MILITARY SPECIFICATION

DATA, TECHNICAL AIRCRAFT: FOR DESIGN OF AVIATION TRAINING DEVICES

This specification is approved for use by the Navy Training Equipment Center, Department of the Navy, and is available for use by all departments and agencies of the Department of Defense.

1. SCOPE

1.1 This specification establishes the requirements for the preparation and submission of aircraft data for use in the design of aviation training devices such as aircraft weapon system trainers, operational flight trainers, tactics trainers, and procedure trainers for military piloted aircraft.

2. APPLICABLE DOCUMENTS

2.1 The following documents of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein:

SPECIFICATIONS

Military

MIL-C 5011 — Charts, Standard Aircraft Characteristics and Performance, Piloted Aircraft

FSC 6930

MIL-D-5480	Data, Engineering and Technical (Reproduction Thereof)
MIL-C-8501	Helicopter Flying and Ground Handling Qualities
MIL-D-8705	Data and Tests, Engineering; Contract Requirements for Aircraft Weapon Systems
MIL-D-8708	Demonstration Requirements for Airplanes
MIL-F-8785	Flying Qualities of Piloted Airplanes
MIL-C-18244	Control and Stabilization Systems; Automatic, Piloted Aircraft, General Specification for
MIL-F-18372	Flight Control Systems; Design, Installation and Test of, Aircraft (General Specification for)
MIL-D-23222	Demonstration Requirements for Rotary Wing Aircraft (Helicopters)
MIL-W-25140	Weight and Balance Control Data (for Airplanes and Rotorcraft
MIL-H-46855	Human Engineering Requirements for Military Systems, Equipment and Facilities

STANDARDS

Military

MIL-STD-847 Research and Engineering Report; Format and General Requirements

PUBLICATIONS

Naval Air Systems Command

SAR-315 Reports Submitted under Contracts for the Development of Aeronautical Power Plants and Equipments

National Aeronautics and Space Administration

NASA Spin Tunnel Reports

Naval Training Equipment Center (NAVTRAEQUIPCEN)

Report 7591-R-1 Simulation of Aircraft; Massachusetts Institute of Technology

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the Procuring Contracting Officer.)

3. REQUIREMENTS

3.1 Application of data requirements.- The requirements of this specification are applicable to the extent specified in the data procurement contract. The design data summary required in 3.3 shall define applicability to the specific aircraft. The analytical method used by the aircraft contractor for development of data shall be defined with the initial submission or presentation of such data. With any subsequent submission of data, a notation shall be made should the method of derivation differ from that used for the initial presentation. Aircraft DD-1423 data items shall be included, as applicable.

3.1.1 Data previously submitted to the Government.- Design data and test results previously submitted in fulfillment of the applicable documents listed in Section 2, such as Publication SAR-315, may be submitted to the Government in whole or in part, when these data and test results fully satisfy the requirements specified herein.

3.1.2 Design data form.- Design data shall be provided in the form specified herein and in accordance with the applicable provisions of MIL-D-5480. Revised or updated data shall be submitted in the same form as that used for the original submission.

3.2 Design data required.- The design data specified herein shall be furnished to cover the complete operating range of the aircraft and all of its systems, including Government Furnished Aircraft Equipment (GFAE), modification, and installation data. Data shall include graphic plots covering the entire operating range of the aircraft including variables such as temperature, pressure altitude, airspeed, angle of attack, gross weight, center of gravity, and various configurations.

3.2.1 Aircraft data.- Aircraft data shall be prepared in two parts as follows:

(a) Construction data:

(1) Stability derivatives

(2) Airframe physical characteristics

(3) System characteristics

(4) Normal and emergency operating procedures for systems

(5) Tolerances and specifications on systems

(b) Testing data - Flying qualities and performance data obtained after the airframe has been flown and tested

Other data sources, where applicable, may be design data, laboratory or static bench test data.

3.2.2 Detail aircraft specification and amendment sheets.- Detail aircraft specification and subsequent amendments covering revisions for the aircraft as noted in 3.2.1, shall be provided by the aircraft contractor in accordance with MIL-D-8706.

3.2.3 Configuration data.- The following data shall be provided by the aircraft contractor:

(a) General arrangement drawing of aircraft as specified in MIL-D-8706

(b) Inboard profile as specified in MIL-D-8706

(c) Structural assembly, subassembly and detail drawings of cockpit area, and other crew stations

(d) Installation, assembly, and detail drawings and illustrated parts breakdown of all controls, equipment, and indicators required for simulation of the cockpit and other crew stations. Vendors, other than the aircraft manufacturer, shall be identified

(e) Contour lines, drawings, or data sheets for cockpit area and other crew stations, including canopies and windshields

(f) Top view outline drawing showing store location and a table showing stores arrangement and mix

(g) Lofting drawings

(h) Mechanical schematics illustrating linkage between aircraft primary control surfaces and cockpit controls

(i) Wing or rotor area

(j) Wing span or rotor diameter

(k) Mean aerodynamic chord

(l) Schedules for wing sweep or maneuver device deflection

(m) Inclination and offset of engine thrust

(n) Aircraft general arrangement drawings may be used for items (i) through (m).

3.2.3.1 Control systems.- Mechanical characteristics of all trim and control systems shall be presented, including boost on and boost off conditions. Mechanical, hydraulic, pneumatic, and electrical schematics shall be provided. See 3.2.7.1 for further requirements.

(a) Fixed wing aircraft

Controls (longitudinal, lateral, and directional):

a. Breakout and friction forces

b. System inertia

c. Dynamic response - damping and natural frequency

d. Surface deflection versus control deflection

e. Control force versus control deflection

f. Trim effects

g. Control centering

h. Deadband

i. Alignment and installation procedures

(b) Rotary wing aircraft

(1) Cyclic column -

a. Breakout and friction forces

b. System inertia

c. Dynamic response - damping and natural frequency

d. Rotor deflection versus column deflection

e. Control force versus column deflection

f. Trim effects

(2) Collective column -

a. Breakout and friction forces

b. System inertia

c. Dynamic response - damping and natural frequency

d. Rotor deflection versus column deflection

e. Control force versus column deflection

f. Trim effects

(3) Rudder pedals -

a. Breakout and friction forces

b. System inertia

c. Dynamic response - damping and natural frequency

d. Rotor deflection versus pedal position

e. Tail rotor deflection versus pedal position

f. Trim effects.

3.2.3.2 Weight, balance, and moments of inertia.- The weight, balance, and moments of inertia data shall be furnished in accordance with MIL-W-25140 as follows:

(a) The 3 first moments and 6 second moments of empty aircraft plus normally fixed articles shall be furnished in tabular form

(b) The 3 first moments and 6 second moments of each article capable of being moved, consumed, or dropped in normal operational flight, shall be furnished in tabular form, including increments or trends showing movement or consumption of articles

(c) Center of gravity changes versus gross weight and configuration for the entire range of fuel and stores and loading, and configuration changes such as wing sweep and landing gear deflection.

