noise & track monitoring topsonic

Aircraft Noise & Track Monitoring System

System Overview

1 Introduction

Our aims for a Noise and Track Monitoring System:

- Accordance with ISO 20906:2009
- Full scope of application functions
- Easy to handle and maintain
- Fast access
- Highest security
- Standard third party software (Oracle, Microsoft)
- Simple and fast integration of new users or stakeholders

2 Schematic overview

The central point of the Aircraft Noise & Track Monitoring System is a powerful Noise- and Database-Server (ORACLE).

Topsonic will configure a permanent connection between this Noise Server and Noise Monitoring Terminals around the airport. This connection will be realised by a CISCO router for a permanently secure virtual private network (VPN) connection.

Local users located inside airport LAN will be able to access the Noise Monitoring and Track Management System directly via Remote Desktop (RDP). In addition defined users will be able to connect securely to the application via Remote Desktop over internet VPN connection from their local workstations. The system is prepared to extend the number of users or to change the type of connection in future.

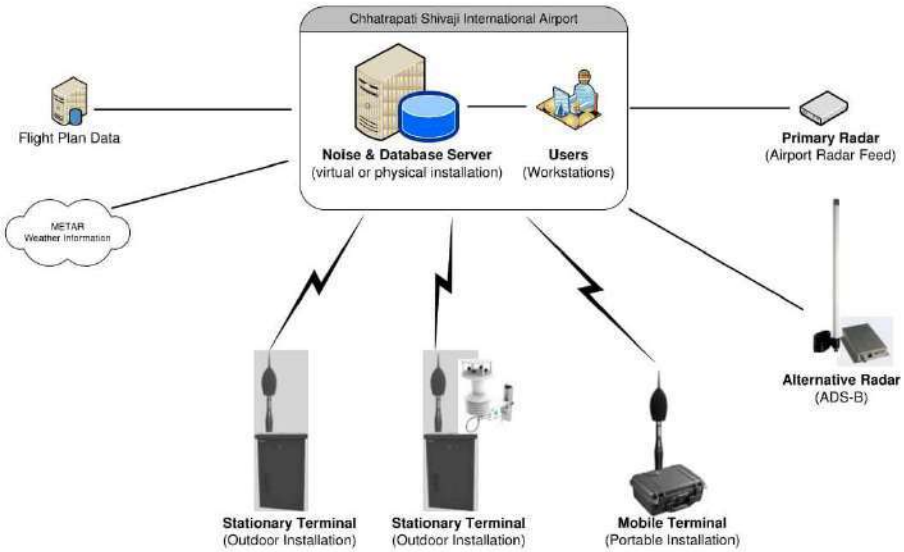


Figure 1: Schematic Overview

2.1 Services

Radar-, flight schedule- and weather information are transferred, processed and stored automatically and permanently by the installed services. We support nearly all ASTERIX-Categories and have realised more than 30 different AODB-interfaces at several airports.

The radar interface will be realised in two steps:

- As there is no airport radar feed available we will install a professional ADS-B receiver and antenna to receive radar information (Alternative Radar).
- In a second step a service will be installed to process the airport radar feed (Primary Radar).

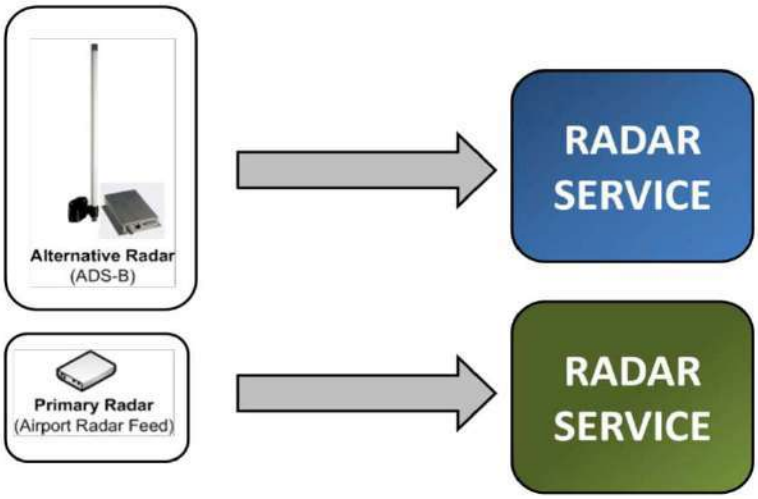


Figure 2: Radar Service

3 User access

Users logon to the system by Microsoft Windows Terminal Server. The protocol used is RDP (Remote Desktop Protocol).

There is no need to install programmes on client site – Windows Remote Desktop is an integrated component of Windows NT, Windows XP, Windows 7 and followers.

Printers, sound and clipboard are redirected to client's local PC.

Although RDP is already encrypted we will use very safe VPN connections from client to server.

3.1 Benefits of Terminal Server

The "Windows Terminal Server" services platform has the following advantages:

- Central deploying of applications to users, regardless of their locations.
- It helps enable branch-office access to feature-rich applications using

lower bandwidth.

- It supports remote control port redirection and network or local printing on client workstations (terminals).
- It enables help desk functions.
- It delivers high-performance computing capabilities to remote workstations with lower bandwidth.
- All users are running the same software and operating system.
- Distribution of new software releases is necessary on server only.
- High security through Remote Desktop Protocol (RDP) encryption. Allows administrators to encrypt the RDP data transmitted between the server running Windows Terminal Server and Terminal Services clients at three different levels, with up to 128-bit bidirectional RC4 encryption.
- Centralised application hosting. Effective delivery of applications across the enterprise to meet different needs, without straining network resources or exposing corporate data to unnecessary risks.

4 IT Components

4.1 Noise & Database Server

This server handles all communication with NMTs and users. The Noise & Database Server provides the application programmes and reports.

The server could be a virtual or a physical one, e. g. Dell PowerEdge R320. Our selected server is a DELL PowerEdge R620 Rack Chassis server.

Technical data:

- 3.5" Chassis with up to 4 Hot Plug Hard Drives
- Intel® Xeon® E5-1410 2.80GHz, 10M Cache, 6.4GT/s, Turbo, 4C, 80W
- 16GB RDIMM, 1333 MHz, Low Volt, Dual Rank, x4 Data Width
- 1333 MHz RDIMMs
- 3 x 500GB, SATA, 3.5-in, 7.2K RPM Hard Drive (Hot Plug)
- C9 - RAID 5 for H310/H710, 3-8 SAS/SATA/SSD HDDs, Max based on the Chassis
- Dual Hot Plug Power Supplies 350W
- Windows Server 2008 R2 SP1

Figure 3: DELL Power Edge 620

4.2 Database

Topsonic prefers Oracle Database Server 11g. Oracle is the world's most powerful and reliable database server and has many advantages against Microsoft SQL Server.

4.3 Router for Airport-Connection

A Cisco 2801 Integrated Services Router is offered for the communication between airport and Noise Monitoring Terminals.

Remark: all routers are included in our calculation.

Figure 4: CISCO 2801 Router

4.4 Router for Noise Monitoring Terminals

The Noise Monitoring Terminals will be connected via reliable and permanent VPN-connection with WELOTEC TK710U for UMTS/3G (cellular).

Figure 5: WELOTEC TK710U for 3G/UMTS (cellular)

The 3G UMTS router WELOTEC TK701U is a machine-to-machine (M2M) industrial cellular router with Din-rail mounting, which works on 2G / 3G cellular networks, provides reliable and robust wireless connections.

The VPN 3G router is designed to endure extreme conditions, such as temperatures ranging from -25 °C ~ +70 °C and low power consumption.

5 NMT-Hardware Details

5.1 Sound Level Meter

With the introduction of the precision handheld sound analyser Nor140, Norsonic sets a new standard for sound level meters, covering the widest range of applications. The Nor140 is packed into the smallest real time analyser featuring sound recording present on the market today.

- Tolerances for overall and differential linearity as defined in IEC 60651 **Type 1**
- Time factor Fast / Slow / Impulse / Peak
- Dynamic range: 120 dB
- Weighting A - C and linear

NOR140 is a sound level meter complying with: ANSI S1.4-1983 Type 1, ANSI S1.43-1997 Type 1, IEC 60651 type 1, IEC 60804 type 1 and IEC 61672-1, class 1, group X measuring exponential time-weighted levels, integrating-averaging levels and sound exposure levels.

