

## Flexibility and Cost Efficiency in Automotive Development



### Key Highlights

#### Industry

Automotive

#### Challenge

Develop front-end modules as efficiently as possible

#### Altair Solution

Access multiple software tools flexibly through the Altair Partner

#### Benefits

- Material reduction
- Fewer prototypes / no prototypes required
- Cost and time savings in the development process

### Customer Profile

HBPO GmbH is a joint venture operated by the worldwide innovation and market leaders for lighting and electronics (Hella KGaA Hueck & Co.), vehicle air conditioning and engine cooling (Behr GmbH & Co. KG), and painted exterior body components and plastic systems (Plastic Omnium Auto Exterior S.A.S.). The joint venture develops, manufactures and distributes intelligent front-end modules for vehicle manufacturers.

Setting new benchmarks in the market with solutions which are as technically sophisticated as they are economically attractive, HBPO is the only system integrator worldwide to specialize in the development, assembly and logistics of complete front-end modules. In 2011, sales totaled 1.05 billion Euros. Worldwide, HBPO employs more than 1,400 people who currently assemble around 4.4 million front-ends per year. For more information, please visit: <http://www.hbpogroup.com>.

### The Challenge: A Prototype-less Design

Front-end modules are very complex assemblies, requiring many different components, such as headlights, the radiator grille, and the bumper. In addition to the visible components, they also contain the front-end carrier as well as the components of the vehicle's air conditioning, engine cooling, and the crash management system. Depending on the customer requests and preset specifications, HBPO covers three types of projects: assembly, development, and systems integration, and supplies them either individually or as an entire process. Within the development and assembly of a front-end module, HBPO has to cover a wide variety of simulation applications, such as structural analysis, molding simulation, virtual crash tests, material data management, and many more. Numerous varying software tools are required, some of which are only rarely used. To cover all these disciplines, it is crucial for HBPO to keep the

# HBPO Success Story



**“It is a great benefit to have access to multiple tools, such as Moldex3D and KEY to METALS, within one licensing system. Through the APA, we can access them as often or as little as necessary, which absolutely gives us a major advantage, since we would not be able to use either at HBPO if we had to buy full licenses. Overall, I am happy and satisfied with the APA and look forward to new opportunities and products in the future.”**

**Robert Raulf**  
CAE Manager, HBPO

development costs as low as possible and to have access to the required tools whenever they are needed.

The front-end carrier forms the centerpiece of a front-end module and ensures the perfect coupling of all components, while using as few assembly operations as possible. Thanks to high quality material rigidity, tolerance accuracy, and a wide-ranging portfolio of molded-on fasteners, outstanding technical, optical, and economic results are obtained.

## The Solution: Start-to-Finish Design Capability via APA

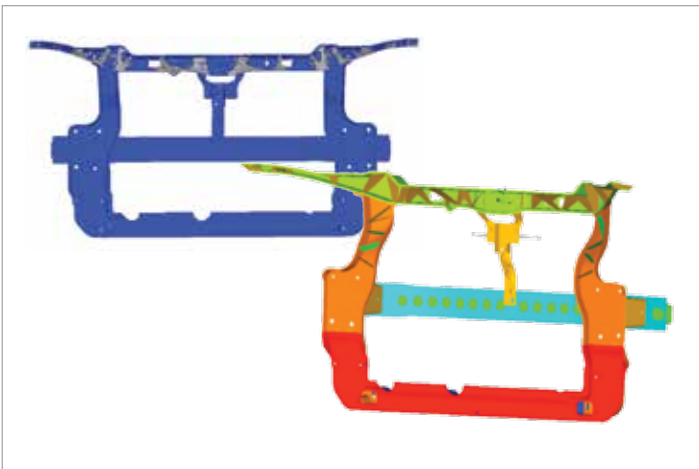
HBPO uses state-of-the-art tools in its module development in order to guarantee a maximum quality at minimized development time and costs. These tools are provided by Altair, the Altair Partner Alliance (APA), and other CAE providers.

HBPO's engineers access floating licenses available at the company to access HyperWorks alongside a suite of third-party applications from Altair Alliance Partners that can be employed with the same units used to invoke HyperWorks software. The flexibility of these HyperWorks units allow users to access the largest and most complete suite of CAE applications available in the market at no incremental cost and with no long-term commitment. As the APA is constantly expanding its offering of software tools, the customer's ROI also continues to grow.