3.2.4 Aerodynamic data.- The data specified herein shall be provided by the aircraft contractor in accordance with the requirements of 3.1.

3.2.4.1 Aerodynamic coefficients.- The aerodynamic coefficients of tables I and II shall be presented in graphical or tabular form, and shall be a function of the variables shown in parenthesis. The coefficients shall include

TABLE I - Fixed Wing Aerodynamic Coefficients

COEFFICIENTS - FIXED WING					
C_X	C_Y	C_Z	C_l	C_m	C_n
C_{x_o} (α,M)	C_{y_β} (M,α)	C_{z_o} (α,M)	C_{l_β} (α,M)	C_{m_o} (α,M)	C_{n_β} (α,M)
$C_{x_{(\beta)}}$	$C_{y_{\delta_R}}$ (M)	$C_{z_{\delta_E}}$ (M)	C_{l_r} (α,M)	C_{m_α} (α,M)	$C_{n_{\delta_R}}$ (α,M)
$C_{x_{\delta_F}}$ (α)	C_{y_r} (M,α)	$C_{z_{\delta_F}}$ (K)	C_{l_p} (α,M)	$C_{m_{\dot\alpha}}$ (M)	$C_{n_{\delta_A}}$ (α,M)
$C_{x_{\delta_B}}$ (M)	C_{y_p} (M,α)	C_{z_α} (α,M)	$C_{l_{\delta_R}}$ (α,M)	C_{m_q} (M)	C_{n_r} (α,M)
C_{x_a} (α,M)	$C_{y_{\delta sp}}$	$C_{z_{\dot\alpha}}$ (M)	$C_{l_{\delta_A}}$ (α,M)	$C_{m_{\delta_E}}$ (M)	C_{n_p} (α,M)
$C_{x_{ES}}$ (M)	$C_{y_{\delta_a}}$ (β)	$C_{z_{\delta_{Et}}}$ (M)	$C_{l_{\delta_{AT}}}$ (α,M)	$C_{m_{\delta_F}}$ (K)	$C_{n_{\delta_{RT}}}$ (M)
$C_{x_{LG}}$ (K)	C_{y_g} (β)	C_{z_q} (M)	$C_{l_{\delta_{RT}}}$ (α,M)	$C_{m_{\delta_B}}$ (α,M)	$C_{n_{ES}}$ (M)
C_{x_u} (K)	C_{y_β} (δF)	C_{z_u} (M)	$C_{l_{ES}}$ (M)	$C_{m_{ES}}$ (M)	$C_{n_{\delta sp}}$
C_{x_A}			$C_{l_{\delta sp}}$	C_{m_u} (M)	C_{h_r}
C_{x_N}			C_{l_g}	$C_{m_{LG}}$ (K)	
C_{x_W}			C_{h_a}	$C_{m_{\delta_{Et}}}$ (M)	
				C_{h_e}	

TABLE II - ROTARY WING AERODYNAMIC COEFFICIENTS

C_X	C_Y	C_Z	C_l	C_m	C_n
$C_{X_o}(\alpha,\beta)$	$C_{y_o}(\alpha,\beta)$	$C_{Z_o}(\alpha,\beta)$	$C_{l_o}(\alpha,\beta)$	$C_{m_o}(\alpha,\beta)$	$C_{n_o}(\alpha,\beta)$
$C_{X_{ES}}(M)$	$C_{y_p}(\alpha,M)$	$C_{Z_\alpha}(\alpha,M)$		$C_{m_q}(\alpha,M)$	$C_{n_r}(\alpha,M)$
$C_{X_{LG}}(M)$	$C_{y_r}(\alpha,M)$	$C_{Z_q}(\alpha,M)$	$C_{l_\beta}(\alpha)$	$C_{m_{\dot\alpha}}(\alpha,M)$	$C_{n_p}(\alpha,M)$
$C_{X_{GE}}(h)$		$C_{Z_{GE}}(h)$	$C_{l_p}(\alpha,\beta)$	$C_{m_{ES}}(M)$	
$C_{X_{MR}}(\lambda,\mu)$	$C_{y_{\theta TR}}(\alpha_{TR},M)$	$C_{Z_{MR}}(\lambda,\mu)$	$C_{l_{A_1}}(\lambda,\mu)$	$C_{m_{GE}}(h)$	$C_{n_\beta}(\alpha,M)$
$C_{X_{HUB}}(\lambda,\mu)$	$C_{y_{A_1}}(\lambda,\mu)$	$C_{Z_{TR}}(\alpha_{TR},M)$		$C_{m_{MR}}(\lambda,\mu)$	$C_{n_{TR}}(\alpha_{TR}\mu)$
$C_{X_{\theta c}}(\mu,\lambda)$	$C_{y_{TR}}(\alpha_{TR},M)$	$C_{Z_{\theta c}}(\mu,\lambda)$		$C_{m_{B_1}}(\lambda,\mu)$	$C_{n_{MR}}(\lambda,\mu)$
$C_{X_{B_1}}(\lambda,\mu)$		$C_{Z_{\theta TR}}(\alpha_{TR},M)$		$C_{m_\alpha}(M)$	$C_{n_{\theta_{TR}}}(\alpha_{TR}M)$

the entire operating range of the aircraft. Axis systems shall be defined and the maximum range of the coefficients and variables shall be indicated. Aeroelastic and ground effects shall be included in the coefficients. Coefficients shall include behavior where applicable, for the effects of wing sweep and propwash. Applicable functions of asymmetrical operations (elevator, aileron, tabs, speed brakes, leading and trailing edge devices) shall also be included. Effects of control systems which normally are autopositioned, but which may malfunction, shall be included. Coefficients and delta changes due to external stores shall be provided. The coefficients of tables I and II are typical and are not to be considered all inclusive. The definitions of the coefficients of tables I and II are listed in Appendix I.

3.2.4.2 Maximum values.- Estimated maximum values based on the operating flight envelope shall be tabulated or plotted for the following, including various combinations of engine on and off for multi-engine aircraft.

(a) True airspeed

(b) Linear and angular accelerations and velocities (along and about aircraft's body axis system)

(c) Rates of climb, dive, and turn

(d) Altitude

(e) Mach number

(f) Rate of change of angle of attack

(g) Rate of change of angle of sideslip

(h) Roll rate

(i) Load factor both 1-G and maximum V-n diagrams

(j) Sink rate versus torgue at various altitudes and attitudes as a function of forward speed for rotary wing aircraft.