Figure 6: Sound level meter Norsonic 140

5.2 OPTION: Frequency

We offer a "frequency option" for the sound level meter NOR140. This additional feature provides the permanent measurement of noise event frequency information and calculation of effective perceived noise level (EPNL).

Furthermore the spectrum of every single noise event can be displayed.

Frequency Measurement includes octave band or third octave band filters complying with ANSI S1.11-1986 Type 1D and IEC 61260, class 1.

5.3 NOR1216 Outdoor Microphone

Our quotation includes outdoor microphones type NOR1216.

Figure 7: Weatherproof outdoor microphone NOR1216

- Measurement microphone for all-weather conditions
- The microphone complies to IEC 60651, IEC 61672 class 1
- ANSI S1.4 type 1 (frequency correction applied)
- The microphone is equipped with rain cap, wind shield and anti-bird spikes
- Protection class IP 55 (dust and water)
- Powered by the sound level meter
- Temperature range: -25ºC to +60ºC

5.4 Uninterruptible Power Supply

Uninterruptible Power Supply (UPS) for stationary Noise Monitoring Terminals provides reliable power supply in case of power failure.

The UPS starts automatically and switches to battery mode without interruption. After the main power supply is established again, the UPS provides and controls the charging of the batteries.

- Stationary NMTs: 24 h
- Mobile NMT: 72 h

Figure 8: Uninterruptible Power Supply

Long lifetime of rechargeable batteries: We offer a high quality UPS which recharges and discharges the batteries carefully and continuously. This ensures a longer battery life time than conventionally battery charger.

5.5 OPTION: Weather Station

Thies clima sensor US (Ultrasonic) works absolutely maintenance-free without movable wear-parts such as ventilator or bearing. The wind velocity and wind direction are measured by means of approved ultrasonic sensors in high-precision. The precipitation and its intensity are acquired via Doppler radar. In addition to four brightness sensors, which are assigned to the geographic directions, the air temperature, relative air humidity as well as the barometric air pressure are measured. An integrated GPS receiver receives automatically the current information of date and time. From these data are then calculated the air pressure on sea level and the position of the sun.

- Measured values:
- Wind speed (0 … 60 m/s)
- Wind direction (0 … 360°)
- Precipitation (0 … 10mm/min)
- Brightness (0 … 150 kLux)

- Temperature (-30 … +70°C)
- Air humidity (0 … 100% rel. humidity)
- Air pressure (300 … 1100 hPa)

Figure 9: Weather Station

5.6 Outdoor and indoor cabinet

The outdoor NMT is equipped with a weatherproof cabinet of aluminium profiles with double wall panel roof (roof and walls ventilated) while the indoor one is made of plastic.

Figure 10: NMT outdoor cabinet

Figure 11: cabinet inside

5.7 Aluminium Pole

The aluminium pole consists of three parts, which are telescoped into each other and reach a total height of 6 m. A lightning protection is mounted on the top element which also carries the microphone adapter. The optional weather sensor is attached to a crossbeam. All cables are routed through the pole. A counterweight is included in the base element.

The pole foot is made of solid galvanised steel. Only one person is needed to tilt the mast (e. g. for calibration purposes).

Figure 12: NMT cabinet and pole

5.8 Mobile NMT

Topsonic's mobile noise monitoring terminal consists of

- tripod mast and
- noise monitoring terminal built in a pelican case

Features:

- Battery power supply
- Uninterruptible power supply for mobile noise monitoring terminals
- Communication via 3G
- Fully integrated into the central software

Figure 13: mobile NMT with tripod and mounted microphone

5.9 NMT-Software

The Noise Monitoring Terminal Software is running permanently and transfers the measured values to the central Noise & Database Server. In addition the measured values are stored on the local NMT-PC for at least 12 months.

The Noise Monitoring Terminal sends the following error and status messages to the central Noise & Database Server automatically:

- High temperature
- Low temperature
- Power loss
- Low battery

6 ADS-B Receiver Module

Topsonic Systemhaus GmbH uses professional ADS-B / Mode-S receivers for airports without ATC antennas or in addition to a poor ATC signal quality.

Our ADS-B Receiver is a 1090MHz Extended Squitter ADS-B receiver complying with the basic requirements as specified in RTCA DO-260A.

The receiver detects incoming ADS-B reports and performs decoding and checking of message validity. The valid ADS-B reports are forwarded to the central server via UDP Network protocol for further processing and generation of traffic depiction.

The unit has the basic capabilities of an ADS-B Class A0 receiver and supports a minimum trigger threshold level (MTL) of -74dBm.

Our Module “AirportRadar” running on the server is able to process both ADS-B and ASTERIX protocols in parallel.

The receiver needs to be installed on a “line to sight” place where no buildings, masts cranes etc. disturb the direct view to the aircraft. The range is up to 200 NM.

Usually antenna and receiver are fixed on one of the installed NMTs which have a mast (6m) and sufficient communication lines (ADSL or 3G) for a proper transfer of the data.

This equipment receives all ADS-B equipped aircrafts (approx. 90%). All newer aircrafts (since 1995) are ADS-B equipped.

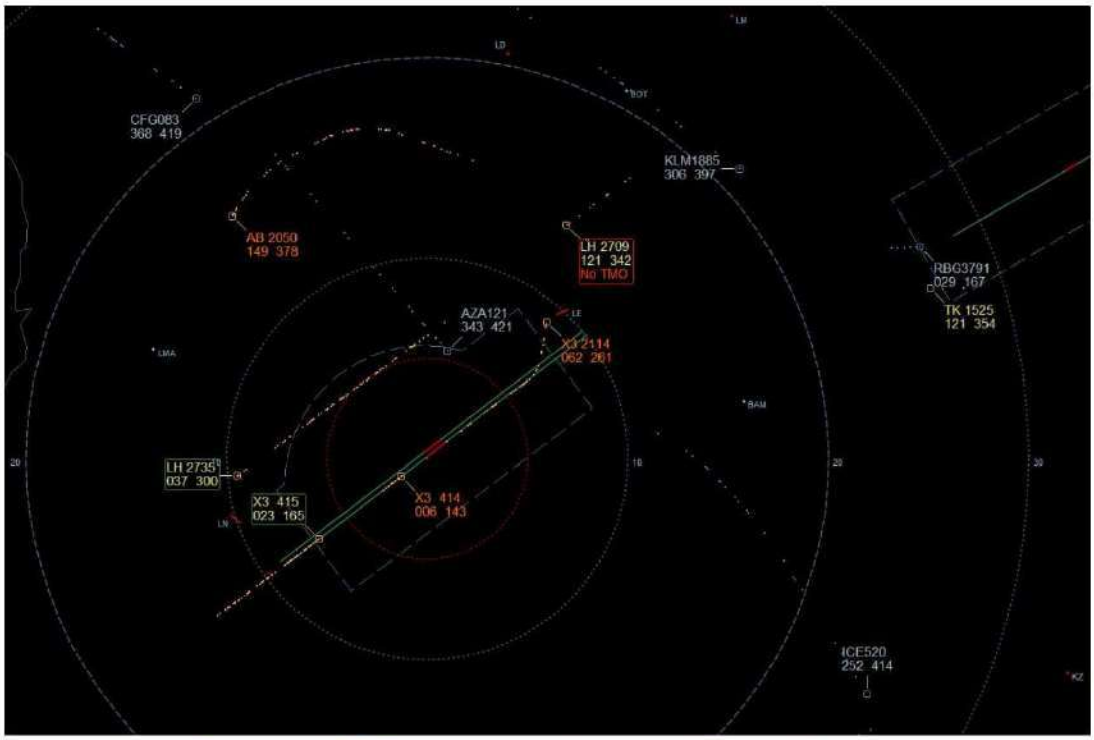


Figure 14: ADS-B received aircrafts in our "Albatros" display

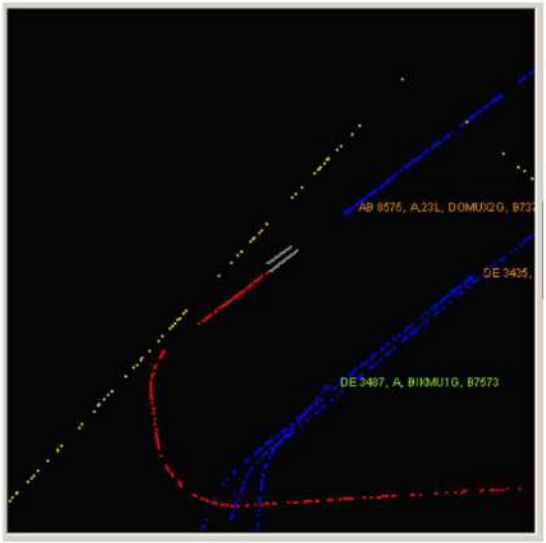


Figure 15: ADSB-received aircrafts in our service "AirportRadar" at Düsseldorf International Airport.

