NUMERICAL AND EXPERIMENTAL INVESTIGATION OF THE FLOW FIELD IN THE LBS 501 AND THE RESPONSE OF A SIMPLE STRUCTURE EXERTED TO SUCH FLOW

G. A. Heilig, A. Klomfass, O. Sieber*, M. Klaus*

Fraunhofer EMI, Eckerstr. 4, D-79104 Freiburg,E-Mail: georg.heilig@emi.fhg.de
* *WTD 52, Oberjettenberg, D-83458 Schneizlreuth*

The Large Blast Simulator 501 serves for the investigation of structures under blast loads. For ecological reasons the LBS 501 was recently equipped with four exit-blast attenuation screens (baffles) and had to be recalibrated afterwards. The suggested paper addresses the investigation of the transient flow field within the LBS and the response of a thin-walled container subjected to these flow fields. This container was specifically designed for the validation of coupled fluid-structural dynamics simulation methods, which are currently developed at EMI. The paper reports about the experimental and numerical results and gives an overview about the numerical methods used.

The flow field in the LBS is generated by an array of up to 100 Laval nozzles driven by air-filled pressure reservoirs (pressure bottles). The huge differences in geometrical scale between the tunnel (100 m length) and the nozzles (0.103 m diameter) prohibit a direct simulation of the complete setup. In order to bypass this problem an analytical model of the blow-out process was developed and incorporated into the APOLLO code as an inflow boundary condition. This simulation model is validated against measurements, the results will be presented.

The APOLLO CFD Code was recently coupled with EMI's CSD Code SOPHIA to simulate blast-structure interaction. After a successful validation of the coupled methods against shock tube experiments performed at EMI, they shall now be tested for structures in the range of the LBS. The container build for this purpose measures 2.1 m x 2.1 m x1.1 m and is built from stiffened Al-plates mounted on a steel profile frame. It is equipped with deformation, acceleration and pressure gages to allow a detailed comparison between experiment and numerical simulation.

Literature:

1) G. Heilig: Bericht EMI 05/02
2) G. Heilig, T. Gröger, A. Klomfass: Bericht EMI 07/03
3) O. Sieber: Bericht WTD 52 Nr. 310-001/02 WTD 52, Vermessung LBS 501 mit Baffle