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SUPERSONIC TRANSPORT

WEIGHT AND BALANCE STANDARD

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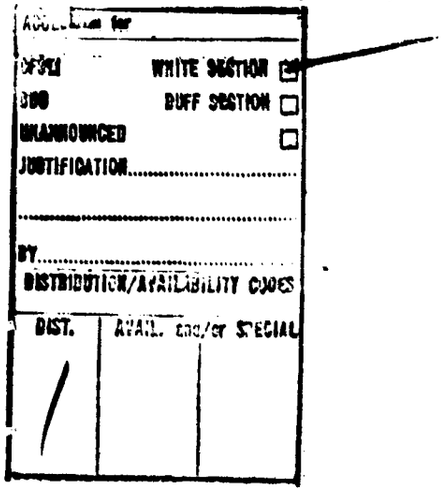

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SUPERSONIC TRANSPORT

WEIGHT AND BALANCE STANDARD

1. SCOPE - A uniform method of weight accounting and reporting will serve as an aid in weight evaluations and subsequent discussions between the airframe contractor and the Office of Supersonic Transport Development. This standard describes the methods that will be used for weight and balance evaluations and discusses the manner in which the weight data is to be reported.

2. CONCEPT - The reporting of weight data is to provide information in the most advantageous form for evaluation purposes and for weight control during the design and construction of the airplane. The data will serve the significant functions of (1) bringing avoidable adverse weight trends to light at an early stage, (2) identifying areas in which design weight control can be most effective, (3) establishing realistic weight goals, and (4) evaluating on a rational basis the weight costs of design features and/or changes.

3. WEIGHT ACCOUNTING - Established methods and procedures of weight reporting currently used by the aircraft industry will be followed if there is no conflict with this standard. The methods shall provide for the breakdown of weight data to the extent necessary to meet the minimum reporting requirements of this standard. The weight shall be accounted for on a functional group basis insofar as practicable. This shall include all tangible and identifiable components regardless of geographic location and physical method of attachment. In the case of components serving multipurpose functions (e.g., doors

and panels which serve as closures for a structural surface as well as a particular installation function), the weight shall be allocated geographically with as complete functional isolation and identification as possible. Where it is necessary for special reasons to deviate from normal weight allocation procedures, adequate cross-reference and a brief reason shall be given. Any additional explanations that will serve for better understanding of the tabulated data and to eliminate confusion in weight allocation is encouraged. The following instructions shall serve to clarify weight allocation:

a. All bolts, nuts, rivets, etc., and loose items of attachment shall be identified and allocated to the same group as the item being attached.

b. Equipment and system supports shall be identified and allocated to the same group as the item being supported. Multipurpose supports shall be allocated to the primary function. Where a primary allocation cannot be determined by observation, an arbitrary allocation may be made.

c. Where more than one weight category is common to Manufacturer's Weight and to Standard and Operational Items (e.g., passenger service equipment), allocation shall be made in accordance with the detail design specification or other general design specifications. The model detail specification shall govern in all cases.

d. All items of power distribution systems (electrical, hydraulic and pneumatic), including fluid in the respective tubing for

hydraulic systems, from main distribution points to actuating units shall be allocated with the items operated. All components from source of power to main distribution points shall be considered to comprise the main system. The distribution system for a given item shall be assumed to include all components which would be unnecessary and could be removed if power actuation of the item were to be eliminated. Where several successive branches from a distribution system are involved, and a clear-cut main distribution point is not readily apparent, it shall be assumed that power is supplied to a given geographic location primarily for the function requiring the greatest amount of power, and to other functions in the sequence of descending power requirements. For hydraulic power transmission to the various operating mechanisms, hydraulic fluid shall be separately identified and allocated in accordance with these instructions.

e. Where a number of identical items and weight for the total number of these items is reported, the number of the specific items shall be given. Design data such as "size", "type", "capacity", etc., shall be given to aid in evaluations.

f. Removable structural panels or structural doors for special functions are to be included in the basic structural groups. Operating mechanisms, hinges, etc., shall be identified with the doors or panels and allocated to the appropriate group.

g. Radomes are to be allocated to the "Electronic Group."

h. Integral tanks in which skin, webs and load-carrying seal fittings are utilized to form the cavity shall be allocated to the appropriate structural group (backing board, separate tank supports, sealant material, bladder-type cells, and non-load-carrying fittings are to be allocated to "Fuel System").

i. Flooring and supports are to be allocated to the appropriate group as follows:

   (1) Basic structure - partially carries flight and landing loads through the airplane structure.

