MILITARY SPECIFICATION

CHARTS: STANDARD AIRCRAFT CHARACTERISTICS AND PERFORMANCE, HELICOPTER

This specification has been approved by the Naval Air Systems Command, Department of the Navy.

1. SCOPE

1.1 Scope - This specification governs the definitions of requirements for, and methods of presenting characteristics and performance for Navy helicopters.

1.2 Application - For all helicopters proposed or contracted for subsequent to the effective date of this specification, characteristics and performance data shall be prepared and presented in accordance with the provisions of this specification and submitted to the Naval Air Systems Command. Deviations from the provisions of this specification to portray more adequately the capability of certain helicopters are permissible, but shall in all cases be approved by the Naval Air Systems Command. Authorized devriations shall be fully explained through proper annotations on the data charts.

1.3 Types of Charts - Characteristics and performance data shall be presented on the following types of charts as required by the Navy, and utilizing format as provided. Unauthorized reproduction of such charts is prohibited.

1.3.1 Standard Aircraft Characteristics Charts - The Standard Aircraft Characteristics Charts are intended to provide staff personnel with a concise, accurate compilation of physical characteristics and performance capabilities of a helicopter. Standardization is required for convenience and to allow direct comparison with other helicopters intended for a similar mission.

1.3.1.1 Arrangement - The Standard Aircraft Characteristics Chart is basically composed of nine pages with provisions for supplemental pages as required by the Naval Air Systems Command. If certain pages are not required for a specific helicopter, they shall be omitted and the remaining pages renumbered consecutively.

1.3.1.1.1 Basic - The arrangement of the Standard Aircraft Characteristics Chart shall be as follows:

(a) Page 1 - Cover sheet which shall include a photograph or perspective drawing of the helicopter model.

(b) Page 2 - A drawing showing a descriptive arrangement of the helicopter, and a drawing showing the armament installations, the tankage installation, and cargo space or interior arrangements as required by the Navy.

(c) Page 3 - Mission, description, and principal characteristics of the helicopter.

(d) Page 4 - Performance data for the aircraft in tabulated form with applicable notes.

(e) Page 5 - Auxiliary performance page giving the alternate loadings and the respective radii and associated performance, where applicable.

(f) Page 6 - Performance graphs. Speed, hover ceiling, vertical climb, and forward flight climb.

(g) Page 7 - Performance graphs. Payload radius and other as applicable.

(h) Page 8 - External store loadings. Tabulated stores and stations on which they may be carried, if applicable.

(i) Page 9 - Notes. Mission profiles, applicable allowances, explanatory notes.

1.3.2 Characteristics Summary Chart - The Characteristics Summary Chart is intended to present a summary of performance capabilities on the basic mission and principal features in abbreviated format. Data shown on the Characteristics Summary Chart shall be in agreement with similar data shown on the Standard Aircraft Characteristics Charts. The oversize format ($14\frac{1}{2}$" x 10 7/8"), NAVWEPS Form 13100/7 (Rev. 7-65) may be obtained on request from the Naval Air Systems Command. Image size of the prints when finally reproduced by the procuring agency shall be $7\frac{1}{4}$" x $9\frac{1}{2}$" positioned on a sheet size of 8" x $10\frac{1}{2}$".

1.3.3 Supplemental Charts - Helicopter characteristics and performance data not coming within the scope of the Standard Aircraft Characteristics charts shall be presented on Supplemental pages. Reasons for preparing Supplemental pages may be as follows:

(a) Possible special loadings or extreme overload conditions which may:

(1) Be used in restricted tactical operations

(2) Involve non-standard procedures and special operating techniques.

(3) Show the maximum potential use of certain helicopters in special missions.

(b) Such loadings that may involve equipment which, for security reasons, are only suitable for limited distribution.

(c) Theater operations involving non-standard atmospheric conditions.

(d) To show inboard profiles, additional drawings, illustrations, and graphs.

The Supplemental page format should be the same as the Standard Aircraft Characteristics Chart or may consist of a special design suitable for binding along with the corresponding basic Standard Aircraft Characteristics Chart.

1.4 Categories - The foregoing charts shall be identified by Categories to show the development status of the helicopter or data involved. All chart format shall be completed in full detail.

1.4.1 Proposal - Proposal data charts are intended to provide information during the evaluation of new designs, design studies, and proposed modifications of existing designs and are primarily for limited distribution within the procuring agency.

1.4.2 Pre mock-up - Pre mock-up charts are intended to provide information on new designs during the initial period from source selection to completion of mock-up. The initial pre mock-up chart need not include the effect of all design changes recommended by the Navy, but should contain under notes a complete list of major design changes.

1.4.3 Pre-service - Pre-service charts are intended to provide information on new designs from the period of time from completion of mock-up to rollout of flight test article. Initial pre-service chart will normally be issued as soon after mock-up as configurations and weight have stabilized to define the initial test article to be fabricated.

1.4.4 Service - Service data charts are intended to provide information on service models. Preparation of the initial issue of a chart on a service model shall normally be initiated not later than when the configuration and weight have stabilized following mock-up inspection. Thus it may take the place of pre service chart or may be delayed until after initial flight test if design changes are anticipated therefrom.

1.5 Markings - Each of the foregoing chart types shall be marked as follows:

1.5.1 Designation - The military model designation or the contractor's model designation (in the case of charts in the proposal category) shall be shown on the lower outer corner.

1.5.2 Category - The chart category as defined in para. 1.4 shall be shown in the upper outer corner.

1.5.3 Date - The date of publication will be specified by the procuring agency and shall be shown on the lower inner corner.

1.5.4 Security - The security classification shall be specified by the procuring agency and shall be shown at top and bottom.

1.5.5 Chart Identification - The upper inner corner is to be used for chart identification. Identification numbers shall be obtained from the Naval Air Systems Command prior to submittal of the charts for approval.

2. APPLICABLE SPECIFICATIONS AND OTHER PUBLICATIONS

The following publications, of the issue in effect on the date of invitation for bids, shall form a part of this specification to the extent specified herein:

2.1 Primary Publications

Military

MIL-D-7822	Drawings; For Standard Aircraft Characteristics and Performance Charts, Piloted Aircraft

MIL-F-5572	Fuel; Aircraft Reciprocating Engine
MIL-F-5616	Fuel; Aircraft Engine, Grade JP-1
MIL-F-5624	Fuel; Aircraft Turbine and Jet Engine, Grades JP-3 and JP-4
MIL-F-5624C	Fuel; aircraft turbine and jet engine Grade JP-5
MIL-STD-210A	Climatic Extremes for Military Equipment, 2 Aug 57

Air Force - Navy - Civil Aeronautical

ANC-2a	ANC Bulletin	Ground Loads

2.2 Other Publications

Air Force - Naval Technical Order

AN 01-1B-40 Handbook of Weight and Balance Data

AS 2694 Engines, Aircraft, Turboshaft and Turboprop, General specification for, 21 Jan 71. (Copies of specifications, standards, and drawings required by contractors in connection with specific procurement functions should be obtained from the procuring agency or as directed by the contracting officer.)

3. REQUIRMENTS

3.1 General - Unless otherwise specified by the Navy, preparation by contractors of Charts (and revision thereto) for each model shall include the preparation of photographically reproducible copy in the required types and categories, and, in addition, satisfactory reports containing supporting characteristics and performance data.

3.1.1 Revisions - Revisions to the charts shall be prepared and submitted by the contractor throughout the life of the contract. Unless otherwise specified by the Navy, revisions are required whenever significant changes in vehicle configuration or data occur, as for:

(1) A change in vehicle dimensions

(2) An accumulation of weight changes resulting in a significant performance change

(3) A change in power plant designation, augmentation, or power plant rating.

(4) The addition of external stores.

(5) The availability of test data or new test data showing significant performance change.

(6) When specifically directed by the procuring agency.

3.1.1.1 Criteria - The following criteria will be used in forming a judgment as to whether a significant change in performance exists:

(1) A change of 5% or more in drag.

(2) A change of 5% or more in specific fuel consumption.

(3) A change in weight which in itself results in a change of 5% or more in mission radius or range.

(4) Any combination of two or more of the above resulting in a change of 5% or more in mission radius or range.

3.1.1.2 Number - Each chart shall cover only one aircraft model. For the information of the contractor, the following guide is given regarding the probable number of charts and revisions thereto which are required throughout the life of the aircraft model. The exact number of revisions required will depend on the number of aircraft changes experienced.

Category of Chart	Reason	Basis for Data
Proposal	New Design	Estimated
Mock-up	Contract for New Aircraft	Estimated
Pre Service	Between Mock-up and First Flight	Estimated
Service	Flight Tests	Flight Test
Service (Revision)	Operational or Fleet Introduction	Flight Test
Service (Revision)	Operational Flight Test	Flight Test of Service Aircraft

3.2 Substantiating Data - All data presented on the charts shall be substantiated by reports which shall be submitted with the charts. The reports may be in legible rough draft form utilizing the contractor's work-sheet copy, but they shall be complete and shall contain a list of adequate references, authority, and justification for all data used. Contractors are free to use calculation methods of their own selection, but such methods shall be fully explained, and sample calculations shall be given. Calculations shall be presented in sufficient detail to permit ready review and check of conclusions, and to enable additional calculations to be made by the procuring agency as required.

3.2.1 Basic Aerodynamic Data - Prior to preparation of the formal Substantiating Data Report, the approval of the Navy shall be obtained for the data which will form the basis for the Standard Aircraft Characteristics charts. These basic data, including adequate calculations and material for verification shall include:

(1) Low speed drag data itemized according to various aircraft components (fuselage, hub, etc)

(2) Fuselage characteristics. Plots of angle of attack vs C_L & C_D of fuselage.

(3) Net thrust - or horsepower - available data with all losses (duct, rotor and mechanical efficiencies and other applicable items) indicated.

(4) Breakout of wetted area and helicopter dimensional data.

(5) Main rotor characteristics must be indicated, including the following:

a. b = number of blades

b. R = tip radius (ft.)

c. TR = taper ratio

d. $C_e = \int_0^R cr^2\,dr \Big/ \int_0^R r^2\,dr$, equivalent blade chord (ft.)

e. e = offset of flapping hinge (ft.)

f. R_c = radius of cutout (ft.)

g. r = distance from center of rotation to center of local blade element (ft.)

h. θ = blade twist; if non-linear, show values for 15 blade elements (deg.)

i. c - chord; if not constant, show values for 15 blade elements (ft.)

j. m = mass of blade per foot of radius (slugs/ft.); if not constant, show values for 15 blade elements

k. $M_w = \int_c^R mg\,(r-c)dr$ = first weight moment of blade about flapping hinge (lb.-ft.)*

l. $I_h \int_c^R m(r-c)^2 dr$ = mass moment of inertia of blade about flapping hinge (slug-ft^2)*

m. δ_3 = effective pitch flap coupling angle

n. K = effective spring constant about flapping hinge (ft.-lbs/RAD.)

o. K_2 = effective damping constant about flapping hinge

p. σ = effective solidity ratio if different from $bc/\pi R$

q. $(\Omega R)^n$ = hover tip speed (ft./sec.)

r. Local airfoil section of blade; if not constant, show values for 15 blade elements

s. C_L, C_D, C_M, vs α vs. Mach No.; for M = .9 and $0 \leq \alpha \leq 180^\circ$ where applicable; for each new airfoil.

t. C_L, C_D vs α for inboard spar

u. Percent overlap and projected disc area for tandem helicopter

v. Correction factors furnished to airfoil data to allow for any required adjustment of profile drag, profile torque, and induced torque.

* If no flapping hinges, show moments about center of rotation.

Data not accepted by the Navy shall be replaced after conference with the contractor by similar data to be designated by the Navy.

3.2.2 Substantiating Performance Data Report - The Basic Aerodynamic Data (Para. 3.2.1) shall, after verification and approval of the procuring service, form the basis for the detailed preparation of the formal substantiating data report. These data shall be expanded as necessary and used to prepare the detailed performance data required to substantiate the validity of the Standard Aircraft Characteristics charts.

3.2.3 Revisions - The substantiating data report shall be revised under the same criteria as the charts (see para. 3.1.1).

3.2.4 Text - The arrangement of the substantiating data report shall be as contained in Appendix II.

3.3 Standards - Characteristics and performance data shall be based on practical engineering analysis which produce results consistent with flight test results of vehicles of like types using standard operating procedures.

3.3.1 Basis for Data - All characteristics and performance data shall be based on the latest reliable aerodynamic, power plant and weight information available. The information given shall include the effect on weight and/or performance of all authorized contract and service changes, together with important changes assured of authorization but pending at the date of chart issue.

3.3.1.1 Changes in Characteristics - Changes in aircraft characteristics which do not result in a significant performance change (para. 3.1.1.1) need not be justification for a revision by the contractor. However, the procuring agency shall be notified by correspondence so that proper notation may be appended to the published chart.

3.3.1.2 Flight Tests - Latest approved flight test data shall be used, as soon as available, as a basis for performance. While official military flight test results are to be preferred, contractor flight test results shall be considered, provided:

(1) The contractor submits his method of flight test, instrumentation used, and analysis leading to reduction of test results to standard for review and approval by the Navy.

(2) Specific "raw" test data and data reduced to standard conditions are provided the Navy for approval prior to use in chart preparation.

3.3.1.3 Guarantees - The data quoted need not necessarily reflect contractor's guarantees.

3.3.2 Limitations - Performance data shall fall within all established limitations on the vehicle and its components, except as specifically provided herein.

3.3.3 Aircraft Condition - Performance shall be presented in such a manner as to show clearly the applicable aerodynamic configuration, power plant, and loading information. Aircraft configurations shall include the installation of complete service equipment applicable to that particular aircraft model for the mission concerned. No special sealing of doors or cracks, filling of seams, waxing, or polishing shall be allowed. Flight performance shall be presented with guns, rotatable enclosures, bomb bay doors, etc., in position of least drag, retractable enclosures and wheels in retracted or closed position, and external bombs or other armament in position for each loading condition, as noted. Fuel loadings shall comprise only those for which service approval has been obtained.

3.3.4 Atmosphere - Performance shall be based on the latest approved standard atmospheric tables as specified by the Navy.

3.3.4.1 Standard Day - Unless otherwise specified, performance shall be based on the ICAO standard atmosphere (59°F @S.L.).

3.3.4.2 Non-Standard Day - Unless otherwise specified, non-standard day performance shall be based on MIL-STD-210A Tropical (89.8° @ S.L.) and not (103°F @ S.L.) conditions.

3.4 Definitions - The following definitions are used for the various data on the charts and shall be strictly adhered to.

3.4.1 Weights - Weights used in preparation of and presented on the charts shall conform with the following.

3.4.1.1 Empty - The empty weight condition shall be as defined in the model detail specification. The empty weight to be used in preparation of the SAC Chart shall be the latest available estimated, calculated or actual empty weight.

3.4.1.2 Basic - The basic weight shall be as defined in the Handbook of Weight and Balance Data, AN 01-1B-40, i.e., the empty weight of paragraph 3.4.1.1 plus trapped fuel and oil and all fixed armament and equipment for normal operation.

3.4.1.3 Operating - The basic weight of paragraph 3.4.1.2 plus crew, engine oil and any special equipment required for the mission, including any weapon racks or pylons not included in basic weight. Does not include usable fuel, ammo, payload (bombs, rockets, troops, cargo, etc.), or auxiliary fuel tanks if such tanks are to be dropped during flight.

3.4.1.4 Combat - The weight over the target for the mission presented; i.e., the operating weight of paragraph 3.4.1.3 plus fuel, ammunition (including missile ordnance) used for air-to-air combat but without bombs, missiles (used for attack of surface targets), torpedoes, mines, cargo or droppable tanks unless otherwise noted.

3.4.1.4.1 Fuel Load - The fuel load is determined as follows:

(1) Except for attack helicopters with external drop tanks, the fuel load shall be 60% of initial fuel. (Includes helicopters with and without external tanks).

(2) For attack helicopters with external drop tanks, fuel load shall be 60% of initial fuel load, or full internal fuel less drop tanks, whichever is less.

3.4.1.5 Takeoff - Defined as the total weight of the helicopter for the mission presented; i.e., the operating weight of paragraph 3.4.1.3 plus the mission fuel and payload and any auxiliary tanks to be dropped during flight. The takeoff weight normally shall be determined prior to the start of the engines except in specially approved cases when weight expended during taxi and take-off are excluded. Take-off weight shall not exceed maximum take-off weight.

3.4.1.5.1 Maximum Take-off - Maximum take-off weight is the greatest weight for take-off established by Technical Orders, design requirements, or other specific recommendations of the Navy.

3.4.1.5.2 Overload - Unless specifically directed by the Navy, the maximum (overload) take-off weight shall not exceed the least weight determined by the following:

(a) The weight of the vehicle fully loaded with fuel, oil, bombs and cargo to capacity for which space and/or tankage is normally provided. Bearing capacity for the floor and/or supporting structure shall not be exceeded. The expendable weight of ATD (Auxiliary Thrust Devices) and water used for take-off may be added to the quoted maximum take-off weight provided the criteria of paragraph 3.4.1.5.1.1(b) is satisfied and a qualifying note appears on the chart.

