Airframe noise	FAA-RD-77-29	M.Fink: Airframe noise prediction method, 1977
Landing gear	NASA-CR-2005-213780	R.A. Golub, Y.P. Guo: Empirical Prediction of Aircraft Landing Gear Noise
	FAA-RD-77-29	M.Fink: Airframe noise prediction method, 1977
	NASA-CR-2004-213255	R.A. Golub, Y.P. Guo, R. Sen: Airframe Noise Sub-Component Definition and Model
Atmospheric absorption	SAE ARP 866 A#	Standard values of atmospheric absorption as a function of temperature and humidity

	Sutherland # (ANSI S1.26)	L.C. Sutherland, J.E. Piercy and H.E. Bass: A method for calculating the absorption of sound by the atmosphere.
	NPL	Sound absorption in air at frequencies up to 100 kHz by E. N. Bazely NPL Acoustics Report Ac 74 National Physical Laboratory February 1976
	ISO 9613 #	Attenuation of sound during propagation outdoors
	SAE ARP 5534#	SAE, Application of pure-tone atmospheric absorption losses to one-third octave-band data, ARP5534, 2013
Wing Shielding	Maekawa	Z. Maekawa: Noise Reduction by Screens. Memoirs of the Faculty of Engineering, Kobe University, Japan, vol. 12, 1966, pp. 472-479.
Ground Reflections	Chien and Soroka #	C.F. Chien and W.W. Soroka (1980), "A note on the calculation of sound propagating along an impedance plane", J. Sound Vib., 69:340-343
Lateral attenuation	SAE AIR 1751	Prediction method for lateral attenuation of airplane noise during takeoff and landing
	SAE AIR 5662	Society of Automotive Engineers: AIR-5662, update to AIR-1751 (2006)
Noise units	ICAO Annex 16	Noise units

methods that can handle discrete tones

Apart from the mentioned prediction methods, databases with static or in-flight measured noise levels may be used. To this end the program is capable of interpolating in necessary parameters in order to calculate noise levels at angles and engine powers or aircraft velocities between those included in the source database.

Changes ('deltas') on noise sources

It is possible to apply one or more deltas to the individual and total source noise levels. These deltas may be applied in order to account for:

- Thermodynamic effects on noise sources (atmospheric conditions, altitude)
- Cycle effects

- Some installation effects (e.g. wing shielding)
- Flight effects on noise sources (e.g. convective amplification)
- Noise reduction technology (e.g. liner effects)

Flightpath and operating conditions

The program can make calculations for a single point on a flight path (although not all noise metrics can be calculated for this case), or for a complete (two or three-dimensional) flight path. For each required calculation point, the operating conditions of aircraft and engine are determined by interpolation in the relevant data (e.g. engine deck).

Noise unit calculations

The program calculates noise levels as would be measured by free-field, ground level, or 1.2m microphones, or any user defined microphone height and at one or more observer positions. A variety of noise metrics is calculated (see Table 3). The results of the calculations are stored in an ASCII output file, for further processing by the post-processor.

Table 3 : Noise metrics included in SOPRANO

Type	**Single-event metrics**
Instantaneous	LA, LC, LZ, PNL, PNLT
Maximum levels	LA_{max}, LC_{max}, LZ_{max}, PNLTM
Integrated	LA_{eq}, LC_{eq}, LZ_{eq}, EPNL, SEL_A, SEL_C, SEL_Z
Relative Level	ΔSEL_A ,ΔLA_{max}
Time related	Time Above Threshold Time Audible

General program layout

The following diagram presents the general layout of the SOPRANO prediction core.

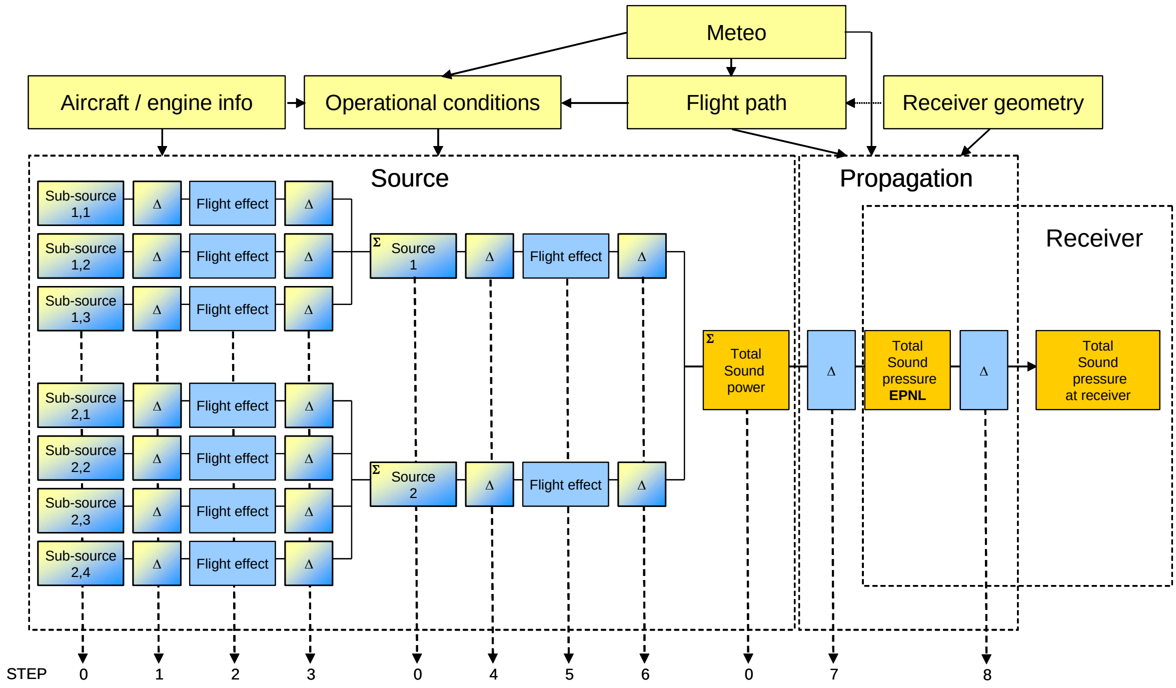

Figure 6 : Schematic representation of SOPRANO

SOPRANO was originally developed in the FP5 Silencer project and has since then been used and upgraded in a variety of research projects (e.g. VITAL, IMAGINE, FRIENDCOPTER, COSMA, NINHA, ARMONEA, ANCORA).

2.3 Noise synthesis tools

As explained in the introduction of this report, the noise calculations done with SOPRANO are to be fed into noise synthesis tools. This way, flyover sounds can be created from scratch and be played through Virtual Reality devices.

In ANIMA, one Task in WP 3 (ST3.2.3) plans on using such sounds in psychoacoustic tests. It was initially planned to create these sounds with FRIDA and SOPRANO, chained to one of the Consortium partners' synthesis tools. In fact, one Task (ST4.2.1) is specifically focused on evaluating the realism of three partners' synthesis tools, in order to choose one for the WP 3 sounds.

However, because of their specifications not only the synthesis tools were benchmarked, but the whole modelling chains of the three involved partners, including noise source prediction.

A slightly different approach is therefore chosen for WP 3. The Noise Reduction Solutions Simulator including FRIDA and SOPRANO is to be part of the Virtual Community Tool (see Figure 7 lower part). For the specific needs of ST 3.2.3 in WP3 (psychoacoustic tests) however, the tools (noise prediction + noise synthesis) benchmarked in Task 4.2.1 will be used (Figure 7 upper part).