   (2) Secondary structure - fixed in place but if removed does not impair flight and landing strength of the airplane.

j. The weight of the landing gear structure, oil, wheels, tires, brakes and controls shall be identified separately. The weight of that portion of the landing gear doors attached directly to the landing gear shall be included with the landing gear weight breakdown.

k. "Inlet/Air Induction" is considered to be the structure, ducting, etc., forward of the engine face. Each item (cowling, controls, secondary air ducts, spike, etc.) shall be identified separately.

l. The weight of "Surface Controls" shall be identified for the surface actuated and shall include the weight of wiring, plumbing, actuators, etc., from the power distribution point to the particular surface for power operated systems. For mechanically operated systems, it shall include the controls

from the "Cockpit Controls" to the surface actuated or to the power operating mechanism, as appropriate. In all instances, plumbing and fluid shall be identified for each surface actuated. Paragraph 3d. above, should be referred to in the weight allocation of "Surface Controls."

m. The weight of power supply and conversion equipment, generators and generator constant speed drives shall be identified separately from the power distribution portion of "Electrical Group." Wiring requires identification with appropriate footnote to indicate the use of aluminum, nylon-jackets, etc.

n. The weight required for installation and/or support of instruments, electronic "black boxes," etc., shall be separately identified.

o. All multiple function cross-bleed ducting that includes engine starting as a function shall be considered a part of the engine starting system.

p. Passenger seat tracks shall be included in the weight of cabin flooring.

q. Cargo and baggage compartment flooring shall be included in the "Fuselage Group." This also applies to fuselage sealing material.

4. <u>WEIGHT REPORTS</u> - Periodic reporting of weight data is required. This data shall include the effects on the airplane balance. The weight reporting shall be in the form of abbreviated "Status Reports" and comprehensive "Weight and Balance Reports." The reports shall include weight and balance data, as follows:

a. Status Reports - Periodic reports shall include a summary of the weight and balance status compared to the base line configuration as well as to the previous reporting period and shall be included as a part of the bi-monthly Technical Progress Report. The weight shall be summarized on a functional group basis with changes noted as they apply. The report shall include a description of each change effecting the weight and/or balance of the airplane. A balance diagram is required to depict the center-of-gravity vs. gross weight of the airplane and shall be representative of the latest reported weight data. The manufacturer's internal weight status reports may serve the purpose of furnishing data desired but will require approval of the Office of Supersonic Transport Development.

b. Weight and Balance Reports - Comprehensive weight and balance reports are required for all formal evaluations. The dates for submittal of these reports are, or will be, established in the Statement of Work for the particular contracting phase of the development program. The weight data shall describe a configuration with the International Interior as defined in the Economic Ground Rules. Weight data may be included, at the option of the contractor, for other interior arrangements. The amount of data that must be included in these reports will be coordinated with the contractor. Certain minimum data is required to facilitate the evaluations and consists of the minimum weight breakdown data indicated in Table III and the minimum structural, dimensional and design data

indicated in Tables IV and V. In addition, a three-view drawing and an inboard profile drawing of the airplane are required. The weight justification data should include the data necessary for evaluation by the methods described in this standard. No duplication of data that is available in other reports is required but adequate cross-references shall be made to facilitate review and/or use of the data. In addition to the justification and minimum data requirements, the report shall include moment-of-inertia data and a comprehensive balance analysis with loading limitations and center-of-gravity control described.

5. WEIGHT EVALUATION - The Office of Supersonic Transport Development will evaluate the weight on a functional group basis with adjustments as required to account for unusual design considerations and/or features. In order to simplify this standard, the methods of weight evaluation that will be used are outlined for the weight of the major functional areas of structures, propulsion, fixed equipment, standard and operational items, and payload and fuel.

   a. Structural Weight Evaluation - A complete substantiation of the structural weight is required as it is the major portion of the empty weight. Unusual design features must be delineated including weight penalties and/or reductions. For evaluation purposes, the structural weight is defined as the group weights of the wing, fuselage, empennage and/or canard, landing gear,

and nacelles. In the determination of the structural weight, the best engineering techniques available will be employed to insure that the major factors effecting the weight are, in fact, realistic and based on sound design criteria.

The structural weight will be determined by detail calculations, analytical methods, parametric studies and statistical comparisons. A brief discussion of the methods that will be used follows:

(1) Detail Calculations - Detail weight calculations will be made based on the amount of design layouts and drawings available. Sample calculations will be made for sections or areas of the structure that are of similar design (fuselage cabin windows, sections of the fuselage flooring, etc.) with factors applied in order to obtain the total weight of that specific detail design. Where it is not possible or practical to make detail calculations, other methods will be employed to determine the weight.

(2) Analytical Methods - Analytical methods will be employed to determine the amount of material required as a function of the aerodynamic, dynamic, taxi and landing loads, stiffness requirements and the material allowable strength. The methods will also be used to validate the detail weight calculations of load critical components.

