

HEAD acoustics and the Ford Motor Company: A Powerful Cooperation

In this issue of the HEAD/lines we would like to present to you the first article of a new series about the long-standing partnership between HEAD acoustics and Ford. We took the January 2003 press release quoted on the right as an occasion to start our new series of articles with this big, internationally operating car manufacturer. More reports will follow in future issues of the HEAD/lines.

The intensive cooperation between HEAD acoustics and Ford began already in the 1980s.

Back then, the business relationship centered around the first generation of artificial heads, the binaural analysis system BAS, and playback systems in the Sound Quality Laboratories in Cologne. Meanwhile, almost all of the Ford development and production facilities in the world are our customers, including the Volvo, Jaguar, Mazda, Aston Martin, and Land Rover divisions.

An important milestone was reached in 1997: the introduction of the multi-channel analysis software ArtemiS. It was a big step to switch

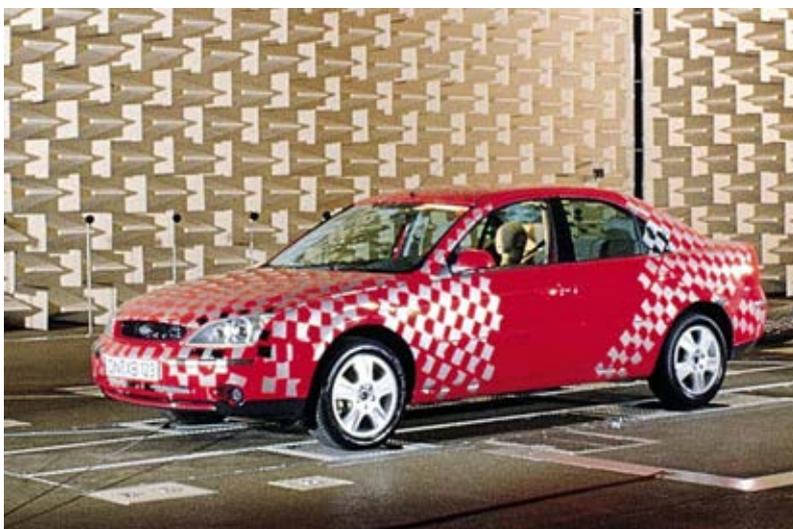
from a well-engineered, proven and accepted DOS program to a completely new philosophy and platform (Windows NT®). Nevertheless, convinced by the new possibilities that the change would offer, the plan was implemented and rewarded: ArtemiS is a successful product. It is no surprise that the first ten licenses were ordered in advance by the Ford Acoustic Center in Cologne. Since then, the license with the serial number 0001 continues to prove its utility on a daily basis, while ArtemiS usage has expanded to become a standard at Ford.

The modern programming architecture of ArtemiS, which was realized already in 1997, allowed the recording and evaluation of data and the creation of reports within one common working environment: thus providing significant time savings for the experts at Ford. The hard disk recording technology superseded the time-consuming transfer of measurement data from tape drives to the evaluation PCs. The straightforward program structure made it possible to meet the requirements of various Ford departments (continued on page 2)

Press Release: HEAD acoustics receives order from Ford Motor Company

HEAD acoustics, a supplier of noise and vibration test systems has received an order from Ford Motor Company to upgrade their artificial head (Aachen Head) measurement systems to the latest digital HMS III HEAD Measurement Systems. Ford has been using the HEAD Measurement Systems during the past 16 years as part of an ongoing program to improve vehicle sound quality. The HEAD Measurement Systems are used for making binaural recordings of interior vehicle noise that provide exceptional realism or "virtual reality" when played back. The recordings enable vehicle engineering teams to quickly compare competitive products, design alternatives, and design improvements, thus greatly aiding the decision making process during product development. Furthermore, engineers listen to binaural recordings while analyzing data on the ArtemiS analysis system to identify and troubleshoot noise problems and select the best metrics for noise evaluation.

The decision to upgrade all the existing HEAD Measurement Systems used throughout the various development groups at Ford was made to improve productivity and reduce long term operating costs. The new systems allow direct recording of data from the head to the Notebook PC via a USB interface in a format that is ready for immediate processing, vs. the older systems that required a "record twice" process; first to a DAT recorder in the field and then to a PC in the office. Since the user interface is simpler and identical for all the new systems, users will spend less time on set-up and have more time available to acquire and process data. A fine digital equalization and 24 bit resolution of data ensures minimum measurement variability between different heads. Since the systems use fewer components and standard PCs, reliability is increased resulting in reduced downtime and lower ongoing maintenance costs.



A vehicle on a chassis roll dynamometer in the anechoic chamber at Ford.

(continued from page 1)
such as Vehicle NVH, Psychoacoustics Lab, Component & System NVH, Powertrain NVH, Engine NVH, and Transmission NVH faster and with higher quality than was possible with other systems available on the market.