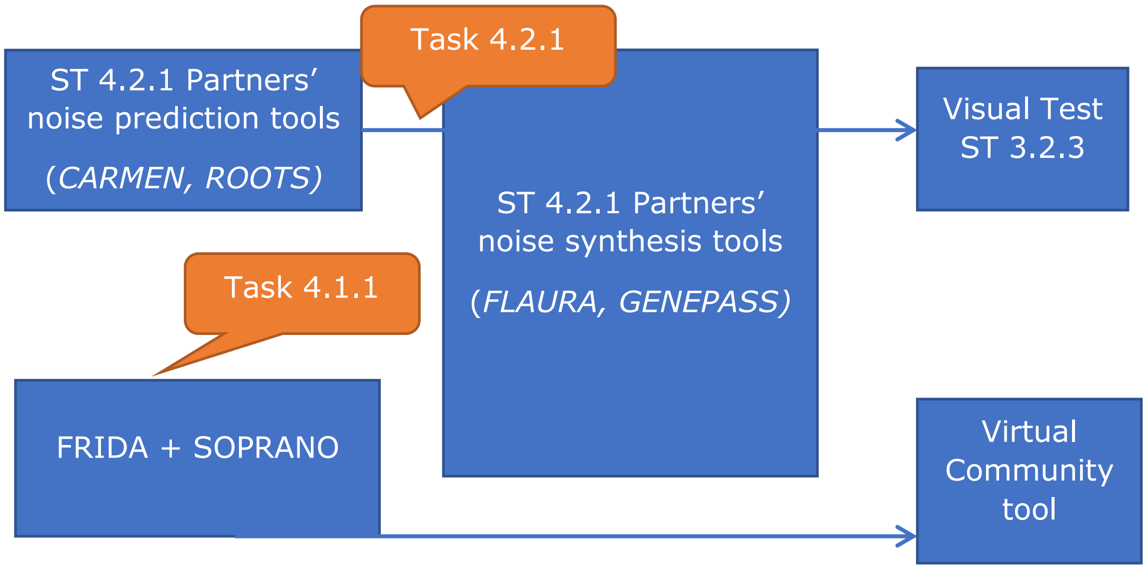

Figure 7 : Upper part: Noise prediction + Auralization chains for WP3, lower part: Noise prediction tool to be included in VTC

In the perspective of creating a noise prediction tool that can be plugged to any noise synthesis tool, we can learn lessons from Task ST4.2.1 with regard to the necessary output/input.

The 3 compared tools have a very similar approach with regard to the synthesis method; they transform spectra at the ground into "hearable" sounds (see more in D4.4). SOPRANO uses a simple noise propagation model. Atmospheric absorption and geometric attenuation are taken into account; atmospheric turbulence however, for instance, is not. The aim of the synthesis tool is to create the most realistic sound possible. Of course the result depends as much on the source modelling as on the propagation and synthesis models.

The tool needs several elements of information:

- The noise spectra, separated in tonal and broadband noise contributions, for sufficiently narrow time steps (0.5 seconds for example, since the noise is unstationnary). This is either at the receiver position, or at aircraft level if the propagation is done in the temporal domain by the noise synthesis tool itself.
- The aircraft trajectory: the noise synthesis tool calculates the sound that comes directly from the aircraft. But it also needs to include the rays that come from the aircraft, are reflected on the ground, and reach the receiver very shortly in time after the direct ray. This is a direct output of FRIDA, since the trajectory impacts engine and high-lift device configurations.
- The atmospheric conditions: the atmosphere modifies the sound rays' trajectory. Depending on where the propagation is done (SOPRANO or synthesis tool) and what model is used, the synthesis model will need meteorological data of different level of detail.

- The receiver environment: that includes the height of the receiver (the listening person) and characteristics of the ground it/he/she stands on. This point is of course independent from SOPRANO and can be arbitrarily defined by the end user.

In the following, the first bullet, the noise spectra, which are the direct output of SOPRANO, are described.

3 Interface description

The following ASCII format is the SOPRANO interface with its postprocessor (*.out) It describes the time evolution of the noise spectra at one observer for each source and optionally their sum. The first column represents the directivity angle, but it could also be used for time. The last column is reserved for one scalar noise metric such as PNLT(t) or LA(t). The separator can be space or tabs.

nSrc	nTime	TimeParID	iband1	ibandN	MetricID
"Source no. 1"					
TimePar(1)	SPL_1(1,1)	SPL_1(2,1)	…	SPL_1(nFreq,1)	Metric_1(1)
…					
TimePar(nTime)	SPL_1(1,nTime)	SPL_1(2,nTime)		SPL_1(nFreq,nTime)	Metric_1(nTime)
"Source no. 2"					
…					
"Source no. nSrc"					
TimePar(1)	SPL_nSrc(1,1)	SPL_nSrc(2,1)	…	SPL_nSrc(nFreq,1)	Metric_nSrc(1)
…					
TimePar(nTime)	SPL_nSrc(1,nTime)	SPL_nSrc(2,nTime)		SPL_nSrc(nFreq,nTime)	Metric_nSrc(nTime)

where:

`nSrc` is the number of sources (incl. the total sum of all sources).
`nTime` is the number of time steps.
`TimeParID` is the alphanumeric ID of the first column e.g. `THETA`, `TIME`,…
`iband1`, `ibandN` are the first and last standard third octave bands (e.g. `17=50Hz`, `40=10kHz`). Note that `nFreq` = `ibandN`- `iband1`+1
`MetricID` is the alphanumeric ID of the last column e.g. `PNLT`, `LA`, `LC`,…

In the following example `nSrc=5`, `nTime=8`, `iband1=17`, `ibandN=40` `(nFreq=40-17+1=24)`.

5 8 THETA 17 40 PNLT

SPL_InletFan(1:nFreq,1:nTime)

PNLT_InletFan(1:nTime)