(3) Parametric Studies - Parametric studies will be made using empirical equations relating various design parameters to the weight of major structural components and will serve as a means of rapid weight estimation for comparison with contractor data. These studies will also serve as a means of determining non-optimum structural weight.

(4) Statistical Comparisons - Statistical comparisons will be made, with corrections applied as necessary to account for differences in material densities, to serve as a means of comparison and additional substantiation for the weight of non-structural doors, panels, hinges, flap-tracks and so forth.

b. Propulsion Weight Evaluation - The propulsion weight is defined as the weight of the complete engines, engine accessories, engine controls, starting system and fuel system. In the determination of the propulsion weight, the best engineering techniques available will be employed to insure that the major factors effecting the weight are considered in the evaluation. For convenience, the methods for determining the weights of the major items comprising the propulsion weight are discussed individually, as follows:

(1) Engines (as installed) - The basic weight, as defined in the engine manufacturer's model specification, will be evaluated separately from the airframe. The weight for the "as installed" engine will be based on the predetermined basic engine

weight plus any features and/or increments added by the airframe company in order to integrate it with his particular configuration. A cross reference with engine manufacturers documentation will be used in the determination of the weight increments for features added by the airframe contractor.

(2) Engine Driven Accessory Gear Boxes and Drives - The weight of the engine driven accessory gear boxes and drives, consisting primarily of the accessory power drive installation, will be determined based on the individual design concept, the power output requirements, the operating environment and location with respect to the engine. Vendor quotes for the gear boxes, drive shafts, etc., will be evaluated to ascertain the validity of quoted weights.

(3) Engine Controls - The weight of the engine controls required between the cockpit and the fuel control lever on the engine will be determined based on the design concept. Comparisons will be made with current high performance, multi-engine aircraft with appropriate consideration given to differences in the particular designs.

(4) Starting System - The weight of the starting system will be determined based on the particular design concept. Vendor quotes will be verified insofar as possible. Comparisons will be made with existing high performance aircraft with consideration given to differences in the designs, power requirements and environment.

(5) Fuel System - The weight of the fuel system will be determined based on the particular design concept. Engineering techniques will be employed to insure that fuel lines are adequately sized to meet flow requirements and operating pressures. The weights of pumps, valves, etc., as quoted by vendors will be verified insofar as possible. Special design features will be evaluated with the aid of design specialists.

c. Fixed Equipment Weight Evaluation - The fixed equipment weight is defined as the weights of the instruments, surface controls, hydraulics system, electrical system, electronics, furnishings, air conditioning or environmental control system, anti-icing or adverse weather system, and insulation if not included in the furnishings weight. In the determination of the fixed equipment weight, the best engineering techniques available will be employed to insure that the major factors effecting the weight are, in fact, realistic and based on sound design criteria to meet established requirements. The fixed equipment weight will be determined based on the design concept of the individual functional groups. Detail calculations, statistical data comparisons, empirical equations and vendor quotes will be used in the determination of the weights. For clarification purposes, the methods for determining the weight of the major items comprising the fixed equipment weight are discussed individually, as follows:

(1) Instruments - Statistical data from current high performance aircraft will be used for comparison purposes to ascertain the validity of proposed weights. Appropriate corrections will be made to account for state-of-art developments.

(2) Surface Controls - Statistical data from current high performance aircraft will be used for comparison purposes where applicable. Vendor quotes for weights of power actuation packages, actuators, etc., will be verified insofar as possible. Empirical equations with parameters included to account for hinge-moments, length of tubing and cable runs, etc., will be used for comparison purposes. Detail calculations will be made based on the data available.

(3) Hydraulic System - The weight shall be determined as a function of system pressure, pump capacities, type of fluid, environment, maximum flow requirements and length of tubing runs. Detail calculations will be made where possible. Vendor quotes for pumps, motors, etc., will be verified insofar as possible. Empirical equations will be used for comparison purposes.

(4) Electrical System - Statistical data from current high performance aircraft will be used for comparison purposes with appropriate allowances for state-of-art improvements. Empirical equations with parameters included to account for power output, length of wiring runs and type of system will

be used for verification purposes. Vendor quotes for power generating equipment will be verified insofar as possible.

(5) Electronics - Statistical data from existing electronic "black boxes" will be used for verification purposes. Vendor quotes for electronic equipment will be evaluated to ascertain the validity of the quoted weights.

(6) Furnishings - Detail calculations will be made where feasible. User inputs will be considered as will data gathered from seat manufacturers. State-of-art improvements will be evaluated to determine feasibility in reducing the weight of specific items. Statistical data from existing commercial aircraft will be used to verify the proposed weight for selected items such as tables, instrument panels, cargo provisions, etc.

