6th Triennial International Aircraft Fire and Cabin Safety Research Conference
October 25 – October 28, 2010
Atlantic City, New Jersey

Author:

Amanda Taylor
Civil Aerospace Medical Institute
Federal Aviation Administration
PO Box 25082
Oklahoma City, OK 73125-0082
Phone 405-954-0248
FAX 405-954-4984
Amanda.M.Taylor@faa.gov

Topic:

Crash Dynamics – Child Restraint Systems

Title:

Selection of Appropriate Child ATDs for Aviation Testing

Abstract:

To properly evaluate the effectiveness of child restraint systems (CRS), appropriately sized, anthropomorphic test dummies (ATD) that are biofidelic in both forward and rear impacts are needed. Currently CRS's may be approved for use on aircraft by meeting one of several different specifications, each of which cites the ATD's that were appropriate as of their writing.

ATD technology continues to advance and the latest automotive safety specifications (FMVSS-213) have been revised to incorporate these advanced ATD's. The child dummies currently specified for aviation use in SAE AS5276 are the CAMI Newborn, the TNO 9-month old and the VIP 3-year old which were the current ATD's cited in FMVSS-213 when the Aerospace Standard was written. In the latest version of FMVSS-213 the 9-month old has been replaced by the CRABI (Child Restraint Air Bag Interaction) 12-month old and the VIP 3-year old has been replaced by the Hybrid-III 3-year old. The CRABI was designed for testing in a rear-facing infant restraint positioned in front of a deploying automotive passenger side airbag. The Hybrid-III was designed for testing forward facing CRS's, and provides better biofidelity and more instrumentation capabilities. The improved injury assessment capabilities provided by the CRABI and Hybrid-III ATD's when used in auto CRS' tests should also provide the same benefits when used in aviation tests of conventional rigid shell CRS's. Therefore, aviation CRS specifications should be updated to cite these ATDs for those applications.

Some CRS's intended for use only in aircraft may create occupant loading conditions that are not adequately evaluated by the ATD's cited in current specifications. CAMI has evaluated the capabilities of currently available ATDs and has identified the ones that provide state of the art prediction of injury for these anticipated loading conditions. One of these conditions is forward facing restraint of the smallest occupants. To provide proper biofidelity when restrained forward facing by belts, the ATD must have certain anatomical features. Also, the ability to measure chest deflection is needed to assess restraint systems that directly load the chest. These anatomical features and measurement capabilities are missing in the CRABI ATD specified in FMVSS-213. The Q-Series ATD, which is currently used for ECE – R44.04 testing, has a chest deflection meter, and biofidelic pelvis and clavicle assemblies for proper belt interaction. Therefore, the Q-Series one-year old has been selected for evaluation during CAMI child restraint research.