"Inlet Fan"																								
20.0	31.7	37.3	42.7	47.4	51.7	56.0	59.6	62.8	65.7	68.3	70.3	71.9	74.9	73.9	74.1	76.7	74.7	71.7	70.7	67.7	64.3	59.6	52.5	43.2	94.6
40.0	37.2	42.8	48.3	52.9	57.3	61.7	65.2	68.5	71.4	74.1	76.2	78.0	81.1	80.3	80.8	83.7	82.1	79.6	79.2	77.1	74.3	70.9	66.0	59.9	102.2
60.0	35.3	41.0	46.4	51.1	55.4	59.8	63.4	66.6	69.6	72.3	74.4	76.2	79.8	78.6	79.2	82.7	81.0	78.4	78.4	76.5	73.7	70.8	66.4	61.2	102.0
80.0	30.0	35.6	41.0	45.7	50.0	54.4	58.0	61.3	64.3	66.9	69.1	70.9	74.3	73.3	73.9	77.2	75.7	73.2	73.2	71.4	68.8	66.0	61.9	57.0	96.2
100.0	21.5	27.1	32.5	37.2	41.5	45.9	49.5	52.8	55.8	58.4	60.6	62.4	65.8	64.8	65.4	68.7	67.2	64.7	64.7	62.9	60.3	57.5	53.4	48.5	87.6
120.0	9.3	15.0	20.4	25.1	29.4	33.8	37.4	40.6	43.6	46.3	48.4	50.2	54.4	52.6	53.2	57.6	55.6	52.4	52.9	51.0	47.9	45.0	40.5	35.2	76.5
140.0	0.0	1.3	6.8	11.4	15.8	20.2	23.7	27.0	29.9	32.6	34.7	36.5	41.7	38.8	39.3	44.9	42.5	38.1	39.2	37.0	33.2	30.0	24.6	18.4	63.0
160.0	0.0	0.0	0.0	0.0	0.0	3.5	7.1	10.3	13.2	15.8	17.8	19.4	25.7	21.4	21.6	28.4	25.4	19.2	20.7	17.6	12.7	8.1	0.2	0.0	42.8
"Fan Aft"																								
20.0	0.2	5.8	11.2	15.9	20.2	24.5	28.1	31.3	34.2	36.8	38.8	40.4	44.6	42.4	42.6	46.9	44.4	40.2	40.1	37.0	33.1	28.4	21.0	11.7	64.8
40.0	14.3	19.9	25.4	30.0	34.4	38.8	42.3	45.6	48.5	51.2	53.3	55.1	59.2	57.4	57.9	62.1	60.1	56.7	57.0	54.8	51.6	48.3	43.1	37.0	80.8
60.0	25.5	31.2	36.6	41.3	45.6	50.0	53.6	56.8	59.8	62.5	64.6	66.4	70.3	68.8	69.4	73.3	71.5	68.6	68.9	67.0	64.0	61.1	56.7	51.4	92.6
80.0	34.5	40.1	45.5	50.2	54.5	58.9	62.5	65.8	68.8	71.4	73.6	75.4	79.0	77.8	78.4	82.0	80.3	77.7	77.9	76.1	73.3	70.5	66.4	61.5	101.4
100.0	39.8	45.4	50.8	55.5	59.8	64.2	67.8	71.1	74.1	76.7	78.9	80.7	84.1	83.1	83.7	87.1	85.5	83.0	83.1	81.3	78.6	75.8	71.7	66.8	106.0
120.0	41.0	46.7	52.1	56.8	61.1	65.5	69.1	72.3	75.3	78.0	80.1	81.9	85.6	84.3	84.9	88.6	86.8	84.1	84.2	82.3	79.5	76.5	72.1	66.9	107.9
140.0	36.7	42.3	47.8	52.4	56.8	61.2	64.7	68.0	70.9	73.6	75.7	77.5	81.0	79.8	80.3	83.7	81.9	79.1	79.0	76.8	73.8	70.5	65.5	59.4	102.6
160.0	23.2	28.8	34.2	38.9	43.2	47.5	51.1	54.3	57.2	59.8	61.8	63.4	67.2	65.4	65.6	69.3	66.9	63.2	62.7	59.7	56.0	51.3	44.0	34.7	87.6
"Jet"																								
20.0	52.6	52.2	51.5	50.8	50.0	49.0	48.1	47.0	45.9	44.6	43.2	41.8	40.2	38.6	36.8	34.7	32.5	30.1	27.3	23.9	21.4	17.1	10.9	2.9	60.4
40.0	62.3	61.9	61.3	60.6	59.8	58.9	58.0	57.0	55.8	54.6	53.4	52.1	50.6	49.2	47.7	45.9	44.1	42.2	40.0	37.5	35.6	32.6	28.6	23.7	71.9
60.0	66.1	65.7	65.1	64.4	63.6	62.7	61.8	60.8	59.7	58.5	57.3	56.0	54.6	53.2	51.8	50.0	48.4	46.6	44.6	42.4	40.6	38.1	34.7	30.8	76.1
80.0	66.0	65.6	65.0	64.4	63.6	62.6	61.7	60.8	59.7	58.5	57.3	56.0	54.6	53.3	51.8	50.1	48.5	46.8	44.9	42.8	41.0	38.6	35.5	31.8	76.2
100.0	60.9	60.4	59.7	59.0	58.1	57.2	56.2	55.2	54.1	52.9	51.8	50.5	49.2	47.8	46.4	44.8	43.2	41.6	39.7	37.7	36.0	33.6	30.6	26.9	70.5
120.0	50.3	49.6	48.8	47.8	46.8	45.7	44.5	43.4	42.1	40.7	39.4	38.0	36.5	35.1	33.7	32.0	30.4	28.7	26.8	24.6	22.9	20.4	17.2	13.2	57.1
140.0	24.7	23.2	21.6	19.9	18.3	16.4	14.7	13.1	11.3	9.4	7.6	5.8	3.8	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
160.0	12.7	10.3	7.8	5.5	3.1	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
"Turbine"																								
20.0	13.2	14.1	15.1	16.1	17.0	18.0	18.9	19.9	20.7	21.6	22.4	23.1	23.9	24.5	25.1	25.5	25.8	25.8	25.6	25.4	22.2	17.8	12.1	4.7	46.0
40.0	26.7	27.7	28.7	29.7	30.6	31.6	32.6	33.6	34.5	35.5	36.3	37.2	38.2	38.9	39.7	40.5	41.1	41.6	42.1	42.9	40.1	37.2	33.6	29.3	64.6
60.0	37.3	38.3	39.3	40.3	41.2	42.3	43.2	44.2	45.2	46.2	47.0	48.0	49.0	49.8	50.6	51.5	52.3	52.9	53.6	54.8	52.0	49.5	46.6	43.2	76.6
80.0	44.4	45.4	46.4	47.4	48.3	49.4	50.3	51.4	52.3	53.3	54.2	55.1	56.1	57.0	57.9	58.8	59.6	60.3	61.0	62.6	59.6	57.2	54.7	51.4	84.3
100.0	50.1	51.1	52.1	53.1	54.0	55.1	56.0	57.1	58.0	59.0	59.9	60.8	61.8	62.7	63.6	64.5	65.3	66.0	66.7	68.7	65.3	62.9	60.6	57.2	91.0
120.0	49.0	50.0	51.0	52.0	52.9	54.0	54.9	55.9	56.9	57.9	58.7	59.7	60.7	61.5	62.3	63.2	64.0	64.6	65.3	67.2	63.7	61.2	58.7	54.9	89.6
140.0	39.0	40.0	41.0	42.0	42.9	43.9	44.9	45.9	46.8	47.8	48.6	49.5	50.5	51.2	52.0	52.8	53.4	53.9	54.4	55.3	52.4	49.5	46.0	41.6	77.4
160.0	23.2	24.1	25.1	26.1	27.0	28.0	28.9	29.9	30.7	31.6	32.4	33.1	33.9	34.5	35.1	35.5	35.8	35.8	35.6	35.4	32.2	27.8	22.1	14.7	57.7
Total																								
20.0	52.6	52.3	52.1	52.5	54.0	56.8	59.9	62.9	65.7	68.3	70.3	71.9	74.9	73.9	74.2	76.7	74.7	71.7	70.7	67.7	64.3	59.6	52.5	43.2	94.7
40.0	62.3	62.0	61.5	61.3	61.8	63.5	66.0	68.8	71.6	74.2	76.2	78.0	81.1	80.3	80.8	83.7	82.1	79.6	79.2	77.1	74.3	71.0	66.0	59.9	102.4
60.0	66.1	65.7	65.2	64.6	64.3	64.7	65.9	68.0	70.4	72.9	74.9	76.7	80.2	79.1	79.6	83.2	81.5	78.8	78.9	77.0	74.2	71.3	66.9	61.7	102.8
80.0	66.1	65.7	65.2	64.7	64.4	64.7	66.0	68.1	70.5	73.0	75.0	76.8	80.3	79.2	79.8	83.2	81.6	79.1	79.2	77.5	74.8	72.0	67.9	63.1	103.0
100.0	61.3	61.0	60.9	61.3	62.7	65.5	68.4	71.4	74.3	76.9	79.0	80.8	84.2	83.2	83.8	87.2	85.6	83.2	83.2	81.6	78.9	76.1	72.0	67.3	106.3
120.0	53.0	53.8	55.6	58.4	61.9	65.8	69.3	72.4	75.4	78.0	80.1	81.9	85.6	84.4	84.9	88.6	86.9	84.1	84.3	82.5	79.6	76.7	72.3	67.2	107.9
140.0	41.1	44.4	48.6	52.8	57.0	61.2	64.8	68.0	71.0	73.6	75.7	77.5	81.0	79.8	80.3	83.7	81.9	79.1	79.0	76.8	73.9	70.6	65.5	59.4	102.7
160.0	26.4	30.1	34.7	39.1	43.3	47.6	51.1	54.3	57.2	59.8	61.8	63.4	67.2	65.4	65.7	69.3	66.9	63.2	62.7	59.7	56.0	51.3	44.0	34.8	87.6

If one or more sources are calculated with a method that can handle tonal descriptions (harmonics frequencies and levels), one more "source" will be added to the output file called "Tones". This "source" will contain the tones of all relevant noise sources, and allocates them to the corresponding one third octave bands.

