YOUR GLOBAL MOBILITY ENGINEERING EXPERTS

DUMMY.CRASHTEST.KONFERENZ 2021

Development of the CAE-Model of the Biofidelic-Dummy in IMPETUS with Special Regards on the Virtual Validation of the Certification Process of Civilian and Military Protection Systems

Jan Bohlen, EDAG Engineering

When using protected vehicles, the objective is the safest and simultaneously the fastest possible transport of persons or objects worthy of protection, while ensuring personal or material integrity. The development of these vehicles therefore requires a large number of blast and impact tests in order to be able to safely assess the effects of constructive changes, to achieve purposeful structural improvements and finally to enable and pass the certification.

Due to the steadily increasing cost and time pressure, test simulation with IMPETUS Afea Solver® is increasingly being used in this field of development in order to supplement or replace cost-intensive and often time-critical iterative tests and thus save prototypes. This explicit FE-solver is especially developed for non-linear and highly dynamic tasks. Therefore it is particularly suitable for the simulation of blast and ballistic events and thus for the numerical recording of large structural deformations under extreme dynamic load conditions.

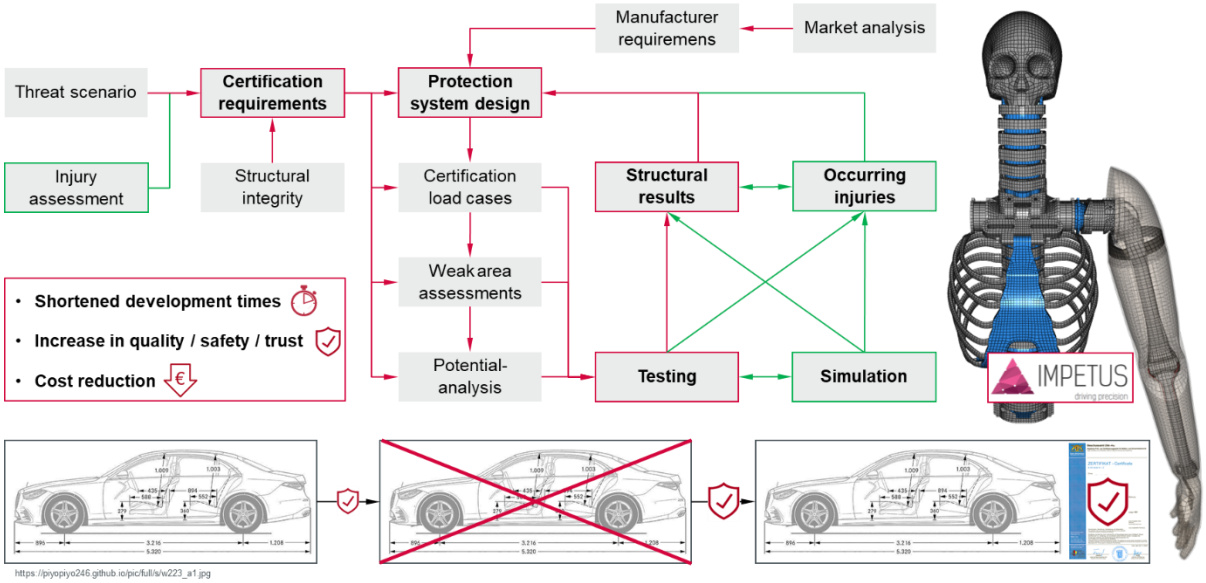

Fig. 1: Changes in the development process of protected vehicles

In addition to the structural results, so-called human criteria, which take the possible injuries of the passengers into account, are included in the certification of protected vehicles. This is why the Primus Breakable® has been included in the ERV (Explosive Resistant Vehicles) by the VPAM (Vereinigung der Prüfstellen für angriffshemmende Materialien und Konstruktionen) in order to assess the severity of injuries in the area of civilian armoured vehicles.

The biofidelic behaviour of the Primus Breakable® enables the assessment of a wide range of injuries as they can occur in protected vehicles. These include in particular penetrating splinters and cuts, as well as the blunt force through the uncontrolled impact of extremities with structural components.