3.2.5 Aerodynamic test data.- The data specified herein shall be provided in accordance with the requirements of 3.1. The data shall provide families of curves; i.e., functions of 2, 3, or 4 variables, as applicable, to include the total range of aircraft performance.

3.2.5.1 Longitudinal stability and control, fixed wing.-

(a) Steady state trim points

(b) Longitudinal trim changes due to changes in thrust and surface deflections in the form of time history plots including landing gear position change

(c) Static longitudinal stability

(d) Dynamic longitudinal stability, short and long period with automatic stability and control system engaged and disengaged, including time histories

(e) Maneuvering stability.

3.2.5.2 Lateral-directional stability and control.-

(a) Static lateral-directional stability

(b) Dynamic lateral-directional stability with automatic stability and control system engaged and disengaged, including time histories

(c) Lateral control effectiveness.

3.2.5.3 Vertical stability and control, rotary wing/VTOL.-

(a) Vertical static stability

(b) Vertical dynamic stability.

3.2.5.4 Performance data.-

(a) Level flight acceleration at various altitudes and airspeeds

(b) Level flight deceleration at various altitudes and airspeeds

(c) Rate of climb

(d) Stall speeds versus gross weight and center of gravity

(e) High angle of attack flying qualities including time histories of significant characteristic phenomena such as wing rock, stall, and the like

(f) Mach number for buffet onset at various gross weights versus lift coefficient

(g) Variations of buffet amplitude (± g's) and frequency at pilot's seat as a function of Mach number and lift. Also, time histories of significant buffet activity associated with control surfaces, engine operation, or weapon firing

(h) Optimum approach speed versus gross weight

(i) Optimum approach speed, horizontal stabilizer incidence versus gross weight with time histories of airspeed, stabilizer position, engine control, flaps, and speed brakes during approach

(j) Time histories of typical departure dynamics including fully developed spins. Reference applicable National Aeronautic and Space Administration (NASA) Spin Tunnel Reports

(k) Other vibrations and jolt data associated with landing, gear extension and retraction, wing flaps, speed brakes, spoilers, slats, vanes, and other significant contributions

(l) Takeoff and landing time history plots

(m) Takeoff speeds versus gross weight

(n) Braking characteristics, speed versus time

(o) Effects of assymetric thrust or stores loading

(p) Weapon firing and release effects on launching aircraft.

3.2.5.5 Notation of axis systems.- The axis systems used shall be described with supporting detail.

3.2.6 Engine data.- Engine data shall include drawings, schematics, and descriptive material to define classification of engine, principles of operation, types, and features of engine subsystems and location of major components.

3.2.6.1 Engine performance data.- Engine performance data shall consist of the following:

(a) Curves, showing the performance of the engine at sea-level, 5000 feet, 10,000 feet, 15,000 feet, and 10,000 foot increments thereafter up to the maximum rated altitude of the engine, shall be furnished and, at each altitude, shall show the variation of the net thrust, fuel flow, air flow, tail pipe or exhaust temperature, and ram pressure ratio with true aircraft speed for various engine speeds throughout the operating range of the engine. Curves, showing fuel flow versus throttle control lever position (excluding conservation factor) for the full operating range of the aircraft for normal, and for emergency fuel control, shall be presented

(b) In the case of V/STOL aircraft, additional curves shall be provided as required to describe all performance factors in the transitional flight regime

(c) Engines which use water injection should include timing response, water flow rate, delta thrust, and temperature data, due to the technique

(d) Data showing all the installation losses and method of calculation

(e) Curves and data for engine operating limits

(f) Description, characteristics, and schematics for the control system used in manipulating variable geometry features of power plant installations

(g) Recirculation and grounds effects to engine operations

(h) External reverser characteristics when applicable

(i) Curves for adjustment derivatives shall be provided to determine the effect of ram recovery, compressor discharge bleed, power extraction, exhaust nozzle area resizing, engine anti-icing, and exhaust duct losses

(j) Windmill speeds and air start envelope

(k) Correction curves for engine performance due to altitude effects

(l) Malfunctions, with their cause, effect, proper corrective action required, and effects of no corrective action.

3.2.6.1.1 Engine transients.- Time histories shall be provided which provide data on all engine parameters for the following conditions:

(a) Controlled start from shutdown to idle

(b) Acceleration and deceleration from idle to 60 percent, 80 percent, and maximum speed

(c) Acceleration and deceleration for small (± 1/2 inch) excursions of the power lever about the optimum approach speed power settings.

3.2.6.2 Engine subsystems.- Pictorial drawings, schematics, wiring diagrams, and descriptive material shall be provided for the following engine subsystems to define operation, interface with, and control of the engine:

(a) Fuel feed system

(b) Fuel control system

(c) Lubrication system

(d) Ignition system

(e) Exhaust nozzle control system

(f) Anti-icing system

(g) Crew station displays and controls

(h) Fire detection and extinguish system.

3.2.6.3 Turboprop engines.- Data for turboprop engines shall consist of all applicable data of 3.2.6.2 and the following:

(a) Propeller data including data related to thrust coefficients, propeller advance ratio, and parameters pertaining to dynamic propeller performance

(b) Performance variations as a function of turbine inlet temperature

(c) Propeller schedules for ground and air modes

(d) Torque

(e) Feather performance including aerodynamic effects and transient times

(f) Data for malfunction backup systems such as negative thrust sensing shutdown, negative torque sensing controls, and decoupling.

3.2.6.4 Auxiliary power plant(s).- Description and schematic diagrams of the Auxiliary Power Plant (APP) system shall be provided, including operation and controls and interface data between the APP and the aircraft systems serviced.

3.2.7 Systems data.- Data for those systems which contain dynamic response characteristics, for example, surface control system or a hydraulic system, shall be presented. In addition, when component specification, specification control drawings or specification sheets are compiled, then such data shall be furnished for the respective component or system. The normal and emergency operation shall be given for each system. Data shall include the indications of failure, the corrective actions required, the results of the applied corrective action, and the results to the system and aircraft if the appropriate action is not taken. Data shall include canopy operation and seat control.