4 15 THETA 17 40 PNLT

"Fan Aft"																									
20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30.0	0.0	0.0	0.0	0.0	0.0	5.0	12.1	18.8	24.8	29.7	32.6	32.8	27.9	35.8	39.9	34.1	40.1	36.2	35.1	31.8	25.0	13.9	0.0	0.0	59.0
40.0	0.0	0.0	0.0	0.8	6.9	15.2	22.3	28.1	32.0	32.5	35.5	42.3	41.0	45.9	45.0	47.1	48.0	48.2	46.3	43.8	39.2	31.4	19.0	0.0	69.0
50.0	0.0	0.0	1.7	6.4	14.3	23.5	30.1	34.2	35.4	40.6	45.2	45.9	49.6	51.8	53.0	54.0	55.2	54.9	54.0	52.1	48.5	42.4	32.3	17.3	75.1
60.0	0.0	2.3	5.5	12.7	22.7	31.4	36.5	38.1	41.5	48.2	48.8	53.3	55.6	57.2	58.6	60.2	60.7	61.0	60.2	58.6	55.6	50.2	41.6	28.7	81.5
70.0	3.0	6.1	9.9	20.9	30.6	38.0	41.0	41.1	49.7	51.6	56.1	57.9	60.7	62.7	63.9	65.3	66.0	66.1	65.6	64.0	61.2	56.4	48.5	37.0	87.3
80.0	6.7	8.5	16.0	27.8	36.5	42.4	43.1	47.2	54.5	55.3	59.8	62.6	64.6	66.7	67.9	69.3	69.8	70.0	69.4	67.8	65.2	60.6	53.2	42.4	90.9
90.0	9.6	10.7	21.8	33.0	40.9	45.6	44.6	52.9	56.9	60.3	62.3	65.6	68.2	69.5	71.1	72.2	72.7	72.7	72.2	70.6	68.0	63.5	56.2	45.8	94.1
100.0	11.9	12.9	25.9	36.5	43.9	47.6	46.4	56.3	58.3	63.3	64.8	67.8	70.1	71.4	73.0	73.9	74.5	74.5	73.8	72.2	69.5	65.0	57.8	47.4	96.0
110.0	13.6	14.7	28.1	38.5	45.6	49.0	47.8	57.9	59.2	64.7	66.1	68.9	70.8	72.5	73.8	74.6	75.2	75.1	74.3	72.5	69.7	65.1	57.7	47.1	96.7
120.0	14.9	15.7	28.6	39.1	46.3	49.8	48.4	58.2	60.0	64.9	66.2	69.1	71.1	72.3	73.7	74.4	74.8	74.6	73.7	71.8	68.8	64.0	56.2	45.0	96.1
130.0	15.8	16.5	27.3	38.2	45.8	50.1	48.8	56.8	60.6	63.6	65.2	68.2	70.4	71.4	72.6	73.4	73.5	73.1	72.1	70.0	66.8	61.5	53.1	41.1	94.4
140.0	14.2	15.6	22.6	34.0	42.2	47.7	47.9	51.6	58.4	58.7	62.7	64.9	66.3	67.9	68.6	69.4	69.3	68.9	67.6	65.2	61.6	55.7	46.3	32.9	89.9
150.0	10.3	12.7	15.9	26.4	35.5	42.2	44.7	44.2	52.1	53.3	57.2	58.3	60.3	61.6	62.0	62.7	62.6	61.8	60.3	57.5	53.2	46.4	35.4	19.8	83.2
160.0	5.4	8.9	11.4	17.9	27.2	35.1	39.5	40.3	42.9	48.7	48.5	52.1	53.5	54.1	54.5	55.0	54.5	53.7	51.5	48.0	42.7	34.1	20.5	0.8	74.9
"Turbine"																									
20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30.0	19.5	19.1	18.7	18.5	19.4	22.0	24.9	27.9	30.3	31.9	32.0	29.8	22.8	29.0	32.0	25.2	30.7	26.8	26.0	23.6	17.9	8.6	0.0	0.0	50.9
40.0	28.2	27.8	27.0	26.6	27.9	31.2	34.2	36.3	36.6	33.9	34.2	38.6	35.3	38.5	36.5	37.7	38.2	38.3	36.8	35.2	31.8	25.8	16.1	0.1	60.9
50.0	33.8	32.9	31.3	30.8	34.0	38.3	40.8	41.3	39.0	41.0	43.0	41.4	43.2	43.8	43.8	44.0	44.9	44.5	44.1	43.2	40.8	36.6	29.3	17.6	66.9
60.0	38.8	37.1	34.5	36.6	41.9	45.8	46.9	44.9	44.9	48.5	46.6	48.8	49.3	49.4	49.7	50.6	50.8	51.2	50.9	50.4	48.6	45.3	39.4	27.0	74.2
70.0	41.0	38.1	36.2	42.2	47.2	49.9	49.0	45.7	51.0	49.8	51.9	51.5	52.4	53.0	53.3	54.1	54.6	54.8	54.9	54.4	53.0	50.3	45.2	34.3	78.4
80.0	42.5	38.5	40.3	47.2	51.4	52.7	49.6	50.3	54.3	52.2	54.3	54.9	55.2	56.1	56.4	57.2	57.6	58.0	58.0	57.8	56.5	54.2	49.7	39.5	81.6
90.0	43.8	39.1	44.7	51.1	54.5	54.6	49.9	54.9	55.8	56.4	56.0	57.3	58.3	58.3	59.2	59.8	60.3	60.6	60.8	60.6	59.4	57.3	53.0	43.3	84.1
100.0	46.0	41.3	48.9	54.8	57.7	57.0	52.1	58.8	57.7	60.0	59.2	60.3	61.0	61.3	62.1	62.7	63.2	63.6	63.8	63.7	62.5	60.4	53.2	43.6	87.5
110.0	46.0	41.5	49.5	55.3	58.1	57.1	52.4	59.3	57.6	60.4	59.7	60.6	61.1	61.7	62.4	62.9	63.6	63.9	64.1	63.8	62.7	60.6	53.2	43.5	87.8
120.0	43.8	39.1	46.6	52.5	55.5	54.8	49.9	56.6	55.5	57.7	57.0	58.0	58.7	58.9	59.8	60.3	60.8	61.2	61.3	61.1	59.8	57.4	49.8	39.6	85.0
130.0	39.5	34.7	40.3	46.7	50.1	50.2	45.5	50.5	51.4	51.9	51.5	52.7	53.7	53.7	54.5	55.1	55.4	55.6	55.7	55.3	53.8	51.1	42.9	32.0	78.8
140.0	35.2	31.2	33.0	39.9	44.0	45.4	42.2	42.9	46.9	44.7	46.8	47.3	47.5	48.3	48.5	49.2	49.4	49.7	49.5	48.9	47.1	43.8	34.7	22.4	72.9
150.0	29.2	26.4	24.4	30.5	35.5	38.1	37.2	33.8	39.1	37.8	39.8	39.3	40.1	40.5	40.6	41.2	41.5	41.4	41.1	40.1	37.6	33.5	22.9	8.4	64.3
160.0	23.5	21.8	19.2	21.3	26.5	30.4	31.5	29.5	29.3	32.8	30.7	32.7	32.9	32.8	32.8	33.3	33.2	33.1	32.1	30.5	27.1	18.2	4.9	0.0	54.9
Tones																									
20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.2	0.0	0.0	22.8	0.0	0.0	0.0	0.0	0.0
30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	42.0	0.0	0.0	31.3	0.0	14.3	0.0	0.0	0.0
40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	54.3	0.0	0.0	45.4	30.6	29.8	18.0	0.0	0.0
50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	58.2	61.3	0.0	0.0	53.7	44.9	0.0	32.5	18.4	0.0
60.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	67.4	0.0	0.0	61.1	0.0	53.2	43.4	32.0	18.2	0.0
70.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	72.2	0.0	0.0	66.5	0.0	59.5	51.1	41.5	29.8	0.0
80.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	75.4	0.0	0.0	70.1	0.0	63.8	56.3	47.9	37.9	0.0
90.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	78.0	0.0	0.0	73.1	67.3	51.5	60.4	53.4	34.5	0.0
100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	78.4	0.0	0.0	73.7	67.6	69.1	61.7	58.8	46.9	38.0	0.0
110.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	80.6	0.0	0.0	75.7	0.0	70.4	64.2	57.9	49.3	41.0	0.0
120.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	80.2	0.0	0.0	75.5	0.0	70.2	64.2	57.7	50.2	37.0	0.0
130.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	78.7	0.0	0.0	73.8	0.0	68.5	62.5	55.8	48.6	30.5	0.0
140.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	74.6	0.0	0.0	69.7	63.0	0.0	58.1	51.5	34.3	25.0	0.0
150.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	68.5	0.0	0.0	63.4	57.5	0.0	51.0	44.0	25.3	15.1	0.0
160.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	61.4	57.3	0.0	55.7	51.6	49.2	41.6	38.8	25.1	12.5	0.0	0.0
Total(BB+Tones)																									
20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.2	0.0	0.0	22.8	0.0	0.0	0.0	0.0	65.1
30.0	19.5	19.1	18.7	18.6	19.4	22.1	25.2	28.4	31.4	33.9	35.3	34.6	29.1	36.6	40.6	34.6	44.4	36.7	35.6	34.9	25.8	17.7	0.0	0.0	63.3
40.0	28.2	27.8	27.1	26.6	27.9	31.3	34.4	36.9	37.9	36.3	37.9	43.8	42.1	46.6	45.5	47.6	55.3	48.6	46.7	47.9	40.4	34.3	22.6	4.6	73.9
50.0	33.8	32.9	31.3	30.9	34.0	38.4	41.2	42.1	40.6	43.8	47.3	47.2	50.5	52.5	53.5	59.7	62.3	55.3	54.5	56.2	50.6	43.4	36.4	22.6	80.9
60.0	38.8	37.1	34.5	36.7	41.9	46.0	47.3	45.7	46.5	51.3	50.8	54.6	56.5	57.9	59.1	68.3	61.2	61.5	63.9	59.2	58.1	52.1	43.9	31.2	87.2
70.0	41.0	38.1	36.2	42.3	47.3	50.2	49.7	47.0	53.4	53.8	57.5	58.8	61.3	63.1	64.2	73.1	66.3	66.4	69.2	64.4	63.8	58.3	50.7	39.4	92.3
80.0	42.5	38.5	40.4	47.3	51.5	53.1	50.5	52.0	57.4	57.0	60.9	63.3	65.0	67.1	68.2	76.4	70.0	70.3	72.9	68.2	67.9	62.7	55.6	45.1	95.9
90.0	43.8	39.1	44.7	51.1	54.7	55.1	51.0	57.0	59.4	61.8	63.2	66.2	68.6	69.8	71.4	79.0	73.0	73.0	75.8	72.6	68.6	65.9	59.2	47.9	98.7
100.0	46.0	41.4	48.9	54.8	57.9	57.5	53.1	60.7	61.0	65.0	65.9	68.5	70.6	71.8	79.6	74.3	74.8	77.3	75.1	74.3	70.9	67.0	59.3	49.2	99.8
110.0	46.0	41.5	49.6	55.4	58.3	57.7	53.7	61.7	61.5	66.0	67.0	69.5	71.3	72.9	81.5	74.9	75.5	78.5	74.7	74.9	71.4	67.0	59.4	49.3	101.1
120.0	43.8	39.1	46.7	52.7	56.0	56.0	52.2	60.5	61.3	65.6	66.7	69.4	71.3	72.5	81.1	74.6	74.9	78.2	74.0	74.3	70.5	65.6	57.9	46.6	100.5
130.0	39.5	34.8	40.5	47.3	51.5	53.2	50.5	57.7	61.1	63.9	65.4	68.3	70.5	71.5	79.7	73.5	73.6	76.5	72.2	72.4	68.3	62.8	54.7	41.9	98.7
140.0	35.2	31.3	33.4	40.9	46.2	49.7	49.0	52.1	58.7	58.8	62.8	65.0	66.4	68.0	75.6	69.5	69.4	72.4	69.0	65.3	63.3	57.3	46.8	33.9	94.3
150.0	29.3	26.6	25.0	31.9	38.5	43.7	45.4	44.5	52.3	53.4	57.3	58.3	60.3	61.6	69.4	62.7	62.6	65.7	62.2	57.6	55.3	48.5	36.0	21.3	87.6
160.0	23.6	22.0	19.9	22.9	29.9	36.4	40.2	40.7	43.1	48.9	48.6	52.2	53.5	62.2	59.2	55.1	58.2	55.8	53.5	48.9	44.3	34.7	21.2	2.2	78.6