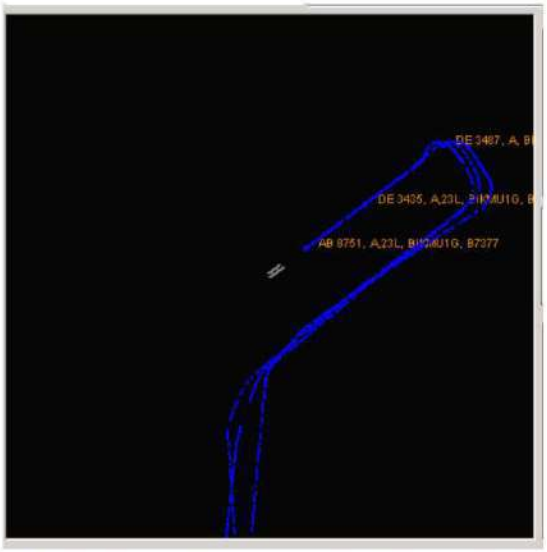


Figure 16: ADSB-received aircrafts in our service "AirportRadar" at Düsseldorf International Airport (arrivals only)

7 Noise Monitoring Software

Topsonic's Noise and Flight Track Monitoring System (NTMS) is a fully scalable and easy-to use Windows application, which is developed to fulfil all the needs of a modern airport. The system consists of Noise Monitoring Terminals (NMTs) which are located in the vicinity of the airport and the Noise & Track Monitoring Server.

The NTMS-Server is responsible for the automatic data transfer from the NMTs (Noise Stations) to the central noise database and all the other interfaces like radar, AODB, weather systems, air pollution, etc.

Topsonic's NTMS runs automatically 24 hours without any interaction of the operator and is clearly structured and user friendly.

With its statistic and reporting module the system fulfils the directive of the European Parliament and Council relating to the Assessment and Management of Environmental Noise 2002/49/EC.

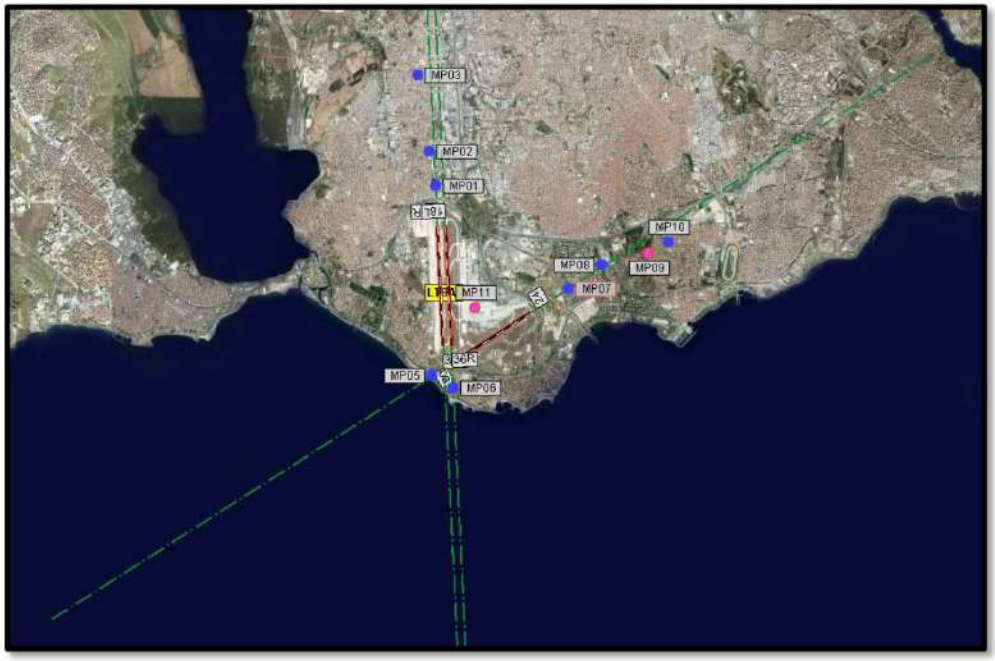


Figure 17: Noise Monitoring Software

Additional Noise Monitoring Terminals can be easily integrated by entering the specific parameters in the Central Unit. No changes of software are necessary.

7.1 System functionality

Passwords: The system supports four levels of user access.

Multi-user access: Several users can have access to the NMT and noise and track database via networking at the same time.

Security of access: data transfer and user access are realised via secured connections (VPN) only. In addition the routers provide activated firewall features.

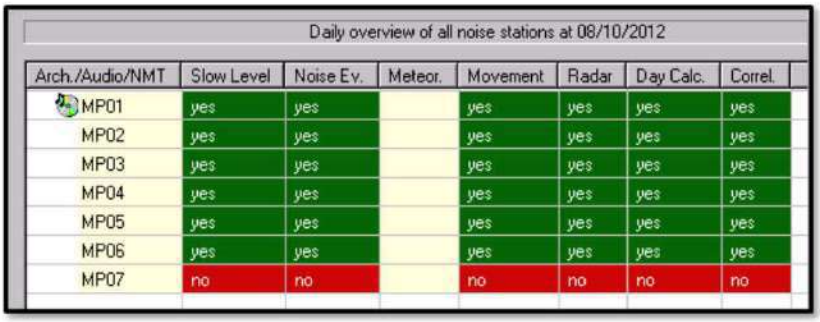
Remote Access: Noise & Track Monitoring Software provides remote access to all noise monitoring terminals. Necessary re-configuration (including ID, name, location, parameters etc.) and calibration check will be started remotely.

Automatic data transfer: measured noise and weather data will be transferred at regular intervals (daily) from noise monitoring terminal to the noise server automatically. Additional to that the data transfer can be started manually. The current measurement won´t be affected.

Overview of data: the system provides the possibility to monitor the completeness of the measured data.

Breakdown times: breakdown times (e. g. caused by wind speed) can be generated automatically or manually edited, entered, and deleted by user.

Daily back-up: a daily back-up of all relevant information stored on the Noise & Track Database is created automatically.



Daily overview of all noise stations at 08/10/2012

Arch./Audio/NMT	Slow Level	Noise Ev.	Meteor.	Movement	Radar	Day Calc.	Correl.
MP01	yes	yes		yes	yes	yes	yes
MP02	yes	yes		yes	yes	yes	yes
MP03	yes	yes		yes	yes	yes	yes
MP04	yes	yes		yes	yes	yes	yes
MP05	yes	yes		yes	yes	yes	yes
MP06	yes	yes		yes	yes	yes	yes
MP07	no	no		no	no	no	no

Figure 18: Daily Data Overview

Status Information: The status of all NMT and the central server is reported by sending e-mails with information of the operation of the noise monitoring system to predefined addresses. Current status of NMT-connectivity, interfaces and weather information can be displayed permanently.

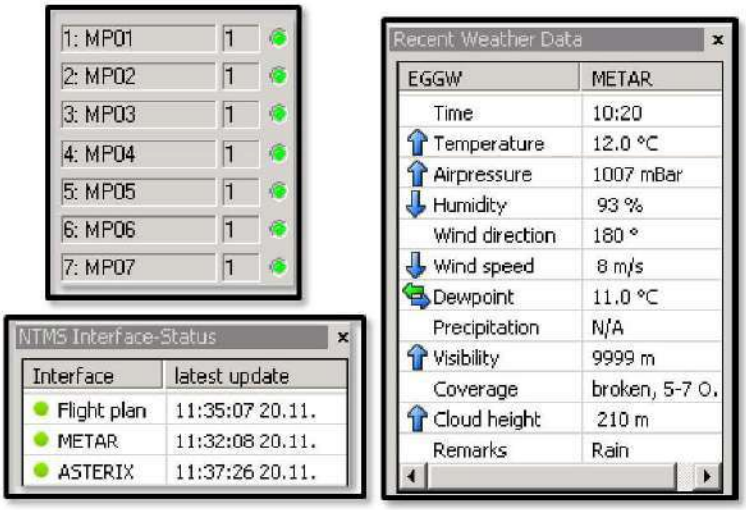


Figure 19: Status Information

7.2 Aircraft / Noise Correlation

7.2.1 Aircraft / Noise Correlation with Radar data

An important task of a noise monitoring system is the correlation between measured noise events and their causes (type of aircraft, registration number, flying route, landing and starting track).