(7) Air Conditioning/Environmental Control - The weight of the system will be determined based on the design concept. Detail calculations will be made insofar as possible. Vendor quotes for heat exchangers, compressors, etc., will be verified by using data obtained from various manufacturers. The use of statistical data from existing aircraft will provide information to establish base points for specific types of systems.

(8) Anti-icing/Adverse Weather System - The weight will be determined based on the design concept. Statistical data

will be used where applicable. Detail calculations will be made based on the data available.

(9) Insulation - The weight will be determined, based on temperature and noise reductions necessary to meet established requirements. The amount of the insulation will be based on evaluated temperature and noise levels. Detail calculations will be made insofar as possible.

d. Standard and Operational Items - The weight of the standard and operational items will be determined based on statistical data from current commercial aircraft with appropriate consideration given to number of passengers, flight time, etc. User inputs will be given primary consideration in the determination of minimum requirements.

e. Payload and Fuel - The weight of the payload and fuel will be determined as the final phase of the airplane weight evaluation. It will be determined as the difference between the maximum design taxi weight and operational empty weight with due consideration for usable volume and seat spacing requirements.

6. BALANCE EVALUATION - The balance of the airplane will be determined based on the evaluated weights. For airplanes with variable wing sweep, all balance data will be presented in terms of the Mean Aerodynamic Chord defined with the wing in the aft (cruise) sweep position. The effects of passenger loading (using accepted procedure of filling window seats first, aisle seats next and all remaining seats), baggage and/or cargo distribution, fuel loading, etc., will be determined

to define restrictions. User inputs will be given primary emphasis in this determination. Any operational restrictions that are imposed such as the use of ballast, fuel transfer and/or selective loading will be given special attention in determining the acceptability of the airplane balance.

7. DEFINITIONS AND SPECIFIC WEIGHT DATA - For evaluation purposes, the attached tables will be used to define various weight terms and to establish weights for specific items that will be in the airplane. The tables also establish minimum weight breakdown and specific minimum design data requirements. A derivation of the weight conditions listed below is required in Weight and Balance Reports. Changes effecting the weight of these conditions shall be noted in Status Reports.

Manufacturer's Empty Weight

Operational Empty Weight

Maximum Zero Fuel Weight

Maximum Design Taxi Weight

Maximum Design Takeoff Weight

Maximum Design Flight Weight

Maximum Design Landing Weight

Airframe Weight

TABLE I - DEFINITION OF WEIGHT TERMS

The following definitions of weight terms shall be used for weight reporting and accounting purposes.

TERM	DEFINITION
Manufacturer's Empty Weight	Weight of the structure, powerplant, furnishings, systems and other items of equipment that are considered an integral part of the airplane. It is essentially a "dry" weight, including only those fluids which are contained in a closed system (such as hydraulic fluid). It is representative of the complete airplane as configured to meet the established requirements less standard and operational items, payload and fuel.
Standard and Operational Items	Weight of: Unusable fuel and oil; usable oil; toilet water and chemical; drinking and washing water; emergency equipment such as life rafts and life vests; manuals; navigational equipment; flight crew and their baggage; cabin crew and their baggage; food, beverages and liquor; other passenger service items not included in the manufacturer's weight empty.
Operational Empty Weight	Sum of the manufacturer's weight empty and the standard and operational items.
Maximum Zero Fuel Weight	The maximum gross weight with zero usable fuel.
Maximum Design Taxi Weight	Maximum weight allowed for ground maneuver including the weight of taxi and run-up fuel.

TABLE I - DEFINITION OF WEIGHT TERMS (Cont'd)

TERM	DEFINITION
Maximum Design Takeoff Weight	The maximum weight for the take-off condition of the loaded airplane, and it excludes the weight of taxi and run-up fuel. This is the airplane weight at "Brake Release" or start of take-off run.
Maximum Design Flight Weight	The maximum weight for flight as limited by aircraft strength and other airworthiness requirements. "Flaps Up" condition is inferred unless otherwise stated.
Maximum Design Landing Weight	The maximum weight at landing at which the aircraft will not exceed governmental or other structural limitations.
Airframe Weight	Manufacturer's weight empty less the weight of: Wheels, brakes, tires and air Engines - as supplied by manufacturer Accessory gear box drive Engine starters Fuel bladder cells Instruments - indicators, transmitters and amplifiers Electrical - power supply, conversion equipment and batteries Electronic - electronic sets less wiring, connectors, racks and radome Air Conditioning - pressurization, cooling, heat exchanger units and fluid

TABLE II - WEIGHT FOR SPECIFIC ITEMS

The weight of the specific items noted below shall be used for weight reporting and evaluation purposes.