(b) The vehicle and its components (rotor, landing gear, supporting structure for ordnance, cargo, etc.) shall make good at least a 2.0 g normal load factor for each phase of operation, and shall meet the minimum criteria of applicable specifications for taxi and ground handling.

(c) The helicopter shall be capable of hover out of ground effect at sea level under standard atmospheric conditions with engine(s) operating at intermediate power.

(d) For multi-engine vehicles the rate of climb with one engine inoperative shall not be less than 100 ft/min out of ground effect, in take-off configuration less quickly jettisonable equipment, at maximum take-off rating, under standard atmospheric conditions at sea level.

(e) Throughout the flight the center of gravity shall remain within the limits for satisfactory ground handling and flight.

(f) Such other criteria as may be specified by the Navy for the specific helicopter model presented.

3.4.1.5.3 Normal - The maximum (normal take-off weight shall not exceed the least weight determined by criteria of paragraph 3.4.1.5.1.1 and the following additional criteria:

(a) The maximum power rate of climb with one engine inoperative shall not be less than 100 ft/min in take-off configuration less quickly jettisonable equipment at sea level on a tropical day.

(b) The vehicle shall be capable of cruising at airspeeds for maximum range at 5000 ft altitude (pressure) on a tropical day with power not exceeding maximum continuous power.

3.4.1.6 Maximum In-flight - The maximum weight at which the aircraft is authorized to be airborne. It is possible for this to be greater than maximum take-off weight if in-flight refueling is utilized.

3.4.1.7 Design - Weight at which specified flight structural design requirements are met or are required to be met.

3.4.1.8 Landing Weights.

3.4.8.1 Mission - The weight as determined by the computation of the mission ground rules. It shall include the fuel reserve as specified by the mission.

3.4.1.8.2 Maximum - Maximum landing weight is the greatest weight established for landing by flight restrictions, detail specifications, or specific recommendations by the Navy.

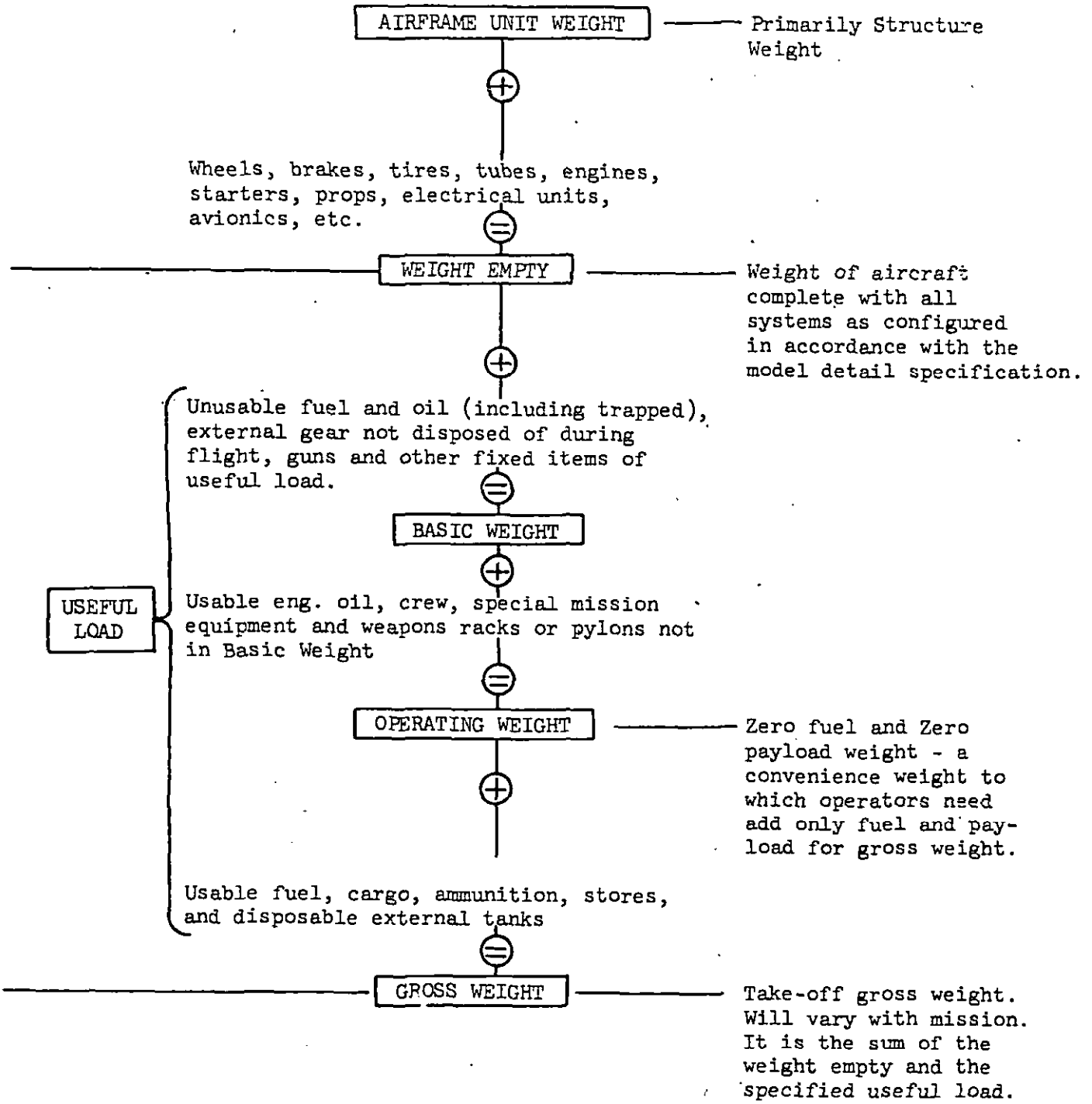
3.4.1.9 Payload - The load which justifies the mission. Payload includes cargo, personnel other than crew (i.e., passengers), droppable weapons, missiles (offensive and decoy), reconnaissance cameras (if not in weight empty), photo flash flares, and ammunition. Special equipment required for the mission such as winterization rescue equipment (except that carried for drop by search and rescue vehicles, cargo handling, etc.), store racks, missile launchers, and other suspension equipment, shall not be included in payload.

3.4.1.10 Fuel - Standard Fuel Weight of fuel in pounds per U. S. gallon shall be as follows:

a. MIL-F-5572 (gasoline in all grades) - 6.0 lbs./gal.

b. MIL-F-5624C-1(UP-5) jet fuel - 6.8 lbs./gal.

3.4.1.11 Weight Definition Guide - For the information of the contractor, the following guide is given to the above weight definitions



3.4.2 Speeds - All speeds shall be level-flight true airspeeds in knots.

3.4.2.1 Maximum - Highest speed obtainable in level flight. State the weight, altitude, and engine-power rating. Such maximum speed shall be within all operating restrictions (i.e. thrust, structural, heating limitations), with the limiting restriction noted. For the Characteristics Summary, maximum speed shall be at combat weight, maximum power, and the altitude for best speed.

3.4.2.2 Combat Speed - Highest speed obtainable in level flight at combat weight with maximum power at combat altitude.

3.4.2.3 Cruise Speed.

3.4.2.3.1 Maximum Range Cruise Speed - The speed for maximum range operation shall be the speed at which maximum nautical miles per pound of fuel are attainable at the momentary weight and altitude.

3.4.2.3.2 Long Range Cruise Speed - The higher of the two airspeeds which give nautical miles per pound of fuel equal of 99% of the maximum nautical miles per pound of fuel for momentary weight and altitude unless otherwise limited by handling characteristics.

3.4.2.3.3 Maximum Cruise Speeds - The highest speed that can be maintained with stated power, altitude, weight and configuration.

3.4.3.2.4 Average Cruise Speed - Total distance covered in cruise divided by time for cruise (distance and time for coimb, loiters, acceleration to combat speed, and combat time are not included).

3.4.2.4 Maximum Endurance (Loiter) Speed - The airspeed for maximum endurance shall correspond to the speed for minimum fuel flow attainable at momentary weight and altitude except as limited by acceptable handling characteristics of the aircraft.

3.4.3 Ceiling.

3.4.3.1 Service Ceiling - Service ceiling is that altitude at which the rate of climb is 100 ft/min at stated weight, configuration and engine power.

3.4.3.2 Combat Ceiling - Combat ceiling is that altitude at which the rate of climb is 500 ft/min at stated weight, configuration, and intermediate power.

3.4.3.3 Cruise Ceiling - Cruise ceiling is that altitude at which the rate of climb is 300 ft/min at maximum continuous power for a given configuration at momentary weight.

3.4.4 Altitude.

3.4.4.1 Cruise Altitude - The cruise altitude is the altitude at which the cruise portion of the missions is computed. Depending on the mission ground rules, the cruise altitude may be assigned or it may be otherwise governed by limitations such as terrain clearance, ceilings, oxygen, or other crew/aircraft restrictions.

3.4.4.2 Combat Altitude - Combat altitude is the altitude at the target for the specific mission shown.

3.4.5 Take-off.

3.4.5.1 Distance - Take-off distance shall be that normally obtainable in service operation at sea level with ICAO standard atmospheric conditions and on hard surfaced runways having a rolling coefficient of friction as specified in paragraph 3.4.5.3.1. For estimated data, the minimum distances shall be increased at least 15 percent until verified by flight tests.

3.4.5.2 Time - Take-off time shall be as stated in the mission ground rules (see Table 1). These estimates are based on times normally obtainable in service operation at sea-level under NACA standard atmospheric conditions with no wind. (See also paragraph 3.5.3.1).

3.4.5.3 Coefficient of Friction - The coefficient of friction, μ , as used in this document is defined as the ratio of the total landing gear system retardation effect, exclusive of aerodynamic effects, to the momentary gross weight of the aircraft.

3.4.5.3.1 Rolling - The rolling (unbraked) coefficient of friction for a dry, hard runway shall be equal to 0.025, for firm dry sod, 0.05.

3.4.5.3.2 Braking - The braking coefficient of friction, for a dry, hard runway shall be equal to 0.30; for firm dry sod, 0.25.

3.4.6 Climb.

3.4.6.1 Enroute Climb - Enroute climb data shall be based on the appropriate configuration power, and weight. The helicopter shall have the landing gear and take-off flaps (if applicable) retracted and have attained the airspeed for best coimb for the applicable condition.

3.4.6.2 Time to Climb - The time to climb to specified altitudes shall be expressed minutes from start to enroute climb.

3.4.6.3 Combat Climb - Combat climb is the maximum vertical speed in feet per minute at combat conditions. (This is a forward flight climb)

3.4.6.4 Vertical Climb - A climb in which there is zero forward speed.

3.4.7 Landing.

3.4.7.1 Distance - Landing distances shall be for operation at standard sea level on hard surface runways with no wind. Distances based on flight tests shall not be less than those required in normal service operation. For estimated data the minimum distance shall be increased at least 15 percent until verified by flight test. The braking coefficient of friction shall be that specified in paragraph 3.4.5.3.2.

3.4.8 Power - The term power is used to mean brake horsepower and/or thrust as applicable with due consideration for installation effects and limitations. Engine and ATO ratings as defined in paragraphs 3.6.2.1.3(c) and 3.6.3.1.4 shall be those which appear in the approved engine model specification without regard to installation effects or limitations.

3.4.8.1 Maximum power - "Maximum power is the highest power which the engine will consistently deliver at specific ground or flight conditions for the durations (incremental and total) specified in the model specification for demonstration during the qualification or preliminary flight rating tests."

3.4.8.2 Intermediate Power - "Intermediate power is the highest power which the engine will consistently deliver at specific ground or flight conditions for an incremental duration of at least 30 minutes, and a total duration as specified in the engine model specification for demonstration during qualification or preliminary flight rating tests."

3.4.8.3 Maximum Continuous Power - "Maximum continuous power is the highest power which the engine will consistently deliver at specific ground or flight conditions for an unlimited time.

3.4.8.4 Cruise Power - The power required to fly the aircraft at cruise speed for the configuration, altitude and weight designated.

3.4.9 Fuel Consumption Service Tolerance - All fuel consumption data, regardless of source, shall be increased by 5% for all engine power conditions as a service tolerance to allow for practical operation. In addition corrections or allowances to engine fuel flow shall be made for all power plant installation losses such as assessory drives, ducts, fans, cabin pressure bleed, etc.

3.4.10 Combat Radius - Combat radius is the distance attainable on a practicable flight to the target and return a distance equal to that flown out, carrying a specific load (bombs, cargo, personnel, etc.) to or from the target according to a sequence of operations specified under "Missions" (paragraph 3.4.12). Droppable fuel tanks are dropped when empty or prior to combat unless such tanks are designed to be carried during combat.

3.4.11 Combat Range - Combat range is the distance (including distance covered in climb) attainable on a practicable one-way flight carrying load (bombs, cargo, personnel, etc.) the entire distance. Droppable fuel tanks are dropped when empty.

3.4.12 Mission - Missions, chosen to portray the typical capabilities of helicopters as military weapons, are defined in terms of combat radius problems and combat range problems. Each helicopter shall be considered capable of performing the following missions:

3.4.12.1 Clean Mission - The first mission to be described in the Standard Aircraft Characteristics charts will be the clean mission. This mission is intended to show the maximum capabilities of the helicopter.

3.4.12.2 Basic Mission - The basic mission is the mission profile detailed in Table I which most nearly depicts the primary intended operational use of the helicopter. To maintain the capability of presenting a direct comparison between similar type aircraft, no deviation from the ground rules of Appendix I can be allowed.

3.4.12.3 Ferry Mission - The greatest distance attainable on a practical one-way mission with maximum fuel and no payload. External fuel tanks may be carried and must be retained for the duration of the flight.

3.4.12.4 Typical Missions - Any missions, preferably from Appendix I, which would present the additional capabilities of the aircraft. Normally these will include at least one mission at the maximum (overload) take-off weight (paragraph 3.4.1.5.1.1) with the ground rules corresponding to the basic mission. Other missions should be as desired or as specified by the Navy.

3.4.12.5 In-flight Refueled Mission - For aircraft capable of in-flight refueling, a refueled mission is the greatest distance (radius or range attainable through receipt of replacement fuel during flight. A single refueling operation is required although multiple refueling operations may be used if considered to be feasible. Basic ground rules from Table I shall apply.

3.5 Mission Detailed Requirements.

3.5.1 General Mission Requirements - Unless otherwise specified, the following general ground rules shall apply:

3.5.1.1 Standard Atmosphere - Data shall be presented for ICAO standard atmosphere.

3.5.1.2 Wind - Data shall be for a no wind condition.

3.5.1.3 Ordnance Expenditure - Ammunition and air to air missiles will not be expended during the mission.

3.5.1.4 Off-Loading Fuel - Fuel may be off-loaded to avoid exceeding the maximum allowable take-off weight.

3.5.1.5 External Fuel Tanks - External fuel tanks shall be dropped when empty or prior to combat unless such tanks are designed to be carried during combat or in the case of a ferry mission. Unless otherwise restricted (e.g., CG, etc), dropping of external tanks shall be sequenced to provide maximum range.

3.5.1.6 Pylons/Racks - Bomb racks, pylons, etc. shall be retained during return to base.

3.5.1.7 Authorized Operation - No operational technique shall be utilized that is not, or is not intended to be included as recommended procedure in the applicable flight manual.

3.5.1.8 Trainer Helicopter - The trainer basic mission as defined by Table I is applicable to basic and advanced trainer helicopters. Combat and tactical trainer helicopters fly the basic mission for the appropriate parent-type airplane.

3.5.2 Mission Loading Requirements - In order to facilitate and expedite the make-up and delivery of the charts, the contractor shall contact the procuring service to discuss the various mission loadings prior to submittal. In the absence of special instructions, the following shall apply:

3.5.2.1 Clean Mission Loading - The loading for the clean mission shall be full internal fuel and no payload.

3.5.2.2 Basic Mission Loading - The fuel and payload loading for the basic mission shall be the same as the fuel as the fuel and payload of the "Primary" or "Basic" load condition given in the Detail Specification for the helicopter.

3.5.2.3 Typical Mission Loading - Loadings shall be selected from those included in the Detail Specification or other approved loadings which depict a particular capability of the aircraft. At least one mission shall conform to the maximum (overload) gross weight (paragraph 3.4.1.5.1.1).

3.5.2.4 Ferry Mission Loading - Loading shall consist of maximum authorized fuel and no payload.

3.5.2.5 In-flight Refueling Mission Loading - One Mission shall be for the same loading as the basic mission. Other loadings may be selected by the typical missions.

