From: "Smith, Jeffrey" <jasmith@sandia.gov>
To: "'Mahendra Shah'" <MJS3@nrc.gov>
Date: 8/21/02 12:54PM
Subject: RE: Aircraft analyses assumptions

Mahendra:

I am addressing some of the issues you stated in your e-mail. While I was looking at some of those things I came was re-reading an e-mail from Steve Attaway (he developed the Aircraft models). It is in regard to the justifications for the "porous" aluminum model for the CTH material models of the aircraft. I cannot remember if I sent this to you. So, I wanted to forward that to you. The issue of the difference between the Reira curve and that from the CTH is something that has been on my mind for sometime. I had started to try and address that a while back and got distracted. I will continue to work on that. I think there are reasonable reasons for the differences. I have not resolved the large diffence yet. I will get back to you on that.

Jeff

From Steve Attaway to Greg Bessette:

The justification for the "porous" aluminum model was based on an AMR 2D CTH run where a ribbed cross section of an aircraft was meshed with sub millimeter accuracy. This cross section was used as a base line to compare with the porous aluminum model. The baseline model was impacted into a hard target and a soil target. The material properties for the p-alpha model were adjusted (within reasonable bounds) to match momentum (=force) time curve for the ribbed cross section.

The underlying assumptions of this method is based on the fact that 95% of the impact force is generated form the change in momentum of material flowing into the active crush zone. In the report "Axial Impact Testing of a C-141B Aircraft Fuselage Section with Shipping Containers," SAND94-2739, the velocity of a C-141B fuselage section was plotted as a function of time for an impact with a rigid target at 47 m/sec. The estimated force transmitted from the crush zone to the fuselage was on the order of 1M lbs. This order of magnitude was consistent with a static crush test done at LANL. The crush force of a would be expected to be less than the C-141 due to the fact that the C-141 is designed to hall cargo.
Reira estimated fuselage crush force to be about) Ex2

Given that the impact force computed from the porous aluminum CTH model for the ; Ex2
(the speed of the
is an order of magnitude greater than the fuselage crush force, the errors associated with the material properties for the p-alpha model will be small compared

E138

Ex 2, portions

to the errors in the location of the mass of the aircraft.

At slower speeds, any error in the crush strength of the fuselage will have a greater effect. There is not doubt that the existing p-alpha model could be improved. However, before we spent effort to to improve this model, a better model of the aircraft is needed. Currently the wings are modeled as a simple cross-section. I was able to find enough data on a [redacted] model to create a wing cross section that has stiffening ribs. However without the weight of the wing as a function of it's length, I have no way to estimate the mass errors. We should get better data from boeing soon.

Ex 2

Remember that the current models are stressing the computing resource. Any refinement in airplane model will require a more materials. As you know, more material will greatly increase the memory and cpu requirements of CTH. Dave Crawford and Bob Schmit have been modifying the Diatom material insert to allow different material properties to be input for a common material model.