ITEM	WEIGHT
Flight Crew	170 lbs. each
Cabin Attendants	130 lbs. each
Crew Baggage	25 lbs./crew member
Passengers	200 lbs. each (Includes baggage)
Fuel	6.7 lbs./gallon
Life Rafts (25 man)	125 lbs. each (Includes rations)
Life Vests	1.5 lbs. each
Passenger Oxygen Masks	0.25 lbs. each
Crew Masks and Regulators	1.0 lbs. each
Fire Axes	3.0 lbs. each

TABLE III - MINIMUM BREAKDOWN OF WEIGHT DATA

Weight reporting shall be done on a functional group basis. Weight and balance reports shall include a breakdown of the data for each group. The extent of the breakdown noted below for the various groups is considered minimum.

WING, HORIZONTAL AND VERTICAL TAIL GROUPS
- BENDING MATERIAL
- COVERS (IF NOT INCLUDED IN BENDING)
- SHEAR MATERIAL
- JOINTS & SPLICES
- RIBS & BULKHEADS
- PIVOT OR ACTUATOR STRUCTURE
- SECONDARY STRUCTURE
  - FIXED L.E.
  - FIXED T.E.
  - TIPS
  - DOORS
  - MOVABLE SURFACES & SUPPORTS (IDENTIFY EACH SURFACE)
  - FAIRINGS, FILLETS, ETC.

FUSELAGE GROUP
- BULKHEADS (LIST MAJOR SUCH AS SPAR, PASSENGER CAB, ETC.)
- FRAMES
- COVERS & LONGITUDINAL STIFFENERS
- LONGERONS
- FLOORS & FLOOR SUPPORTS
- PRESSURE DECKS (IF APPLICABLE)
- WINDOWS & WINDOW FRAMES
- DOORS, HATCHES AND OPERATING MECHANISM (LIST MAJOR DOORS)
- WINDSHIELD
- TRANSLATING AND/OR ROTATING NOSE (DEFINE FUSELAGE STATION LIMITS)
- WING-BODY FITTINGS
- SEALING
- PRODUCTION JOINTS
- TAIL CONE
- FAIRINGS, FILLETS, ETC.

LANDING GEAR GROUP
- MAIN - WHEELS
  - TIRES
  - AIR
  - BRAKES
  - BRAKE CONTROLS
  - OLEO ASSEMBLY

TABLE III - MINIMUM BREAKDOWN OF WEIGHT DATA
(Cont'd)

LANDING GEAR GROUP(Cont'd)
- MAIN - STRUTS & LINKS
  - TRUCK ASSEMBLY
  - TORSION LINKS
  - TRUNNION AND/OR SUPPORT STRUCTURE
  - FOREIGN OBJECT DEFLECTOR
  - MISCELLANEOUS
  - OIL
  - RETRACTION SYSTEM
  - EXTENSION SYSTEM
  - OTHER
- NOSE - WHEELS
  - TIRES
  - AIR
  - BRAKES
  - BRAKE CONTROLS
  - OLEO ASSEMBLY
  - STRUTS & LINKS
  - TORSION LINKS
  - TRUNNION AND/OR SUPPORT STRUCTURE
  - FOREIGN OBJECT DEFLECTOR
  - OTHER
  - OIL
  - EXTENSION - RETRACTION
  - STEERING SYSTEM

NACELLE GROUP
- INLET/AIR INDUCTION
  - INLET SPIKE/RAMP
  - COWLING
  - SUPPORTS
  - CONTROLS
  - BY-PASS DOORS
  - OTHER
- NACELLE-COWLING
  - ENGINE MOUNTING
  - PYLON STRUCTURE
  - INSTALLATION
  - OTHER

TABLE III - MINIMUM BREAKDOWN OF WEIGHT DATA
(Cont'd)

PROPULSION GROUP
- ENGINES - MANUFACTURER SPECIFICATION
  - AIRFRAME INSTALLATION ITEMS (TABULATE)
- ENGINE ACCESSORIES
  - POWER DRIVE INSTALLATION
  - DRAIN SYSTEM
  - MISCELLANEOUS
- ENGINE CONTROLS
- STARTING SYSTEM
- LUBE SYSTEM (IF NOT INCLUDED ABOVE)
- FUEL SYSTEM
  - TANKS AND SEALANT
  - ENGINE FEED
  - FUEL TRANSFER
  - PRESSURE REFUELING
  - FUEL DUMP
  - VENT
  - INERTING
  - FUEL VAPOR BARRIER (IF NOT INCLUDED ELSEWHERE)

INSTRUMENT GROUP
- (TABULATE & GIVE WIRING, SUPPORTS, ETC., DATA)