The correlation will be based on radar data. The correlation process verifies all noise events and encloses the traffic- and meteorological information.

The meteorological information is added to the noise and flight data of each noise event. Noise data will be related to radar data through time and position information.

In practice we achieve a correlation rate of 95-100 % with radar data.

7.2.2 Aircraft / Noise Correlation without Radar Data

If no radar data is available the correlation noise to aircraft is performed by means of the so called time-window-method. With this method the exact time of the closest approach for each aircraft is calculated based on the ATA/ATD times of the flight table.

The highly sophisticated method to correlate noise and aircraft **without** radar data is implemented on many airports in Germany, Europe and Asia and works reliably and with a very high correlation ratio.

7.2.3 Manual Correlation

The software system offers - in addition to an automatic correlation - a manual and interactive correlation method for noise events which allows a manual identification of exceptional events.

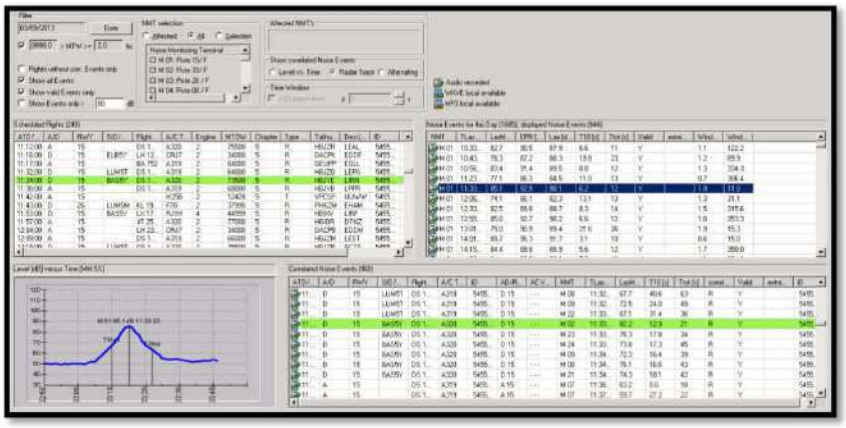


Figure 20: Manual Correlation

The non-correlated noise events and flight schedules are presented to the operator for a decision. The central unit additionally offers powerful help for decision by displaying the time history of the noise level. The system will also be able to propose a correlation based on a radar track.

With a mouse click on the flight, the specific flight track is displayed. Events which are not caused by an aircraft can be removed from the list of aircraft noise events.

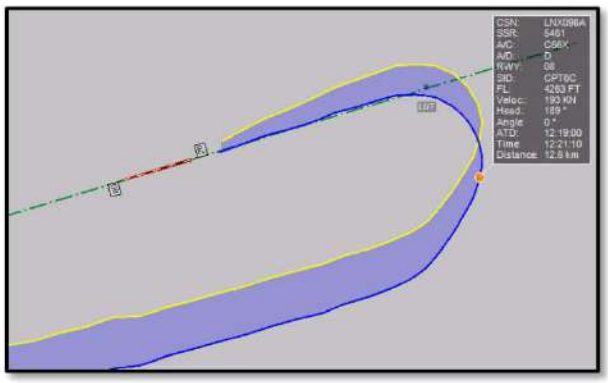


Figure 21: Lateral track view

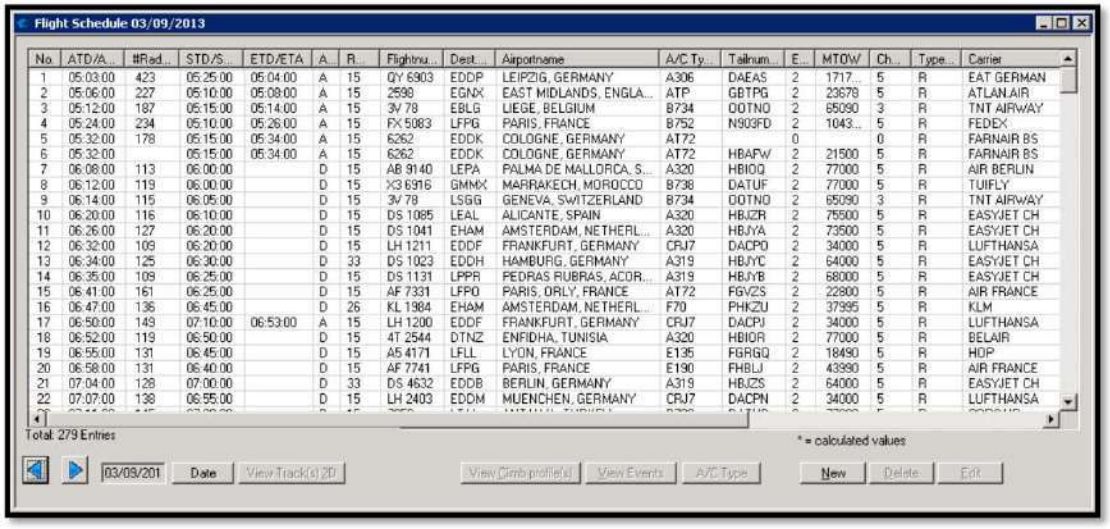
7.3 Automatic Creation of a Flight Table

The system is able to create (with the help of radar data) artificial flight schedules of all relevant flights from and to the specific airport with following data:

- Time of arrival / departure
- Departure / arrival corridor
- Runway
- Direction
- Time first scanned on radar
- Number of times scanned by radar (=number of plots)
- Noise events will be correlated to these flights automatically.

7.3.1 Display, Edit and Change of the Flight Table

The flight data table can be displayed sorted user-defined.