3.2.7.1 Surface control systems data.-

(a) Drawings of all surface control systems from controls to surface

(b) Control deflections versus surface deflections at no load including gearing characteristics. Control forces versus longitudinal accelerations, including control forces due to aircraft states; i.e., dynamic pressure, Mach, and propellers

(c) Boost tab (or other load relieving device) characteristics

(d) Power boost system

(e) Time histories of control deflection and force, surface deflection, trim actuation including hinge moment effects, and normal and side acceleration for control forces

(f) Friction characteristics, including static and dynamic coulomb and viscous friction

(g) Deformation characteristics

(h) Ratio of torque at stick and pedal axes to angular accelerations of respective controls

(i) Trim tab (or other trim device) deflections versus tab indicator readings, and control forces for given settings

(j) Rates of movement of trim and maneuvering devices, flaps, speed brakes, and other control surfaces for normal and degraded modes of operation

(k) Blowback characteristics and hinge moment limited deflections for all control surfaces

(l) Control system dynamics, including effects of artificial feel components and control feel devices such as bob weights and dynamic pressure bellows

(m) Breakout force characteristics

(n) Hysterisis characteristics

(o) Deflection due to activation of cockpit control devices ((trim, speed brakes, wing flaps, and the like)

(p) Control and surface limitations including function of hydraulic boost available, and the like.

3.2.7.1.1 Automatic stabilization and control systems data.- These data shall be provided for fixed wing aircraft in accordance with MIL-C-18244. For other types of aircraft, equivalent data shall be provided:

(a) Description and operation of automatic stabilization and control systems

(b) Dynamic characteristics of automatic stabilization and control surfaces

(c) Equation and transfer functions of automatic stabilization and control systems.

3.2.7.2 Electrical systems data.-

(a) Circuits and schematics of electrical systems and electronic system installations

(b) Electrical load analysis

(c) Voltmeter, ammeter, power meter, and frequency meter readings as a function of electrical system operation

(d) Detail of system management including normal and emergency procedures

(e) Description and schematic diagram of constant speed drive systems and systems controls

(f) Power source characteristics and controls, and regulators

(g) Descriptive data for any emergency power plant or ram air turbine

(h) Cockpit lighting and caution and advisory light data.

3.2.7.2.1 Interior lighting.- Data shall be provided to describe control panel lighting, instrument panel lighting, console lights, flood lights, utility lights, and the like. Data shall include wattages, illumination levels, filters, diffusers, and the like.

3.2.7.2.2 Exterior lighting.- Data shall be provided to describe all exterior lighting such as position, formation, anti-collision, fuselage, landing, and taxi lighting. The data shall include location, orientation, intensity or illumination level, field of illumination, and the like. Filter and lens data and rotation speed of anti-collision lights shall be provided.

3.2.7.3 Hydraulic and pneumatic systems data.-

(a) Description and schematic of hydraulic and pneumatic systems including detail system management for normal and emergency conditions

(b) Operating values of bypass valves, volume flow of pumps, volume flow through hydraulic motors, and hydraulic ram displacements

(c) Hydraulic and pneumatic pressure readings as a function of system operation including time histories of variations

(d) Pressure, temperature and mass flow characteristics of pneumatic systems.

3.2.7.4 Cabin pressurization system and pilot equipment support data.-

(a) Description, including schematic diagrams and control characteristics of pressurization system, cabin air conditioning system, G suit, oxygen, and full pressure suit systems

(b) Cabin altitude and its relation to aircraft altitude, cabin pressure control setting and the effect of engine shutdown

(c) Emergency cabin pressurization dump effects and the procedure for smoke and fumes elimination.

3.2.7.5 Armament control system data.-

(a) Description, including schematic diagrams and theory of operation of all gun, missile and rocket firing, bomb releasing systems, and safety

(b) Switch functions and sequence of operations for normal and emergency operation of these systems

(c) Time for each operation in each system

(d) Air data computer and other automatic weapon delivery systems

(e) Pictorial data for cockpit displays and data necessary to implement these displays

(f) Built-in-test controls and procedures.

3.2.7.6 Anti-icing system data.-

(a) Description of operation, including schematic diagrams

(b) Cycle times, response times and other response characteristics.

3.2.7.7 Fuel system data.-

(a) Description of installation and operation including schematic diagrams, operation pressures of valves, and volume flow of pumps as a function of RPM and pressure differences, inverted flight, and various "g" loadings

(b) Fuel pressure readings for each combination of boost pumps and engine pumps as a function of pump RPM and pressure differences, inverted flight, and various "g" loadings

(c) Maximum and minimum rates of consumption and rates of transfer and dump

(d) Details of fuel system management, including fuel flows under emergency conditions.

3.2.7.8 Emergency escape system data.-

(a) Description of operation of all emergency escape equipment, including drawings for same

(b) Procedure for use of emergency escape equipment.

3.2.7.9 Ground brake and steering system data.-

(a) Deceleration due to foot brakes as a function of brake pedal force and aircraft velocity, boost on and boost off, if applicable

(b) Pedal force versus pedal position for braking, boost on and boost off, if applicable. Also indicate system degradation as a function of number of brake applications under emergency operations

(c) Turn angle of nosewheel as a function of cockpit control deflection. Also cockpit control force shall be provided as a function of deflection, to include breakout and maximum force

(d) Description and operating characteristics of anti-skid systems

(e) Description and operating characteristics of braking chute and tail hook

(f) Takeoff and landing roll times including friction coefficients for dry and wet runway conditions.

3.2.7.10 Landing gear system data.-

(a) Rates of extension and retraction including effects of air speed and hydraulic pressure

(b) Forces for handle or control(s) operation

(c) Shock strut characteristics such as length of stroke and deflection

(d) Shock strut dynamics as a function of aircraft mass

(e) Tire deflection data.

3.2.7.11 Navigation equipment systems data.-

(a) Description of operation of navigation computer sets and display systems

(b) Description of inertial navigation system and radar altimeters

(c) Schematic diagrams, functional diagrams, and transfer functions of the complete system

(d) System for failures and malfunctions

(e) Description of operation and interface with other systems.

3.2.7.12 Aircraft instruments data.- The aircraft contractor shall supply the following data for all instruments. Installation information covering operating pressures, activation voltages, or other activating devices for instrument operation shall be provided.

(a) Description of normal and emergency operation of instrument

(b) Sources, form and range of instrument driving signals

(c) Instrument malfunction data presented for various cases of instrument failure or resulting from associated system failure

(d) Instrument reading tolerances and accuracy for scales indicated on the instrument face

(e) Instrument dynamics (e.g., rate of climb lag)

(f) Instrument reliability data

(g) Instrument qualification data showing dynamic data such as actual slew rates and damping.

3.2.7.13 Electronic equipment data.- The aircraft contractor shall supply the following data for all electronic and avionic equipments. These data shall include individual characteristics of each equipment and its installed characteristics.

(a) Power requirements data

(b) Preliminary stock list

(c) Operating and test procedures

(d) External wiring diagrams including power input circuitry

(e) Reports on contractor's test

(f) Detail equipment specification for CFE

(g) Installation specification

(h) Final engineering reports

(i) Drawing requirements for control units and panels

(j) Engineering change data.