In this case, sources "Fan Aft" and "Turbine" contain only the broadband component, harmonics of both "Fan Aft" and "Turbine" are added in "Tones". Note that if MetricID is PNLT, it will not be calculated (column of zeros) because PNLT is not meant for pure tonal sources without the presence of any broadband (since it is based on the tone level with respect to surrounding bands). However, other metrics like L_A or L_C can be calculated.

Time histories of harmonics are described in format *.ton which has a similar format to *.out

nSrc nTime TimeParID

"Source no. 1" NH = nHarmonics_1

TimePar(1)	HarmFreq_Src1(1,1)	HarmLevel_Src1(1,1)	…	HarmFreq_Src1(nHarmonics_1,1)	HarmLevel_Src1(nHarmonics_1,1)
…					
TimePar(nTime)	HarmFreq_Src1(1,nTime)	HarmLevel_Src1(1,nTime)	…	HarmFreq_Src1(nHarmonics_1,nTime)	HarmLevel_Src1(nHarmonics_1,nTime)

"Source no. 2"

…

"Source no. nSrc" NH = nHarmonics_nSrc

TimePar(1)	HarmFreq_nSrc(1,1)	HarmLevel_nSrc(1,1)	…	HarmFreq_nSrc(nHarmonics_nSrc,1)	HarmLevel_nSrc(nHarmonics_nSrc,1)
…					
TimePar(nTime)	HarmFreq_nSrc(1,nTime)	HarmLevel_nSrc(1,nTime)	…	HarmFreq_nSrc(nHarmonics_nSrc,nTime)	HarmLevel_nSrc(nHarmonics_nSrc,nTime)

where:

`nSrc` is the number of sources.
`nTime` is the number of times.
`TimeParID` is the alphanumeric

`nHarmonics_1`	is the number of harmonics of the first source.
`nHarmonics_nSrc`	is the number of harmonics of the last source.

`nHarmFreq_Src1(1:nHarmonics_1,1:nTime)`	harmonics frequencies of the first source, Hz
`nHarmLevel_Src1(1:nHarmonics_1,1:nTime)`	harmonics levels of the first source, dB
`nHarmFreq_nSrc(1:nHarmonics_nSrc,1:nTime)`	harmonics frequencies of the last source, Hz
`nHarmLevel_nSrc(1:nHarmonics_nSrc,1:nTime)`	harmonics levels of the last source, dB

In the following example `nTime=15`, `nSrc=2`, the first source has 6 harmonics and the second source 6 harmonics as well.

