# InterAC

*Ingénierie Technique & Recherche en Acoustique*
*Technical Engineering & Research in Acoustics*

***InterAC was established in 1992 and is located in Toulouse in the French Aerospace Valley***

***InterAC is a SME offering high-tech engineering services in numerical vibroacoustics and in methodology***

***Main activity is dedicated to SEA* development and applied to Aeronautics, Automotive, Building acoustics, Defense, Energy, Mechanical, Railway, Space…***

- *SEA is a powerful technique to improve noise control by modeling high frequency response of various dynamical systems*
- *SEA is widely used for predicting and optimizing internal sound levels in complex design vehicles or to anticipate and derive noise specifications*
- *Random vibrations are derived from SEA models in Aerospace, Railway and Automotive applications. SEA works for most vehicles over broadband frequency range (200 Hz-10 kHz)*
- *Supported by a long-termed expertise, InterAC is helping industrialists in implementing SEA at project design stage*
- *Virtual SEA (VSEA) technology leads to cost reduction in prototyping and testing, VSEA transforms Finite Element (FE) model into accurate SEA subsystems based on actual 3D geometry*

## PROJECT MANAGEMENT

Qualification procedure for the cryogenic rocket engine Vulcain of the Ariane 5 European launch vehicle
- Vibroacoustic model for the engine
- Acoustical improvement of the ground test facilities

Acoustic design of the space station Columbus

Qualification procedure for a microgravity experiment

Development of an acoustic device for lift off qualification of the cryogenic engine of Ariane 5

Prediction of machinery noise using SEA

SEA models of double glazing and heating system

Development of SEA models of railway vehicles, TGV passenger's coach, TGV driver's cabin and experimental validation

SEA model of a car cabin and identification of vibrational sources and quantification of associated injected powers from acceleration measurements

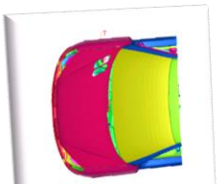
Prediction and optimization of noise in driver's cabin of a truck using SEA model

Development of predictive SEA models to investigate pyroshock responses of space electronic equipment

Prediction of high frequency shock response of a satellite using SEA

Measurement of Damping Loss Factors (**DLF**) & Coupling Loss Factors (**CLF**) on navy ship structures

Model of noise generation mechanisms in wind turbine



Procédure de qualification du moteur cryogénique fusée Vulcain du lanceur européen Ariane 5
- Modèle vibroacoustique du moteur
- Amélioration acoustique du banc d'essais moteur au sol

Conception acoustique de la station orbitale Columbus

Procédure de qualification d'une expérience de microgravité

Développement d'un dispositif acoustique pour la qualification du moteur cryogénique d'Ariane 5

Prévision du bruit d'une machine industrielle par SEA

Modélisation SEA de double vitrage et d'une chaudière

Modélisation SEA de véhicules ferroviaires, d'une remorque et cabine conducteur d'un TGV et validation expérimentale

Modélisation SEA d'une cabine automobile et identification de sources vibratoires et quantification des puissances associées à partir de mesures accélérométriques

Prédiction et optimisation du bruit dans la cabine d'un porteur par un modèle numérique SEA

Développement de modèles SEA prédictifs pour étudier les réponses aux chocs pyrotechniques d'un équipement spatial électronique

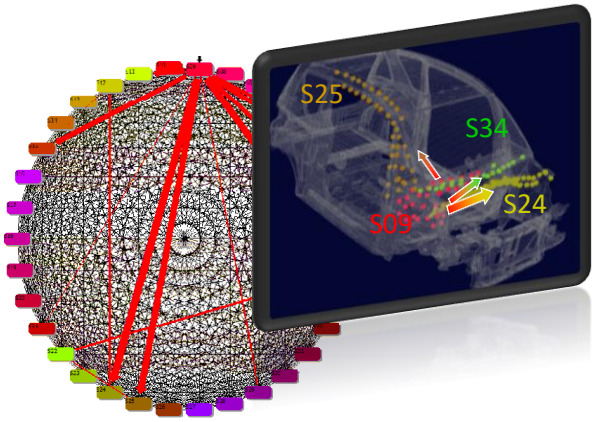
Prévision de la réponse choc hautes fréquences d'un satellite avec la SEA

Mesure des facteurs de perte par dissipation (**DLF**) & facteurs de perte par couplage (**CLF**) sur des structures navales

Modélisation des mécanismes de génération du bruit dans une éolienne

*Using both Theoretical and Experimental SEA speeds up engineering time in building consistent SEA models of complex dynamical systems*

*The easy-to-use SEA model allows changing parameters and predicting, in pilot studies, the future trends of the vibroacoustic environment in a machine*




# Noise & Vibration N&V

## SOFTWARE DEVELOPMENT

### SEA+: Predictive solution for N&V design

SEA+ is a SEA* modeler based on wave theory to predict energy transfers in complex industrial dynamical systems. SEA+ incorporates support for orthotropic plate and shell, can couple light or heavy fluids to structures and can calculate both vibratory and acoustic transmissibility.