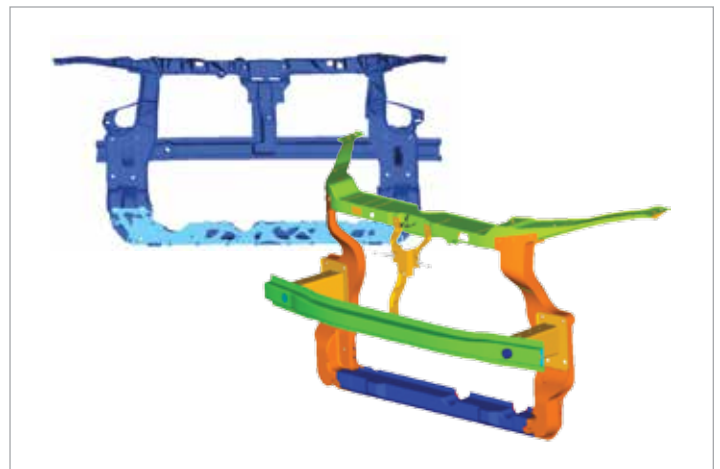
Among the tools HBPO accesses via the Altair Partner Alliance are Moldex3D for mold simulation, KEY to METALS for material data management and material selection, MADYMO for occupant safety analyses and design optimization. From the HyperWorks Suite the company uses HyperMesh,

HyperView and the BatchMesher for pre- and post-processing tasks, HyperForm for forming simulation, Result Mapper to map the simulation results, HyperStudy and HyperGraph also for post processing, plus OptiStruct as well as RADIOSS for optimization, linear, and nonlinear structural analysis. For the future, HBPO is considering the use of CONVERSE from PART Engineering and DIGIMAT from e-Xstream.

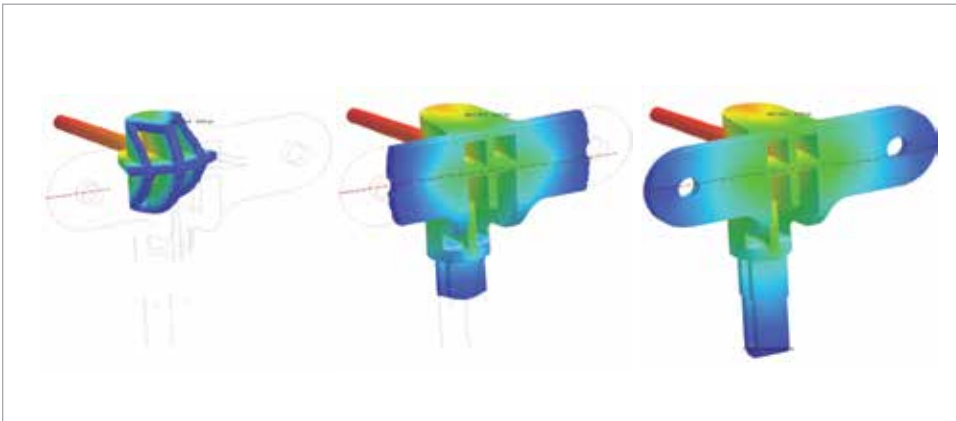
As some of the development tools are only used in a few projects once or twice a year, an investment in full licenses of those tools would not be justifiable due to the rare use cases. Nevertheless, the tools are required and provide value to the development process of HBPO. Therefore, cost efficient access to those tools, as supplied via the Altair Partner Alliance, is the best, if not the only, solution to include those tools in the development process.



*Optimization of plastic ribs and results*



*Optimization of sheet metal and results*



*Mold filling simulation of an upper radiator attachment bracket using Moldex3D*



*Finished bracket*

## The Use Case: Typical Development Process at HBPO

Within the typical development process of a front-end module, HBPO receives the specification package from the OEM that places the order. First, the engineers view the package in order to understand the customer's expectations. Once the specifications have been defined and the engineers know the customer's expectations, they start the process by developing a concept. In this phase, they pre-define the material, and understand whether the customer needs an aluminum hybrid, full aluminum, or a steel welded assembly, and if it is a magnesium design or something else. The choice of a particular material is then leading in a specific direction. Detailed material decisions, such as whether a 50 ksi or a 45 ksi steel has to be used, are postponed until later in the development process. In the beginning, the only important thing is to find out whether the front end module will be a hybrid (a combination of metal and plastic), magnesium or full plastic carrier.