3.2.7.14 Communication and identification system.- Communication and identification system data for the following areas shall be provided by the aircraft contractor:

(a) A detailed description of all types used in the aircraft and including the type number, modification letters, operation, operating frequencies, manufacturer, and control box type and associated indicators

(b) System diagrams of intercabling between receivers, transmitter, control and power sources

(c) Control panel data covering the following shall be furnished:

(1) Type and number of each control panel used with each type of radio receiver

(2) Schematic diagram of the control panels

(3) Drawings and photos showing mounting dimensions and types of fasteners

(4) Panel manufacturer

(d) Circuit and schematic drawings description of operation and management, and system failures and malfunctions.

3.2.7.15 Aircraft sound recordings data.- The aircraft contractor shall supply typical aircraft sound recordings on tape as follows:

(a) Tape characteristics:

(1) One-quarter inch wide plastic backing sound recording magnetic tape

(2) Recorded at 7 1/2 or 15 inches per second

(3) Recorded through a system with a minimum frequency response of 50 to 15,000 cycles per second with plus or minus 5 decibels

(b) Recording content

(1) Sounds as heard by the flight personnel inside the aircraft at the pilot's station and the crew or tactics station(s) of the aircraft shall be recorded

(2) Sounds shall include starting, taxiing, take-off and in-flight and landing modes, and shut down, including wind noise versus speed, with voice annotations for each condition. The sounds shall be identified for both open and closed canopy while on the ground and for specific speed ranges while airborne

(3) Sounds of any aircraft equipment which may be audible to the aircraft personnel. Flight, ground, and weapons sounds shall include detection and track data/characteristics for all radar modes, switching procedures for mode control, and cockpit displays and controls.

3.2.7.16 Radar system.- Radar system data shall include the following:

(a) Type (pulse, doppler, attack, terrain following, and the like)

(b) Modes of operation and a description of each mode

(c) Antenna:

(1) Scan pattern generator equations

(2) Tracking equations

(3) Radiation pattern for all modes including side and back lobes

(4) Stabilization platform transfer function, with respect to aircraft and ground reference

(5) Scan rates

(d) Transmitter:

(1) Pulse repetition frequency (PRF) in each mode

(2) Pulse width in each mode

(3) Peak and mean power

(4) Frequency

(5) Special capabilities such as jitter, pulse compression, stagger, and the like

(e) Receiver (for each mode):

(1) Automatic gain control (AGC) characteristics

(2) Linear/Logarithmic characteristics

(3) Detection capability including minimum detectable level

(4) Special processing for displays

(5) Noise figures

(6) Special effects such as jamming response

(7) Video bandwidth

(8) Dynamic range

(f) Tracking system (for each mode):

(1) Ranging capability including maximum and minimum ranges and range rate

(2) Velocity capability

(3) Lock-on characteristics in terms of signal strength and range rate

(4) Resistance to jamming

(5) Break lock criteria such as signal strength, manual control, and the like

(6) Air to ground ranging criteria

(7) Details of interface with other displays, fire control system, and on board computer

(g) Display system (for each mode):

(1) Photographs, movies or video tapes to illustrate the effects of radar mode and noise, jamming, target returns, environmental conditions, and equipment status

(2) Sensitivity to input signals (shades of gray versus video signal strength)

(3) Photographs of various display presentations (A scope, B scope, pulse doppler, and the like)

(4) Photographs of ground maps and descriptions of system use in navigation fixing with cursors or other interactive controls

(5) Response times of display changes due to changes in controls and radar modes

(h) Scan converter characteristics

(i) Cooperating systems:

(1) Functional diagrams and descriptions showing interfaces with all other cooperating systems

(2) Interface specifications.

3.2.7.17 Head up display (HUD).- Data shall be provided for the head up display as follows:

(a) Description of modes of operation and correlated symbolic displays, with photographs

(b) Field of view relative to eye point, with details

(c) Standby reticle

(d) Mirror deflections

(e) Cooperating systems:

(1) Description and functional diagrams showing interface of the HUD with other systems and equipment

(2) Interface specifications with all external interface signals.

3.2.7.18 On board computer.- On board computer data shall include the following:

(a) A complete description of the operation and performance of each computer, to include computer architecture, word length, memory, memory access and timing, cycle time, iteration rates, data transfer format and rates, programming language and instructions, analog to digital and digital to analog conversion equipment, interface with other aircraft systems, and the like

(b) Software documentation including programming manuals

(c) A complete set of software including operational software, support software, and diagnostic routines.

3.2.7.19 Tactics.- The following tactics data shall be furnished:

(a) Radar homing and warning system (RHAWS)

(1) Nomenclature

(2) Description of controls for all threats

(3) System schematics or equations showing decision logic and system operation, with narrative descriptions

(4) Interaction with other systems such as radar, audio, and countermeasures

(5) Audio tone characteristics and criteria

(6) Receiver sensitivity

(b) Electronic countermeasures (ECM):

(1) Controls and system response

(2) Interface with other tactics systems

(c) Countermeasures dispenser system:

(1) Description of control and indicators

(2) Break track characteristics

(3) Interaction with other tactics systems

(d) Jammers

(1) Nomenclature and description

(2) Transmitted power

(3) Frequency, bandwidth, and the like.

3.2.7.20 Weapon descriptions.- Weapon descriptions shall include the following information for weapons as applicable:

(a) Nomenclature

(b) Type and quantity per station and release sequence

(c) Ballistic characteristics for trajectory and impact prediction

(d) Prelaunch procedures

(e) Missile antenna characteristics

(f) Launch criteria

(g) Search and lock on tone frequency and indicators

(h) Lethal envelope

(i) Homing characteristics

(j) Manual control inputs

(k) Firing rate

(l) Dispersion.

3.2.7.21 Anti-submarine warfare (ASW).- A complete description of all acoustic and non-acoustic ASW systems shall be provided including active and passive acoustic processing, magnetic anomaly detection (MAD), dipping sonar, sonobuoys, acoustic arrays, advanced sonobuoy communication link (ASCL), mission recorders, smoke markers, sound underwater source (SUS), and the like. Data shall also be provided on interface and integration with other aircraft systems.

3.2.8 Characteristics and performance data.- When required, copies of Standard Aircraft Characteristic Charts shall be submitted in accordance with MIL-C-5011. Substantiating performance data shall be submitted by the aircraft contractor as described below.

3.2.8.1 Estimated flying qualities.- Estimated flying qualities shall be submitted by the aircraft contractor in accordance with MIL-F-8785.

3.2.8.2 Demonstration data.- The following reports shall be submitted in accordance with MIL-D-8708:

(a) Aerodynamic Demonstration Report

(b) Power Plant Demonstration Report

(c) Equipment Demonstration Report

(d) Demonstration Progress Report

(e) Electronic Demonstration Report (where applicable)

(f) Special Weapon Demonstration Report.

