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DATA ITEM DESCRIPTION

Form Approved
OMB No. 0704-0188
Exp. Date: Jun 30, 1986

1. TITLE	2. IDENTIFICATION NUMBER
INTERNAL LOADS AND STATIC STRENGTH ANALYSIS REPORT	DI-GDRQ-80198

3. DESCRIPTION/PURPOSE

3.1 This report presents the derivation of internal loads, resulting stresses and strength computations that analytically substantiate the structural ability of aircraft and aircraft-carried stores to react critical external loading conditions. This analysis is used to monitor the structural adequacy of the design for meeting contract requirements, to evaluate any engineering change proposals, to serve as a basis for modifications, structural repair, establishing damage limits, and to evaluate any possible incidents or accidents during operation.

4. APPROVAL DATE (YYMMDD)	5. OFFICE OF PRIMARY RESPONSIBILITY (OPR)	6a. DTIC REQUIRED	6b. GIDEP REQUIRED
860731	ASD/ENESS		

7. APPLICATION/INTERRELATIONSHIP

7.1 This Data Item Description (DID) complies with the functional task generated by 5.2.5 of MIL-STD-1530A, 3.10 of MIL-M-8856A, and 4.10 of MIL-A-87221. This DID includes the format and content preparation instructions required by 3.8.1 of MIL-A-8868A.

7.2 This DID is applicable to the analyses of aircraft, missiles, aircraft-carried stores, and follow-on modification programs.

7.3 Portions of this DID are subject to deletion tailoring, depending upon the program phases in which it is applied in the solicitation or contract.

8. APPROVAL LIMITATION	9a. APPLICABLE FORMS	9b. AMSC NUMBER
		F3902

10. PREPARATION INSTRUCTIONS

10.1 Source document. The applicable issue of the documents cited herein, including their approval dates and dates of any applicable amendments and revisions, shall be as reflected in the contract.

10.2 Format. The Internal Loads and Static Strength Analysis Report shall include the format within 3.8.1 of MIL-A-8868.

10.3 Content. The report shall present detailed analyses of major components and abbreviated analyses of all secondary components of the structure to demonstrate load paths of adequate strength. Internal loads will be tabulated for all members, but repetitive type structures may be substantiated by analysis of the common structural member having the maximum loading.

10.3.1 Aircraft structures. The report shall be subdivided, as applicable, to present analyses of the following major structural components or groups:

a. Wing, including all attachments and actuating structures, moveable control surfaces, wing-mounted speed reduction devices and auxiliary lift devices, engine mounts, and nacelles.

b. Fuselage, including canopy, fuselage-attached engine mounts, fuselage-mounted speed reduction devices, tie-down structure for seats, litter, cargo, and equipment racks, and all actuating structure and attachments.

c. Empennage, including fixed horizontal and vertical surfaces, moveable surfaces, their attachments, and actuating support structures.

d. Control system, either manual or powered, including cables, rods, bellcranks, automatic parts, devices, and actuators.

e. Landing and takeoff gear, including actuators and attachments, catapult and arresting gears, beaching gear and auxiliary floats.

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10. PREPARATION INSTRUCTIONS (Cont'd)

f. Miscellaneous structure, including seats, equipment racks, hoisting gear, pylons, armament attachments, fuselage and wing external fuel tanks, their fittings and attachment, as well as fittings, attachments and actuators not elsewhere analyzed.

g. Rotor systems, both main and tail.

h. Aerial refueling system.

i. Cargo handling/aerial delivery system.

10.3.2 Missiles and aircraft-carried stores. The report shall be subdivided, as applicable, to present analyses of the following major structural components:

a. Body structure, including pressure vessels and those serving as primary structures, engine mount structure, control surfaces and control systems support structures, wing support structure and its actuating structure.

b. Wing, either fixed or deployable, and attachments.

c. Control surfaces, including fixed, deployable, and moveable.

d. Control system actuators, mechanisms, and attachment.

e. Suspension structure, including lugs and captive-carry interface hardware.

f. Miscellaneous structure, including welded joints, mounted equipment and attachments, fittings, mechanisms, and actuators not elsewhere analyzed.