3.5.2.6 Combat Range Mission Loading - Identical to the loading of the associated combat radius mission.

3.5.3 Mission Segments.

3.5.3.1 Take-off - Ground operation, including starting engines, taxi, take-off, and acceleration to climb speed, are variable and in most cases are immune to prediction. A fuel allowance based on statistical analysis, must be used. The average assumed for jet powered helicopters is a quantity of fuel equal to the fuel used during 5 minutes of maximum continuous power operation at sea level on a standard day.

3.5.3.2 Climb - All climbs shall be enroute with power and speed schedules optimized to gain maximum distance for the fuel expended.

3.5.3.3 Cruise - Unless specifically assigned, aircraft shall cruise at the altitude for maximum specific range for the applicable configuration, power, and weight. This altitude shall not exceed cruise ceiling. For helicopters have a low optimum altitude (e.g. reciprocating engine aircraft) the cruise altitude shall not be less than 5000 feet for terrain clearance over land or 1500 feet over water.

3.5.3.4 Combat - Combat shall be considered by setting aside a quantity of fuel to be used as needed. Fuel flow for this range free allowance shall be based on the level flight stabilized speeds for the altitude and power(s) stated in Appendix I. The change in speed due to weight reduction during the combat period shall be ignored. When more than one power setting is used, the lesser powers will be used first and each treated independently as specified above.

3.5.3.5 Descent - No distance will be credited for descent.

3.5.3.6 Landing Reserve - The landing reserve for Navy helicopters shall be the greater of the following, unless otherwise specified:

(a) 10% of initial internal fuel.

(b) Fuel required for 20 minutes flight at the speed for maximum range.

3.5.4 Mission Time - Time in air (excludes time before start of enroute climb and reserve, unless otherwise specified and noted).

3.5.5 Cycle Time - The time of flight from the start of enroute climb (omitting take-off time) to stopping engines after landing.

3.5.6 Block Time - The total time of flight from start engines to stop engines after landing.

3.6 Detail Requirements.

3.6.1 General Information.

3.6.1.1 Source - The oversize format (15" x 12"), NAVWEPS Form 13100/6 (rev. 7-65) may be obtained on request from the Naval Air Systems Command. Image size of the prints when finally reproduced by the procuring agency shall be $7\frac{1}{4}$" x $9\frac{1}{2}$" positioned on a sheet size of 8" x $10\frac{1}{2}$".

3.6.1.2 Size - All pages submitted must be a photographic black and white matte print of the same size as the oversize format. The image shall be $14\frac{1}{4}$" x 10 7/8" centered on a photographic sheet 15" x 12". A Kodak Kodagraph, matte finish, type C4 contact paper or equivalent may be used. All line weights used throughout must be suitable for 1/3 photographic reduction.

3.6.1.3 Graphic Presentation - All graphic data shall be presented in the spaced provided on the format and must be mounted and positioned so as to constitute one complete piece of artwork for each page. (An exception to this rule applies only to the cover page)

3.6.1.4 Text - Principal text entered into the format shall be typeset characters using 12 point Futura Medium or equivalent. Typewriter may be used provided machine is equipped with a carbon acetate ribbon. In order of preference: a typewriter face with proportionally spaced letters, IBM Modern Boldface # 2; or Vari-Type styles in keeping with the general format may be used. In all cases, typewriter copy must be clean and sharp to be suitable for reproduction by camera and offset printing.

3.6.1.5 Identification - Identification and markings required under paragraph 1.5 shall be so located as to start or end flush with the vertical border lines as applicable. Pages shall not be numbered. Omit references to security classification on pages which are unclassified.

3.6.1.6 Graphs - Curves shall be drawn with a sufficiently broad pen so that they stand out clearly from the grid, but do not compromise the accuracy of the reading. If desired, a 1/32 inch wide, black matte, pressure sensitive tape may be used. Grid lines shall be properly increased in weight to emphasize the scale readings. Select a scale which will provide ease and accuracy of readying. Figures and words shall not obliterate a curve on a chart, and when appearing on a chart shall be set in a white background block.

3.6.2 Standard Aircraft Characteristics Charts.

3.6.2.1 Required Characteristic Data (including Descriptive Detail) - A sample SAC Chart is provided for reference as Appendix III.

3.6.2.1.1 Cover Photograph (Page 1) - Cover sheet shall include a picture of the helicopter. In order of preference: A photograph of the helicopter in flight, a photograph of the helicopter on the ground, a photograph of a model, or an artist conception drawing

of the helicopter in flight. The photograph of drawing shall be of good contrast or permit satisfactory reproduction and should portray the distinguishing features of the helicopter. The photograph shall be dimensions not less than 5" x 8" and not greater than 7" x 11½", not including the border. The helicopter model designation and the approved popular name shall be typeset using 24 point Futura Demibold or equivalent, centered below the title leaving a ½ inch space. One-half inch below the aircraft designation, center the contractor's name using 18 point Futura Demibold or equivalent.

3.6.2.1.2 Descriptive Arrangement/Armament and Tankage (Page 2) - The three-view drawings shall be drawn in ink on suitable drawing material and may be made oversize at whatever scale the manufacturer deems suitable. This over-size ink drawing shall then be photographically reduced and inserted on the appropriate block within the format sheet. Full advantage shall be taken of the space allotted so as to provide the largest three-view arrangement attainable within the 7 1/8" x 10 7/8" block in keeping with the positioning guidelines of paragraph 3.6.2.1.2.1. The line weights used on the three-view drawings must be suitable to provide reproduction of the format page when reduced to 9½" wide. All dimensions and text entered on this format page shall be typeset using 10 point Futura Medium or equivalent.

3.6.2.1.2.1 Descriptive Arrangement - Material pertinent to each view shall be as follows:

(a) Plan view - The plan view shall show the main rotor blade extended, and shall contain external tankage as indicated in paragraph (b). Span of the horizontal tail shall be given, if applicable. Drawing shall contain no other dimensions unless the peculiarities of the aircraft warrant the usage for identification not elsewhere described.

(b) Front view - The front view shall be a front elevation in flight attitude with gear extended. External tanks (fixed) shall be shown in solid line. If tanks of alternate capacities can be used interchangeably or in combination the tankage of maximum permissible capacity shall be shown. Dimensions shall include the span (if applicable) and maximum tread. Width of helicopters with foldable parts (rotor, tail boom, etc.) folded and open shall be given. Maximum tread shall be shown to the centerline of the outer wheel for single wheel gear and to the centerline of the outer struts for dual wheel gear.

(c) Side elevation - The side elevation (nose pointing either right or left to best show the cargo doors,

windows, etc.) shall be placed in a level flight attitude. Maximum overall length of the basic aircraft and height above ground in a static attitude with foldable parts (rotor, tail boom, etc.) folded and open (rotor pulled through to maximum height) shall be shown.

(d) Scale - The scale shall be placed to the right or left of the aircraft grouping. The scale is to be prepared as to best compare to the actual dimensions. A scale bar, approximately $1\frac{1}{2}$ inches long shall be divided into multiples of 1, 5, and 10 feet as appropriate.

(e) Dimensions and Markings for Descriptive Arrangement Drawings - The dimensions and data for drawings of the helicopter with essential features clearly delineated shall include the following:

(1) Rotor diameter(s) in feet and tenths.

(2) Tread in feet and tenths.

(3) Fuselage length in feet and tenths.

(4) Height in feet and tenths.

(5) Main rotor disc area(s), blade area(s), and rotor airfoil section(s) (root and tip).

3.6.2.1.2.2 Armament and Tankage Drawing - One three-view outline drawing of the helicopter, without dimensions, showing armor, fixed and flexible guns, turrets, bomb, rocket, and torpedo stations, fuel and oil tanks with the cross hatching convention shown to illustrate type of tanks. The nominal capacity of each of the tanks shall be tabulated.

3.6.2.1.3 Mission and Description (page 3) - The mission and description page shall include the information given below.

(a) Mission and Description - The first paragraph in this block shall be a concise statement of the principal mission of the helicopter. This statement shall be followed by a brief, descriptive narrative concerning pertinent background information and status of the helicopter together with general design features and principal components such as configuration, structure, operational limitations, etc. Other

designations by which the model has been identified shall be listed. Under a subheading, DEVELOPMENT, dates of prototype first flight, first flight of the production configured helicopter, and date of service acceptance should be noted.

(b) Power Plant - Data to be listed shall include, as applicable:

Number and model of engines

Manufacturer

Engine Specification No.

Reduction gear (ratio)

Augmentation (type)

Tail pipe nozzle (type)

Gas turbine compressor (type, length, and diameter)

Number and type of assist devices such as ATO

Rotor gear ratio(s)

(c) Ratings - Engine ratings shall include power or thrust, fpm, altitude(s) and time limits or deviations, as applicable. Engine rations and ATO ratings shall conform to those established in the officially approved engine specifications. Ratings with an augmentation shall be identified by note. If performance items are based on powers which differ appreciably from the listed specification ratings due to flight or engine laboratory test results or restrictions, such powers with explanations will be listed under notes. Reference to source of such power shall be clearly stated in the performance data report.

(d) Weight and Load Factors - The gross weights and the corresponding allowable load factors shall not exceed the limits established by the latest applicable technical orders, design requirements, or other specific recommendation of NASC. Maximum weights for which a mission is shown on the Standard Aircraft Characteristics charts to illustrate maximum combat capabilities, but

which may involve non-standard operating procedure and/ or special operating techniques associated with such weight may be given, provided such weights are clearly identified with a note defining the limitations on usage. The following weights with corresponding load factors as applicable shall be given:

Loading	Pounds	Load Factor	Reference
Empty			3.4.1.1
Basic			3.4.1.2
Design			3.4.1.7
Combat (basic mission			3.4.1.4
Maximum take-off			3.4.1.5.1
Maximum in-flight			3.4.1.6
Maximum landing			3.4.1.8

NOTE: Basis of Weight Data - The weights given shall correspond to the definitions of paragraph 3.4.1. Weight empty shall be identified by the symbols "E: (estimated), "C: (calculated), or "A: (actual). As applicable, notation shall be made immediately below the take-off weight of the immediate factor(s) limiting take-off weight.

(e) Fuel and Oil - The number of fuel and oil tanks, their usable capacities and locations, extent of self sealing provisions, together with grade and specification of fuel and oil used, shall be listed. Fuel tanks shall be grouped by fuel system.

(f) Electronics - Data concerning the principal types of electronic gear in the aircraft shall be listed.

(g) Ordnance - Data concerning the standard size and number of each type of droppable ordnance items such as bombs, torpedoes, mines, rockets, missiles, and the maximum bomb load which may be accommodated by the helicopter. Ordnance carried externally shall be identified. The number and caliber of guns, the number of turrets, rounds of ammunition per gun, and the gun stations shall be listed.

(h) Cargo - Maximum cargo load, clear space dimensions, limit floor loads, door size and location, usable cubage, etc. are to be given as applicable. Additional cargo information may be entered on a supplemental "Notes" page. Maximum cargo shall not exceed that for

which the aircraft has a combat range of at least 50 nautical miles. The cargo block is to be placed in that shown on the sample page for "Ordnance" when cargo rather than ordnance applies.

(i) Dimensions - Overall dimensions, in agreement with the general arrangement drawings of the basic helicopter in the three point static position, such as length, height, main rotor diameter, maximum tread, etc. Dimensions should be given in the stowed and flight conditions, where applicable.

3.6.2.1.4 Tabulated Performance Data (Page 4) - Tabulated performance for the clean mission, basic mission, ferry mission, and other typical missions (paragraphs 3.4.12.1 to 3.4.12.4) shall include applicable loading and performance items. (See Page 4 of sample chart in Appendix III). Columns 1 and 2 of page 4 are restricted to the clean and basic missions, as defined in paragraph 3.4.12.1 and 3.4.12.2, respectively. Other columns, except the last column are restricted for the contractor's use in presenting performance data depicting the mission for which the vehicle was designed; requirement for compliance with ground rules outlined in this specification is wavied for presentation of data on these typical missions (see paragraph 3.4.12.4). Criteria (ground rules for the typical missions shall be presented on page 9. The last column used is restricted for use in depicting data for the Ferry Mission (see paragraph 3.4.12.3).

3.6.2.1.5 Auxiliary Performance (Page 5) - Give alternate loadings and the respective radius and mission time for such loadings where applicable (i.e. attack helicopters).

3.6.2.1.6 Graphic Performance Data (Page 6) - Performance data shall also be shown graphically in the appropriate grids as provided in the formats. Grid lines may be broadened at significant intervals to improve readability. Curves shall not extend beyond any applicable limits.

3.6.2.1.6.1 Speed - As a function of altitude, plot maximum speed at clean mission combat weight with maximum, intermediate and normal power, as applicable; and for additional loadings including clean mission take-off weight with military or normal power, to show the effects of drag of significant external stores and/or important weight changes.

3.6.2.1.6.2 Forward Flight Climb - As a function of altitude, plot rate-of-climb at clean mission combat weight with maximum, military, or normal power as applicable. Show rates-of-climb for alternate loadings in order to show the effects of drag

changes with various external stores and/or important weight changes. The effect of weight reduction during climb shall not be considered.

3.6.2.1.6.3 Vertical Rate of Climb - As a function of gross weight plot rate-of-climb at sea level, without ground effect, with maximum, intermediate, or maximum continuous power as applicable. Show rates of climb for standard and non-standard conditions as applicable (see paragraph 3.3.4).

3.6.2.1.6.4 Hover Ceiling - As a function of gross weight plot hover ceiling at maximum, intermediate, or maximum continuous power as applicable. Hover ceiling shall be shown for standard and non-standard conditions as applicable (see paragraph 3.3.4).

3.6.2.1.7 Graphic Performance Data (Page 7) - The following data shall be shown graphically for the basic, design, and typical mission loading conditions as applicable:

3.6.2.1.7.1 Combat Helicopters - Show graphically combat radius at maximum range air speed vs. altitude from sea level to initial cruising ceiling with maximum continuous power. Also show combat radius vs. cruise airspeed from the minimum acceptable flight speed to maximum speed with maximum continuous power at a representative cruising altitude.

3.6.2.1.7.2 Non-combat helicopters - Show graphically combat range at maximum range airspeed vs. altitude from sea level to initial cruising ceiling with maximum continuous power. Also show combat range vs. cruise airspeed from minimum acceptable flight speed to maximum speed with maximum continuous power at a representative cruising altitude.

3.6.2.1.7.3 Additional Graphs - Additional performance graphs, as appropriate, may be shown at the discretion of the contractor.

3.6.2.1.8 External Store Loadings (Page 8) - This page shall contain a simplified drawing of the helicopter showing external store stations. A front view is usually the most adequate; however, another view may be substituted if it is more appropriate. The stations are to be numbered, and external stores capable of being carried on each station are to be listed under the corresponding number.

3.6.2.1.9 Notes (Page 9) - The notes page shall contain profiles of the typical missions for the particular

helicopter as well as any explanatory notes for which space is not otherwise provided. Adequate description of the conditions and qualifications affecting the aircraft performance shall be given on the charts in the space provided under "NOTES".

3.6.2.1.9.1 Required Data -

(a) Performance basis; one or more of the following, as applicable, shall be shown:

(1) Estimated data

(2) Calculated data based on preliminary flight test of __(no.)__ helicopters.

(3) Calculated data based on flight test of __(no.)__ helicopters.

(4) Combat range and/or radius is based on _____ (Insert Engine Spec., Laboratory or flight tests, or other applicable data) fuel comsumption data.

(b) Brief description (or diagram) of the flight plan (or profile).

(c) Basis of a reason for revision if applicable.

3.6.2.1.9.2 Supplemental Data - Additional applicable information may also be required such as:

(a) The effect on combat range and/or radius when using alternate fuel or jet engines.

(b) The effect on important performance items resulting from dropping or installing principal armament or tankage items, engine operating limits, one engine inoperative, etc.

(c) Power on which performance is based if significantly different from standard engine ratings, as required in paragraph under the same conditions.

3.6.3 Characteristics Summary Chart - Required unless otherwise specified by the Navy.

3.6.3.1 Characteristics Data - Characteristics data shall be entered in the appropriate blocks of the standard format in accordance with the following requirements:

3.6.3.1.1 Dimensions - Enter length, height, and main rotor diameter of the helicopter in accordance with paragraph 3.6.2.1.3(i).

3.6.3.1.2 Procurement and Availability - Information regarding helicopter procurement and availability shall not be given. This block on the Characteristics Summary shall be left blank for possible use by recipients of the document.

3.6.3.1.3 Status - On the Characteristics Summary pertinent notes regarding dates of contract, mock-up, first flight, and service use shall be given.

3.6.3.1.4 Power Plant - Enter the number, model(s), manufacturer(s), and rating of engines and assist devices as applicable. Only engine ratings for normal, take-off and maximum powers are required.

3.6.3.1.5 Features - List in brief form such items as crew, special electronics installations, unusual aerodynamic or equipment features etc. Maximum fuel capacity and maximum cargo capacity, if applicable, are shown.

