dummy in their research and developmental testing. Finally, NHTSA uses the Hybrid III dummy in its New Car Assessment Program (NCAP). This program involves testing new cars and trucks by crashing them into a fixed collision barrier at 35 mph, which is five mph faster and 36 percent more severe than the crash test specified in Standard No. 208. NCAP results are made available to consumers as the tests are completed each model year, and insurance and consumer organizations use the results as the basis for information they publish.

In using the Hybrid III dummy, vehicle manufacturers have identified three areas in which they believe the dummy should be improved. Two of these areas were identified by Ford in a petition for rulemaking submitted in March 1991, and the third was identified in petitions submitted by Toyota, Honda and Nissan between September 1993 and April 1994.

One of the requests in Ford's petition was for NHTSA to increase the ankle dorsiflexion motion of the Hybrid III dummy. That company argued that the current dummy's ankles have a lower rotation range compared to human ankles. Ford believes that this can cause unrealistic transfer of crash forces through the lower leg and knee to the femur, adversely affecting the femur response.

Ford's other request was for the agency to specify the use of a soft foam neck shield for the Hybrid III dummy. That company believes that the dummy's neck is too small in cross section for air bag applications and that portions of a deploying air bag can get caught around the neck and in the concave sections of the bottom of the dummy head. According to Ford, when this occurs, the dummy's head snaps rearward in an unhumanlike manner, and unrealistic head and neck responses are measured by the dummy instrumentation. That manufacturer stated that this problem can be avoided by using a special purpose shield around the dummy's neck when testing with an air bag.

Toyota, Honda and Nissan petitioned NHTSA to increase femur flexion ranges in the dummy. They argued that this change is needed to avoid unhumanlike femur-to-pelvic bone interaction, or hip lock. According to these petitioners, hip lock produces acceleration spikes throughout the dummy in general, and in the thorax in particular, resulting in overly high chest g's for the unrestrained (air bag only), passengerside test condition. Several manufacturers, including Ford, Chrysler, Mazda and Mitsubishi, submitted letters supporting the basic intent of the Toyota/Honda/Nissan petitions, although not necessarily all of the specific arguments.

NHTSA notes that, until it received these petitions, it was unaware that any manufacturers had these concerns about the Hybrid III dummy. These issues were not raised during the rulemaking to add the dummy as a compliance option for Standard No. 208. Moreover, the agency had not encountered any of the alleged problems during Standard No. 208 compliance tests or evaluations of the dummy in sled tests.

NHTSA also notes that, in evaluating the petitions, the agency was aware that manufacturers use the Hybrid III dummy in contexts other than the test conditions specified in Standard No. 208. To fully understand the problems alleged by the petitioners, the agency had to consider the test conditions under which the problems arise.

The test conditions vary according to the purposes for which the dummy is used. For the agency to specify the Hybrid III dummy in Standard No. 208, it is only necessary for the dummy to be biofidelic and otherwise appropriate for the specific injury criteria and impact conditions specified in that standard. And, to the extent that the Hybrid III dummy is used for NCAP purposes, it is necessary for it to be appropriate for those test conditions. The agency understands, however, that manufacturers wish to be able to use the same dummy for a third purpose, for research and vehicle development. In these applications, the dummies are often exposed to much more severe conditions than specified in Standard No. 208 or experienced under NCAP.

NHTSA granted each of the petitions for rulemaking and conducted extensive analysis, including a test program, of the issues raised in the petitions. Among other things, the agency consulted with the Society of Automotive Engineers (SAE) Human Biomechanics and Simulations Committee concerning the hip lock issue.

The agency has prepared a Technical Assessment which presents the agency's analysis of the issues raised by the petitioners. A copy of that document is being placed in the docket for this rulemaking. While the conclusions of that document are summarized below, persons who are interested in the details of the agency's analysis are encouraged to read the Technical Assessment.

As discussed in the Technical Assessment, the agency's analysis shows that motion ranges of the Hybrid III hip joint and ankle have minor biomechanical shortcomings that can easily be improved with minimal design modifications.

With respect to the hip joint, the current dummy design is within generally accepted biomechanical limits for femur free motion range. However, the hip joint design needs modification to assure the same motion range between the right and left femurs. Moreover, to the extent that the dummy is used in impact environments where the dummy will be forced to exceed these limits, i.e., environments more severe than that of the Standard No. 208 test procedure or the NCAP test procedure, it is desirable to prevent metal to metal contact from occurring between the femur and the pelvic bone. Such contact can cause spurious test results. An SAE Task Force has identified modifications in the design of the femurs that would address forced motion range needs of the dummy's hip joints and eliminate the possibility of either metal to metal or hard contact impacts at maximum femur flexion. Agency testing indicates that the dummy femur-hip joint modification will result in somewhat reduced chest responses for those test exposures in which the hip joint and the ankle are forced to exceed the available motion ranges, i.e., test exposures considerably more severe than Standard No. 208 testing

With respect to the ankle, the agency's analysis shows that modifying the ankle to allow 45 degrees of dorsiflexion instead of the current 30 degrees would be anthropometrically in the correct direction.

NHTSA has tentatively concluded that the specifications for the Hybrid III dummy should be changed to incorporate these minor femur and ankle modifications. As part of these changes, a calibration test would be added for hip joint-femur flexion.

The proposed modifications would have practically no effect on the dummy impact responses for either Standard No. 208 or NCAP testing. The agency believes, however, that the modifications would provide a more realistic assessment of the effectiveness of occupant protection systems under more severe impact conditions. Changing the part 572 specifications to incorporate these modifications would help ensure that manufacturers can use the same dummies for Standard No. 208 certification testing and for research and vehicle development testing.

NHTSA believes the evidence is less clear with respect to whether a neck shield should be specified for the Hybrid III dummy. The agency has evaluated the neck shield recommended by Ford. As discussed in the agency's