

U.S. Department of Transportation  
Federal Aviation Administration

Subject:	INFORMATION: Additional Guidance on Seat Dynamic Testing	Date:	December 9, 1
From:	Manager, Airframe and Cabin Safety Branch, Transport Standards Staff, ANM-115	Reply to Attn. of:	99-115-17
To:	Manager, Airframe Branch, ANM-120S Seattle Aircraft Certification Office		

This is in reply to your memorandum 99-120S-568, of July 13, 1999, requesting additional guidance on several seat dynamic test issues. As you are aware, some of the issues are currently under discussion in the Aviation Rulemaking Advisory Committee (ARAC), and recommended guidance is expected to be forthcoming. Those issues will be deferred until the ARAC activity is complete.

### **Seats Certificated via Similarity**

The approach to approval on the basis of similarity should be basically the same, whether the seat in question is identified at the beginning of a program, or as a follow on. The main issue is to test the critical configuration. If it can be shown that the “similar” seat is not the critical configuration as compared to the seat that was tested, an additional test should not be necessary. We agree that changes to basic stiffness, elongation, and deformation, in particular, are not easily addressed analytically, and probably would result in additional tests at the outset of the certification program. Changes such as these are more characteristic of different families of seat designs. One of the ARAC objectives is to sufficiently define the concept of a “family of seats” to enable this determination to be more easily made.

### **Deployable Items**

Generally it is undesirable for items such as footrests, video arms or tray tables, to deploy as a result of the dynamic tests. In those cases where deployment occurs, the effect of the deployment should be assessed, both for passenger egress and as a potentially injurious object. The installation may have a direct impact on whether or not a deployment is acceptable, and should be considered as part of the assessment. The basic guidelines are given in Advisory Circular 25.562-1A, Appendix 2. The additional discussion provided in your memo is consistent with the advisory circular.

### **Selection of Seat Pitch for Canted Seats**

Guidance memo TAD-96-002 describes an acceptable procedure for assessing Head Injury Criterion, including seats that are canted relative to one another. In summary, a cant that results in a lateral offset of no more than 6” can be disregarded with respect to head injury testing, assuming the seat(s) in question have been assessed using the remainder of the procedure outlined in the memo. Differences in seat pitch as a result of the cant may be ignored where these differences are an inch or less. Seat pitch may be determined by measuring from seat reference point to seat reference point.

### **Measurement of Seat Back Aft Deformation for a 14g Down Test**

For a horizontal test facility, the fixture angles required to produce the 14g pulse impose an unrealistic load on the seat back. Due to the unrealistic loading condition, measurement of aft deformation in this test

is not meaningful. For a drop tower type installation, such measurements would be meaningful, and should be addressed, if deformation is present.

### **Design Changes to the Seatback Upright Position**

Changes that result in 3 degrees or more difference in the normal seatback upright position will generally require retest. Other changes in upright angle should be assessed to determine if they would affect any of the pass/fail criteria by, for example, changing the lumbar loading of the anthropomorphic test dummy (ATD) on the seat. Seatback angle can also influence Head Injury Criterion (HIC) of the occupant in the row behind the seat. In addition, if the pass/fail results were marginal on the original test, smaller changes in angle may require retest.

### **Design Changes and Retest Requirements for Structural Failures**

This is an issue that is being discussed in ARAC, and additional guidance is expected. However, we expect that the guidance will provide for both design changes that do not require retest, as well as retests without first making a design change, as appropriate.

### **Acceptable Seat cushion Changes without Additional Testing**

Most changes to the seat back cushion do not require retest. The seat bottom cushion directly affects lumbar load and is therefore more critical. Generally, a thinner cushion is less critical than a thicker cushion for non rate-sensitive foams, for the part 25 test. Changes to the load bearing area of the bottom cushion should be substantiated by test. For a given material type, it may be possible to qualify a range of cushion thickness, by conducting testing at the extremes of the range. Acceptable results at both ends of the range should qualify the intermediate cushion thickness.

### **Items of Mass**

The currently approved Revised Means of Compliance (RMOC) for Boeing allows items of 1 kilogram or less to be restrained by artificial means. It is likely that this will not be carried over in the guidance forthcoming from ARAC. While it is recognized that retention of items attached to the seat is not a primary aspect of the regulation, these items are part of the seat type design and therefore should comply with the regulations for seats. However, since retention of these items is primarily an issue of strength of attachment, it should be possible to substantiate improved attachment analytically, as discussed in Transport Directorate Letter 96-114-3, dated May 8, 1996. Nonetheless, allowance for small items is necessary, and we expect the ARAC recommendation to provide for this. In the meantime, the RMOC procedure should not be extended to other seat programs.

### **Lifestest Configurations**

As with items mounted to the seat, lifestest retrieval is not one of the primary aspects of the regulation, and should therefore not drive test conditions. However, the ability to retrieve the lifestest should be substantiated for the various installation configurations. Assuming that the lifestest installation does not affect the dynamic behavior of the seat, we would expect that this would be possible on a static mockup, simulating the posttest configuration of the seat. In terms of retention, the means should be substantiated for the dynamic test conditions, but again, we would not expect this to drive the number of tests in a program.

## **Changes to Seat Attachments**

This is another area where guidance will be proposed by ARAC. Changes to the seat attachment to the airplane will require retest if the load path is altered, either in terms of strength, stiffness or basic geometry.

## **Seat Belt Changes for Type III Exit Seating**

We understand this question to relate to airplanes which do not require compliance with § 25.562(c)(5), HIC, but are required to show compliance with § 25.562(c)(8), which addresses rapid egress. Since the test in this case is to demonstrate whether the seatback of a seat adjacent to a type III exit can cause an impediment to rapid egress, the main issue is that the seat back be subject to a representative impact, and results assessed relative to the installation. Variations in seatbelt should not affect this assessment. In fact, it should be possible to conduct the seatback assessment with a component level test, imparting comparable energy to the seatback, rather than a full-scale test, if assessment of HIC is not required.

Once the ARAC recommendations have been submitted to, and accepted by, the Federal Aviation Administration, we intend to issue a revised advisory circular capturing this and other guidance to the extent that it is general in nature. We also intend to propose a standardization workshop in order to familiarize field personnel with the latest developments for seat dynamic testing. If you have any questions, Jeff Gardlin, telephone 425-227-2136, is the person most knowledgeable on this subject.

Franklin Tiangsing

cc:

Manager, Small Airplane Directorate, ASW-100  
Manager, Engine and Propeller Directorate, ANE-100  
Manager, Rotorcraft Directorate, ASW-100  
Manager, Aircraft Engineering Division, AIR-100  
Manager, Seattle Aircraft Certification Office, ANM-100S  
Manager, Los Angeles Aircraft Certification Office, ANM-100L  
Manager, Anchorage Aircraft Certification Office, ACE-115N  
Manager, Boston Aircraft Certification Office, ANE-150  
Manager, Denver Aircraft Certification Office, ANM-100D  
Manager, Atlanta Aircraft Certification Office, ACE-115A  
Manager, Wichita Aircraft Certification Office, ACE-115W  
Manager, Chicago Aircraft Certification Office, ACE-115C  
Manager, New York Aircraft Certification Office, ANE-170  
Manager, Airplane Certification Office, ASW-150  
Manager, Special Certification Office, ASW-190  
Manager, Brussels Certification Staff, AEU-100  
Van Gowdy, AAM-630,  
Steve Soltis, ANM-102N