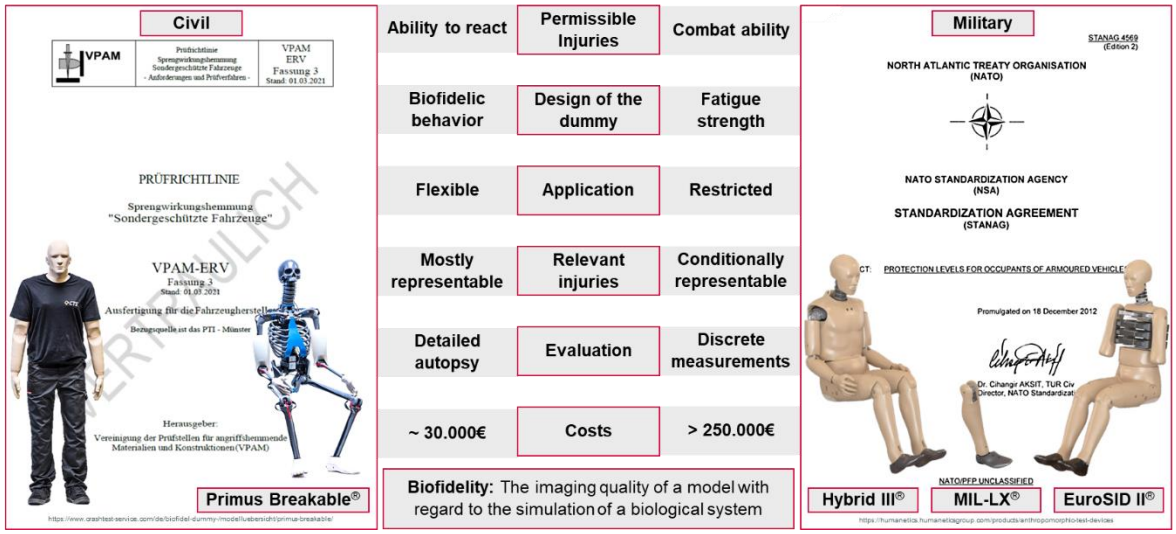

Fig. 2: Assessment approaches for the injury severity

Coupled with the assessment of the severity of the injury and the assignment of the corresponding injury mechanisms, the technical autopsy together with the structural assessment forms the basis for the further development and optimization of the protection system. Accordingly, CTS, the AFUS Forschungsgesellschaft and EDAG Engineering GmbH have signed a cooperation to implement the Primus Breakable® in IMPETUS Afea Solver®.

The requirements for the simulation model correspond to the requirements for the real dummy, since the virtual design and certification criteria do not differ from reality. The meshing and material modelling therefore must be carried out in a manner appropriate to the injury mechanisms. In addition, the connection techniques have to be implemented in such a way that the biofidelic behaviour is not hindered.

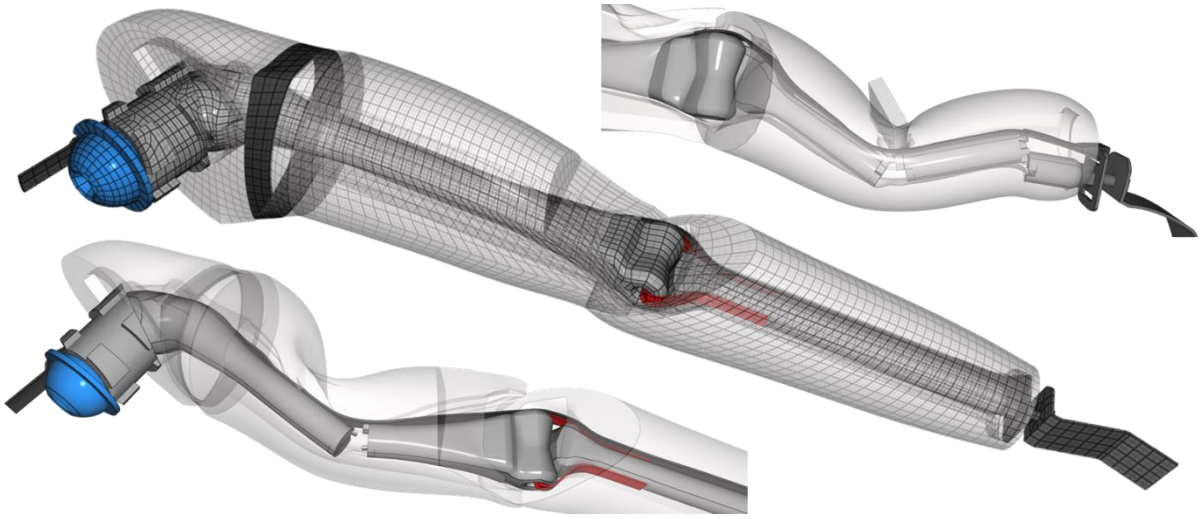

Fig. 3: Meshing and damage capacity of the arm of the Primus Breakable®

The necessary preliminary considerations with regard to the model structure were made, corresponding material tests were carried out, the material modelling was tackled and a satisfactory model status was already achieved. We are currently working on the final meshing of the model so that we can shortly enter the validation phase and thus bring the simulation model of the Primus Breakable® to the IMPETUS MARKET® as fast as possible.