### SEAVirt: Add the power of FEM in SEA modeling (add-on SEA+ optional Module)

SEAVirt transforms Finite Element (FE) models into SEA models by automatic detection of SEA subsystems.

In SEA+, Virtual SEA models are mixed with any other classical SEA subsystems and extended to high frequency increasing the frequency range of your original FEM model.

### SEA-Foam & SEA-Cyl (add-on SEA+ optional Modules)

Multi-layered flat or curved panels are modeled by SEA-Foam. SEA-Foam incorporates porous, fiber, limped foam, septum, perforated plates, thin or thick elastic plates, heavy or light fluid layers. With SEA+/SEA-Foam, full vibroacoustic coupling is analyzed including structure and air borne sound transmission.

SEA-Cyl (developed by CSTB) is a very efficient spectral approach of cylindrical multilayered systems improving accuracy of acoustic transfers in SEA or Virtual SEA models. It leads to refined physical behavior with quick and robust simulation of any trimmed curved element.

### SEA-Shock (add-on SEA+ optional Module)

SEA-Shock predicts time history and shock response spectra of very high frequency content. High vibration levels arising in rocket stage separation, spacecraft separation or shock test are easily modeled with the included advanced shock source library with pyrozip, clampband and point force models for aerospace and other transient applications.

### SEA-XP and SEA-TEST: Experimental solutions for N&V design

SEA-XP allows engineers to apply more effective laboratory testing to the N&V design process. It offers highly optimized data acquisition, signal processing and data reduction capabilities to extract parameters used in the Energy Flow N&V design process based on SEA.

SEA-TEST is designed to work with data in universal file generated by a Modal Analysis System.

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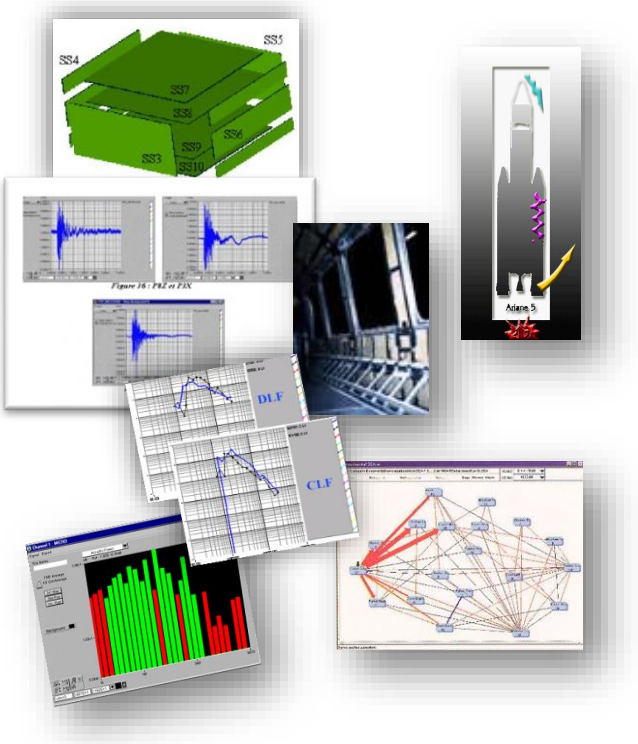
### *Wide-ranging applications include*

- ***Automobile interior acoustic design***
- ***Air- & rotor -craft interior noise control***
- ***Rocket & spacecraft vibroacoustics***
- ***Railcar interior, railway structure noise***
- ***Shipboard & underwater noise***
- ***Architectural acoustic***
- ***Consumer appliance noise control***




## TRAINING

Analytical & Experimental SEA Training
Formation SEA Analytique & Expérimentale

## REFERENCES

AIRBUS Operations - AIRBUS Defence & Space - ALSTOM - ArcelorMittal - ACOEM - CEA - CERA/TREVES - CNES - CONTINENTAL Automotive - DGA - EDF - EMPA - ESA/ESTEC - FAURECIA - FCBA - FIAT Chrysler Automobiles - General Electric Energy - IRKUT Russia - Israel Aircraft Industries - KRYLOV Shipbuilding Research - MBDA -MERCEDE Benz - NAVAL GROUP – NAVANTIA - PSA - RIETER Automotive - SAFRAN Electronics & Defense - SAINT GOBAIN Glass - SIEMENS Transportation

ASTRA Space - CATERPILLAR - HONEYWELL Turbotechnologies - Jet Propulsion Laboratory - MIT LL - Material Sciences Corporation - SANDIA NATIONAL Laboratories – Virgin Orbit

Beijing Institute of Technology - BYD Shenzhen - China Academy of Space Technology - Chittaranjan Locomotive Works - COMAC Aviation - DONGFENG Motor Group - DSO National Laboratories - HARBIN Turbine - HYUNDAI Rotem – Korea Railroad Research Institute - MAHINDRA & MAHINDRA Trucks & Bus - MAZDA Motor Corporation - NSPO Taiwan – PARACOAT Products - Ship Fire Fighting - ST Electronics Singapore - WUHAN Aviation Sensing Technology - Wuhan Marine Electric Propulsion

***SEA: Analyse Statistique de l'Energie / Statistical Energy Analysis***



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