3.6.3.1.6 Armament - List the number and caliber of guns and/or rockets, number of turrets, rounds of ammunition, and other features of ordnance. For cargo and transport aircraft, substitute data in accordance with paragraph 3.6.2.1.3(h) with appropriate heading.

3.6.3.2 Drawings.

3.6.3.2.1 Outline - An undimensioned 3-view drawing shall be inserted in the appropriate block within the format sheet. Full advantage shall be taken of the space allotted so as to provide the largest 3-view arrangement obtainable within the 4" x 10 7/8" block. Centered within the upper portion of the block, the helicopter model designation and the approved popular name shall be typeset using 24 point Futura Demibold or equivalent. Centered below the aircraft designation enter the contractor's name using 18 point Futura Demibold or equivalent.

3.6.3.2.2 Flight Profile - Show a simple line sketch of the principal portions of the applicable combat radius problem to outline the flight profile key altitudes and give title of combat radius problem in accordance with Table I.

3.6.3.3 Tabulated Performance Data - Performance items given in the appropriate blocks on the Characteristics Summary shall be in agreement with similar items given for the

basic mission in the second column of the Tabulated Performance Data of the Standard Aircraft Characteristics Chart.

3.6.3.4 Notes - Notes entered on Characteristics Summary shall conform to paragraphs 3.6.2.1.9 and 3.6.2.1.9.1. All material entered on this page must be in agreement with data contained in the Standard Aircraft Characteristics Charts.

3.6.3.5 Workmanship and Material - Workmanship and material shall be subject to approval of the Navy.

4. SAMPLING, INSPECTION, AND TEST PROCEDURES

4.1 Inspection and Acceptance - Charts shall be subject to final inspection and approval of the Naval Air Systems Command. All data contained in the charts shall be subject to review and analysis and shall be closely coordinated with the engineering office.

5. PREPARATION FOR DELIVERY

5.1 Packing - Reproduction copy shall be packed separately and in such manner that contents will not be damaged during shipment. Reproduction copy shall not be folded or rolled. All shipping containers containing reproduction copy shall also contain a copy of the applicable letter of transmittal.

5.2 Marking and Labeling - all shipping containers shall be addressed to:

Naval Air Systems Command
Department of the Navy
Washington, DC 20361
Attn: AIR-53012

The following information shall appear on all shipping containers for reproduction copy:

"Reproduction Copy"
"Government Order No. (or Contract No.)"

6. NOTES

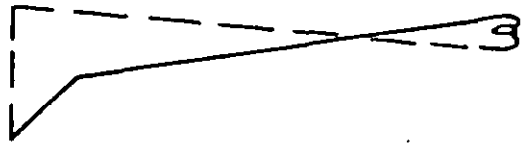
6.1 Formats - Formats and interpretations of the technical requirements of this specification may be obtained by addressing AIR-53012 (see paragraph 5.2).

APPENDIX I

STANDARD MISSIONS

CLEAN - HIGH ALTITUDE

(No external tanks, full internal fuel)



(1) Warm-up and Take-off: Fuel allowance of 5 minutes at Maximum Continuous Power.

(2) Climb out: On course at best climb speed at intermediate power to optimum cruise altitude not to exceed 10,000 feet (unless limited by cruise ceiling).

(3) Cruise out: To target at speed for maximum range at optimum cruise altitude not to exceed 10,000 feet. (unless limited by cruise ceiling)

(4) Hover: 5 minutes at hover ceiling, not to exceed 10,000 ft., out of ground effect.

(5) Cruise back: To home base at speed for maximum range at optimum cruise altitude not to exceed 10,000 ft., (unless limited by cruise ceiling).

(6) Descend to sea level: No fuel used, no distance gained.

(7) Landing reserve: 10% of initial fuel or fuel for 20 minutes at speed for maximum range at sea level, whichever is greater.

CLOSE SUPPORT

(1) Warm-up and Take-off: Fuel allowance of 5 minutes at Maximum Continuous Power at sea level.

(2) Cruise out: To target at speed for maximum range at sea level.

(3) Loiter: 1 hour at speed for maximum endurance at sea level.

(4) Combat: 5 minutes at intermediate power at sea level.

(5) Expend all ordnance.

(6) Cruise back: To home base at speed for maximum range at sea level.

(7) Landing reserve: 10% of initial fuel or fuel for 20 minutes at speed for maximum range at sea level, whichever is greater.

ATTACK MISSION

(1) Warm-up and Take-off: Fuel allowance of 5 minutes at Maximum Continuous Power at sea level.

(2) Dash out: To target at Maximum Continuous Power at sea level.

(3) Combat: 5 minutes at intermediate power at sea level.

(4) Expend all ordnance.

(5) Dash back: To home base at Maximum Continuous Power at sea level.

(6) Landing reserve: 10% of initial fuel or fuel for 20 minutes at speed for maximum range at sea level, whichever is greater.

PLANE GUARD ENDURANCE

(1) Warm-up and Take-off: Fuel allowance of 5 minutes at Maximum Continuous Power at sea level.

(2) Endurance: Fuel used at 30 knots at sea level.

(3) Landing reserve: 10% of initial fuel or fuel for 20 minutes at speed for maximum range at sea level, whichever is greater.

TROOP EVACUATION

(1) Warm-up and Take-off: Fuel allowance of 5 minutes at Maximum Continuous Power at sea level.

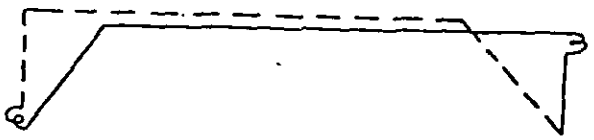
(2) Cruise out: To remote base at Maximum Continuous Power at sea level.

(3) Land and pick up troops: Mid-point fuel allowance of 2 minutes at Maximum Ctoninuous Power at sea level.

(4) Cruise back: To home base at Maximum Continuous Power at sea level.

(5) Landing reserve: 10% of initial fuel or fuel for 20 minutes at speed for maximum range at sea level, whichever is greater.

DUD RETRIEVAL



(1) Warm-up and Take-off: Fuel allowance of 5 minutes at Maximum Continuous Power at sea level.

(2) Climb out: On course to 3000 feet at best climb speed at intermediate power.

(3) Cruise out: To downed aircraft at speed for maximum range at 3000 feet.

(4) Hover: At 3000 feet for 10 minutes (out of ground effect).

(5) Descend to sea level: No fuel used, no distance gained.

(6) Pick up maximum external payload.

(7) Climb back: On course to 3000 feet at best climb speed at intermediate power.

(8) Cruise back: To home base at speed for best range (not less than 80 kts.) at 3000 feet.

(9) Descend to sea level: No fuel used, no distance gained.

(10) Hover: 5 minutes at sea level with payload out of ground effect.

(11) Landing reserve: 10% of initial fuel or fuel for 20 minutes at speed for maximum range at sea level (with payload), whichever is greater.

HLH

(1) Warm-up and Take-off: Fuel allowance of 5 minutes at Maximum Continuous Power at sea level.

(2) Cruise out: 50 nautical miles with payload at speed for maximum range at sea level.

(3) Hover: 5 minutes out of ground effect at sea level with payload.

(4) Release payload.

(5) Hover: 5 minutes out of ground effect at sea level without payload.

(6) Cruise back: To home base without payload at speed for best range at sea level.

(7) Landing reserve: 10% of initial fuel or fuel for 20 minutes at speed for maximum range at sea level, whichever is greater.

TRAINING MISSION

(1) Warm-up and Take-off: Fuel allowance of 5 minutes at Maximum Continuous Power at sea level.

(2) Endurance: Endurance at speed for maximum range at sea level. (Not less than 100 knots.)

(3) Landing reserve: 10% of initial fuel or fuel for 20 minutes at speed for maximum range at sea level, whichever is greater.

TROOP TRANSPORT

(1) Warm-up and Take-off: Fuel allowance of 5 minutes at Maximum Continuous Power at sea level.

(2) Cruise out: To remote base at Maximum Continuous Power at sea level.

(3) Land and unload troops: Mid-point fuel allowance of 2 minutes at Maximum Continuous Power at sea level.

(4) Cruise back: To home base at Maximum Continuous Power at sea level.

(5) Landing reserve: 10% of initial fuel or fuel for 20 minutes at speed for maximum range at sea level, whichever is greater.

SEARCH AND RESCUE

(1) Warm-up and Take-off: Fuel allowance of 5 minutes at Maximum Continuous Power at sea level.

(2) Dash out: To target at maximum cruise speed for Maximum Continuous Power at sea level.

(3) Search: Over target at speed for best endurance for 15 minutes at sea level.

(4) Pick up survivor: Hover out of ground effect 2 minutes at sea level.

(5) Cruise back: To base at speed for maximum range at sea level.

(6) Landing reserve: 10% of initial fuel or fuel for 20 minutes at speed for maximum range at sea level.

LONG ENDURANCE SENSOR CARRIER (LESC)

(1) Warm-up and Take-off: Fuel allowance of 5 minutes at Maximum Continuous Power.

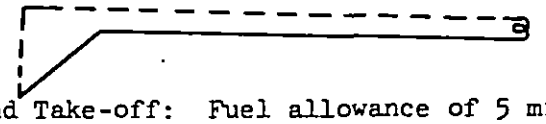
(2) Cruise out: 100 nautical miles at sea level at Maximum Continuous Power.

(3) Endurance: Loiter at hover out of ground effect 30% of the time and at speed for best endurance 70% of the time at sea level.

(4) Cruise back: To home base at speed for maximum range at sea level.

(5) Landing reserve: 10% of initial fuel or fuel for 20 minutes at speed for maximum range at sea level, whichever is greater.

ANTI-SHIP MISSILE DEFENSE (ASMD)



(1) Warm-up and Take-off: Fuel allowance of 5 minutes at Maximum Continuous Power.

(2) Climb out: On course to 1500 feet at best climb speed at intermediate power.

(3) Cruise out: 10 nautical miles at speed for maximum endurance at 1500 feet.

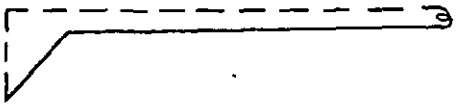
(4) Loiter: 3 hours at speed for best endurance at 1500 feet.

(5) Cruise back: 10 nautical miles for maximum range at 1500 feet.

(6) Descend to sea level: No fuel used, no distance gained.

(7) Landing reserve: 10% of initial fuel or fuel for 20 minutes at speed for maximum range at sea level, whichever is greater.

ANTI-SUBMARINE WARFARE (ASW)



(1) Warm-up and Take-off: Fuel allowance of 5 minutes at Maximum Continuous Power at sea level.

(2) Climb out: On course to 1500 feet, at best climb speed at intermediate power.

(3) Cruise out: To target at speed for maximum range at 1500 feet.

(4) Loiter: One hour at 1500 feet at speed for maximum endurance.

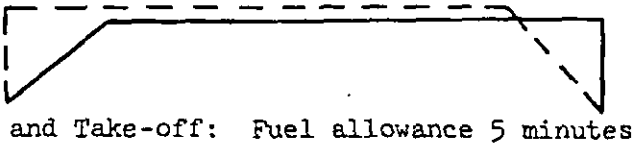
(5) Drop stores.

(6) Cruise back: To home base at speed for maximum range at 1500 feet.

(7) Descend to sea level: No fuel used, no distance gained.

(8) Landing Reserve: 10% of initial fuel or fuel for 20 minutes at speed for maximum range at sea level, whichever is greater.

MEDICAL EVACUATION



(1) Warm-up and Take-off: Fuel allowance 5 minutes at Maximum Continuous Power.

(2) Climb out: On course at speed for best climb at intermediate power at 5000 feet.

(3) Cruise out: To remote base at 5000 feet at Maximum Continuous Power.

(4) Descend to sea level: No fuel used, no distance gained.

(5) Land pick up litter patients: Mid-point fuel allowance of 2 minutes at Maximum Ctoninuous Power at sea level.

(6) Climb back: On course at best climb speed at Maximum Continuous Power at 5000 feet.

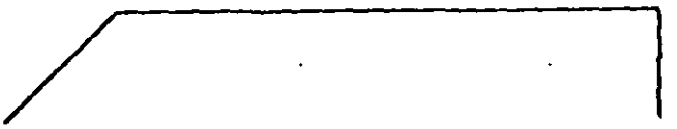
(7) Cruise back: To home base at 5000 feet at Maximum Continuous Power.

(8) Descend to sea level: No fuel used, no distance gained.

(9) Landing reserve: 10% of initial fuel or fuel for 20 minutes at speed for maximum range at sea level, whichever is greater.

FERRY RANGE

Rolling Take-Off Allowed



(1) Warm-up and Take-off: Fuel allowance of 5 minutes at Maximum Continuous Power at sea level.

(2) Climb out: On course at best climb speed at intermediate power to optimum cruise altitude not to exceed 10,000 feet (unless limited by cruise ceiling).

(3) Cruise out: To remote base at speed for maximum range at optimum cruise altitude not to exceed 10,000 feet (unless limited by cruise ceiling). External fuel tanks retained.

(4) Descend to sea level: No fuel used, no distance gained.

(5) Landing reserve: 10% of initial fuel or fuel for 30 minutes at speed for maximum range at sea level, whichever is greater.

APPENDIX II

SUBSTANTIATING DATA REPORT

APPENDIX II

The substantiating data report is to be detailed and arranged as follows:

A title page, an index, a list of figures, a list of symbols and abbreviations, and other pertinent items should be located in the front of the report.

Section 1

Summary - Summarize all pertinent backgroun information regarding the helicopters. Also include approved helicopter configuration changes, similarity of the helicopter model to other helicopters of the series, general description of the model including armament, radar, major and special equipment and controls, and essential comments on mission capabilities.

Section 2

Introduction - Include pertinent background information regarding data upon which performance calculations are based, general basis of performance calculations of the helicopter and engine(s), indication of consistency of presented performance data with the Flight Manual Operating Data if the latter are available, and any further special considerations useful in the evaluation of the helicopter.

Section 3

Basic Aircraft Data - Tabulate all data important in the computation of performance and establishment of operational limitations, such as:

(1) Helicopter dimensional data (including wetted areas).

(2) Derivation of weight, with reference to latest applicable weight report; operational weight limitations; maximum allowable load factors at take-off, combat and design weights, etc.

(3) Power plant sea level power ratings, specific fuel consumption ratings and include source of rations (applicable engine specification).

(4) Drive system data (gear ratios, etc.).

Section 4

Aerodynamic Data - Present an analysis leading to the establishment of the helicopter drag. Include also main and tail rotor airfoil

data. Show graphical presentations of C_L vs. α for various Mach numbers, drag polars, and pitching moment vs. α for various Mach numbers for these airfoils. For helicopters carrying external weapons, fuel tanks, or other expendables, dimensional scale drawings adequate for use in drag estimation of external stores and the contractor estimate of the drag of these external stores must be included.

Section 5

Hover Performance - State the basis of all hover data presented and reference any flight tests which substantiate the data. Show pertinent flight test correlation with calculated performance data. Include all appropriate constants used in calculations. Show the following dimensional and non-dimensional graphical data for standard, tropical, and hot day conditions, in and out of ground effect:

(1) Thrust coefficient vs. power coefficient.

(2) Hover power required vs. gross weight.

(3) Hover ceiling vs. gross weight, all engines operative and, if applicable, one engine inoperative.

Section 6

Vertical Climb Performance - State the basis of all vertical climb data presented and reference any flight tests which substantiate the date. Show pertinent flight test c orrelation with calculated performance data. Include all appropriate constants used in the calculations. Show the following graphical data:

(1) Vertical rate of climb at sea level vs. gross weight. Use intermediate power, all engines operative and, if applicable, one engine inoperative.

Section 7

Level Flight and Cruise Performance - State the basis of all data presented in this section and reference any flight tests which substantiate the data. Show pertinent flight test correlation with calculated performance data. Show the following dimensional and non-dimensional graphical data all engines operative and, if applicable, one engine inoperative.

(1) Power coefficient vs. thrust coefficient for various speeds (non-dimensional).

(2) Shaft horsepower required vs. true airspeed at sea level for various weights (important mission weights) and with significant drag considerations for external loads, including weapon loads, if applicable.

(3) Specific range vs. airspeed for various gross weights at sea level. Show flight envelope limitations and effect of external loads, if applicable.

(4) Maximum specific range and airspeed at maximum specific range vs. gross weight for altitudes from sea level at 10,000 feet. Include flight envelope limitations. Show effect of external loads, if applicable.

(5) Fuel consumption vs. airspeed for various gross weights at sea level. Show flight envelope limitations and effect of external loads, if applicable.

(6) Minimum fuel consumption and airspeed for minimum fuel consumption vs. gross weight for altitudes from sea level to 10,000 feet. Include flight envelope limitations and effect of external loads, if applicable.