Harmonic no. 1 of source no. 1 — Harmonic no. 6 of source no. 1

```
        2             15    THETA
 "Fan Aft"    NH=   6
       20.0      1961.     32.5     3922.     11.5     5882.    -20.6     7843.    -63.5     9804.   -116.2    11765.   -177.7
       30.0      1925.     47.3     3850.     35.6     5775.     18.3     7699.     -4.3     9624.    -31.7    11549.    -63.4
       40.0      1869.     56.3     3738.     47.6     5607.     35.4     7476.     19.8     9345.      1.0    11214.    -20.7
       50.0      1798.     63.3     3596.     56.2     5394.     46.6     7192.     34.4     8991.     20.0    10789.      3.5
       60.0      1718.     69.3     3436.     63.2     5153.     55.1     6871.     45.1     8589.     33.3    10307.     19.8
       70.0      1633.     74.7     3267.     69.2     4900.     62.1     6533.     53.5     8167.     43.4     9800.     31.9
       80.0      1549.     78.6     3098.     73.5     4647.     67.1     6196.     59.4     7745.     50.5     9294.     40.5
       90.0      1468.     82.2     2937.     77.4     4405.     71.4     5873.     64.4     7341.     56.3     8810.     47.2
      100.0      1393.     84.4     2787.     79.8     4180.     74.2     5573.     67.6     6967.     60.1     8360.     51.6
      110.0      1326.     86.3     2651.     81.8     3977.     76.4     5303.     70.1     6628.     62.9     7954.     54.9
      120.0      1266.     86.9     2532.     82.5     3798.     77.2     5064.     71.0     6330.     64.0     7596.     56.2
      130.0      1215.     86.1     2430.     81.7     3645.     76.4     4859.     70.2     6074.     63.2     7289.     55.4
      140.0      1172.     82.9     2344.     78.4     3516.     73.0     4688.     66.7     5860.     59.4     7032.     51.3
      150.0      1137.     77.7     2275.     73.0     3412.     67.3     4549.     60.5     5687.     52.7     6824.     44.0
      160.0      1111.     71.6     2221.     66.5     3332.     60.2     4443.     52.6     5553.     43.7     6664.     33.7
 "Turbine"    NH=   3
       20.0      9804.   -130.4    19608.   -497.2    29412.   -947.0
       30.0      9624.    -45.1    19249.   -231.0    28873.   -459.6
       40.0      9345.    -11.7    18690.   -136.5    28035.   -290.9
       50.0      8991.      8.0    17981.    -85.8    26972.   -202.9
       60.0      8589.     22.0    17178.    -53.2    25767.   -148.1
       70.0      8167.     32.2    16333.    -30.8    24500.   -111.1
       80.0      7745.     40.3    15490.    -14.3    23235.    -84.6
       90.0      7341.     47.1    14683.     -1.7    22024.    -65.1
      100.0      6967.     52.4    13933.      7.6    20900.    -51.1
      110.0      6628.     55.7    13257.     13.3    19885.    -42.6
      120.0      6330.     53.6    12661.     12.3    18991.    -42.6
      130.0      6074.     46.9    12148.      5.4    18223.    -50.2
      140.0      5860.     39.2    11720.     -4.1    17579.    -62.9
      150.0      5687.     30.0    11373.    -17.5    17060.    -82.9
      160.0      5553.     18.5    11107.    -37.7    16660.   -116.2
```

Harmonic no. 3 of source no. 2

4 Sample datafile

SampleSopranoOutputFile.out is an example of the total noise of a Cessna Citation II flyover (375m overhead, centreline microphone) predicted by SOPRANO.

This example is provided as an ASCII file as part of this report. Hereafter only a part of this file is reproduced.

```
1       241     THETA   17      40      PNLT
Total
14.58   43.8    38.6    40.0    43.4    50.4    51.9    43.1    48.4    49.2    49.1    47.7    45.1    43.8    43.2    41.8    40.2    38.1    34.1
14.84   43.5    39.1    40.7    43.6    50.5    51.5    43.8    48.6    49.5    49.0    47.9    45.2    43.9    43.3    42.0    40.3    38.2    34.3
15.09   43.0    39.5    41.0    43.9    50.7    51.0    44.4    48.6    49.8    48.9    48.0    45.3    44.0    43.4    42.1    40.5    38.3    34.5
15.32   42.8    40.1    41.7    44.2    50.7    50.1    45.0    48.8    50.4    48.7    47.8    45.4    44.0    43.5    42.2    40.4    38.2    34.5
15.56   42.6    40.8    42.4    44.5    50.6    49.2    45.6    49.0    51.1    48.5    47.5    45.4    44.1    43.5    42.3    40.2    38.0    34.4
15.83   42.0    41.3    42.9    44.9    50.7    48.1    46.2    49.0    51.8    48.3    47.3    45.5    44.1    43.5    42.3    40.3    37.9    34.5
16.09   41.5    41.8    43.3    45.1    50.8    47.0    46.7    48.9    52.4    48.2    47.2    45.6    44.1    43.6    42.4    40.3    37.9    34.5
16.37   40.7    42.4    43.8    45.4    50.8    45.8    47.2    48.8    53.1    48.1    47.1    45.7    44.1    43.7    42.5    40.4    37.9    34.6
16.64   39.9    42.6    44.1    45.9    50.8    44.6    47.5    48.6    53.5    48.3    47.2    46.0    44.2    43.9    42.7    40.6    38.1    34.8
16.93   38.9    42.7    44.5    46.4    50.9    43.5    47.8    48.4    53.7    48.5    47.3    46.2    44.3    44.0    42.8    40.9    38.3    35.1
17.20   38.1    42.8    44.8    46.8    50.8    42.6    48.1    48.1    53.9    48.7    47.5    46.3    44.3    44.1    43.0    41.0    38.6    35.3
17.48   37.3    42.8    45.0    47.3    50.8    42.0    48.4    47.8    54.0    49.0    47.6    46.4    44.4    44.3    43.1    41.3    38.7    35.6
17.75   36.5    42.8    45.2    47.6    50.8    41.5    48.6    47.6    54.0    49.3    47.8    46.5    44.4    44.4    43.2    41.5    39.0    35.8
18.06   35.9    42.8    45.4    47.9    50.8    41.2    48.7    47.3    54.0    49.5    48.0    46.7    44.4    44.5    43.3    41.7    39.2    36.1
18.35   35.5    42.8    45.5    48.3    50.7    41.2    48.8    47.1    53.9    49.7    48.1    46.7    44.3    44.5    43.4    41.8    39.4    36.3
18.62   35.3    42.6    45.6    48.5    50.6    41.2    48.6    47.1    53.6    49.6    48.1    46.6    44.3    44.5    43.3    41.9    39.5    36.5
```

SampleSopranoOutputFileTonal (.out and .ton) are also provided as an example in case of a simulation with tonal and third octave descriptions (Additional block “Tones” is added).

