

**AEROSPACE  
INFORMATION  
REPORT**

**SAE** AIR1494

REV. B

Issued 1978-02  
Revised 1997-03  
Reaffirmed 2007-07  
Cancelled 2010-04

Superseded by ARP1311C

Verification of Landing Gear Design Strength

RATIONALE

AIR1494 Verification of Landing Gear Design Strength will be cancelled as the contents of this document were included in the latest update of ARP1311C Landing Gear Structures and Mechanisms.

CANCELLATION NOTICE

This document has been declared "CANCELLED" as of April 2010 and has been superseded by ARP1311C. By this action, this document will remain listed in the Numerical Section of the Aerospace Standards Index noting that it is superseded by ARP1311C.

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## FOREWORD

Changes in this reaffirm are format/editorial only.

## INTRODUCTION

The recommendations of this AIR are generally applicable to aircraft and landing gear arrangements of conventional design. Unusual designs may entail additional verification requirements.

Final strength verification requirements, including test procedures and documentation may be specified by the procuring activity or cognizant regulatory agency. Such specific requirements will take precedence over the general guidelines provided herein.

It should also be noted that the inputs making up this document have some bias toward military and larger commercial aircraft. Not all of the analysis and tests recommended are necessarily applicable to landing gear in the "light aircraft" category.

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## 1. SCOPE:

Verification of landing gear design strength is accomplished by dynamic and static test programs. This is essentially a verification of the analytical procedures used to design the gear. An industry survey was recently conducted to determine just what analysis and testing are currently being applied to landing gear. Timing in relation to first flight of new aircraft was also questioned. Opinions were solicited from designers of the following categories and/or types of aircraft:

- a. Military - Large Land Based (Bomber)
- b. Military - Small Land Based (Fighter)
- c. Military - Carrier Based (Navy)
- d. Military - Helicopter (Large)
- e. Military - Helicopter (Small-attack)
- f. Commercial - Large (Airliner)
- g. Commercial - Small (Business)
- h. USAF (WPAFB) - Recommendations

It is the objective of this AIR to present a summary of these responses. It is hoped that this summary will be useful to designers as a guide and/or check list in establishing criteria for landing gear analysis and test.

## 2. REFERENCES:

There are no referenced publications specified herein.

## 3. ANALYTICAL STUDIES RECOMMENDED AND/OR REQUIRED PRIOR FIRST FLIGHT:

- a. A preliminary static analysis of all primary structural elements.
- b. A preliminary fatigue analysis of all primary structural elements.

NOTE: Both A and B should incorporate secondary loads resulting from gear deflections, as well as deflection of gear support points.

- c. A preliminary dynamic study of shock strut energy dissipation (calculated metering pin).
- d. A preliminary study of brake energy dissipation.
- e. A preliminary study of nose and main gear shimmy stability.
- f. A preliminary in-flight dynamic analysis to avoid resonance (for helicopters).
- g. A preliminary ground stability analysis.

## 3. (Continued):

- h. Analysis of loads and response time for extension and retraction (both in flight and during ground check). Include analysis of manual operation.
- i. Analysis of loads and response time for steering system.
- j. USAF requires completion of a failure mode and effects analysis prior to first flight.

## 4. TESTING RECOMMENDED AND/OR REQUIRED PRIOR FIRST FLIGHT:

- a. Static test of gear structure to limit load (or to 80% of limit).
- b. Drop tests to limit loads (with wheel spin-up) may serve as an alternative to A unless loading conditions that would not be developed in drop test are critical for design.
- c. Laboratory testing to refine structural analysis by use of photostress and strain gage techniques.
- d. Drop tests to limit load for preliminary metering pin verification.
- e. Nose gear shimmy jig test required if analysis indicates potential problem.
- f. Main gear shimmy jig test required if analysis indicates potential problem.
- g. Taxi tests to confirm brake and control system integration.
- h. Taxi tests to confirm steering control and adequate shimmy damping.
- i. Ground vibration and spring rate tests (to check parameters used in dynamic analysis).
- j. Preliminary (normal and emergency) gear retraction/extension cycle tests with operational loads applied. Also unrestricted free-fall tests.
- k. Ground resonance damping test (for helicopters).