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**DEPARTMENT OF DEFENSE
HANDBOOK**

**AIRCRAFT USAGE AND SERVICE LOADS STATISTICS,
VOLUME 1, CRITERIA AND METHODOLOGY**



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FOREWORD

1. This handbook is approved for use by all Departments and Agencies of the Department of Defense.
2. This handbook covers the results from work performed to develop aircraft usage and operational loading statistics from parameter data recorded during operational flight conditions. The Flight Systems Integrity Group of the Aerospace Mechanics Division at the University of Dayton Research Institute (UDRI) performed this work under the Navy Service Loads Handbook Program supported by Air Force Funding. Mr. Daniel Tipps was the principal investigator for the University of Dayton and provided coordination with the Navy and Air Force. Mr. Nam D. Phan of the Navy and Mr. William Buckey of the Air Force provided valuable direction in completion of this effort. Mr. John Rustenburg developed the separation methodology, performed the data analysis and prepared the report. Mr. Donald Skinn developed the data reduction algorithms, and performed the data reduction in support of the methodology development.
3. Comments, suggestions, or questions on this document should be addressed to AFLCMC/EZSS, 2145 Monahan Way, Bldg. 28, Wright-Patterson AFB OH, 45433-7017 or emailed to Engineering.Standards@us.af.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at <https://assist.dla.mil>.

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1. SCOPE

1.1 Scope.

The objective of the handbook is to serve as a practical reference guide to aircraft usage and operational statistics that can be used to establish rational repeated loads criteria for aircraft structure. The aircraft structure is understood to include the fuselage, wing, empennage, landing gear, control system and surfaces, engine mounts, and structural operating mechanisms. The handbook will consolidate available aircraft usage and operational statistics obtained from many in-service aircraft into a single document. It is intended to serve as a reference document for those individuals charged with developing aircraft usage and repeated load spectra. The information in the handbook will allow those individuals to make intelligent selection of the expected operating statistics where such information is not otherwise readily available. It will allow the determination of repeated loads for new designs or for use in the evaluation of previously designed aircraft. The handbook is divided into eight separate volumes. Volume 1 covers the criteria and methodology used in the derivation of usage and operational statistics from measured data. Successive volumes cover seven main aircraft categories consisting of refueling, cargo, bomber, fighter, attack, trainer, and special aircraft. For each aircraft within a category the specific volume of the handbook includes statistical data for four loading environments consisting of aircraft mission usage, ground operations, flight operations and system operations are shown. Also included, is a listing of the recorded parameters used to derive the loading statistics.

The aircraft operational usage will influence the repeated loading conditions to which the aircraft is subjected and ultimately determine the durability, damage tolerance, and maintenance requirements of the aircraft's structure. The operational usage consists of a definition of the different flight profiles and profile mix. These flight profiles are described in terms of flight duration or distance for the flight phases of departure, climb, cruise, descent, and approach with their attendant altitudes and speeds. Takeoff and landing weights also form part of the usage description. The mission mix will describe the distribution of different profiles that the aircraft encounters in services. Subsequently, the aircraft usage is used in conjunction with statistical ground and flight loads data to establish repeated loading/stress spectra for input to the analysis for durability and damage tolerance, definition of testing requirements, or establishment of inspection intervals. Figure 1 shows the information flow for determining the repeated loading spectra for input to the durability and damage tolerance analyses of the aircraft structure.

All the data presented in subsequent volumes of this handbook represent average data from a fleet of aircraft over a period of time and is presented herein for development of a repeated load spectrum necessary to perform a Damage Tolerance Analysis. Guidance from JSSG 2006, Section A.3.2.14.6 indicates that all Durability Analysis will be performed using a more severe spectra such that 90 percent of the fleet is expected to meet the aircraft service life. Appendix F of this handbook presents one approach based on a normal distribution approximation that could be used by the spectra developer to generate such a spectra. When using this approach or any other, the 90 percentile spectra should produce a given severity damage related to a mean spectra to ensure 90 percent of the fleet meets the service life for that particular weapon system. The target severity or usage severity factor (USF) needs to be approved by the government agency. As an example, actual usage variation of legacy data has determined that a USF of ~1.6 is appropriate for a fighter aircraft and will vary for other types of aircrafts.