Sound Design for Industry
AUTOMOTIVE
Engine sound design
Active sound generation
Mechanical sound refinement
Sound for driving simulators
Sound refinement for locks, seats, windows, air conditioning and windshield wipers

LEA is the premier software solution for sound design, sound analysis, sound quality and sound synthesis, and it is able to link sound to driving simulators, flight simulators and virtual reality platforms.

LEA paves the way to target sound definition, brand sound creation, subjective and objective testing, component separation, troubleshooting and sound dataset preparation.

AUDIO & TELECOM
Telephones
Audio systems
Loudspeakers
Speech intelligibility

CONSUMER & LUXURY GOODS
Home appliances: washing machines, refrigerators and vacuum cleaners
DIY and garden tools
Watches, alarm clocks, lighters, packaging

For consumers, the sound of a product triggers a sensorial and emotional response, which has a direct impact on their buying decisions.

A product’s sound provides information about the quality of the materials used and its craftsmanship.

This is a selling point for your product and it is crucial to be able to control its impact.

Sound level is just one parameter for maximizing sound comfort.

Measuring and controlling it is a step further.

It is more effective to refine a sound rather than simply trying to reduce it.
Better sound, better life!

*Sound is everywhere, bringing us information and emotion, alerting us to potential threats and giving us the feeling of quality and comfort.*

**GENESIS’s** mission is to help companies to give their products a better sound. To provide a better customer experience, a distinctive sound signature, or for reducing the annoyance of air, rail or road transportation systems, sound matters for various reasons. Rather than simply reducing the noise level, it is more effective to investigate the components of the sound and analyze precisely the influence each component has on human perception.

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**AEROSPACE**

- Engine noise
- Cabin noise
- Fly-over noise
- Sound rendering in the cockpit

**RAILWAYS**

- Passenger audio comfort
- Pass-by noise
- Train driver cabin noise

**INDUSTRIAL**

- Diesel engines, turbo machines, wind turbines, pumps, electric motors and other applications: noise control, noise reduction, fault diagnosis
- Quality control, end of line tests, objective metrics for the pass/fail test

**DEFENSE**

- Quietness evaluation
- Noise source identification
- Sound for sonar operator training simulator
- Sound for flying, driving and mission simulators
- Sound database

*Genesis contributes to a better world*

Through collaborating on projects aimed at reducing transportation noise and developing energy efficient technologies, Genesis demonstrates its commitment to a cleaner environment and quieter communities.

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*Better sound, better life!*
The acoustic signal from a car’s electric starter allows for an in-depth analysis of the engine starting sequence.

With just a few clicks, LEA separates the components of the sound, plays them and extracts the harmonics. The rotating speed profile is also extracted, and the behavior of the freewheel can be analyzed.

“...I use LEA to analyze transient electric starter signals, which are short and random. I also use the tool for signal post-processing, quantification of acoustic signals, vibration, voltage, temperature, etc. I also do sound quality work... In fact, I use LEA for 90% of my work. The same tasks that used to take me half an hour using two or three programs now takes me only two minutes to do with LEA.”

NVH Manager, Automotive supplier

LEA is able to calculate crucial metrics concerning noise perception inside and out of an aircraft. For example, to analyze the comfort level inside the cabin of a helicopter, LEA calculates standard indicators like Loudness (Zwicker - ISO532B), Sharpness, Roughness, Fluctuation strength and others.

LEA offers the possibility to calculate a user-defined Comfort Index, based on Zwicker or polynomial form, to obtain an overall measurement of the comfort inside the cabin using only a single indicator.

Additional indexes are provided for evaluating intelligibility and calculating the EPNL (required for aircraft and helicopter certification).

“We use LEA everyday, mainly for target sound design, psychoacoustic indicator calculations, time-frequency sculptures and playback. We record the signals and sculpt the sounds in the time-frequency diagram, which then allows us to modify certain signal components. Then we analyze the results using psychoacoustic indicators and listening tests.

LEA also allows us to create new signals to share with the decision makers to validate comfort modifications. In addition, GENESIS has equipped our studio with a playback system that perfectly reproduces the 3D Sound environment inside the cabin.”

Acoustics Engineer, Internal Noise Dept, Helicopter manufacturer
SOUND DESIGN

There are many applications for transient and impulsive sounds. Beyond the classic car door slam, LEA can also be used to analyze and improve the sound of locks, windshield wipers, switches and alarms.