Section 8

Forward Flight Climb Performance - State the basis of all forward flight rate of climb data and reference any flight tests which substantiate the data. Show pertinent flight test correlation with calculated performance data. Identify all previously unidentified symbols used in this section. Show the following graphical data:

(1) Rate of climb vs. gross weight for various altitudes at normal rated power.

(2) Show time, distance, and fuel used in climb from sea level vs. gross weight for various altitudes.

(3) Show the flight envelope - gross weight, altitude, and power limitations.

(4) Show the effect of external loads if applicable.

(5) Show one engine inoperative rate of climb vs. gross weight at sea level, when applicable.

Section 9

Engine and Drive System Characteristics - Reference the source (applicable engine specification) of the power available and fue

flow derivations. Reference any flight tests which substantiate the data presented in this section. Show pertinent flight test correlation with calculated performance data. Identify any previously unidentified-symbols used in this section. Show the following graphical data:

(1) Altitude vs. shaft horsepower available at intermediate or normal rated power. Show transmission limitations.

(2) Shaft horsepower vs. fuel flow (installed). Fuel flow shall reflect the 5% increase as specified in paragraph 3.4.9 of this specification.

(3) Show transmission and accessory power losses in plots of rotor horsepower vs. shaft horsepower.

(4) Tail rotor horsepower as a percentage of main rotor horsepower vs. velocity.

(5) Mechanical efficiency vs. velocity.

Section 10

Operating Limits - Maximum permissible airspeeds center of gravity limitations, weight limitations, torque limits, and other pertinent limitations are to be shown in this section. Basis of data shall be stated. Show the following graphical data:

(1) Never-exceed-speed due to structural limitations for any combination of altitude, temperature, and gross weight.

(2) Center of gravity envelope - Gross weight vs. maximum allowable distance from datum of c.g. location. Show any structural limits.

Section 11

Mission Calculations - Briefly describe each mission calculated and present the calculations in orderly form.

Section 12

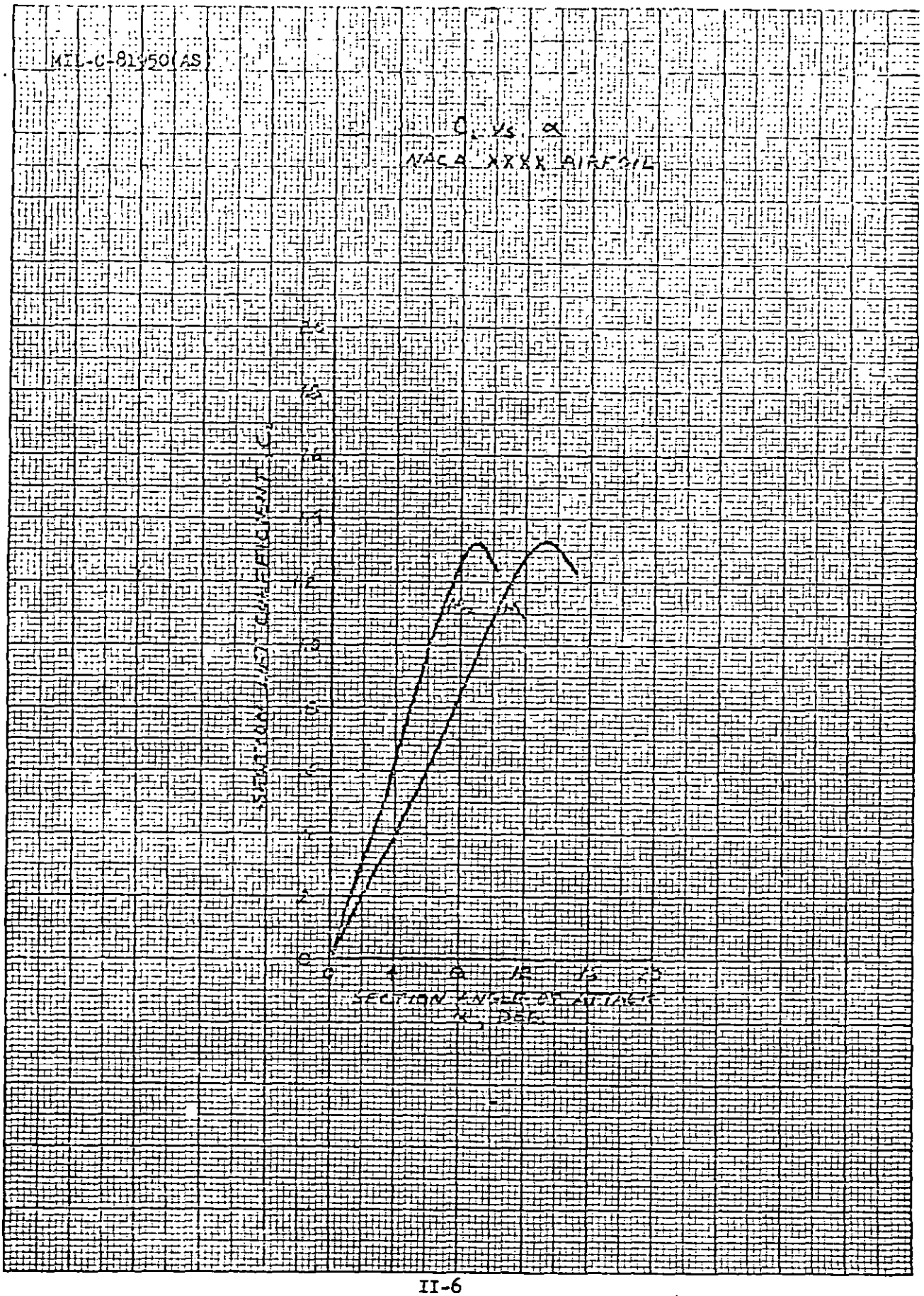
Standard Aircraft Characteristics Charts - The first page should contain an index to the Standard Aircraft Characteristics Charts. Reproductions of the Standard Aircraft Characteristics Charts and

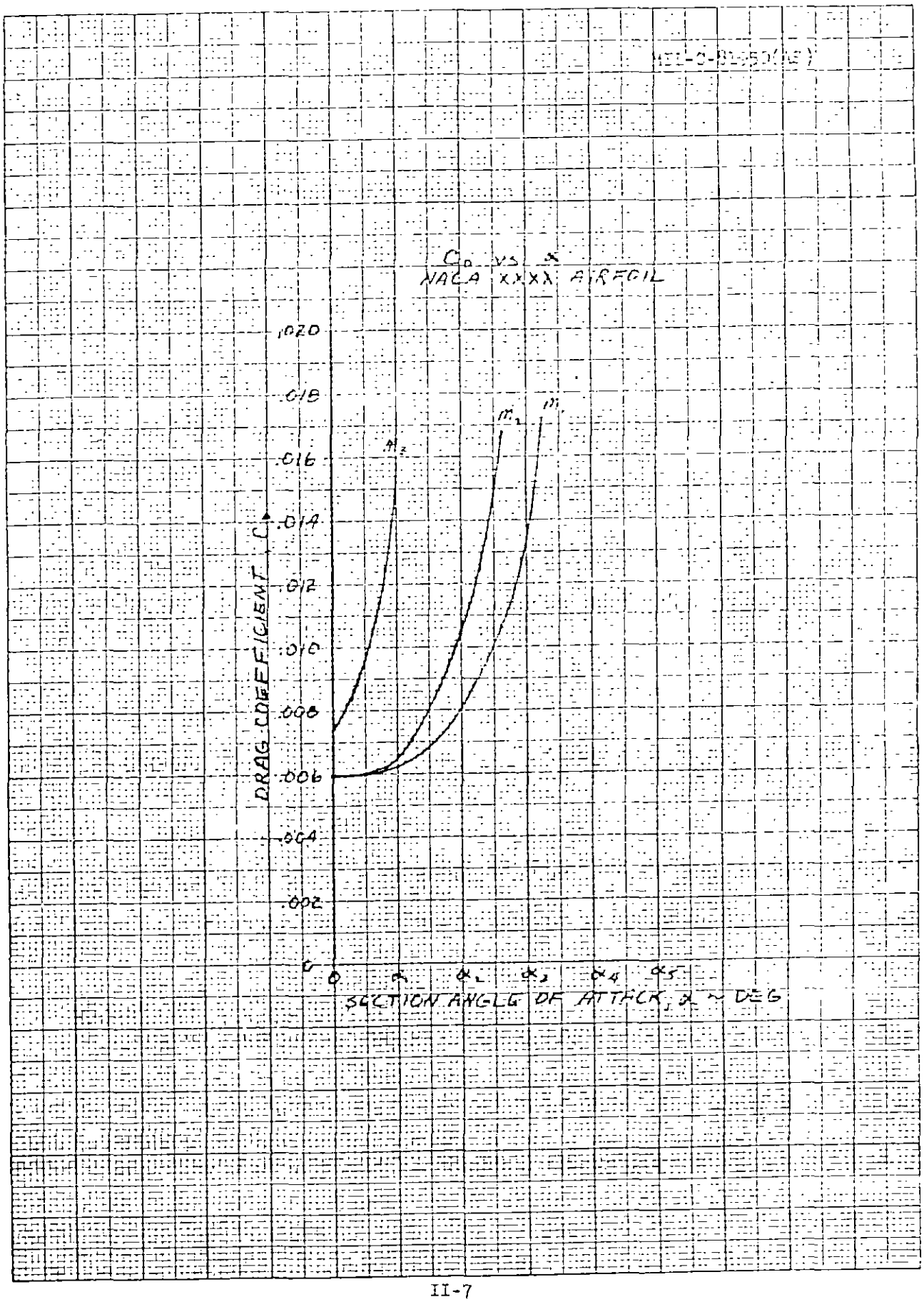
Characteristics Summary Charts should be included in this section.

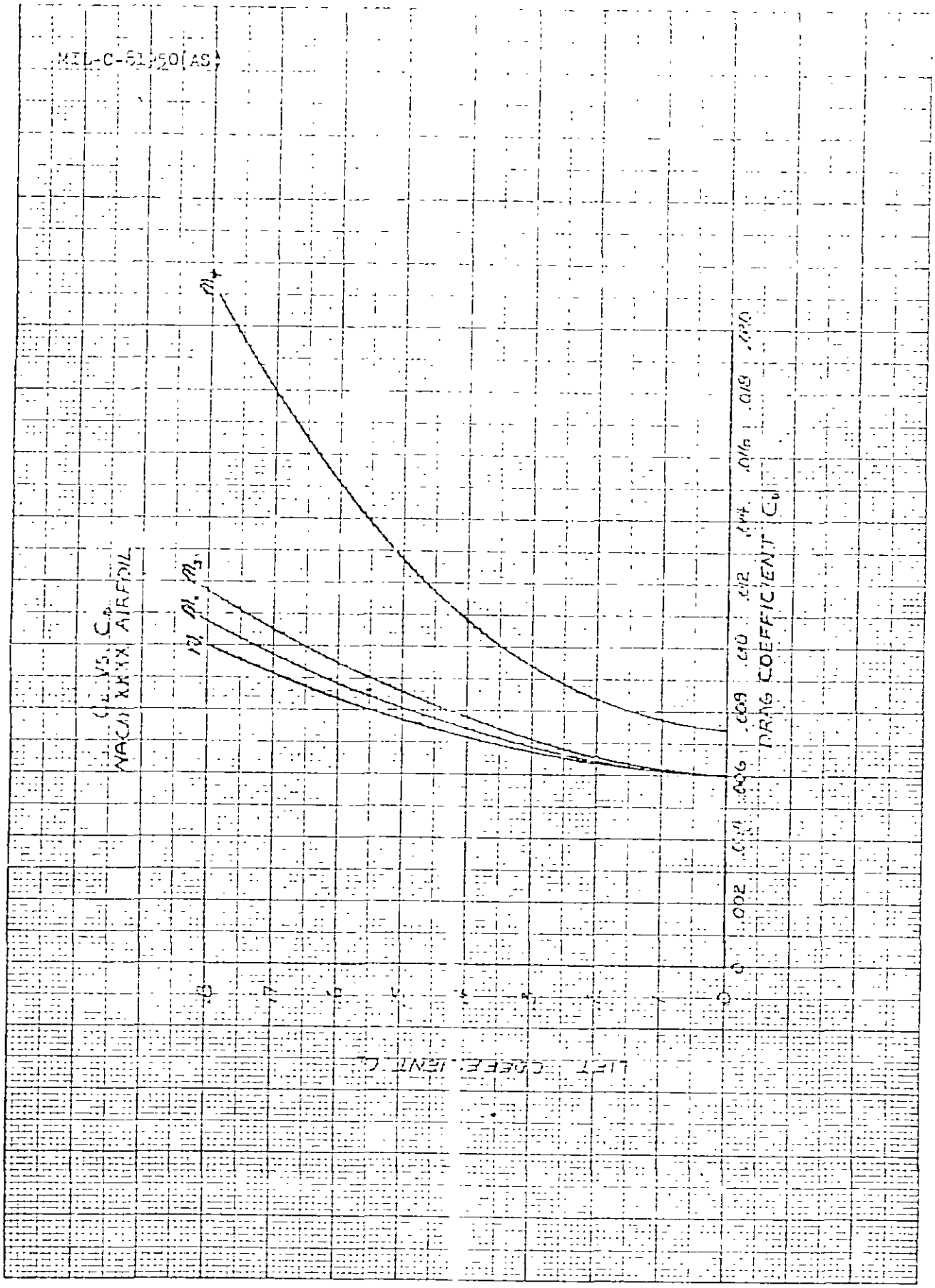
Section 13

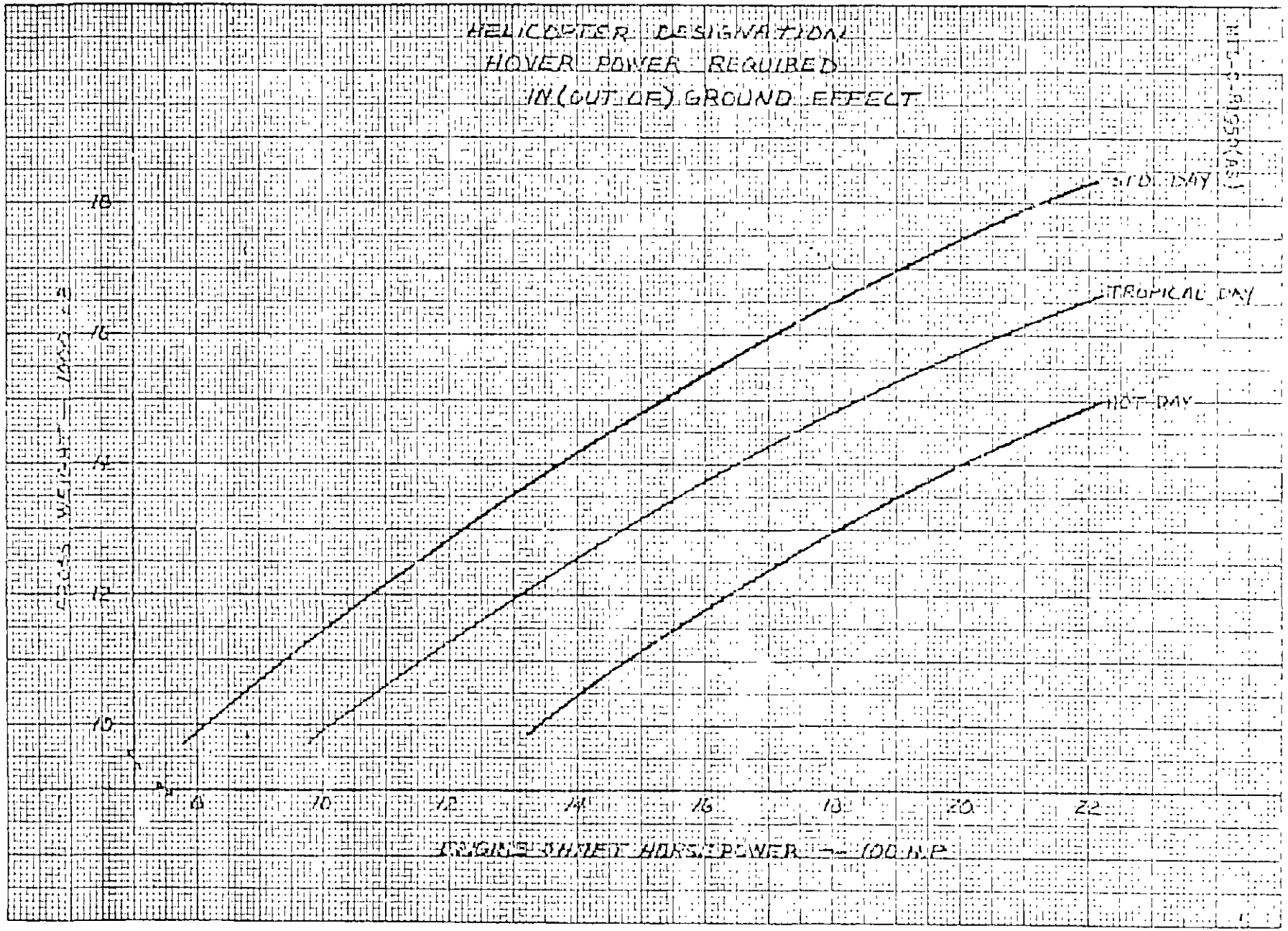
References - All reference material concerning the preparation of the substantiating data report should be tabulated.