`SampleSopranoOutputFileTonal.out`

	5		29	17	40		PNLT																		
"Inlet Fan"																									
20.0	42.4	45.4	48.5	51.3	54.1	57.2	59.8	62.4	65.0	67.4	69.7	71.8	68.2	64.9	62.1	59.5	57.1	53.8	48.2	38.7	24.5	1.6	0.0	0.0	84.1
25.0	46.9	49.9	53.0	55.9	58.7	61.9	64.5	67.3	70.0	72.6	75.1	77.4	74.0	70.9	68.3	66.0	64.2	61.9	58.1	51.6	42.0	26.3	1.1	0.0	90.3
...																									
160.0	46.1	49.1	52.2	55.1	58.1	61.3	64.0	66.8	69.7	72.5	75.1	77.7	74.3	71.1	67.9	64.1	60.3	56.2	51.2	44.8	37.2	26.5	10.9	0.0	89.6
"Fan Aft"																									
20.0	0.0	0.0	0.0	0.0	0.0	3.1	7.5	11.4	15.0	18.3	20.9	23.1	25.1	26.3	27.0	26.9	25.6	22.8	17.4	8.0	0.0	0.0	0.0	0.0	40.8
25.0	0.0	0.0	0.0	0.0	3.5	8.9	13.4	17.4	21.2	24.6	27.4	29.9	32.1	33.6	34.7	35.1	34.6	32.9	29.4	23.1	13.5	0.0	0.0	0.0	52.1
...																									
160.0	6.1	12.7	19.2	24.9	30.2	35.7	40.2	44.4	48.3	51.9	54.9	57.6	60.0	61.8	63.2	64.2	64.4	63.9	62.2	59.0	53.8	45.3	31.7	12.3	84.0
"Turbine"																									
20.0	10.6	11.5	12.5	13.4	14.2	15.1	15.8	16.5	17.1	17.5	17.9	18.2	18.6	18.8	18.8	18.2	17.0	14.5	10.0	2.1	0.0	0.0	0.0	0.0	30.3
25.0	16.0	17.0	18.0	18.9	19.8	20.8	21.5	22.4	23.1	23.7	24.3	24.9	25.5	25.9	26.3	26.3	25.8	24.5	21.9	17.0	9.0	0.0	0.0	0.0	43.7
...																									
160.0	29.8	30.8	31.8	32.7	33.7	34.7	35.5	36.5	37.3	38.2	38.9	39.7	40.6	41.3	42.0	42.5	42.8	42.6	41.9	40.0	36.4	30.4	16.7	0.0	64.4
"Tones"																									
20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	61.4	0.0	0.0	40.5	0.0	8.3	0.0	0.0	0.0
25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	68.2	0.0	0.0	53.3	0.0	31.1	1.7	0.0	0.0
30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	72.3	0.0	0.0	60.5	0.0	43.2	20.7	0.0	0.0
35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	75.1	0.0	0.0	65.2	0.0	50.9	32.5	10.3	0.0
40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	77.3	0.0	0.0	68.6	53.6	52.8	40.7	21.9	0.0
45.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	78.4	0.0	0.0	70.6	59.8	0.0	46.2	29.9	0.0
50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	75.5	78.5	0.0	0.0	71.4	62.4	0.0	49.7	35.3	0.0
55.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	79.2	0.0	0.0	71.2	0.0	63.9	51.5	40.0	25.1	0.0
60.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	79.2	0.0	0.0	73.1	0.0	65.0	55.0	43.2	29.7	0.0
65.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	78.9	0.0	0.0	73.1	0.0	65.5	56.3	45.5	33.1	0.0
70.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	78.9	0.0	0.0	73.4	0.0	66.3	57.7	47.7	36.2	0.0
75.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	79.2	0.0	0.0	73.9	0.0	67.2	59.0	49.8	39.2	0.0
80.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	79.9	0.0	0.0	74.8	0.0	68.4	60.7	52.1	42.1	0.0
85.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	81.1	0.0	0.0	76.1	61.2	70.0	62.7	54.6	45.1	0.0
90.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	82.5	0.0	0.0	77.7	71.7	56.0	64.7	57.5	38.5	0.0
95.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	81.3	0.0	0.0	78.8	73.0	0.0	66.2	57.7	40.1	0.0
100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	83.5	0.0	0.0	78.9	72.8	74.2	66.7	63.7	51.7	42.8	0.0
105.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	85.4	0.0	0.0	80.9	0.0	75.4	69.0	62.3	53.4	44.9	0.0
110.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	86.3	0.0	0.0	81.8	0.0	76.4	70.1	63.7	54.9	46.6	0.0
115.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	86.6	0.0	0.0	82.2	0.0	76.9	70.6	64.1	55.7	47.5	0.0
120.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	86.9	0.0	0.0	82.5	0.0	77.2	71.0	64.4	56.7	43.5	0.0
125.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	86.6	0.0	0.0	82.1	0.0	76.8	70.7	63.9	56.5	38.0	0.0
130.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	86.1	0.0	0.0	81.7	0.0	76.4	70.2	63.3	55.9	37.4	0.0
135.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	84.6	0.0	0.0	80.1	0.0	72.8	68.6	61.5	52.4	35.3	0.0
140.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	82.9	0.0	0.0	78.4	71.7	0.0	66.7	59.9	42.4	32.7	0.0
145.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	80.4	0.0	0.0	75.8	70.3	0.0	63.8	56.9	38.7	28.6	0.0
150.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	77.7	0.0	0.0	73.0	67.3	0.0	60.5	53.3	34.3	23.7	0.0
155.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	71.4	74.0	0.0	66.5	69.1	63.9	53.5	56.4	46.6	29.2	16.9	0.0
160.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	71.5	67.4	0.0	66.4	62.3	60.2	52.4	49.6	35.5	22.7	5.9	0.0
"Total(BB+Tones)"																									
20.0	42.4	45.4	48.5	51.3	54.1	57.2	59.8	62.4	65.0	67.4	69.7	71.8	68.2	64.9	62.1	59.5	62.8	53.8	48.2	42.7	24.5	9.1	0.0	0.0	85.5
25.0	46.9	49.9	53.0	55.9	58.7	61.9	64.5	67.3	70.0	72.6	75.1	77.4	74.0	70.9	68.3	66.0	69.6	61.9	58.1	55.6	42.0	32.3	4.4	0.0	91.7
30.0	50.3	53.3	56.4	59.3	62.2	65.4	68.1	70.9	73.7	76.4	78.9	81.4	78.0	75.0	72.4	70.1	73.8	66.7	63.8	62.7	51.4	44.7	23.3	0.0	96.0
35.0	53.7	56.7	59.8	62.7	65.6	68.8	71.5	74.3	77.2	79.9	82.5	85.1	81.7	78.7	76.0	73.5	76.8	70.1	67.6	67.4	57.4	52.5	35.0	12.6	99.5
40.0	56.6	59.6	62.7	65.7	68.6	71.8	74.5	77.3	80.2	83.0	85.7	88.2	84.9	81.9	79.1	76.4	79.1	72.7	70.5	70.8	62.2	56.0	43.1	24.1	102.5
45.0	58.8	61.8	64.9	67.9	70.8	74.0	76.7	79.6	82.5	85.3	88.0	90.6	87.3	84.2	81.3	78.4	80.4	74.2	71.9	72.7	65.3	56.3	48.3	31.7	104.6
50.0	60.8	63.8	66.9	69.9	72.8	76.0	78.8	81.6	84.5	87.3	90.0	92.7	89.4	86.3	83.3	81.5	81.1	75.4	73.0	73.7	67.2	58.5	51.8	37.0	106.4
55.0	61.6	64.7	67.8	70.7	73.6	76.8	79.6	82.5	85.4	88.2	90.9	93.6	90.3	87.2	84.2	83.2	78.4	76.0	75.6	70.5	68.3	60.5	50.3	36.0	106.8
60.0	62.3	65.4	68.5	71.4	74.3	77.5	80.3	83.2	86.1	88.9	91.7	94.3	91.1	88.0	85.0	83.7	79.0	76.5	76.6	71.0	69.1	62.0	52.2	39.0	107.6
65.0	61.2	64.2	67.3	70.2	73.2	76.4	79.2	82.0	85.0	87.8	90.6	93.2	90.0	86.9	84.0	83.0	78.2	76.0	76.4	71.0	69.5	62.9	53.6	41.2	106.7
70.0	60.0	63.0	66.1	69.0	71.9	75.1	77.9	80.8	83.8	86.6	89.3	92.0	88.8	85.8	82.9	82.4	77.6	75.6	76.6	71.3	70.2	64.0	55.2	43.5	105.8
75.0	58.5	61.4	64.5	67.4	70.3	73.5	76.3	79.2	82.2	85.0	87.8	90.4	87.2	84.3	81.5	82.0	76.9	75.5	76.9	71.8	71.0	65.1	56.8	45.7	104.8
80.0	57.1	59.9	62.9	65.8	68.7	71.9	74.7	77.5	80.5	83.3	86.1	88.8	85.6	82.8	80.3	82.1	76.8	75.9	77.8	72.9	72.3	66.7	58.7	48.1	103.9
85.0	56.9	59.6	62.6	65.4	68.2	71.4	74.2	77.0	80.0	82.9	85.6	88.3	85.2	82.4	80.2	83.0	77.5	76.9	79.0	74.4	73.8	68.4	60.6	50.3	104.7
90.0	56.7	59.3	62.2	64.9	67.7	70.9	73.7	76.5	79.5	82.3	85.1	87.8	84.7	82.1	80.2	84.1	78.5	78.1	80.5	77.1	73.0	70.2	62.7	51.1	105.6
95.0	57.0	59.5	62.2	64.9	67.7	70.8	73.6	76.4	79.4	82.2	85.0	87.6	84.6	82.2	80.6	83.6	79.4	79.1	81.6	78.3	74.2	71.5	63.8	52.6	105.9
100.0	57.4	59.7	62.3	64.9	67.6	70.7	73.4	76.2	79.2	82.0	84.8	87.5	84.6	82.3	85.4	80.5	80.4	82.6	80.3	79.5	75.9	71.9	64.1	54.0	106.4
105.0	57.5	59.7	62.2	64.8	67.4	70.5	73.2	76.0	78.9	81.8	84.5	87.2	84.4	82.3	86.8	80.9	81.0	83.9	80.2	80.3	76.8	72.3	64.7	54.7	107.5
110.0	57.6	59.7	62.1	64.6	67.2	70.2	72.9	75.7	78.6	81.5	84.2	86.9	84.2	82.3	87.5	81.4	81.5	84.6	80.7	81.0	77.4	72.9	65.2	55.1	108.1
115.0	57.0	59.1	61.6	64.1	66.7	69.8	72.5	75.3	78.2	81.1	83.8	86.5	83.8	82.1	87.8	81.4	81.6	84.9	80.8	81.2	77.5	72.8	65.0	54.8	108.3
120.0	56.3	58.5	61.0	63.5	66.2	69.2	72.0	74.8	77.7	80.6	83.4	86.0	83.4	81.8	87.9	81.5	81.7	85.1	80.9	81.3	77.5	72.5	64.7	53.6	108.3
125.0	55.1	57.4	60.1	62.7	65.5	68.6	71.3	74.2	77.2	80.0	82.8	85.4	82.9	81.4	87.6	81.1	81.4	84.7	80.5	80.9	76.9	71.7	63.8	51.8	107.9
130.0	53.9	56.4	59.2	61.9	64.7	67.9	70.6	73.5	76.5	79.4	82.1	84.8	82.3	80.8	87.2	80.7	81.0	84.3	80.0	80.3	76.3	70.8	62.6	50.1	107.4
135.0	52.8	55.4	58.3	61.0	63.9	67.1	69.8	72.7	75.7	78.5	81.3	84.0	81.3	79.7	85.7	79.2	79.4	82.7	78.3	77.9	74.3	68.6	59.7	46.8	105.8
140.0	51.6	54.4	57.3	60.1	63.0	66.2	69.0	71.8	74.8	77.6	80.4	83.0	80.3	78.5	84.1	77.6	77.7	81.0	77.7	74.3	72.2	66.2	56.0	43.1	104.1
145.0	50.4	53.2	56.2	59.1	62.0	65.2	67.9	70.8	73.8	76.6	79.3	82.0	79.0	76.9	81.6	75.1	75.0	78.2	75.1	71.0	68.9	62.5	51.4	37.6	101.6
150.0	49.1	52.0	55.0	57.9	60.8	64.0	66.8	69.7	72.6	75.4	78.1	80.8	77.7	75.2	79.1	72.6	72.1	75.3	71.9	67.5	65.2	58.3	46.1	31.3	98.9
155.0	47.7	50.7	53.8	56.6	59.6	62.8	65.5	68.4	71.3	74.1	76.8	79.4	76.2	75.6	75.9	69.9	71.0	71.7	68.5	64.0	60.9	52.8	39.9	23.6	95.4
160.0	46.2	49.2	52.3	55.2	58.1	61.3	64.0	66.9	69.8	72.5	75.2	77.8	74.5	74.6	71.4	67.1	69.1	66.6	64.6	60.0	55.3	45.9	32.4	13.4	92.2