SURFACE CONTROLS GROUP
- COCKPIT CONTROLS
- AUTO PILOT
- STABILITY AUGMENTATION
- MOVABLE SURFACES (IDENTIFY EACH & LIST THE FOLLOWING)
  - ACTUATORS
  - OPERATING MECHANISM
  - PLUMBING, WIRING, ETC.
  - FLUID (IDENTIFY TYPE)
  - SUPPORTS, ETC.
- WING SWEEP ACTUATION
  - ACTUATORS
  - DRIVES
  - FLUID
  - CONTROLS
  - OTHER

TABLE III - MINIMUM BREAKDOWN OF WEIGHT DATA
(Cont'd)

HYDRAULIC GROUP
- PUMPS - ENGINE DRIVEN (NO. & SIZE)
  ELECTRICALLY DRIVEN (NO. & SIZE)
- RESERVOIRS
- HEAT EXCHANGERS
- MODULAR PACKAGES
- FILTERS, VALVES, ETC.
- PLUMBING
- FLUID (IDENTIFY TYPE)
- SUPPORTS, BRACKETS, ETC.

ELECTRICAL GROUP
- GENERATORS (NO. & SIZE)
- CONSTANT SPEED DRIVES (NO. & SIZE)
- POWER CONVERSION EQUIPMENT (TABULATE)
- POWER DISTRIBUTION SYSTEM (IDENTIFY WIRING WEIGHT)
- BATTERIES & PROVISION (NO. & SIZE)
- LIGHTING (SEPARATE INTERIOR & EXTERIOR)
- INSTALLATION

ELECTRONIC GROUP
- LIST EQUIPMENT WEIGHT, INSTALLATION & PROVISIONS

FURNISHINGS & EQUIPMENT GROUP
- ACCOMMODATIONS FOR PERSONNEL
  - SEATS - CREW & OBSERVER
    ATTENDANTS
    PASSENGERS
  - ATTENDANT PANELS
  - UTILITY RACK
  - PASSENGER SERVICE UNITS
  - COAT COMPARTMENTS
  - LAVATORIES
  - WATER SYSTEM
  - OXYGEN SYSTEM
  - GALLEYS
- PROVISIONS - FLIGHT CREW
  - WORK TABLES
  - INSTRUMENT PANELS
  - CURTAINS & VISORS
  - FLIGHT MANUAL STOWAGE
  - OTHER

TABLE III - MINIMUM BREAKDOWN OF WEIGHT DATA
(Cont'd)

FURNISHINGS & EQUIPMENT GROUP (Cont'd)

- FLOOR COVERING
- TRIM & CEILING PANELS
- SOUNDPROOFING & THERMAL INSULATION
- CURTAINS, PARTITIONS, DIVIDERS, ETC.
- OTHER
- EMERGENCY EQUIPMENT
- CARGO HANDLING

AIR CONDITIONING GROUP

- HEAT EXCHANGERS - PRIMARY (NO. & SIZE)
  SECONDARY (NO. & SIZE)
- AIR CYCLE MACHINES (NO. & SIZE)
- COMPRESSORS (NO. & SIZE)
- WATER SEPARATORS (NO. & SIZE)
- BLOWERS (NO. & SIZE)
- PUMPS, FANS, ETC.
- PRESSURE & TEMPERATURE CONTROLS
- AIR SUPPLY DUCTING
- CABIN DISTRIBUTION SYSTEM
- EQUIPMENT SUPPORTS
- FLUID IN SYSTEM (IDENTIFY)

ADVERSE WEATHER SYSTEM

- ANTI-ICING - ENGINE INLET
  OTHER (IDENTIFY)
- RAIN AND FOG REMOVAL

STANDARD ITEMS (IDENTIFY - REFERENCE TABLE II)

OPERATIONAL ITEMS (IDENTIFY - REFERENCE TABLE II)

PAYLOAD

- PASSENGERS
- CARGO

USABLE FUEL

TABLE IV - MINIMUM STRUCTURAL AND DIMENSIONAL DATA

The following structural and dimensional data is required to expedite the evaluation process and is to be included in weight and balance reports.

MAXIMUM DESIGN CONDITIONS — WEIGHT(LBS.) LIMIT L.F.
- TAXI
- TAKEOFF
- FLIGHT
- LANDING
- ZERO FUEL

MINIMUM FLYING WEIGHT

AIRFRAME WEIGHT (LBS.) — MANUFACTURER'S EMPTY WEIGHT (LBS.)

BASIC INT'L PAYLOAD (LBS.) — NO. OF PASSENGERS ( )DISTRIBUTION ( )

SPACE LIMIT PAYLOAD (LBS.) — NO. OF PASSENGERS

LENGTH - OVERALL (FT.) — HEIGHT-OVERALL-STATIC (FT.)

