JAR NPA 25CD-279
SHOCK ABSORPTION TESTS

COMMENT DOCUMENT

INTRODUCTION

This notice proposes to amend the landing gear shock absorption test requirements of JAR 25. This action is necessary because the increasing complexity of landing gear shock absorption systems and the improvements in other requirements concerning landing loads have rendered the current requirements inconsistent and outdated. In addition, differences between the current European and US requirements impose unnecessary costs on aeroplane manufacturers. These proposals are intended to update the landing gear requirements to be consistent with other requirements, to reflect modern technology, and to achieve common requirements and language between the requirements of the JAR and the Federal Aviation Regulations (FAR) without reducing the level of safety provided by the regulations.

These proposals were developed in co-operation with the Federal Aviation Administration (FAA) of USA and the European, American and Canadian aviation industry through the Loads and Dynamics Harmonisation Working Group of the US Aviation Rulemaking Advisory Committee (ARAC).

JUSTIFICATION

The proposed revisions to JAR 25.473(d) and JAR 25.723(a) would provide for the new objective of the landing gear energy absorption tests which would be to validate the landing gear dynamic characteristics rather than directly determine landing gear load factors. These revisions would require that these characteristics be substantiated over the range of landing conditions and aeroplane configurations expected in service. The manufacturer would be expected to substantiate the landing gear dynamic characteristics over the full range of weight conditions and configurations. As a minimum, the energy absorption characteristics would be confirmed by an energy absorption test at the weight condition for landing (maximum takeoff weight or maximum landing weight) that provides the maximum impact energy. The proposed rule would continue to provide for the substantiation of minor changes by analysis. To provide guidance in complying with the proposed rules, a revised ACJ 25.723(a) is proposed.

This proposal for the revised JAR 25.473(d) and JAR 25.723(a) takes into account the potential for detailed computer simulations that accurately represent the dynamic characteristics. It is consistent with improvements in the landing load requirements that necessitate an accurate representation of the landing gear shock absorption characteristics. This proposal also provides more flexibility for the aeroplane manufacturer to determine the range of conditions and configurations over which to validate the analytical model for the landing conditions. The extent to which this analytical model could be extrapolated to include future design changes would depend on the range of conditions and configurations originally selected by the manufacturer for validation of the model.

The current JAR 25.725 and 25.727 are proposed to be deleted as regulatory requirements and moved to the new proposed ACJ 25.723(a). These criteria would be modified to reflect the advisory nature of the material as well as the revised objective of determining landing gear dynamic characteristics instead of landing gear limit inertia load factors. For the most part, these rules just provide acceptable means of conducting energy absorption tests by means of a drop test. JAR 25.725 provides an acceptable means of conducting a limit drop test for compliance with JAR 25.723(a) and

JAR 25.727 provides an acceptable means of conducting a reserve energy drop test in compliance with JAR 25.723(b). Most of the guidance is limited to a "free" drop test in which a reduced effective weight is used to represent lift during the landing impact. The only item in these paragraphs that is considered to be regulatory in nature is the current JAR 25.725(c) concerning the attitude of the landing gear and the representation of drag loads during the tests. Therefore this paragraph has been modified to apply to all types of landing gear energy absorption tests (not just drop tests) and it is now set forth in subparagraph 25.723(a)(2) of the proposed rule.

DISPOSITION OF COMMENTS

A number of supportive comments were received indicating acceptance of the proposed amendments without change to the text. Other comments were considered in detail by the Structures Study Group (SSG) at its Meeting No. 97 held in Stockholm on 24-25 June 1997 and by the ARAC Loads and Dynamics Harmonisation Working Group at its meeting on 29 October 1997. Comments were resolved as follows:-

COMMENT: The [commenter] fully supports this NPA and its intent. However, the proposed ACJ 25.273(a) is inconsistent in its use of a mix of terminology between weight and mass units, which could lead to confusion. For example, paragraph 4.2 uses the terms "the weight used for the drop" and "dropped with an effective mass". It is suggested that the text be reviewed and amended to ensure consistency in references to weight and mass throughout.
SSG RESPONSE: Comment accepted. The final proposal will use consistent and appropriate terminology.

COMMENT: The proposed text of JAR 25.723(a) refers to test conditions at maximum take-off weight and maximum landing weight. On the other hand, ACJ 25.723(a) paragraph 4.1 refers to design landing weight and design take-off weight conditions. Again consistency should be assured by referring to maximum take-off and landing weights throughout.
SSG RESPONSE: Comment accepted. The terms maximum take-off weight and maximum landing weight shall be used since this would be consistent with the terminology of JAR 25.1533.