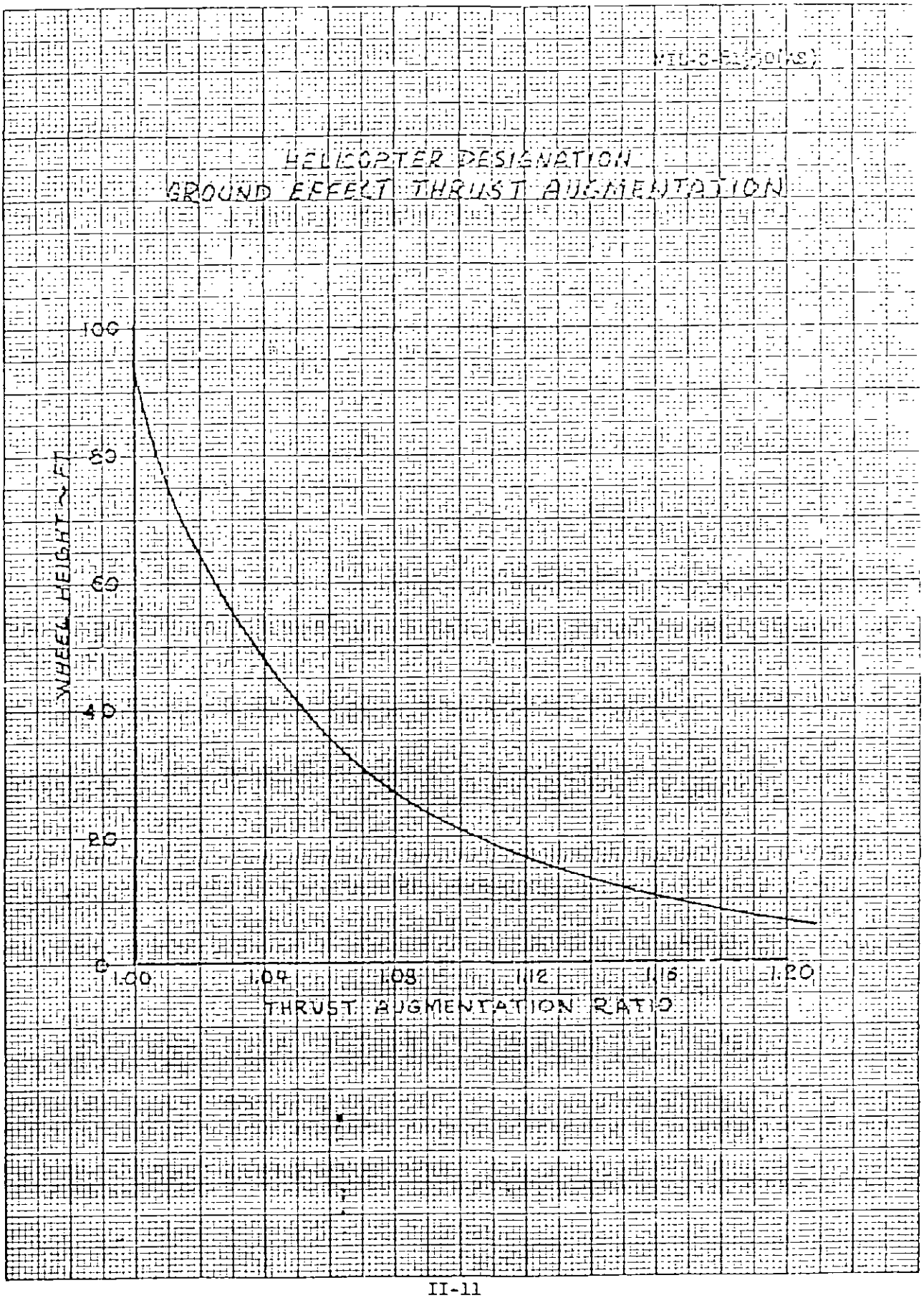
Appendix - Any specific material prepared by the Contractor and not previously submitted should be included as an appendix to the substantiating Performance Data Report.