	FUSELAGE	NACELLES	
LENGTH-MAXIMUM (FT.)			(EA.)
DEPTH-MAXIMUM (FT.)			(EA.)
WIDTH-MAXIMUM (FT.)			(EA.)
WETTED AREA (SQ.FT.)			(EA.)

FUSELAGE VOLUME (CU.FT.) - PRESSURIZED — - TOTAL

ULTIMATE DESIGN PRESSURE DIFFERENTIAL (P.S.I.)

	WING	H.TAIL	V.TAIL
BASIC AREA(SPECIFY POSITION FOR VARIABLE SWEEP SQ.FT.)			
SPAN (FT.)			
SWEEP ANGLE -@ 25% CHORD(FOR BASIC AREA DEG.)			
-@ __% CHORD (DEG.)			
THEORETICAL ROOT CHORD - LENGTH (IN.)			
- MAX.THICKNESS(IN.)			
CHORD AT PLANFORM BREAK-LENGTH(IN.)			
- MAX.THICKNESS(IN.)			
THEORETICAL TIP CHORD - LENGTH(IN.)			
- MAX.THICKNESS(IN.)			

DORSAL AREA INCLUDED IN (FUS.) (V.TAIL) AREA (SQ.FT.)

TAIL LENGTH - 25% MAC WING TO 25% MAC H. TAIL (FT.)

AREA - MOVABLE SURFACES (SQ.FT.)

TABULATE AREAS OF EACH TYPE MOVABLE SURFACE SEPARATELY

TABLE IV - MINIMUM STRUCTURAL AND DIMENSIONAL DATA
(Cont'd)

HYDRAULIC SYSTEM CAPACITY (GALS.)

LANDING GEAR	MAIN	NOSE
LENGTH - OLEO EXTENDED ℄ AXLE TO ℄ TRUNNION(IN)		
OLEO TRAVEL - OLEO EXTENDED TO FULL COLLAPSED(IN.)		
NO., SIZE AND TYPE TIRES		

FUEL CAPACITY (GALS.)	NO. OF TANKS	CAPACITY
WING		
FUSELAGE		

OIL CAPACITY (GALS.) NO. OF TANKS

LANDING SPEED @ MAX. LANDING WEIGHT (KNOTS)
TAKEOFF SPEED @ MAX. TAKEOFF WEIGHT (KNOTS)

TABLE V - DESIGN DATA REQUIREMENTS

The design data noted below for the various groups is required for weight evaluations and shall be included in the weight and balance reports. No duplication of data that is available in other reports submitted for the evaluation is required but adequate cross-reference shall be made to facilitate the review and/or use of the data.

WING, HORIZONTAL AND VERTICAL TAIL GROUPS
- STRUCTURAL LAYOUTS
- ENGINEERING DESIGN ALLOWABLES (INCLUDING DESIGN ULTIMATE AND 1-g GROSS AREA TENSION STRESS LEVELS)
- ENGINEERING CURVES OF LOADS (BENDING, SHEAR, AND TORSION)
- ENGINEERING CURVES OF SPAR DEPTHS VS. STATION
- SPEED RESTRICTIONS FOR MOVABLE SURFACES
- SPECIAL DESIGN FEATURES DEFINED W/Δ WT. INCREMENTS
- DISCUSSION - WEIGHT JUSTIFICATION
- MINIMUM MATERIAL GAGES - PRIMARY & SECONDARY STRUCTURE

FUSELAGE GROUP
- STRUCTURAL LAYOUTS
- ENGINEERING DESIGN ALLOWABLES (INCLUDING DESIGN ULTIMATE AND 1-g GROSS AREA HOOP TENSION STRESS LEVEL)
- ENGINEERING CURVES OF LOADS (BENDING, SHEAR, AND TORSION)
- ENGINEERING CURVE OF EFFECTIVE DEPTH VS. STATION
- SPECIAL DESIGN FEATURES DEFINED W/Δ WT. INCREMENTS
- PASSENGER FLOOR AREAS AND DESIGN LOADING
- MAJOR DOOR AREAS DEFINED
- MINIMUM MATERIAL GAGES - PRIMARY AND SECONDARY STRUCTURE
- DISCUSSION - WEIGHT JUSTIFICATION
- NUMBER, SIZE, AND MATERIAL DENSITY OF WINDOWS

LANDING GEAR GROUP
- STRUCTURAL LAYOUTS
- MATERIAL ALLOWABLES
- CRITICAL STRUCTURAL LOADS (DEFINE)
- SPECIAL DESIGN FEATURES DEFINED W/ΔWT. INCREMENTS
- BRAKE ENERGY REQM'TS. - DESIGN LANDING & REJECTED T.O.
- MAXIMUM STATIC LOAD WHEELS & TIRES (MAIN & NOSE)
- DISCUSSION - WEIGHT JUSTIFICATION