Sensorial marketing and expectations of quality make it also important to control the sound of watches, pen caps, lighters, packaging and chocolate bars (to name a few).

ENGINE SOUND SYNTHESIS

LEA provides an intermediary between sound synthesis, simulators and virtual reality platforms.

With GeneCARS, the sound prepared with LEA can be tested in a Desktop Sound Simulator with a steering wheel, gears, a brake and a throttle. This sound can be loaded into a Driving Simulator with 3D sound capability for high-quality sound rendering.

With GeneBOX, the target sound designed with LEA can be tested on the road in a vehicle. The driving parameters are acquired from the CAN bus and the sound is delivered through the audio system or headphones.

“With LEA, creating time-frequency sculptures allows us to produce accurate sound databases without defects so much simpler and faster, and avoids re-recordings that are costly in both time and money.

In addition, LEA brings us knowledge and practices that allow us to be more fluid in the way we work with sounds. We can highlight the characteristics of a sound and communicate by creating ‘sound cartoons’ for our customers, or internally, to talk to engineers who will work on the development of the object, making the link between the perception of sound and its time and/or frequency representation.”

Team manager, Sound Perception and Sound Quality Dept, Car manufacturer
LEA can be adapted to fit your needs and applications. The standard package offers features for sound design and sound analysis. A series of optional modules provide access to dedicated functions, including order analysis, psychoacoustics, sound synthesis, 3D sound and sound simulation. LEA offers a set of exceptional features in a straightforward format that allows you to zero in on your critical tasks. While capable of performing advanced analytics and processes, LEA’s intuitive interface is easy to use and does not require a background in signal processing.

LEA’s Time-frequency diagram is manipulated through the use of graphic Autosize FFT, Autoscale, zoom and slice display tools.

The Magic Wand tool is a unique and efficient way to visually select a sound component. Other easy-to-use selection tools, like the line, rectangle, and freehand options, allow you to extract or modify any area in the time-frequency diagram. Any extracted component can be listened to, amplified, attenuated, combined with others and saved.

The harmonic detector easily extracts the fundamental and any number of harmonics. It is also used to extract the RPM signal from a simple microphone signal, for order analysis or engine sound refinement.

Sync Playback makes it easy to compare the original sound to the modified sound and instantaneously switch between the two during playback.
STANDARD MODULES

TIME DOMAIN
- File format: wav (multichannel), xrc, uff (ascii)
- Sampling frequency: any up to 192kHz
- Resolution: 8, 16, 32 bits integer & float
- Number of channels: 1 to 8 inputs, 1 or 2 outputs
- Display: Lin vs time, zoom, auto or fixed scaling
- dB(A), dB(B), dB(C), dB(G) and time history
- Unit, reference, sensitivity: selectable
- H&V Zoom, markers
- Resampling: adjustable frequency up to 192 kHz
- Equalizer: 1/3 octave, octave and Bark
- Play controls: Start, Stop, Pause, Repeat, full or between markers, output level 1 or 2 channels
- Playlist: unlimited number of signals, play simultaneously

FREQUENCY DOMAIN
- Window: Hanning, Hamming, Gauss, Flattop, Blackman, Rectangular, Triangular
- FFT: from 16 to 131072 lines
- Overlap: 0 to 99%, step 1%
- Average: Lin or Peak
- Scale: lin, log, dB(A), dB(B), dB(C), H&V zoom, fixed or auto
- Markers, harmonic cursors
- Add, remove, overlay signal traces, reference trace
- Overall level in frequency bands

TIME-FREQUENCY DOMAIN
- 1 or 2 channels simultaneously
- FFT settings: automatic or manual
- Color scale: automatic, manual, customized
- Selection tools: magic wand, line, rectangular, free hand, point
- Expand / shrink selection
- Harmonic detection
- Isolate, delete, adjust gain of selected components
- Save selected components as wav files
- Synchronized playback of original and modified sounds

EXPORT and REPORT
- Time domain, frequency domain, time-frequency diagram, psychoacoustic metrics, orders, order spectra
- ASCII format, .txt file
- Compatible with Microsoft Word and Excel
- Automatic report in 1 click
- Formatted for Microsoft Word with traces, settings, markers, comments