3.2.9 Handbooks.- Copies of the Pilot's Flight Handbook, as specified in MIL-D-8706, and the Aircraft Handbook of Maintenance Instructions and Parts Catalog shall be furnished.

3.2.10 Photographs.- Aircraft mockup color photographs specified in MIL-D-8706 and general color photographs of the cockpit and crew area shall be submitted.

3.2.11 Human engineering task analysis data.- Data generated on aircrew and maintenance tasks under MIL-H-46855 shall be furnished.

3.3 Data summary reports.- The aircraft contractor shall submit Data Summary Reports. The summary reports shall contain titles and delivery dates of all data submitted. When data submittal dates are revised, both the original and revised date shall be noted accordingly.

3.4 Consulting services.- Consulting services relating to the data specified herein shall be provided by the design basis aircraft contractor, as required during the entire contract period. The consulting services shall include, but not be limited to, resolution of questions and interpretation of data. It shall also include the review of trainer design and test criteria. The consulting services shall include liaison with Government procuring activity personnel and trainer personnel. Participation at trainer mockup and design reviews, and provision for test pilot participation in testing of the trainer shall be provided.

3.5 Revision of data.- Data shall be updated on a continuing basis throughout the life of the contract to incorporate aircraft changes and include more recent or accurate data, resulting from laboratory and flight test programs. As new versions of aircraft are developed and produced, data shall be updated to include differences in configuration and performance. Data revisions shall indicate the serial number(s) of applicable aircraft.

3.6 Data accuracy and maturity reports.- Data accuracy and maturity reports shall be submitted to define the accuracy and maturity of data provided. The reports shall also include the source of all data, such as predicted, wind tunnel, laboratory tests, flight test, vendor specifications, and the like. The reports shall also provide a plan for providing new and revised data as the aircraft program progresses. The initial report shall be provided with the initial data submission of data and additional reports or revisions shall be provided with data revisions and updates.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection.- Unless otherwise specified in the contract or purchase order, the data supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the supplier may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Inspection and acceptance.-

4.2.1 Inspection.- The Government inspector will examine all design data for completeness, and for compliance with applicable specifications and contractual requirements. Design data not conforming to applicable requirements will be returned to the aircraft contractor for revision prior to submittal. The Government inspector will include and forward comments by endorsement on the contractor's forwarding letter.

4.2.1.1 Design data summary report.- The Government inspector will review the design data summary reports and comment accordingly when forwarding the summary and revisions.

4.2.2 Completeness of design data and drawings.- In the acceptance of design data, the Government procuring activity will not check or assume

responsibility for accuracy or completeness of details or for any deviation from applicable specifications unless specifically approved. All authorized deviations from the aircraft contract detail specification and other applicable specifications shall be specifically brought to the attention of the Government procuring activity.

4.2.2.1 Revision of design data.- Revisions of design data and drawings which have been previously supplied to the procuring activity or to the trainer manufacturer shall be distributed in the same quantity and manner as the original data.

5. PACKAGING

5.1 Delivery requirements.- The delivery requirements of MIL-D-5480 shall apply to the design data and reports specified herein.

6. NOTES

6.1 Intended use.- The data supplied shall be of sufficient accuracy and detail to permit the design and manufacture of aviation training devices.

6.2 Restriction on use of design data.- Contract design data and related information furnished under this specification shall not bear any notation limiting or restricting its use by the Government in any manner whatsoever.

6.3 Deviations.- Deviations from this specification shall not be made unless specified in contract amendments, or by other written authorization of the Government procuring activity.

6.4 Security classification.- Classified design data and drawings shall contain the proper security classification on drawings and on each page of reports, specifications, and photographs, in accordance with existing security regulations.

6.5 Vendor data.- Vendor handbooks and data may be furnished for items such as navigation, communications, electronic equipment, radar, on board,

computer, and the like, provided the requirements of this specification are met.

6.6 Definitions.-

6.6.1 Weapon system trainer (WST).- The weapon system trainer is an electromechanical device simulating an aircraft's flight systems, weapon systems, electronic and avionic systems, and engine characteristics for the purpose of training air crews in the full mission of the aircraft. Crew response to search, detection, intercept and attack systems, to simulated targets, and simulated flight are integrated in the WST.

6.6.2 Operational flight trainer (OFT).- The operational flight trainer is an electromechanical device simulating an aircraft's flight, systems, weapon systems, electronic and avionic systems, and engine characteristics resulting from operation of the aircraft's controls to the degree necessary to provide effective training in operation and control of the aircraft.

6.6.3 Tactics trainer.- The tactics trainer is an electromechanical device simulating the electronic and avionic operational systems of an aircraft for the purpose of air crew training in tactical use of the aircraft and its equipment.

6.6.4 Procedure trainer.- The procedure trainer is a device used to train aviation personnel in normal, alternate and emergency procedures, and aircraft systems management involved in the operation of a given aircraft.

Custodians:
Navy - TD

Review Activities:
Navy - AS, OS

Preparing Activity:
Navy - TD

Project No. 6930-N099

APPENDIX I

10. Scope.- This appendix defines the aerodynamic coefficients of tables I and II of the specification.

20. Fixed wing aerodynamic coefficients definitions.- See table I:

NOTE: Stability derivatives, $C_{\underline{a}_{\underline{b}}} = \frac{\partial C\underline{a}}{\partial \underline{b}}$

C_X - Total x-axis force coefficient

$C_{X_o}(\alpha,M)$ - x-axis force coefficient with all perturbations zero; a function of Mach number (M) and angle of attack (α)

$C_X(\beta)$ - Change in x-axis force coefficient due to sideslip angle (β) (all perturbations zero except β), a function of sideslip angle

$C_{X_{\delta_F}}$ - Change in x-axis force coefficient due to flap extension (δF) (all purturbations zero except δF); a function of angle of attack

$C_{X_{\delta_B}}$ - Change in x-axis force coefficient due to speed brake deflection of δB) (all perturbations zero except δB); a function of Mach number

C_{X_α} - Change in x-axis force coefficient due to changes in angle of attack (α) (all purturbations zero except α); a function of Mach number and angle of attack

$C_{X_{ES}}$ - Change in x-axis force coefficient due to External Stores (ES); a function of Mach number

$C_{X_{LG}}$ - Change in x-axis force coefficient due to Landing Gear (LG); a constant

C_{X_u} - Change in x-axis force coefficient due to changes in aircraft forward velocity (u) (all perturbations zero except u); a constant, K