No.	ATD/A...	#Rad...	STD/S...	ETD/ETA	A...	R...	Flightnu...	Dest...	Airportname	A/C Ty...	Tailnum...	E...	MTOW	Ch...	Type...	Carrier
1	05:03:00	423	05:25:00	05:04:00	A	15	QY 6903	EDDP	LEIPZIG, GERMANY	A306	DAEAS	2	1717...	5	R	EAT GERMAN
2	05:06:00	227	05:10:00	05:08:00	A	15	2598	EGNX	EAST MIDLANDS, ENGLA...	ATP	GBTPG	2	23678	5	R	ATLANAIR
3	05:12:00	187	05:15:00	05:14:00	A	15	3V 78	EBLG	LIEGE, BELGIUM	B734	OOTNO	2	65090	3	R	TNT AIRWAY
4	05:24:00	234	05:10:00	05:26:00	A	15	FX 5083	LFPG	PARIS, FRANCE	B752	N903FD	2	1043...	5	R	FEDEX
5	05:32:00	178	05:15:00	05:34:00	A	15	6262	EDDK	COLOGNE, GERMANY	AT72		0		0	R	FARNAIR BS
6	05:32:00		05:15:00	05:34:00	A	15	6262	EDDK	COLOGNE, GERMANY	AT72	HBAFW	2	21500	5	R	FARNAIR BS
7	06:08:00	113	06:00:00		D	15	AB 9140	LEPA	PALMA DE MALLORCA, S...	A320	HBIOQ	2	77000	5	R	AIR BERLIN
8	06:12:00	119	06:00:00		D	15	X3 6916	GMMX	MARRAKECH, MOROCCO	B738	DATUF	2	77000	5	R	TUIFLY
9	06:14:00	115	06:05:00		D	15	3V 78	LSGG	GENEVA, SWITZERLAND	B734	OOTNO	2	65090	3	R	TNT AIRWAY
10	06:20:00	116	06:10:00		D	15	DS 1085	LEAL	ALICANTE, SPAIN	A320	HBJZR	2	75500	5	R	EASYJET CH
11	06:26:00	127	06:20:00		D	15	DS 1041	EHAM	AMSTERDAM, NETHERL...	A320	HBJYA	2	73500	5	R	EASYJET CH
12	06:32:00	109	06:20:00		D	15	LH 1211	EDDF	FRANKFURT, GERMANY	CRJ7	DACPO	2	34000	5	R	LUFTHANSA
13	06:34:00	125	06:30:00		D	33	DS 1023	EDDH	HAMBURG, GERMANY	A319	HBJYC	2	64000	5	R	EASYJET CH
14	06:35:00	109	06:25:00		D	15	DS 1131	LPPR	PEDRAS RUBRAS, ACOR...	A319	HBJYB	2	68000	5	R	EASYJET CH
15	06:41:00	161	06:25:00		D	15	AF 7331	LFPO	PARIS, ORLY, FRANCE	AT72	FGVZS	2	22800	5	R	AIR FRANCE
16	06:47:00	136	06:45:00		D	26	KL 1984	EHAM	AMSTERDAM, NETHERL...	F70	PHKZU	2	37995	5	R	KLM
17	06:50:00	149	07:10:00	06:53:00	A	15	LH 1200	EDDF	FRANKFURT, GERMANY	CRJ7	DACPJ	2	34000	5	R	LUFTHANSA
18	06:52:00	119	06:50:00		D	15	4T 2544	DTNZ	ENFIDHA, TUNISIA	A320	HBIOR	2	77000	5	R	BELAIR
19	06:55:00	131	06:45:00		D	15	A5 4171	LFLL	LYON, FRANCE	E135	FGRGQ	2	18490	5	R	HOP
20	06:58:00	131	06:40:00		D	15	AF 7741	LFPG	PARIS, FRANCE	E190	FHBLJ	2	43990	5	R	AIR FRANCE
21	07:04:00	128	07:00:00		D	33	DS 4632	EDDB	BERLIN, GERMANY	A319	HBJZS	2	64000	5	R	EASYJET CH
22	07:07:00	138	06:55:00		D	15	LH 2403	EDDM	MUENCHEN, GERMANY	CRJ7	DACPN	2	34000	5	R	LUFTHANSA

Figure 22: Flight Schedule

The specific radar track and the correlated noise event can be displayed. New flights can be entered into the flight schedule or existing flight information can be changed.

7.4 Flight Track Monitoring

An interface to the airport's radar system or ADS-B receiver technology enables the Airport Noise Monitoring System to correlate aircraft movements with the recorded noise

events. Flight and noise data can either be viewed in real-time or replayed to display historical flight tracks.

The user is able to select an individual aircraft or a group of aircrafts. Flight tracks can be displayed together with other detailed flight information, e. g. all aircraft of a specific airline, all departures or arrivals using a certain runway.

The altitudes of the aircrafts are shown with coloured lines and the user can add gates and corridors. He can also check whether aircrafts follow the assigned arrival and departure routes.

7.4.1 Single Track and Mass Plot

The level of displayed details can be defined by the user. Additional maps can be added to the system (bitmap or vector maps).

All tracks are stored for any aircraft. The system displays user-selectable flight tracks in a pseudo 3-D mode.

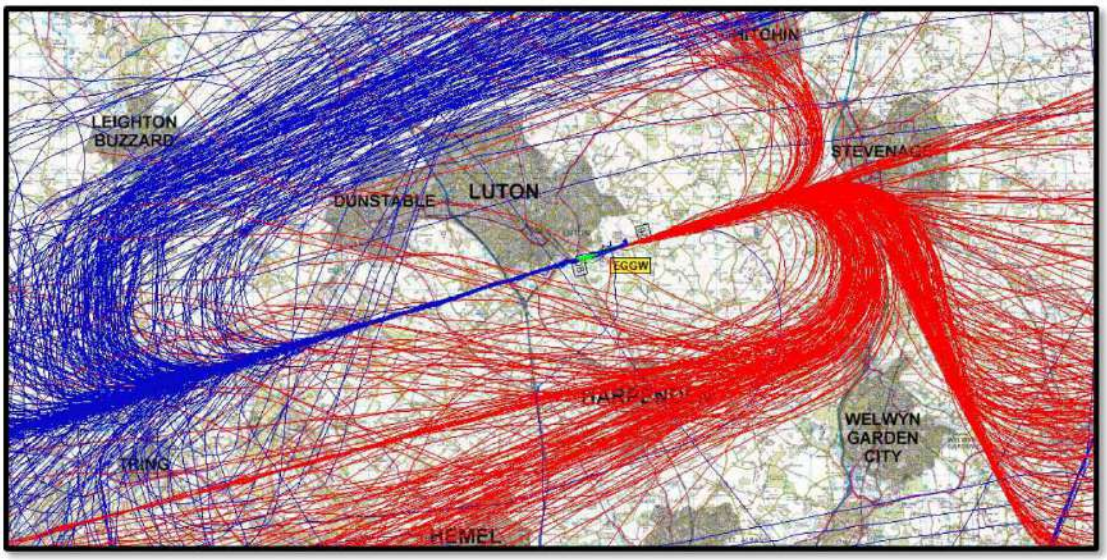


Figure 23: Track Mass Plot

7.4.2 Mean Track Module

Mean Track Module produces mean tracks for a free definable set of tracks, which have all the same SID. After loading the tracks into the Track Display View there are two ways of creating a mean track:

- Define a Mean Track Corridor (as a set of single gates) with the gate editor (which is also used for the Gate Penetration module) and create the mean track in this corridor.
- Create the mean track for an existing route object.

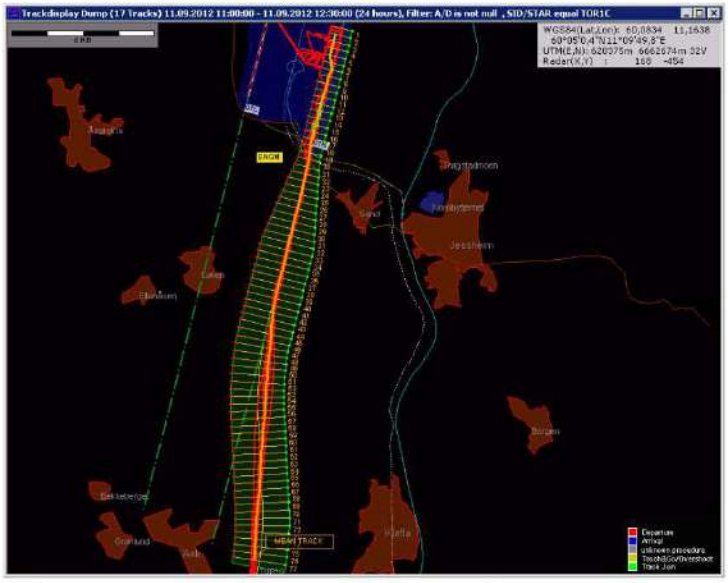


Figure 24: Mean Track

In any case the mean track function needs a corridor with a set of gates. It calculates a mean penetration point on every gate of the corridor/route and connects these points. The resulting line is the mean track for the loaded tracks

The user can save the mean track, load previously created tracks, export a mean track in csv format, export a mean track to INM, print the Track Display View with the mean track, copy it to the clipboard or save it in a graphic file.

After creation of the mean track the user can open a gate diagram for every gate in the corridor/ route. This diagram shows a single gate in vertical direction with bullets at the positions, where the flight tracks hit this gate

7.4.3 Track Density Module

Topsonic's Track Density Module calculates the number of over-flights for freely definable rectangles within the calculation area and plots the calculation results on a background map.
The colour of each rectangle depends on the number of over-flights for the rectangle.