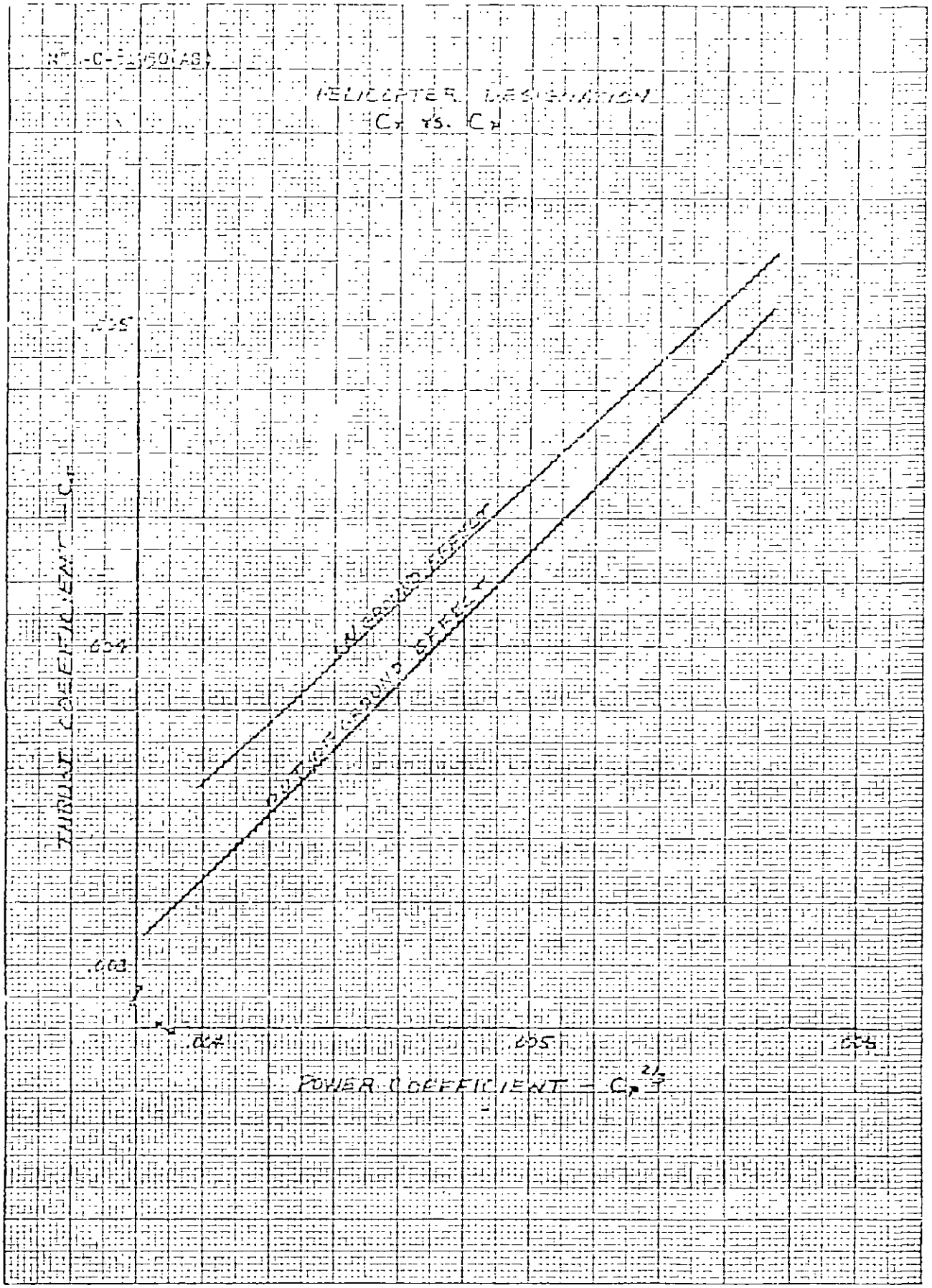




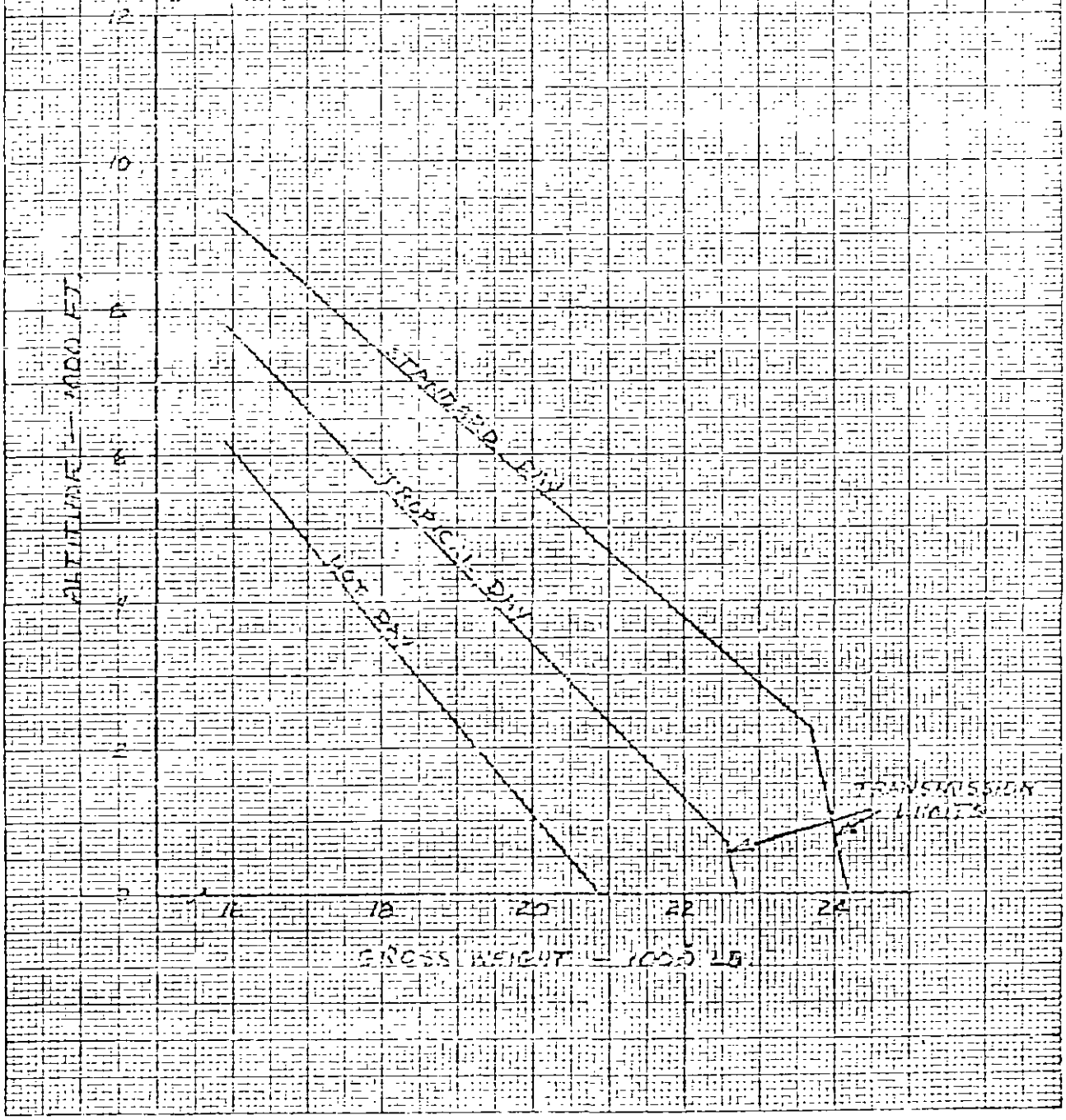




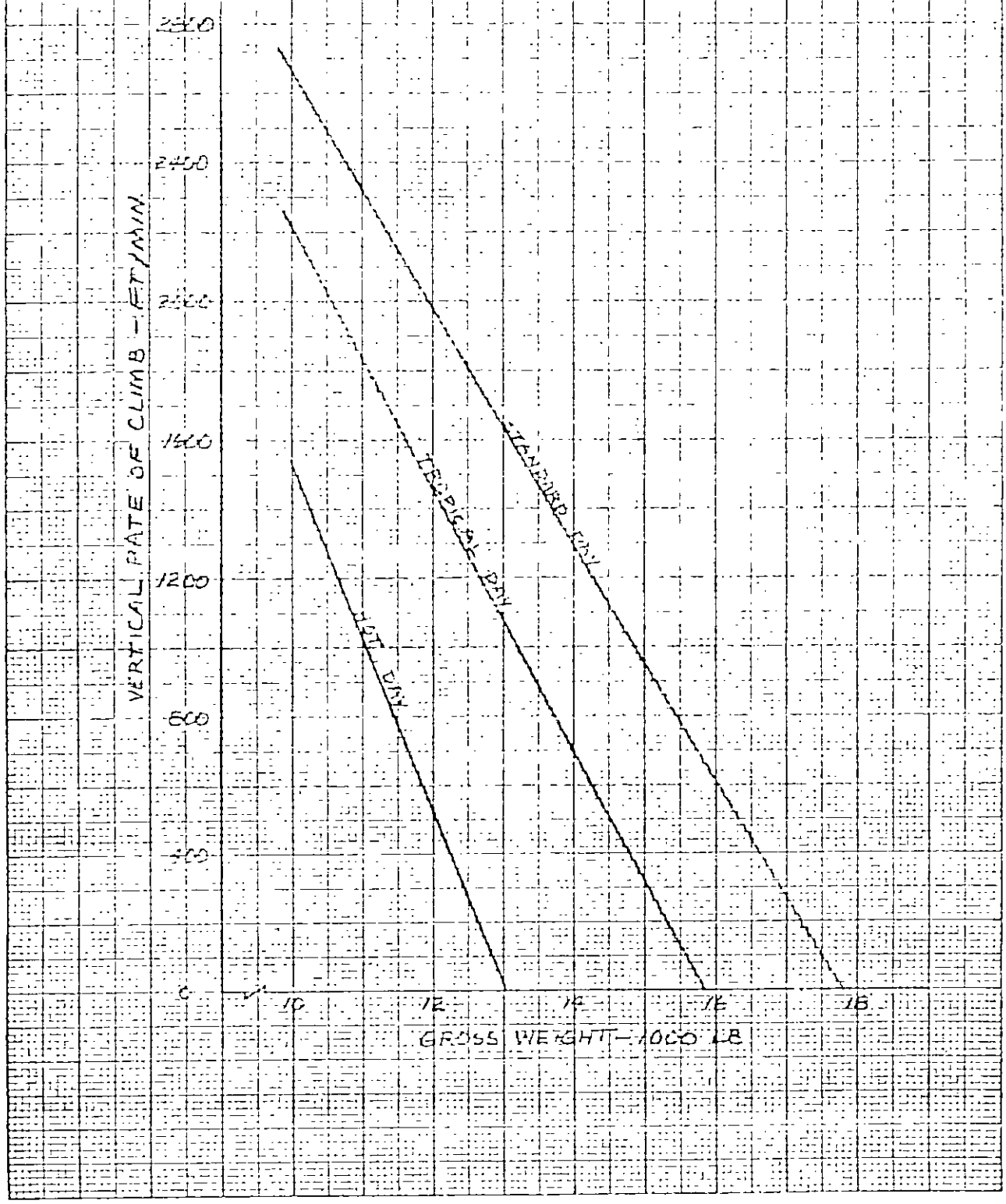


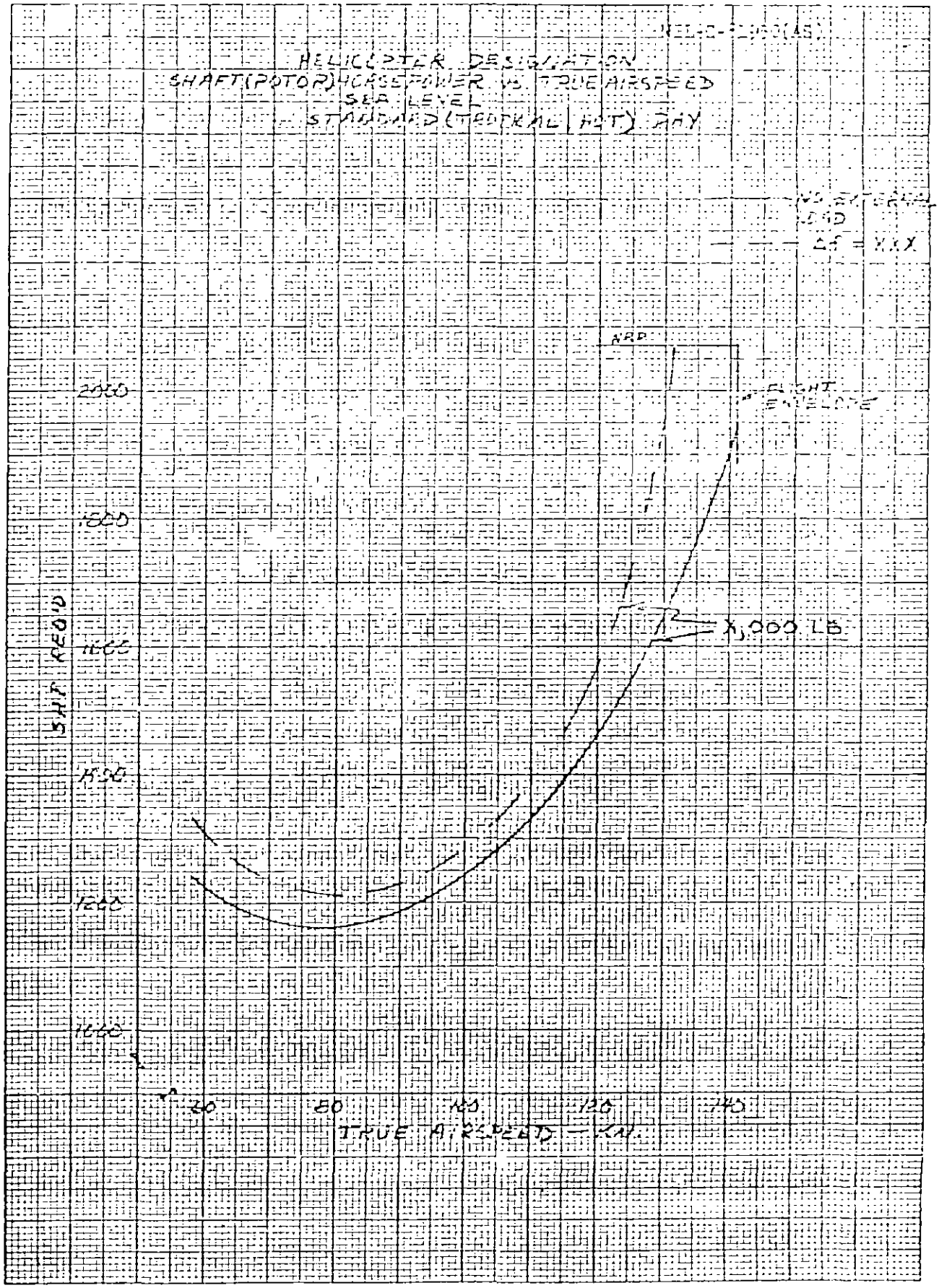


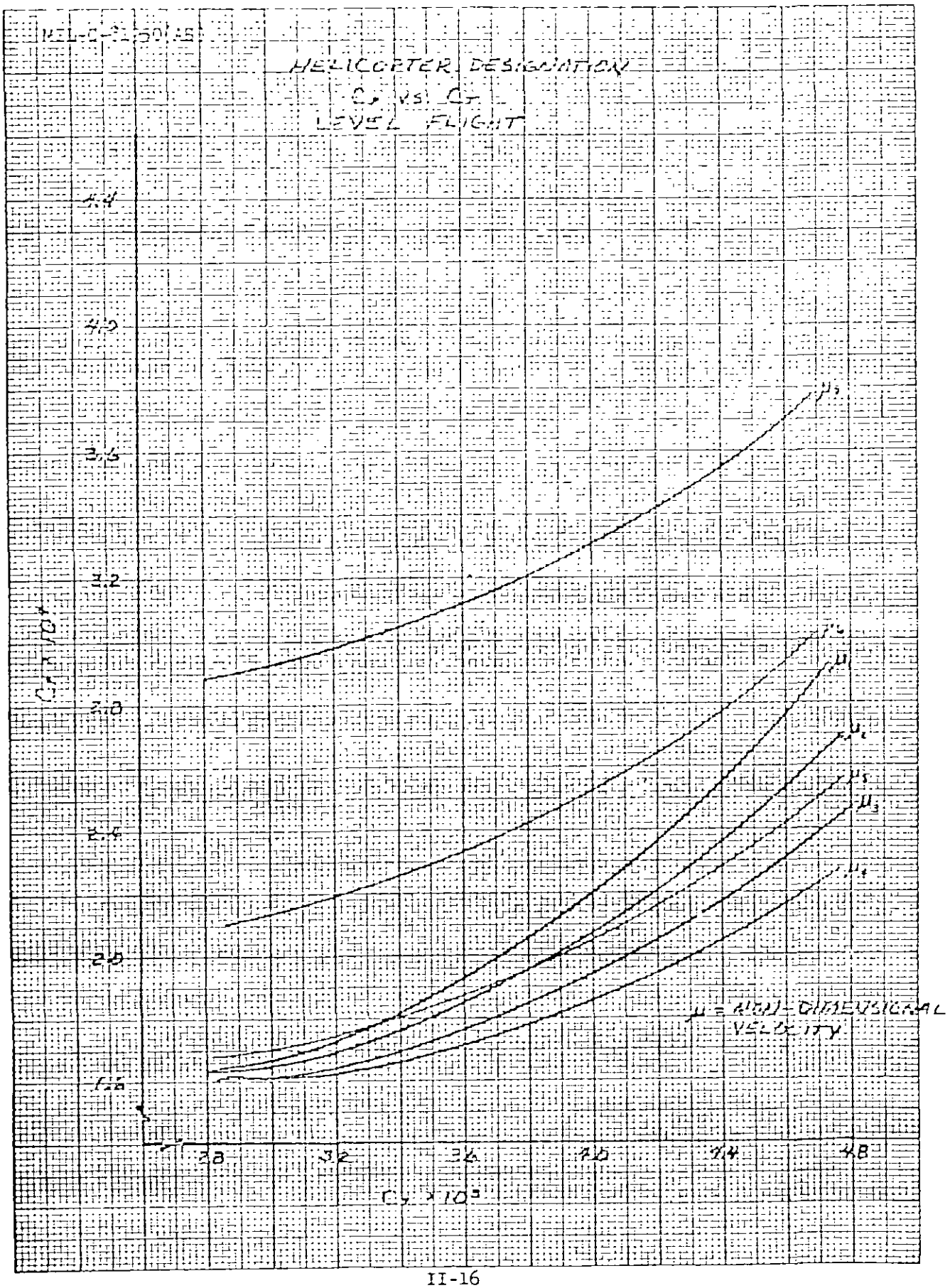
HELICOPTER DESIGNATION
HOVER CEILING
OUT-OF-GROUND-EFFECT
INTERMEDIATE POWER



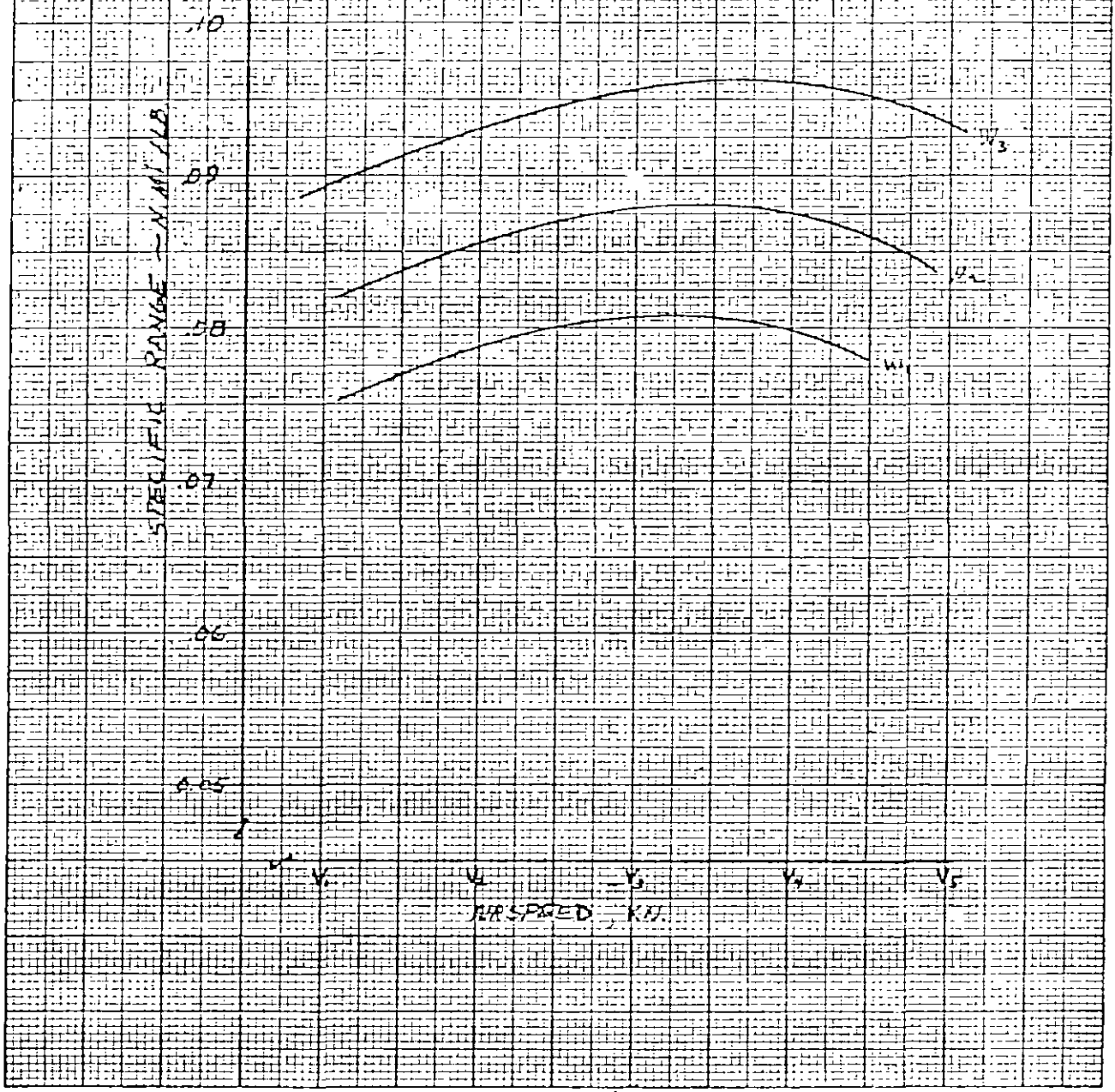
HELICOPTER DESIGNATION
VERTICAL RATE-OF-CLIMB VS GROSS WEIGHT
SEA LEVEL
INTERMEDIATE POWER