TABLE V - DESIGN DATA REQUIREMENTS
(Cont'd)

NACELLE GROUP
- INLET/AIR INDUCTION - TYPE
  CAPTURE AREA (SQ. IN.)
  DESIGN PRESSURES (P.S.I.)
- NACELLE COWLING AREAS AND LOADS
- STRUCTURAL LAYOUTS
- SPECIAL DESIGN FEATURES DEFINED W/ Δ WT. INCREMENTS
- DISCUSSION - WEIGHT JUSTIFICATION
- TYPE MATERIALS INCLUDING MINIMUM GAGES

PROPULSION GROUP
- NO ENGINE DESIGN DATA OTHER THAN WEIGHT
- POWER DRIVE INSTALLATION DRAWING W/POWER INPUT/OUTPUT
- LAYOUT OF ENGINE CONTROLS
- TYPE OF STARTING SYSTEM W/LAYOUTS
- LIST TYPE & CAPACITY OF FUEL TANKS
- REQUIRED FUEL FLOW RATES - PRESSURE FUELING, FEED & DUMP
- NOMINAL FUEL SYSTEM OPERATING PRESSURES
- TYPE OF BLADDER CELLS AND/OR DENSITY OF INSULATING MATERIAL
- SPECIAL DESIGN FEATURES DEFINED W/Δ WT. INCREMENTS
- DISCUSSION - WEIGHT JUSTIFICATION

SURFACE CONTROLS GROUP
- LAYOUTS OF SYSTEMS
- SYSTEM PRESSURE AND MATERIALS SELECTION
- FOR ALL SURFACES - DEFLECTION, HINGE-MOMENTS, DISTANCES FROM POWER SOURCES, TYPE SYSTEM AND SPEED RESTRICTION
- DISCUSSION - WEIGHT JUSTIFICATION

HYDRAULIC GROUP
- SYSTEM PRESSURE AND NUMBER OF SYSTEMS
- LAYOUT OF SYSTEMS
- PUMPS - NO. REQUIRED, SIZE (CU.IN./REV.), FLOW(GPM) OF EACH
- TUBING DESIGN PRESSURES AND TYPE OF MATERIAL
- MAXIMUM FLOW REQUIREMENTS
- RESERVOIR CAPACITIES
- SPECIAL DESIGN FEATURES W/Δ WT. INCREMENTS
- DISCUSSION - WEIGHT JUSTIFICATION - TO INCLUDE A BRIEF DESCRIPTION OF THE SYSTEM

TABLE V - DESIGN DATA REQUIREMENTS
(Cont'd)

ELECTRICAL GROUP
- TYPE OF SYSTEM AND POWER REQUIREMENTS
- MAJOR ELECTRICAL LOAD BREAKDOWN
- TYPE WIRING, LAYOUT OF SYSTEM
- CONSTANT SPEED DRIVE INPUT/OUTPUT RPM & HP RATING
- SPECIAL DESIGN FEATURES W/Δ WT. INCREMENTS
- DISCUSSION - WEIGHT JUSTIFICATION - TO INCLUDE A BRIEF DESCRIPTION OF THE SYSTEM

FURNISHINGS AND EQUIPMENT GROUP
- SPECIAL DESIGN FEATURES W/Δ WT. INCREMENTS
- INSULATION REQUIREMENTS VS. INTERIOR NOISE LEVELS
- DISCUSSION - WEIGHT JUSTIFICATION
- NUMBER OF LAVATORIES, GALLEYS AND DRINKING FOUNTAINS
- WATER SYSTEM AND OXYGEN SYSTEM CAPACITIES
- INTERIOR SURFACE AREAS FOR TRIM, RUGS, ETC.
- LENGTH OF UTILITY RACKS

AIR CONDITIONING GROUP
- LAYOUTS OF SYSTEMS
- VENTILATION RATE/PASSENGER
- AIRFLOW - POUNDS/MINUTE
- CABIN ALTITUDE AND TEMPERATURE LEVELS
- SPECIAL DESIGN FEATURES W/Δ WT. INCREMENTS
- DISCUSSION - WEIGHT JUSTIFICATION - TO INCLUDE A BRIEF DESCRIPTION OF THE SYSTEM W/TYPE DUCTING

ADVERSE WEATHER SYSTEMS
- DESCRIBE SYSTEMS AND JUSTIFY WEIGHTS

STANDARD AND OPERATIONAL ITEMS
- IDENTIFY AND GIVE QUANTITY OF FUELS, OILS, ETC.
- BASIS FOR ESTABLISHING WATER, PASSENGER SERVICE EQUIPMENT, FOOD AND BEVERAGE, AND GALLEY SERVICE ALLOWANCES PER PASSENGER OR PER FLIGHT