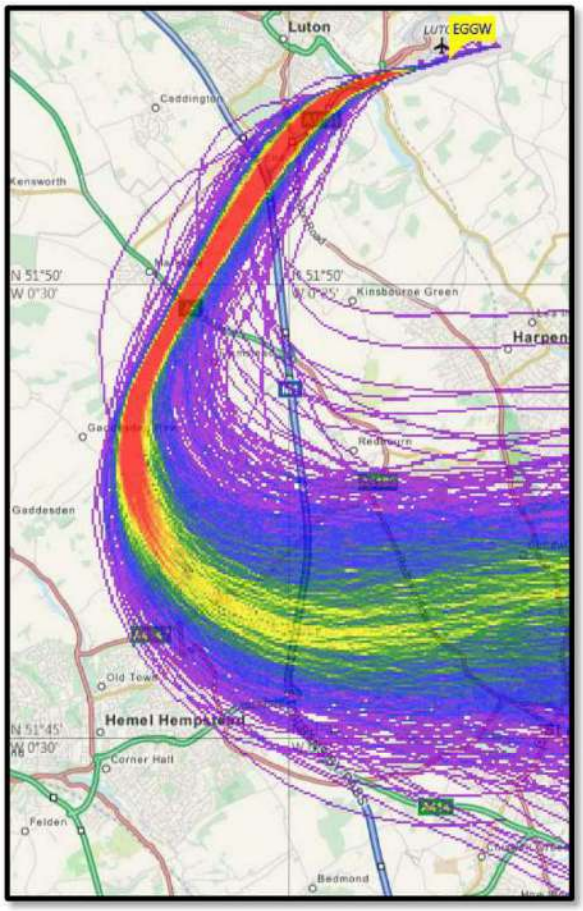


Figure 25: Track Density

7.4.4 Gate Penetration Module

A gate is defined as an imaginary vertical surface or window in space that aircrafts pass through along their flight paths.

The user can define a gate by entering point and the upper and lower altitudes. He can also define the period of time and the type of movements he wants to evaluate (arrival departures etc.). The software plots all points where the aircraft penetrates that gate.

The defined gates can be stored thus enabling the user to load predefined gates.

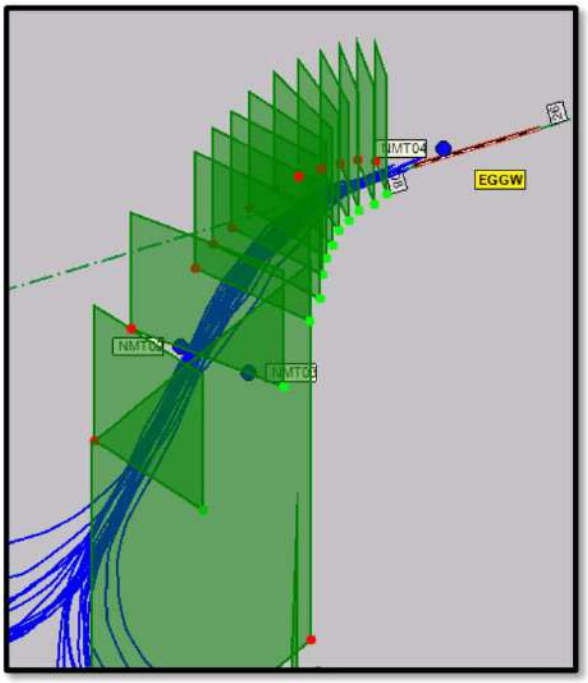


Figure 26: Gate Penetration

7.4.5 Track Violations

All flight tracks are analysed over defined routes. Possible violations are detected, listed and can be sent to several users via E-Mail.

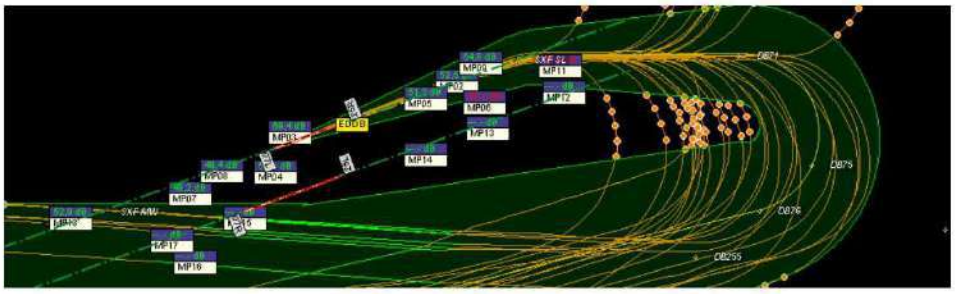


Figure 27: Route Violations

The Violation Detection Monitor shows possible violations of all current flights in a "live mode".

7.4.6 Climb Profile and CDA

The Noise Tracking and Monitoring System displays the climb profiles or glide paths of user-selected flights. The function of the altitude versus the distance along the flight track is displayed. All arrival flight tracks are checked automatically if they are CDA or not.

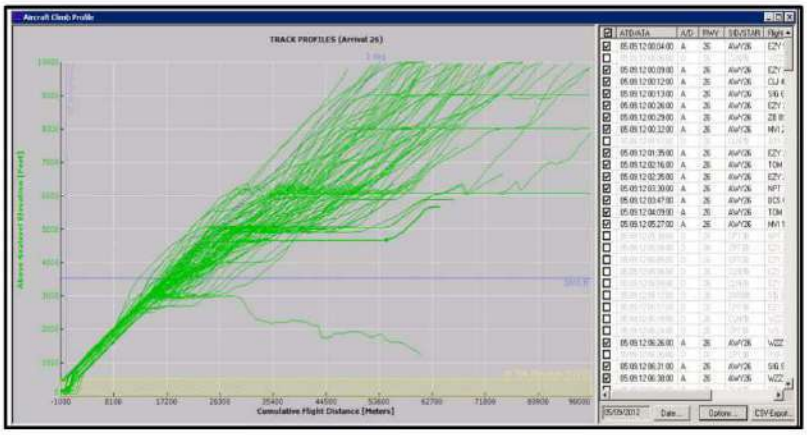


Figure 28: Climb Profile Plot

7.5 Real Time Displays

7.5.1 Map with Real Time Noise Levels

The Real Time Display shows the actual noise levels of one station on a map. The Real Time data is updated at one second intervals.

The user can also switch to a Graphic Noise Display for one or more selected NMT.

7.5.2 Real Time Noise Level Diagram

When starting the menu function "Online Noise Level Diagram", the system dials up to the selected station and shows the actual Leq – A-weighted.

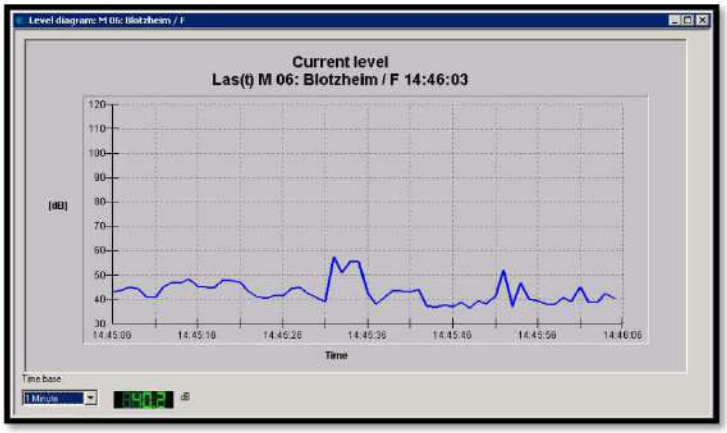


Figure 29: Real Time Level vs. Time

7.6 Data Presentation

Noise data is presented in tabular and graphical form (with cursor and zoom facilities).

All statistics are provided for output to printer.

7.6.1 One-Second $L_{Aeq}(t)$

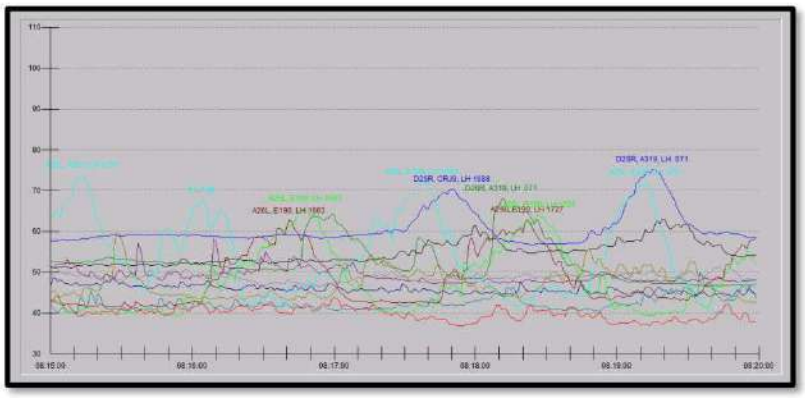


Figure 30: Level vs. Time

Every noise event is marked by its L_{max} and every correlated noise event is marked and labelled with its correlated flight, i. e. SSR code or call sign.