OPTIONAL MODULES

ORDER
- Self extraction of RPM signal when not recorded
- Orders extraction: adjustable resolution in frequency, resolution in order down to 0.01 order
- Order listening and individual tuning and mixing
- Order tracking vs Time or RPM + overall
- Display Orders/Time, RPM/Frequency, RPM/Orders
- Engine Sound Design: sound synthesis test and adjustment
- Generation of synthesis data sets for real-time Sound Simulators: GeneBox and GeneCars formats

PSYCHOACOUSTICS
- Metrics for Stationary, Non-stationary and Impulsive sounds
- Loudness ISO532B, Sharpness, Fluctuation strength, Roughness
- Specific Loudness, Spectral Centroid, Impulsive Loudness
- Time history of Loudness, Sharpness
- N5 and N10 for non-stationary sounds
- EPNL, Effective Perceived Noise Level, requested for aircrafts and helicopters certification
- dB SIL3 & 4, Speech Interference Level, for Aircraft Interior Noise Level Measurements, dB PSIL, Preferred Speech Interference Level
- TNR and PR for pure tones hearing assessment
- Loudness equalization: normalization of sound files in preparation of jury testing
- Comfort equation (polynomial or Zwicker): user defined coefficients for the definition of a custom metric

3D SOUND - TRANSAURAL
- Calibrated process from recording to playback
- Extends the effect of 3D binaural audio for use with 2 loudspeakers
- Provides highly realistic, natural perception and immersion feeling
- Real-time operation from any binaural recording
- Recommended for subjective tests

XTRACT
- Denoise a signal from a known background noise or from an automatically estimated noise.
- Extract together or separately from any signal tonal, transient and noisy components
- Conservative approach: summing up all the components leads to the original unmodified signal
- Mix, design and listen every of these components
- Automatic batch processing for a set of WAV files

ACQUISITION
- Direct recording from any professional sound card and supported front ends
- Supports binaural recording from artificial head or in-ear microphones
- Vu meters
- Direct display of time domain signals and one click frequency or time-frequency analysis

www.genesis-acoustics.com
GENESIS is a world leader in the field of Sound Design and Acoustic Simulators. We specialize in consulting and software products in psychoacoustics, acoustic signal processing, sound design and soundscape simulation. As a pioneer in perception analysis, 3D playback and simulation, GENESIS is involved in many research projects with major companies and world-class research institutes.

LEA software is fully developed by GENESIS, in cooperation with renowned research labs in acoustics, and established as a market standard for sound design applications since its first release in 2003. It is used every day by experts in the automobile industry as well as aeronautic, railway, defense, audio, consumer and telecom industries.

In the creation of LEA, GENESIS invented the intuitive and powerful technique of Sound Sculpture in the Time-Frequency domain, which was quickly adopted by professionals in need of preparing target sounds and creating databases of expressive sound files.

GENESIS provides high quality and highly realistic real-time sound generation for driving and flight simulators. LEA allows for the preparation of sound data sets for simulators that will be produced in 3D sound in real-time.

In the automobile industry, GENESIS proposes state-of-the-art solutions for engine Sound design, active sound generation (for internal combustion engines as well as electric and hybrid vehicles) and sound generation for dynamic driving simulators. GeneCARS offers a range of sound generation solutions for desktop target sound testing, on-road target sound testing and sound generation for driving simulators. GeneBOX is an embedded sound generator that can be connected to CAN bus for In-vehicle target sound testing as well as prototyping active sound generation for gasoline and electric vehicles.

At GENESIS, we provide tools and techniques to make the sounds in our environment better, more comfortable and more significant. We offer our competencies in the form of products, consulting and research works.

OPTIS, the virtual prototyping company, brings life and emotion to all industrial projects. Its worldleading solutions pave the way for a revolutionary design process: towards zero physical prototype.

Since 1989, OPTIS offers its expertise in light and human vision simulation through famous CAD/ CAM software and dedicated virtual immersive solutions. This synergy creates true-to-life virtual mockups, which are used as real decision-making tools.

Today, more than 2500 customers in over 50 countries already trust OPTIS and innovate day after day with our solutions to ensure the look and safety of their designs, reduce their ecological footprint and bring their future products to the market faster.

By joining their knowledge, GENESIS and OPTIS can now simulate Sound and Light, for a full immersive experience simulation and an holistic design process.