10.3.3 Aircraft internal and external modifications. Analysis shall be presented to substantiate the structural adequacy of internal and external modifications to an existing aircraft. Internal equipment installations and exterior surface additions, as well as existing structure affected by the modification, are analyzed to accommodate applicable aerodynamic, pressurization, and inertia loads, including emergency landing crash load factors. Revisions to previous airframe stress analyses, in addition to new analyses, may be written to document the strength capability of added installations and affected structure.

10.4 Content requirements. The general format of the report shall be organized as shown in the following subparagraphs. The contractor's format, within these general outlines, is acceptable.

10.4.1 Introductory information. Introductory information shall include the following:

a. Table of contents.

b. Revision status sheet.

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10. PREPARATION INSTRUCTIONS (Cont'd)

c. Drawing list.

d. List of references.

e. Table of minimum margins of safety that includes part name, load condition, type stress, and analysis page.

f. Discussion describing purpose, structural design criteria, structural arrangement, and load paths.

g. Curves or tables showing maximum external loadings of shears, bending moments, torsion and, where appropriate, temperatures and time/temperature gradients.

10.4.2 Internal loads. The internal loads section may be separately prepared or combined with the detailed stress analysis described in 10.4.3, below. The computation of internal loads on all structural members shall be shown to be complete for critical, external loading conditions and show clearly the steps considered in their development. Internal loads are identified as limit or design ultimate loads. When internal loads computations are accomplished by computer programs, rather than by classical, hand-solution methods, pertinent data considered integral to the report shall be included as follows:

a. Program user's manual, when not readily available to the Government.

b. Sample listing of computer input and output with definitions.

c. Sufficient geometric sketches or computer-generated plots showing the computer model or finite element model.

d. Coordinate system origins and orientations of applicable local and global systems.

e. Node point locations and numbering.

f. Section property derivations.

g. Applicable material properties.

h. Element locations, numbering and types, with selection justification described.

i. Boundary constraints, with described justifications.

j. Applied loads.

k. Outputs of element forces, restraint forces and, where necessary, relative deflections.

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10. PREPARATION INSTRUCTIONS (Cont'd)

10.4.3 Detailed stress analysis. The detailed stress analysis section shall include:

a. A description of the structural component analyzed, giving the type of construction, arrangement, materials, coordinate locations of load carrying members and other related data. Provide adequate sketches throughout the report to minimize the necessity of referring to drawings.

b. Stress calculations that reflect the maximum loading conditions. Designate the critical load case and type of applied stress. Substantiate unconventional methods of analysis for accuracy and applicability by referencing the derivation source of unusual formulas.

c. The calculation of stresses based on design ultimate loads. Where computation based on limit loads are more critical for material yield strength allowables, they shall be shown. Allowable loads and stresses shall be calculated or identified by reference. Calculated margins of safety are clearly indicated. If a computer program does not adequately account for joint attachment strength, combined loadings, local discontinuities and eccentricities, beam column effects, crippling, panel buckling, etc., a separate hand-solution analysis shall be performed to develop correct margins of safety.

d. Calculations of thermal stresses on structures that experience significant heating or cooling, whenever expansion or contraction is limited by external or internal constraints. Combine thermal stresses with concurrent stresses produced by other load sources.

e. Sketches of the component that clearly depict the orientation, dimensions, fastener locations, material, load application and reaction points. Include isometric views in addition to two-dimensional sketches where such views would enhance the description of the component. Present all free body diagrams with applied loads and reactions clearly distinguished. The free body of the component or any part, thereof, shall exhibit correct boundary constraint forces or reactions to balance the applied loads in static equilibrium.

f. Section cuts showing dimensions and reference source. Label the structure by name and part number.

g. Equations within the analysis, prior to numerical substitution.

h. Calculations or reference sources of all applicable factors such as fitting factors, casting factors, form factors, etc., that are included in the analysis.

i. Specific page number, table, or figure of referenced material that has been adequately described by title. Referenced data, which may be conveniently included within the report's list of references, shall be readily available to the procuring activity.

10.4.4 Analysis-static test correlation. Whenever prior, design development test measurements are available, include the correlation of those results with the report's analytically-determined values.