7.6.2 Presentation of the Noise Events

A noise event will be displayed with all its associated parameters.

All noise event data, as well as all parameters and the meteorological data at the corresponding moment in time T_{Lasmax} will be displayed in the dialogue window.

For each noise event detected at a NMT, the following data will be displayed:

- Noise data including SEL
- Correlated flight/ radar track
- Correlated meteorological conditions
- Threshold and parameters for the noise detecting function valid at the time of measurement

Figure 31: Detailed Noise Event View

By clicking the “listen” button the user can hear the recorded audio file of the noise of the event.

7.7 Standard Reports and Database Queries

The user can set several filters (time, station, day/night, etc.). The user can easily create even the most complicated queries with a few mouse clicks. The result is presented on the GIS map. The query can be modified and stored on disc for later reuse. The user does not need to have any SQL know-how.

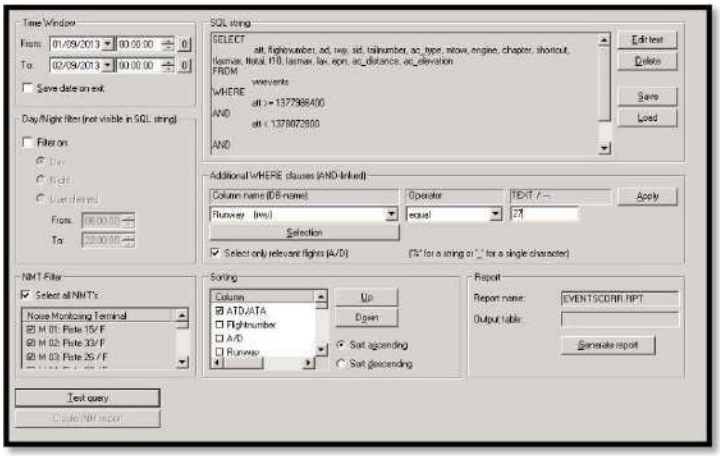


Figure 32: Database Query Wizard

Our Ssandard statistics and reports are:

- Daily / weekly / monthly report with all relevant noise and traffic data
- Presentation of the noise events
- Average L_{EQ} (aircraft noise and background noise)
- Level distribution diagram
- Calibration results
- Equivalent sound levels for all NMTs
- Distribution of L_{max} (the maximum level of a noise event)
- Track and runway usage
- Average noise values sorted by aircraft
- Average noise values sorted by carrier

7.8 Link to Noise Modelling System (INM)

Topsonic's system supports the latest version of INM in order to calculate noise contours for actual aircraft operations and future operations.

INM plots noise contours based upon aircraft movement occurrences.

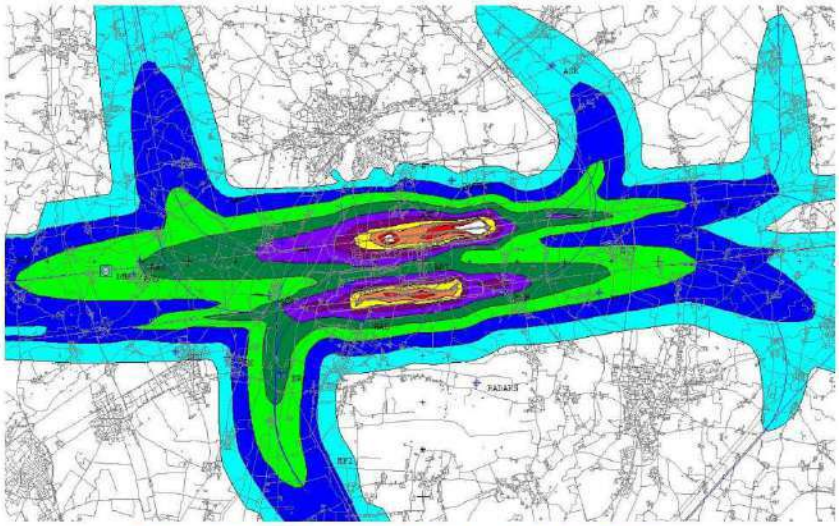


Figure 33: INM Export: Calculated Noise Contours

Noise contours base on real traffic. The user can specify the period of time, the noise contours should cover e. g. a day, a week, one hour, or any period. The application generates the movement data into the INM standardisation automatically.

Features:

- Import of noise maps as a layer of the monitoring software
- Export radar tracks into INM
- Indicate number of inhabitants inside a noise contour (if map of density of inhabitants is available)

7.9 Display of the flight tracks in GoogleEarth 3D

All radar tracks can be displayed in a client GoogleEarth View in 3D.

In addition user is able to export these tracks into KML file format for further processing inside the GoogleEarth programme or other applications.

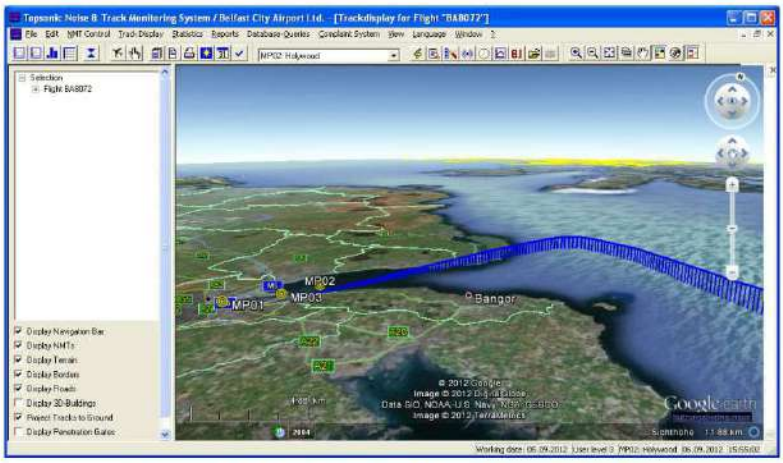


Figure 34: Track Presentation (GoogleEarth)

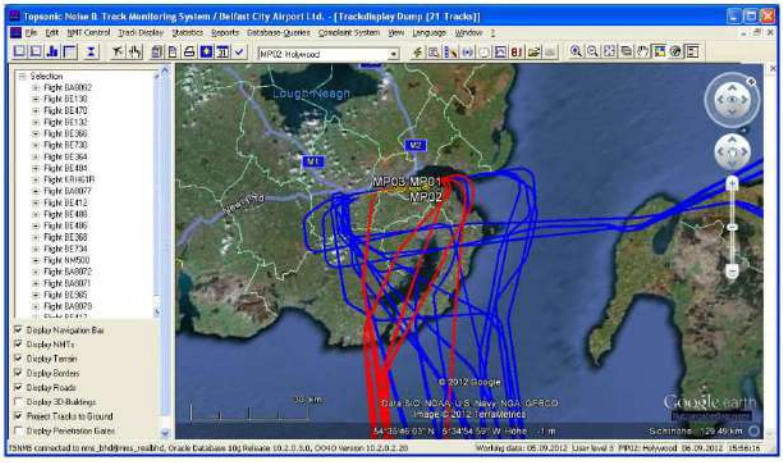


Figure 35: Track Selection (GoogleEarth)

8 Report Engine

A comprehensive and flexible reporting application is provided to create noise reports. The application connects automatically with the database and generates several reports quickly and reliably.

General features of the reporting module:

- Export into Excel/HTML/PDF format
- Batch Mode (multiple reports in single calculation step)
- Modular application framework (easily extendable)
- Dockable views
- Easy to extend and user friendly handling

Figure 36: Reporting Menu

For promulgation or further processing, the generated reports can be export to EXCEL, PDF or HTML.