The next development step depends on the customer and the timing of the project. Usually, the boundary conditions such as load cases, the package itself and others are well described. To understand the topology of the component (i.e. the plastic ribs or the sheet metal close of a front end module), a topology optimization can be made with OptiStruct to optimize weight and material costs, stiffness, and strength. If the engineers have not yet defined the material, they will also use KEY to METALS alongside OptiStruct to understand what the most weight efficient material selection

is to meet the stiffness and other targets. Simultaneously, a minimum weight of the component has to be reached and costs must be optimized. Then the engineers start with the actual design by applying the OptiStruct results. With this data, they set up a CATIA V5 or NX model of the carrier and use the meshed CAD model to make a fully non-linear analysis. Using the results from the non-linear analyses the engineers can check if the model passes the required targets and loads. If it does not pass, the engineers will start with a full scale nonlinear optimization and iterate the model until it passes the targets.

Later in the development process the engineers also utilize Moldex3D, which they access to via the Altair Partner Alliance. Moldex3D is one of the world's leading CAE products for plastics injection molding. The tool enables in-depth simulation with the widest application range of injection molding processes to optimize product design and manufacturability, helping to reduce time to market. HBPO applies Moldex3D to the design and simulation of upper radiator attachment brackets. In this use case, the tool designs, simulates and optimizes the filling process and investigates filling weld lines. Since the small areas close to the knit lines have to withstand stresses of up to 60N/mm<sup>2</sup>, the engineers simulate and optimize the component and look for the perfect material to reduce the risk of cracking, specifically by introducing enlarged washers. Thanks to simulation, it is possible to reduce the number of physical prototypes of the component as well as significantly shorten the development time.

## Benefits

"Our first motivation to enter the Altair Partner Alliance was to access and test software, such as MADYMO and Moldex3D," said Robert Raulf, CAE Manager at HBPO. "Today we are utilizing the APA products mainly for those software packages that are not regularly used in our development process – something that has proven to be quite efficient in terms of software cost control."

The continuous expansion of the APA offers its customers an increasingly expanding ROI with every tool that is added. The program offers benefits, especially for tools that are rarely used, and for tools that are only used at a certain point in the development process, i.e. KEY to METALS, since the license units are freed up after each use for other HyperWorks or APA software applications. KEY to METALS offers HBPO access to a broad library of material data the company would not be able to access without being a member of the program or buying a full scale license of the tool. Since the material data is crucial for the development of HBPO's front-end modules, the APA allows for a cost efficient access to the data, and it also provides access to other simulation tools of the program at no additional costs.

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## About Altair

Altair empowers client innovation and decision-making through technology that optimizes the analysis, management and visualization of business and engineering information. Privately held with more than 2,000 employees, Altair has offices throughout North America, South America, Europe and Asia/Pacific. With a 28-year-plus track record for high-end software and consulting services for engineering, computing and enterprise analytics, Altair consistently delivers a competitive advantage to customers in a broad range of industries. Altair has more than 3,000 corporate clients representing the automotive, aerospace, government and defense, and consumer products verticals. Altair also has a growing client presence in the electronics, architecture engineering and construction, and energy markets.

## About Altair Partner Alliance

One Platform. One License. One Source. **All Access.**

Altair's HyperWorks platform applies a revolutionary subscription-based licensing model in which customers use floating licenses to access a broad suite of Altair-developed, as well as third-party, software applications on demand. The Altair Partner Alliance effectively extends the HyperWorks Platform from 28 internally developed solutions to more than 65+ applications with the addition of new partner applications. Customers can invoke these third-party applications at no incremental cost using their existing HyperWorks licenses. Customers benefit from unmatched flexibility and access, resulting in maximum software utilization, productivity and ROI.

[www.altairalliance.com](http://www.altairalliance.com)



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