The previous file is generated alongside with this time history of the harmonics.

`SampleSopranoOutputFileTonal.ton`

```
      3          29   THETA
"Inlet Fan"   NH=  6
     20.0    1961.   61.4    3922.     40.5    5882.    8.3    7843.  -34.6    9804.  -87.3   11765. -148.7
     25.0    1946.   68.2    3891.     53.3    5837.   31.0    7782.    1.7    9728.  -34.2   11674.  -75.9
     30.0    1925.   72.3    3850.     60.5    5775.   43.2    7699.   20.6    9624.   -6.7   11549.  -38.5
     35.0    1899.   75.1    3798.     65.2    5697.   50.9    7597.   32.5    9496.   10.2   11395.  -15.4
     40.0    1869.   77.2    3738.     68.6    5607.   56.3    7476.   40.7    9345.   21.9   11214.    0.3
     45.0    1835.   78.3    3670.     70.5    5505.   59.8    7340.   46.1    9175.   29.8   11010.   11.1
...
    130.0    1215.   51.6    2430.     47.1    3645.   41.8    4859.   35.6    6074.   28.6    7289.   20.8
    135.0    1192.   48.8    2385.     44.3    3577.   39.0    4769.   32.7    5962.   25.6    7154.   17.7
    140.0    1172.   45.9    2344.     41.3    3516.   35.9    4688.   29.6    5860.   22.3    7032.   14.2
    145.0    1154.   42.8    2307.     38.2    3461.   32.7    4614.   26.2    5768.   18.7    6922.   10.4
    150.0    1137.   39.6    2275.     34.9    3412.   29.2    4549.   22.4    5687.   14.7    6824.    5.9
    155.0    1123.   36.2    2246.     31.3    3369.   25.4    4492.   18.3    5615.   10.1    6738.    0.8
    160.0    1111.   32.6    2221.     27.4    3332.   21.1    4443.   13.5    5553.    4.6    6664.   -5.4
"Fan Aft"   NH=  6
     20.0    1961.   32.5    3922.     11.5    5882.  -20.6    7843.  -63.5    9804. -116.2   11765. -177.7
     25.0    1946.   41.3    3891.     26.4    5837.    4.1    7782.  -25.2    9728.  -61.1   11674. -102.8
     30.0    1925.   47.3    3850.     35.6    5775.   18.3    7699.   -4.3    9624.  -31.7   11549.  -63.4
     35.0    1899.   52.2    3798.     42.3    5697.   28.0    7597.    9.6    9496.  -12.7   11395.  -38.4
     40.0    1869.   56.3    3738.     47.6    5607.   35.4    7476.   19.8    9345.    1.0   11214.  -20.7
     45.0    1835.   60.0    3670.     52.2    5505.   41.4    7340.   27.8    9175.   11.5   11010.   -7.2
...
    130.0    1215.   86.1    2430.     81.7    3645.   76.4    4859.   70.2    6074.   63.2    7289.   55.4
    135.0    1192.   84.6    2385.     80.1    3577.   74.8    4769.   68.6    5962.   61.4    7154.   53.5
    140.0    1172.   82.9    2344.     78.4    3516.   73.0    4688.   66.7    5860.   59.4    7032.   51.3
    145.0    1154.   80.4    2307.     75.8    3461.   70.3    4614.   63.8    5768.   56.3    6922.   47.9
    150.0    1137.   77.7    2275.     73.0    3412.   67.3    4549.   60.5    5687.   52.7    6824.   44.0
    155.0    1123.   74.8    2246.     69.9    3369.   63.9    4492.   56.8    5615.   48.6    6738.   39.3
    160.0    1111.   71.6    2221.     66.5    3332.   60.2    4443.   52.6    5553.   43.7    6664.   33.7
"Turbine"  NH = 3
     20.0    9804. -130.4   19608.   -497.2   29412.   -947.0
     25.0    9728.  -74.9   19456.   -321.4   29184.   -623.8
     30.0    9624.  -45.1   19249.   -231.0   28873.   -459.6
     35.0    9496.  -25.8   18991.   -175.1   28487.   -359.2
     40.0    9345.  -11.7   18690.   -136.5   28035.   -290.9
     45.0    9175.   -0.8   18351.   -108.0   27526.   -241.1
...
    130.0    6074.   46.9   12148.      5.4   18223.    -50.2
    135.0    5962.   43.2   11924.      1.0   17885.    -55.8
    140.0    5860.   39.2   11720.     -4.1   17579.    -62.9
    145.0    5768.   34.8   11536.    -10.2   17304.    -71.7
    150.0    5687.   30.0   11373.    -17.5   17060.    -82.9
    155.0    5615.   24.7   11230.    -26.5   16845.    -97.2
    160.0    5553.   18.5   11107.    -37.7   16660.   -116.2
```

5 Conclusions

In ANIMA WP4 the Noise Reduction Solutions Simulator is being developed. This tool will be able to predict the noise of novel aircraft including noise reduction technology concepts for a fleet of aircraft, operating at an airport. In order to be able to make these future (non-existing) aircraft audible, this Simulator (comprised of FRIDA and SOPRANO) generates the output that is required by noise synthesis tools. The present document describes the output generated by SOPRANO for this purpose.

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