Figure 37: Report Export

The user can use different provided "themes" to modify the general display type and colours (black-based, blue-based, silver-based). Furthermore, the display mode is user-defined:

- Single report
- Multiple reports as tabs
- Multiple reports in parallel
- Modification of window size multiple reports

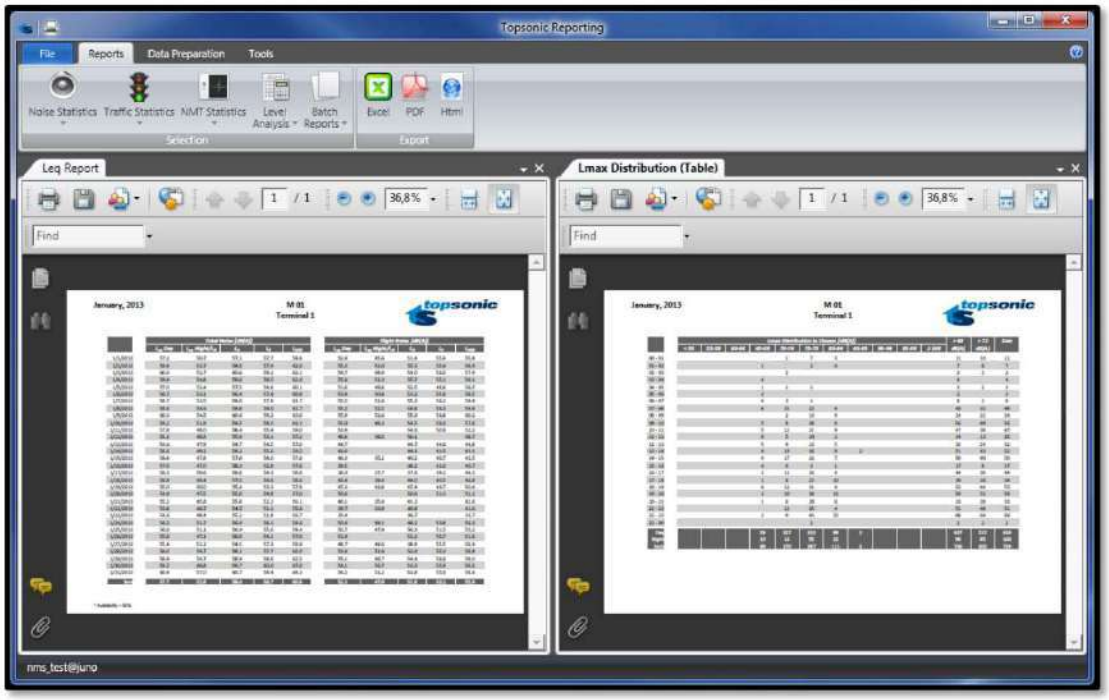


Figure 38: Reporting Split Window

All reports are individually designed to meet the customer's requirements.

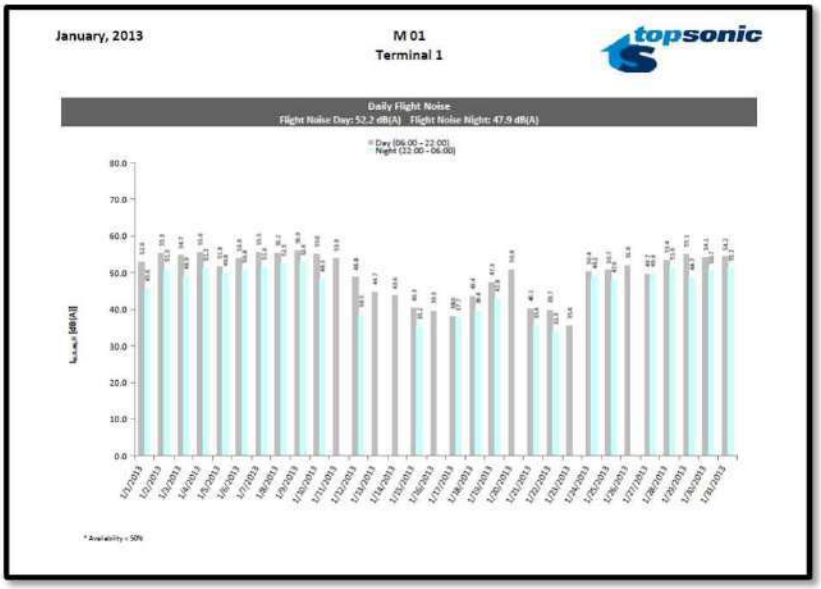


Figure 39: Reporting Statistic

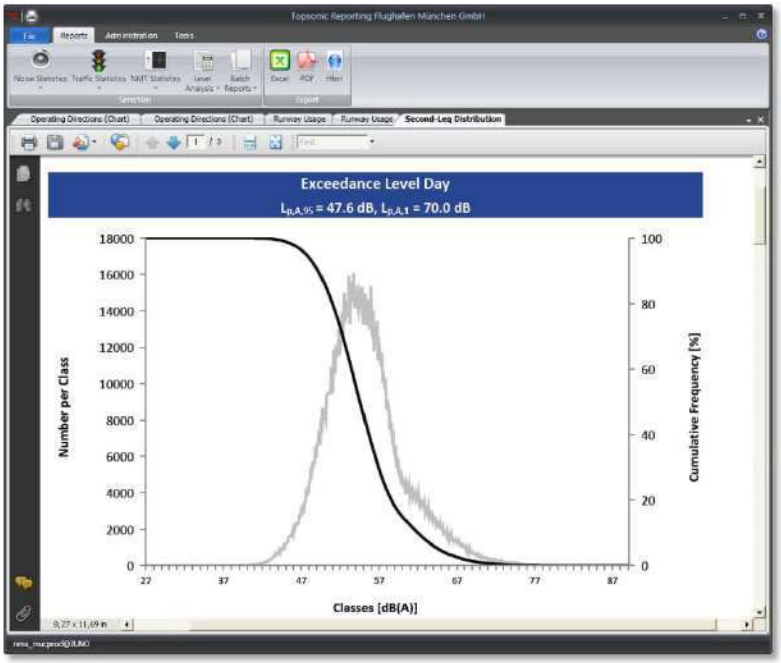


Figure 40: Reporting Diagram

The "Batch Report" feature provides the possibility to set up and create an own individual report. All reports, noise monitoring terminals, noise events and flights can be filtered into one report.

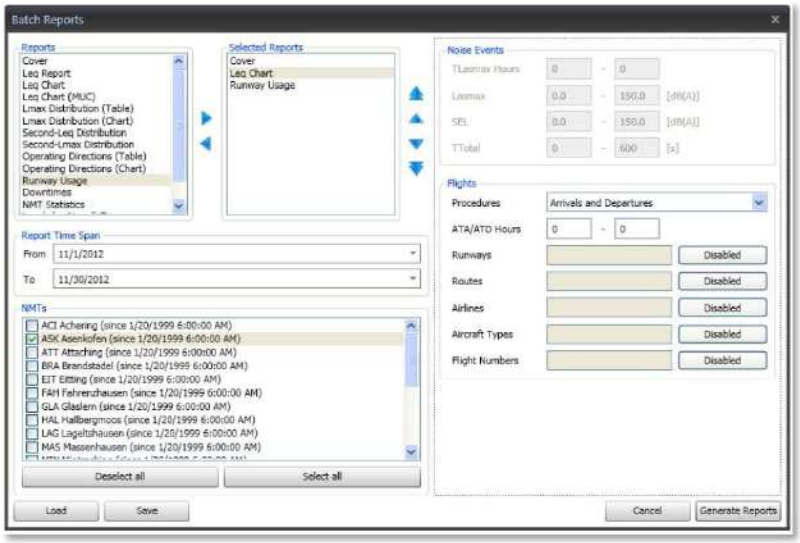


Figure 41: Batch Report

The user can save these configurations for further processing or to reload these parameters in future.

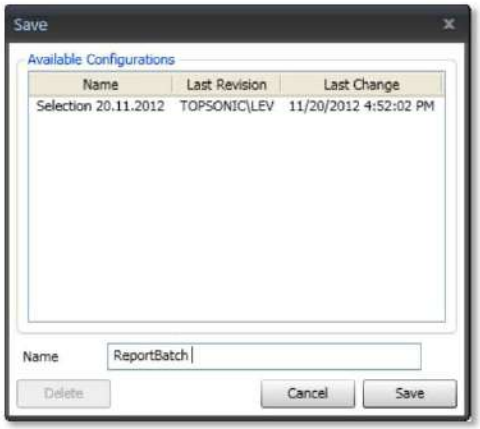


Figure 42: Save Configuration