C_{X_A} - Change in x-axis force coefficient due to afterburner operation

C_{X_N} - Change in x-axis force coefficient due to engine nozzle position

C_{X_W} - Change in x-axis force coefficient due to windmilling engine(s)

C_y - Total y-axis force coefficient

$C_{y_{\beta(M,\alpha)}}$ - Side force coefficient due to rate of sideslip

$C_{y_{\delta_R}}$ - Changes in y-axis force coefficient due to rudder deflection (δR) (all perturbations zero except δR); a function of Mach number

C_{y_r} - Change in y-axis force coefficient due to changes in rate of yaw (r) (all perturbations zero except r); a function of Mach number and angle of attack

C_{y_p} - Change in y-axis force coefficient due to changes in roll rate (p) (all perturbations zero except p); a function of Mach number and angle of attack

$C_{y_{\delta_{SP}}}$ - Change in y-axis force coefficient due to spoiler deflection

$C_{y_{\delta_a}}$ - Side force coefficient aileron deflection as a function of sideslip angle

C_{y_g} - Side force coefficient due to landing gear as a function of sideslip angle

$C_{y_\beta}(\delta F)$ - Side force coefficient due to sideslip angle as a function of flap deflection

C_z - Total z-axis force coefficient

$C_z(\alpha,M)$ - z-axis force coefficient with all perturbations zero; a function of Mach number (M) and angle of attack (α)

$C_{z_{\delta_E}}$ - Change in z-axis force coefficient due to elevator deflection (δE) (all perturbations zero except δE); a function of Mach number

$C_{z_{\delta_F}}$ - Change in z-axis force coefficient due to flap deflection (δF) (all perturbations zero except δF); a constant, K

C_{z_α} - Change in z-axis force coefficient due to changes in angle of attack (α) (all perturbations zero except α); a function of angle of attack and Mach number

$C_{z_{\dot{\alpha}}}$ - Change in z-axis force coefficient due to changes in angle of attack rate of change ($\dot{\alpha}$) (all perturbations zero except $\dot{\alpha}$); a function of Mach number

$C_{z_{\delta E_t}}$ - Change in z-axis force coefficient due to elevator trim deflection (δE_t) (all perturbations zero except δE_t); a function of Mach number

C_{z_q} - Change in z-axis force coefficient due to changes in rate of pitch (q) (all perturbations zero except q); a function of Mach number

C_{z_u} - Change in z-axis force coefficient due to changes in aircraft forward velocity (u) (all perturbations zero except u); a function of Mach number

C_l - Total rolling moment coefficient

C_{l_β} - Change in rolling moment coefficient due to change in sideslip angle, β (all perturbations zero except sideslip angle β); a function of angle of attack and Mach number

C_{l_r} - Change in rolling moment coefficient due to change in rate of yaw (r) (all perturbations zero except r); a function of angle of attack and Mach number

C_{l_p} - Change in rolling moment coefficient due to change in rate of roll (p); (all perturbations zero except p); a function of angle of attack and Mach number

$C_{l_{\delta R}}$ - Change in rolling moment coefficient due to rudder deflection (δR) (all perturbations zero except δR); a function of angle of attack and Mach number

$C_{l_{\delta A}}$ - Change in rolling moment coefficient due to aileron deflection (δA) (all perturbations zero except δA); a function of angle of attack and Mach number

$C_{l_{\delta A_t}}$ - Change in rolling moment coefficient due to aileron trim deflection (δA_t) (all perturbations zero except δA_t); a function of angle of attack and Mach number

$C_{l_{\delta R_t}}$ - Change in rolling moment coefficient due to rudder trim deflection, δR_t; (all perturbations zero except δR_t); a function of angle of attack and Mach number

$C_{l_{ES}}$ - Change in rolling moment coefficient due to external stores (ES); a function of Mach number

$C_{l_{\delta SP}}$ - Change in rolling moment coefficient due to spoiler deflection

C_{l_g} - Rolling coefficient due to landing gear

C_{h_a} - Hinge moment coefficient, aileron

C_m - Total pitching moment coefficient

$C_{m_o}(\alpha,M)$ - Pitching moment coefficient with all perturbations zero; a function of angle of attack and Mach number

C_{m_α} - Change in pitching moment coefficient due to change in angle of attack (α) (all perturbations zero except angle of attack α); a function of angle of attack and Mach number

$C_{m_{\dot{\alpha}}}$ - Change in pitching moment coefficient due to change in angle of attack rate ($\dot{\alpha}$); (all perturbations zero except $\dot{\alpha}$); a function of Mach number

C_{m_q} - Change in pitching moment coefficient due to change in rate of pitch (q) (all perturbations zero except q); a function of Mach number

$C_{m_{\delta_E}}$ - Change in pitching moment coefficient due to elevator deflection δE (all perturbations zero except δE); a function of Mach number

$C_{m_{\delta_F}}$ - Change in pitching moment coefficient due to flap deflection δF (all perturbations zero except δF); a constant, K

$C_{m_{\delta_B}}$ - Change in pitching moment coefficient due to speed brake deflection δB (all perturbations zero except δB); a function of angle of attack and Mach number

$C_{m_{ES}}$ - Change in pitching moment coefficient due to External Stores (ES); a function of Mach number

C_{m_u} - Change in pitching moment coefficient due to change in aircraft forward velocity (u) (all perturbations zero except u); a function of Mach number

$C_{m_{LG}}$ - Change in pitching moment coefficient due to Landing Gear (LG); a constant

$C_{m_{\delta_{E_t}}}$ - Change in pitching moment coefficient due to elevator trim deflection (δE_t) (all perturbations zero except δE_t); a function of Mach number

C_{h_e} - Hinge moment coefficient, elevator

C_n - Total yawing moment coefficient

C_{n_β} - Change in yawing moment coefficient due to changes in sideslip angle (β) (all perturbations zero except β); a function of angle of attack and Mach number

$C_{n_{\delta_R}}$ - Change in yawing moment coefficient due to rudder deflection (δR) (all perturbations zero except δR); a function of angle of attack and Mach number

$C_{n_{\delta_A}}$ - Change in yawing moment coefficient due to aileron deflection (δA) (all perturbations zero except δA); a function of angle of attack and Mach number

C_{n_r} - Change in yawing moment coefficient due to change in rate of yaw (r) (all perturbations zero except r); a function of angle of attack and Mach number

C_{n_p} - Change in yawing moment coefficient due to change in rolling rate (p) (all perturbations zero except p); a function of angle of attack and Mach number

$C_{n_{\delta_{R_t}}}$ - Change in yawing moment coefficient due to rudder trim deflection (δR_t) (all perturbations zero except δR_t); a function of Mach number

$C_{n_{ES}}$ - Change in yawing moment coefficient due to External Stores (ES); a function of Mach number.