The numerous tests for product development and benchmarking demand a high level of mobility for the measurement systems used. Especially on the test tracks in Cologne-Merkenich and in Lommel (Belgium), where the vehicle teams require compact and easy-to-use multi-channel measuring devices for airborne and structure-borne sound analysis. Thanks to ArtemiS, the multi-channel analysis system SQLab II from HEAD acoustics and the HEIM DATaREC recorders can be configured with just a few easy

steps. Another significant advantage is the fact that measurements can be checked, analyzed and played back on the spot.

Besides using ArtemiS and SQLab II, the Sound Quality specialists in Cologne are using the interactive sound simulation system H3S from HEAD acoustics in order to determine target sounds. With the help of this system, built into a roadworthy vehicle, the acoustic character of future car models is designed, and targeted product improvements are made.

In addition to the use of our NVH products, it is important to mention our joint projects.

From individual orders and tasks, such as the development of calculation models for Ford-specific psychoacoustic parameters, joint research projects and publications have emerged. For example, within the German FVW consortium (Forschungsver-

einigung Verbrennungskraftmaschinen e.V. = Research Association for Combustion Engines) and also within the DEGA (Deutsche Gesellschaft für Akustik = German Association for Acoustic) are ongoing activities for both companies to conduct joint scientific projects and lectures.

Meanwhile, the cooperation has expanded into the consulting area, for example, conducting binaural transfer path analysis and synthesis of chassis as well as engine components of several vehicles. With these tools, airborne and structure-borne sound transfer paths between the sound source and the interior of the vehicle can be quantified. In the next step, these transfer paths can be modified, and simulations of the airborne sound based on the changes can be made audible.

Last but not least, active communication with our sales and technical support staff is much appreciated, along with the flexibility of our service and calibration department. By the way, the Ford plants and HEAD acoustics are geographically close to each other in Germany as well as in the USA. If maintenance of our products is required, they can be brought to our service on the same day and returned to our customers at Ford as quickly as possible.

The close cooperation over more than a decade has shown how much both companies can benefit from each other. We are looking forward to continuing the joint activities.



HMS III mounted in a vehicle.

What the Year 2003 will bring ...

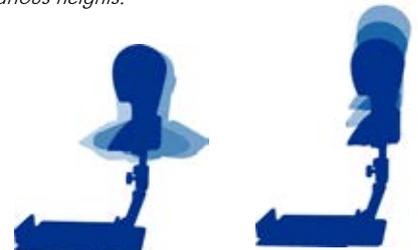
HSM IV



The new seat mounting called **HEAD Seat Mount, HSM IV**, turns your artificial head into a handyman. Measurements in the laboratory or in the vehicle, stationary or mobile: The new HSM IV is more than just a convenient and safe mounting for your entire measuring equipment. You can quickly and easily turn your artificial head into a driver or co-driver that can be moved and adjusted in several directions. The sturdy mounting arm and a built-in tray for your measuring hardware guarantee a high stability and extraordinary flexibility even under extreme conditions.



The HSM IV can be bent, turned, and adjusted in various heights.



SQLab III

is the extended mobile multi-channel analyzer system for acoustic and vibration analysis which is now available in addition to SQLab II. The basic concept of the SQLab II has remained unchanged – in combination with ArtemiS 5.0, all SQLab II modules can also be used with the new SQLab III. The "power version" of the mobile multi-channel analyzer is distinguished by the following features:

- Total sampling rate of 1280 kHz for more channels with higher bandwidth.
- Data acquisition with up to 11 two- or six-channel modules.
- Possibility to connect TEDS sensors (planned for June 2003).



- Simultaneous multi-channel recording and playback.
- Firewire (IEEE1394) interface as a convenient link to the PC.
- Integrated seat belt holder and seat protector for convenient use in vehicles.

ArtemiS 5.0

Following is a preview of innovations you can expect from ArtemiS 5.0, the latest version of ArtemiS. It is scheduled for release in March 2003.

- Order analysis now also works with rotation-speed-synchronous sampling. Thus, the resolution no longer depends on the rotation speed, but is constant, for example during a complete run-up. Even a complex calculation is possible. The diagram provides a Multiple Order cursor.
- The determination of a missing tach signal from a dominant order is now performed automatically.
- The automatic processing of previously calculated analysis results, in batch mode, is supported.
- The system analysis has been extended to include multiple and partial coherence. The signal of an output channel can now be related to several or specific input channels.
- Complex curves can be displayed in two diagrams (Re/Imag and Amp/Phase) above each other.
- Integration and differentiation are now also available in the frequency domain.
- The frequency weighting (A/B/C ...) can be assigned per channel. This allows the simultaneous analysis of airborne and structure-borne sound channels with different weightings.
- New and expanded text box functions enhance the documentation possibilities.
- The most important analysis types can be set via the COM interface.

... To be continued: In the next issue of our HEADlines, we will inform you about more product news from HEAD acoustics.

HEAD acoustics & ASAM ODS

ASAM (Association for Standardization and Automation of Measurement systems) ODS (Open Data Service) is a standard that specifies unified methods to access measurement data. This standardization is important to make the exchange and storage of measurement data and experimental results possible.