$C_{n_{\delta_{SP}}}$ - Change in yawing moment coefficient due to spoiler deflection

C_{h_r} - Hinge moment coefficient, rudder

30. Rotary wing aerodynamic coefficients definitions.- See table II.

C_x - Total x-axis force coefficient

$C_{x_o}(\alpha,\beta)$ Fuselage x-axis force coefficient with all perturbations zero; a function of angle of attack and sideslip angle

$C_{x_{ES}}$ - Change in x-axis force coefficient due to External Stores; a function of Mach number

$C_{x_{LG}}$ - Change in x-axis force coefficient due to Landing Gear; a function of Mach number

$C_{x_{GE}}$ - Change in x-axis force coefficient due to Ground Effect (all other perturbations zero); a function of altitude

$C_{xMR}(\lambda,\mu)$ - Main rotor x-axis force coefficient with all perturbations zero; a function of inflow ratio (λ) and tip speed ratio (μ)

$C_{xHUB}(\lambda,\mu)$ - Hub x-axis force coefficient; a function of inflow ratio and tip speed ratio

$C_{x_{\sigma_c}}$ - Change in x-axis force coefficient due to change in collective blade pitch angle (σ_c) (all perturbations zero σ_c); a function of inflow ratio and tip speed ratio

$C_{x_{\beta_1}}$ - Change in x-axis force coefficient due to change in longitudinal cyclic blade pitch angle (β_1) (all perturbations zero except β_1); a function of inflow ratio and tip speed ratio

C_y - Total y-axis force coefficient

$C_{y_o}(\alpha,\beta)$ - Fuselage y-axis force coefficient with all perturbations zero; a function of angle of attack and sideslip angle

C_{y_p} - Change in y-axis force coefficient due to change in rate of roll (all perturbations zero except p); a function of angle of attack and Mach number

C_{y_r} - Change in y-axis force coefficient due to change in yaw rate (all perturbations zero except r); a function of angle of attack and Mach number

$C_{y_{TR}}(\lambda,\mu)$ - Tail rotor y-axis force coefficient with all perturbations zero; a function of tail rotor angle of attack and Mach number

$C_{y_{\sigma_{TR}}}$ - Change in y-axis force coefficient due to change in tail rotor blade pitch angle (σ_{TR}) (all perturbations zero except σ_{TR}); a function of tail rotor angle of attack and Mach number

$C_{y_{A_1}}$ - Change in y-axis force coefficient due to change in lateral cyclic blade pitch angle (A_1) (all perturbations zero except A_1); a function of λ and μ

C_z - Total z-axis force coefficient

$C_{z_o}(\alpha,\beta)$ - Fuselage z-axis force coefficient with all perturbations zero; a function of angle of attack and Mach number

$C_{z_{\dot{\alpha}}}$ - Change in z-axis force coefficient due to change in angle of attack rate (all perturbations zero except $\dot{\alpha}$); a function of angle of attack and Mach number

C_{z_q} - Change in z-axis force coefficient due to change in rate of pitch (all perturbations zero except q); a function of angle of attack and Mach number

$C_{z_{GE}}$ - Change in z-axis force coefficient due to Ground Effect (all other perturbations zero); a function of altitude

$C_{z_{MR}}(\lambda,\mu)$ - Main rotor z-axis force coefficient with all perturbations zero; a function of λ and μ

$C_{z_{TR}}$ - Tail rotor z-axis force coefficient with all perturbations zero; a function of tail rotor angle of attack and Mach number

$C_{z_{\sigma_c}}$ - Change in z-axis force coefficient due to change in collective blade pitch angle (all perturbations zero except σ_c); a function of inflow ratio and tip speed ratio

$C_{z_{\sigma_{TR}}}$ - Change in z-axis force coefficient due to change in tail rotor blade pitch angle (all perturbations zero except σ_{TR}); a function of tail rotor angle of attack and Mach number

C_l - Total rolling moment coefficient

$C_{l_o}(\alpha,\beta)$ - Fuselage rolling moment coefficient with all perturbations zero; a function of angle of attack and sideslip angle

C_{l_β} - Change in rolling moment coefficient due to change in sideslip angle (all perturbations zero except β); a function of angle of attack

C_{l_p} - Change in rolling moment coefficient due to change in roll rate (all perturbations zero except p); a function of angle of attack and sideslip angle

$C_{l_{A_1}}$ - Change in rolling moment coefficient due to change in lateral cyclic blade pitch angle (all perturbations zero except A_1); a function of inflow ratio and tip speed ratio

C_m - Total pitching moment coefficient

$C_{m_o}(\alpha,\beta)$ - Fuselage pitching moment with all perturbations zero; a function of angle of attack and sideslip angle

C_{m_q} - Change in pitching moment coefficient due to change in pitch rate (all perturbations zero except q); a function of angle of attack and Mach number

$C_{m_{\dot{\alpha}}}$ - Change in pitching moment coefficient due to change in angle of attack rate (all perturbations zero except $\dot{\alpha}$); a function of angle of attack and Mach number

$C_{m_{GE}}$ - Change in pitching moment due to Ground Effect; a function of altitude

$C_{m_{MR}}$ - Main rotor pitching moment with all perturbations zero; a function of inflow ratio and tip speed ratio

$C_{m_{\beta_1}}$ - Change in pitching moment coefficient due to change in longitudinal cyclic blade pitch angle (all perturbations zero except β_1); a function of inflow ratio and tip speed ratio

C_{m_α} - Change in pitching moment coefficient due to change in angle of attack (all perturbations zero except α); a function of Mach number and angle of attack

C_n - Total yawing moment coefficient

$C_{n_o}(\alpha,\beta)$ - Fuselage yawing moment coefficient with all perturbations zero; a function of angle of attack and sideslip angle

C_{n_r} - Change in yawing moment coefficient due to change in yaw rate (all perturbations zero except r); a function of angle of attack and Mach number

C_{n_p} - Change in yawing moment coefficient due to change in roll rate (all perturbations zero except p); a function of angle of attack and Mach number

C_{n_β} - Change in yawing moment coefficient due to change in sideslip angle (all perturbations zero except β); a function of angle of attack and Mach number

$C_{n_{MR}}$ - Main rotor yawing moment coefficient with all perturbations zero; a function of inflow ratio and tip speed ratio

$C_{n_{TR}}$ - Tail rotor yawing moment coefficient with all perturbations zero; a function of tail rotor angle of attack and Mach number

$C_{n_{\sigma_{TR}}}$ - Change in yawing moment coefficient due to tail rotor blade pitch angle (all perturbations zero except σ_{TR}); a function of tail rotor angle of attack and Mach number

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STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

OMB Approval
No. 22-R255

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