Thanks to the ODS interface, all ODS-compatible applications can work with files that have been created with ArtemiS or other products from HEAD acoustics. For such applications it is no longer required to convert the data from the HEAD acoustics data format (HDF) into the respective target data format

– the ODS interface is used instead. Existing HEAD acoustics files can also be accessed via this interface. The database model applicable for the NVH area is currently being defined by ASAM. As soon as it is available, it will be supported by ArtemiS 5.0.

Wind Tunnel Measurements with 4 x HMS III

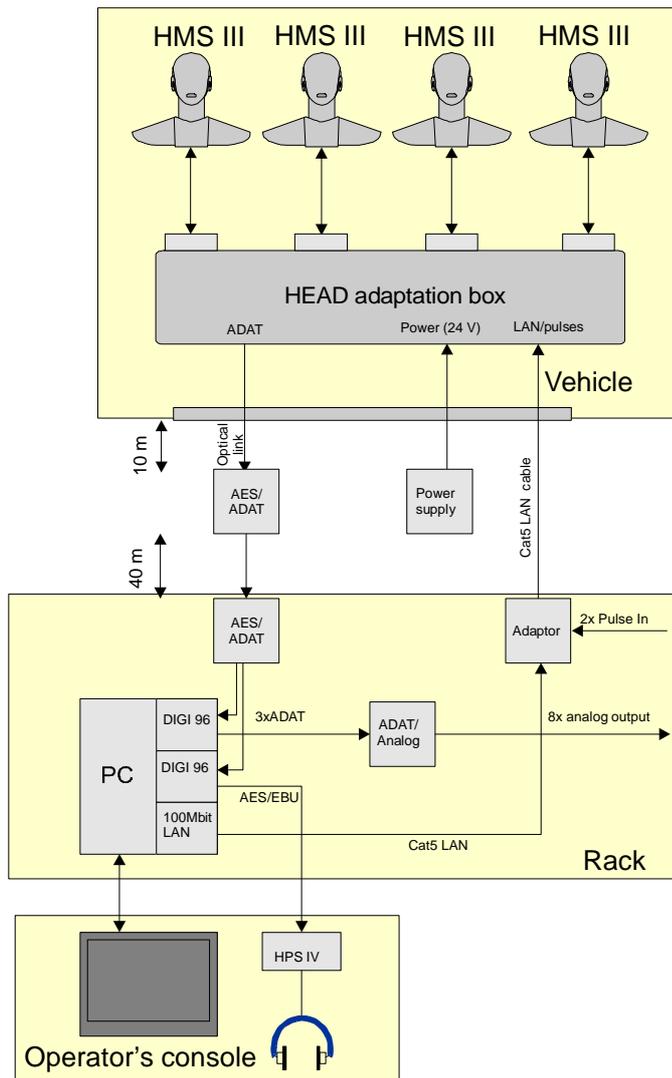
Acoustic measurements in a wind tunnel are a challenging task: The signals from up to four digital artificial heads (HMS III) must be recorded simultaneously, the background noise must be extremely low, and the wiring leading from the car interior through the wind tunnel to the recording system must be minimal. For such measurements, the vehicles often remain on the chassis roll dynamometer for several days without interruption. During this phase, access to the artificial heads in the interior of the car is often not possible. Therefore, the system must be extremely reliable and remotely controllable from the control room. Another important requirement for the system is that the operator in the control room must have the option to listen to each of the signals from the individual

heads in order to detect and analyze problems before and during the recording.

For the realization of such wind tunnel measurements, HEAD acoustics has developed a system

consisting of four HMS III.0 units (24 bit artificial head measurement systems), which allows the transfer of the data

from the interior of the vehicle through a very thin optical cable (Ø 2 mm). Two other cables are used for remote control, the transfer of pulse information, and the power supply for the heads. Signals from all four heads are recorded simultaneously on a PC in the control room, where the data are immediately available for analysis or the creation of a standard report with ArtemiS. The playback system from HEAD acoustics guarantees a precise, aurally compensated reproduction of the artificial head signals. This system is not only suitable for wind tunnel measurements, but also for any other application involving several HMS III.0, BEQ I or BEQ II units that require remote controlled recordings of up to 8 channels with 24 bit resolutions.



Did you know that ...

- ... a CAN bus module is available with SQLab that allows vehicle bus data such as engine RPM and wheel speed to be embedded in the data for use as a control signal in ArtemiS?
- ... many customers are using the UFF58b export function of ArtemiS in order to further process measurement data with Modal analysis programs?
- ... with ArtemiS 4.0 there is an AVI builder that allows you to present analysis results in the form of a movie that can easily be distributed to colleagues?
- ... any dynamic signal may be used as a control signal? For example, thermal transducers can be used in combination with microphone data to create plots of sound pressure level versus temperature.
- ... the Consulting department of HEAD acoustics will soon be equipped with a new four-wheel chassis roll dynamometer?

Represented by



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