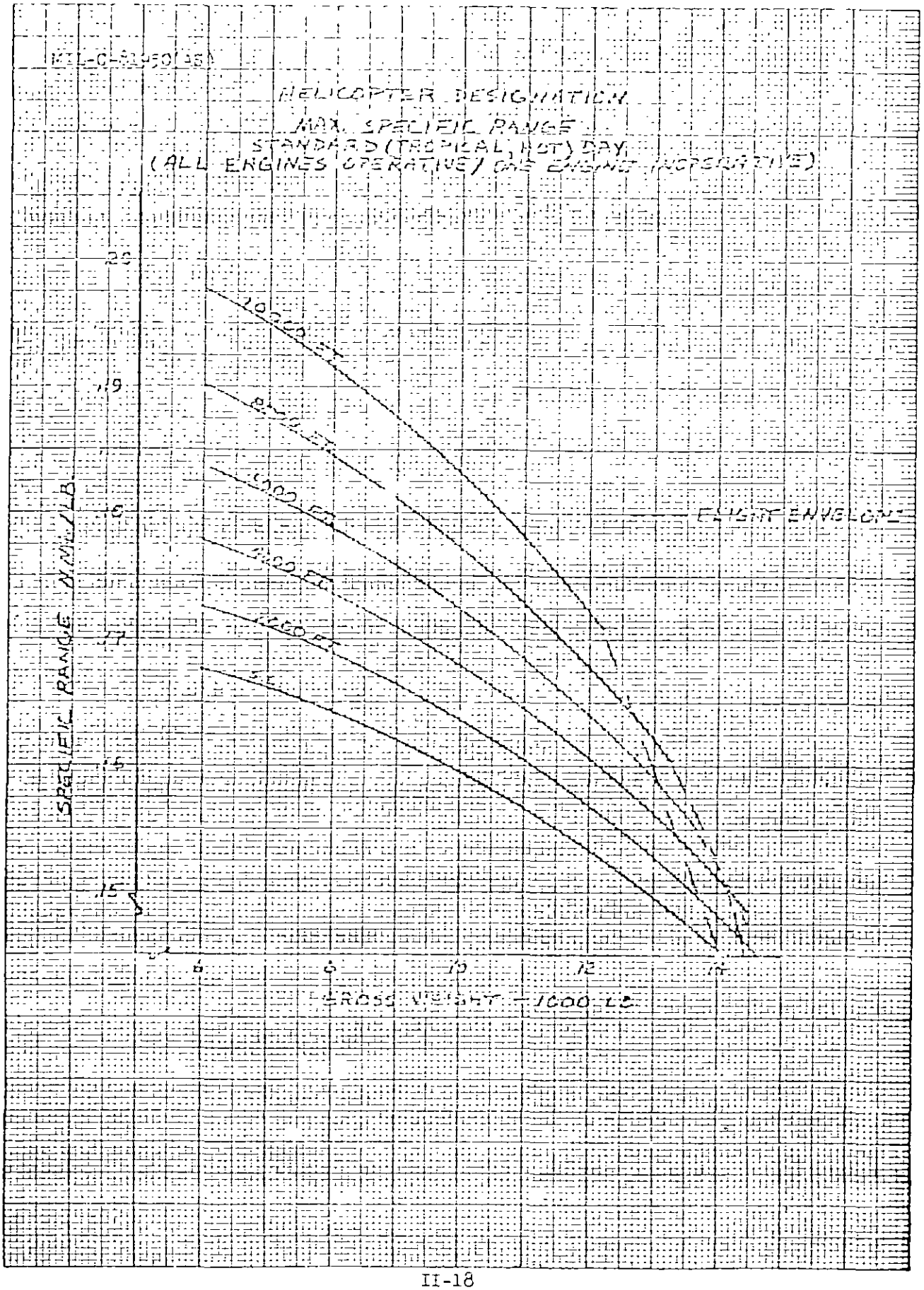


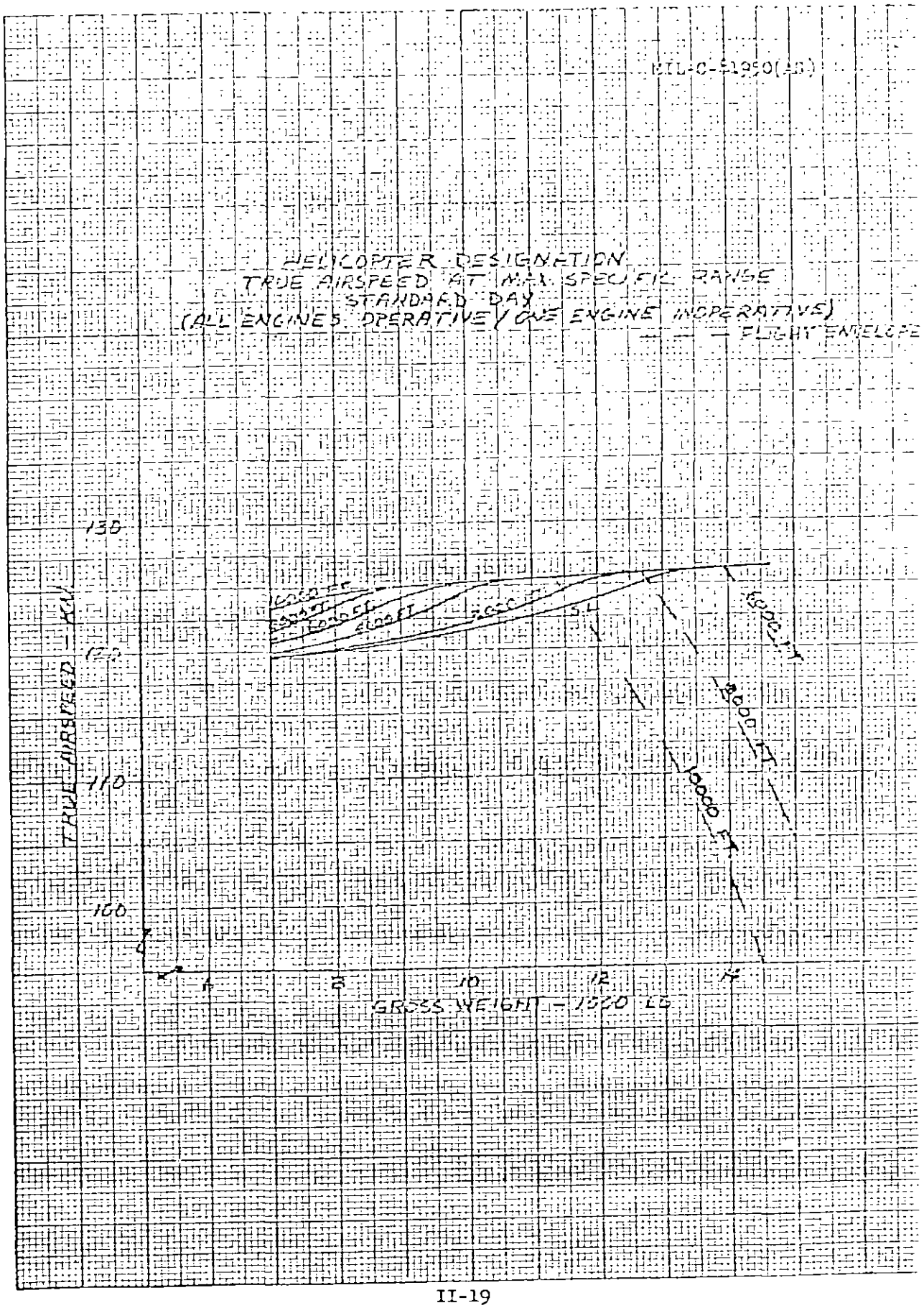


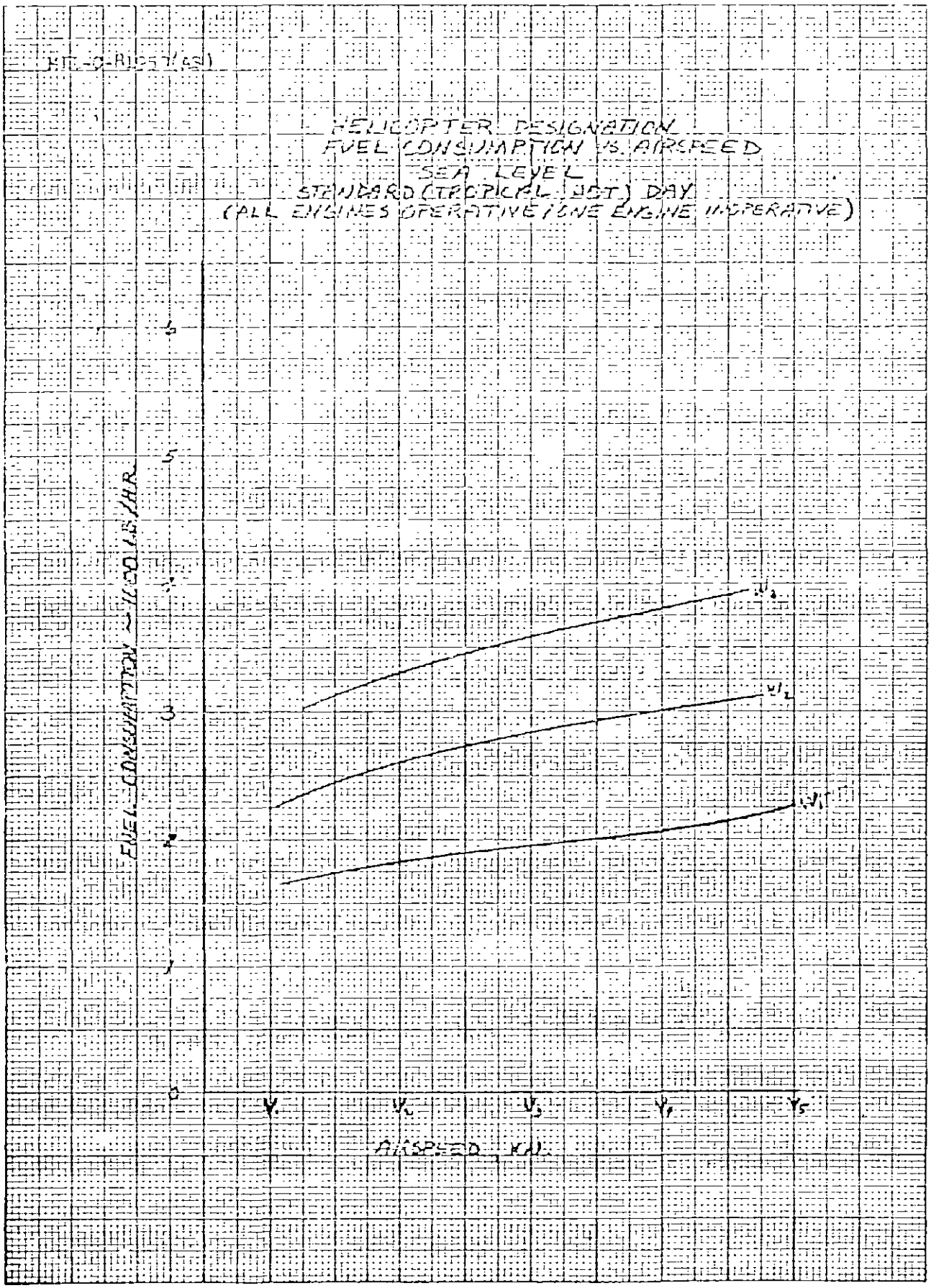


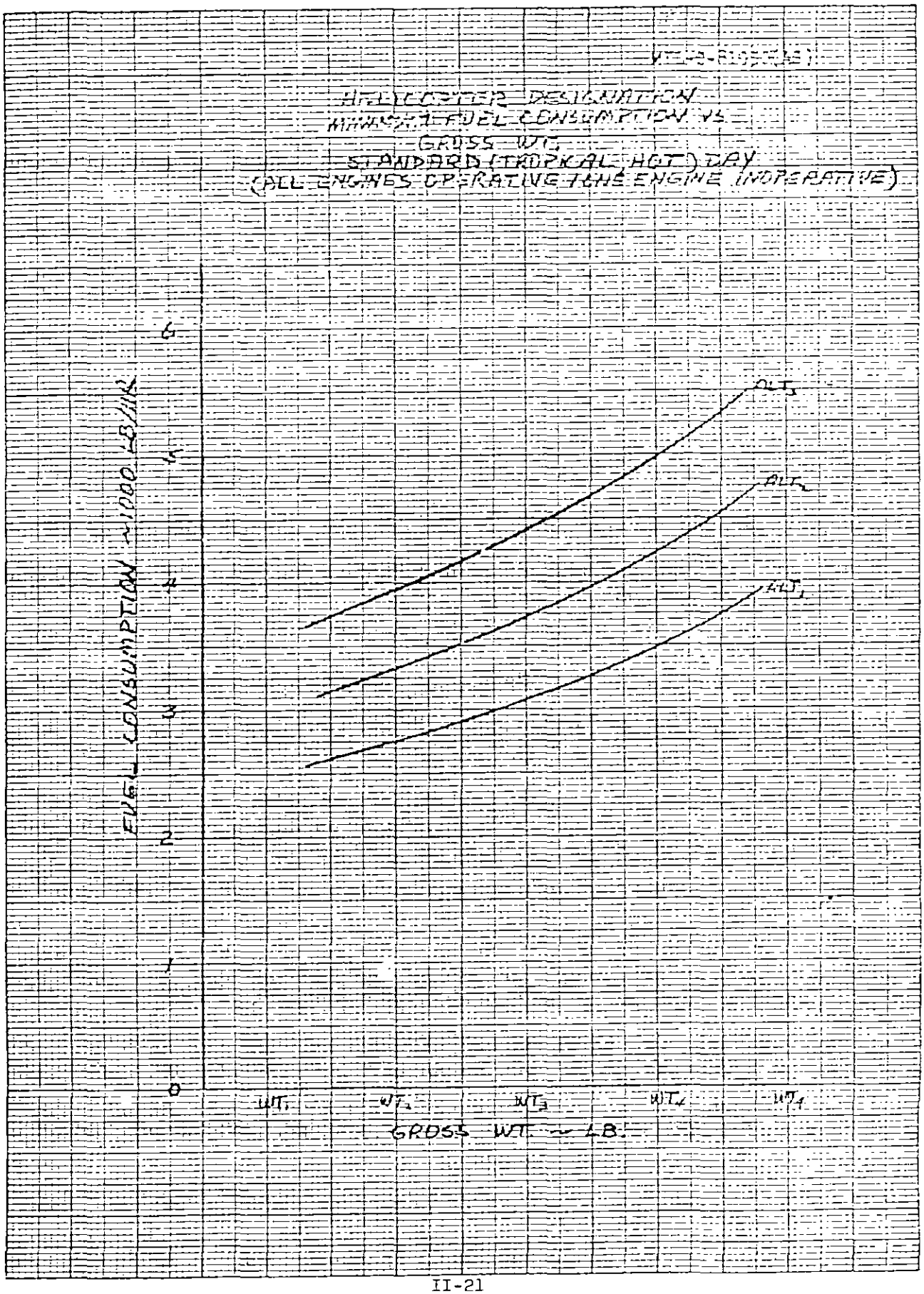
HELICOPTER DESIGNATION
SPECIFIC RANGE VS AIRSPEED
SEA LEVEL
STANDARD (TROPICAL HOT) DAY
(ALL ENGINES OPERATIVE/ONE ENGINE INOPERATIVE)

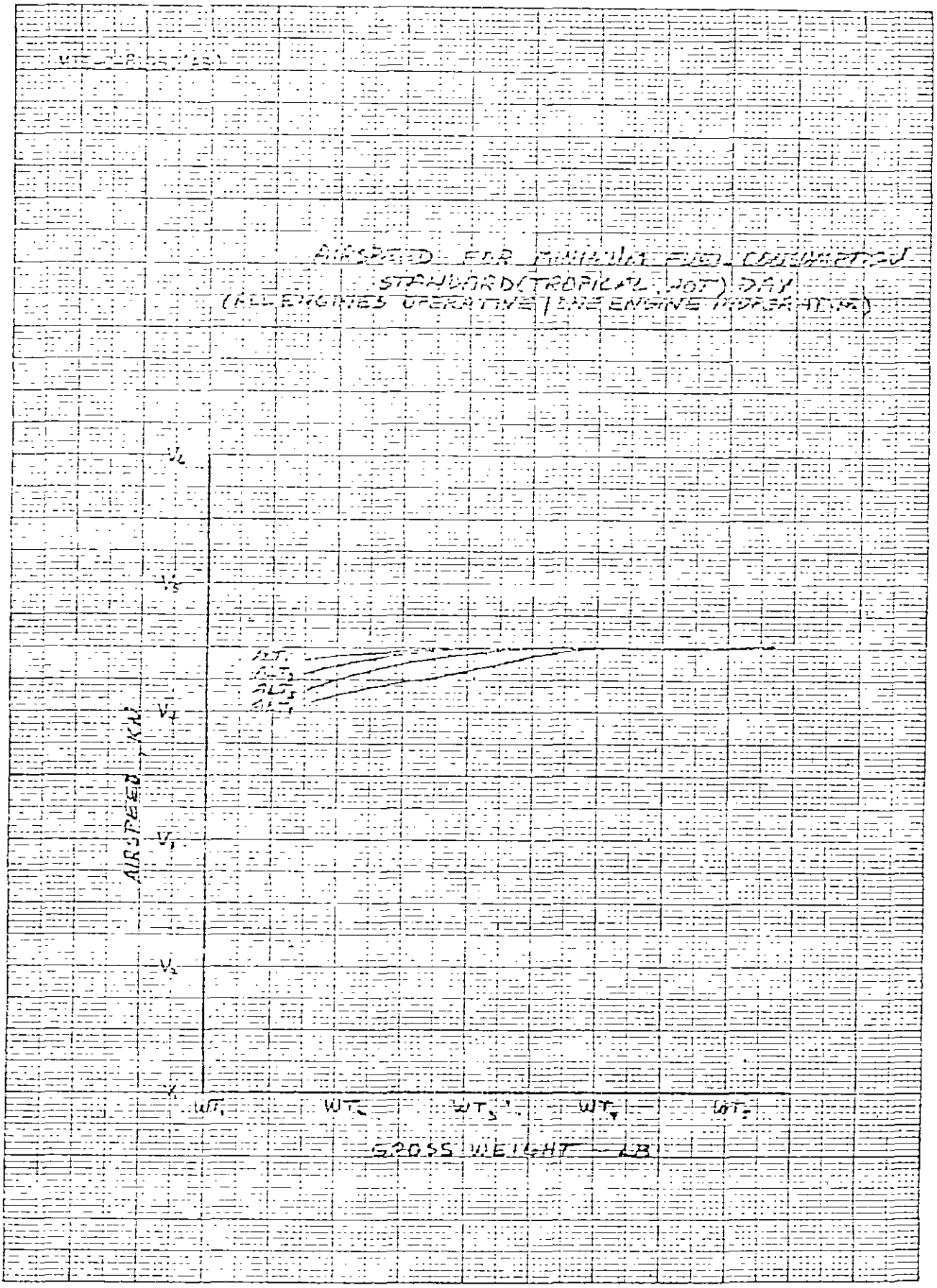




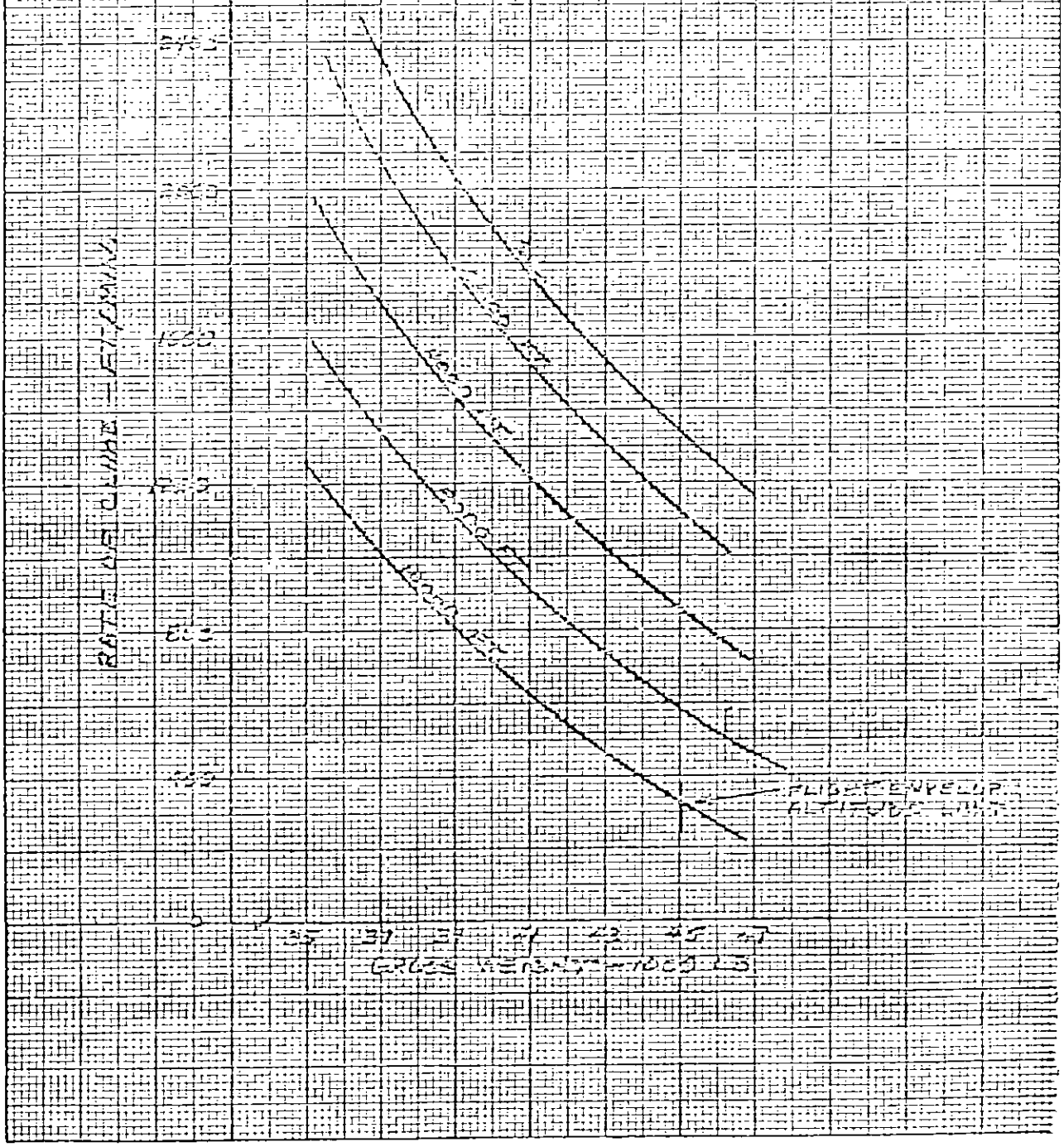


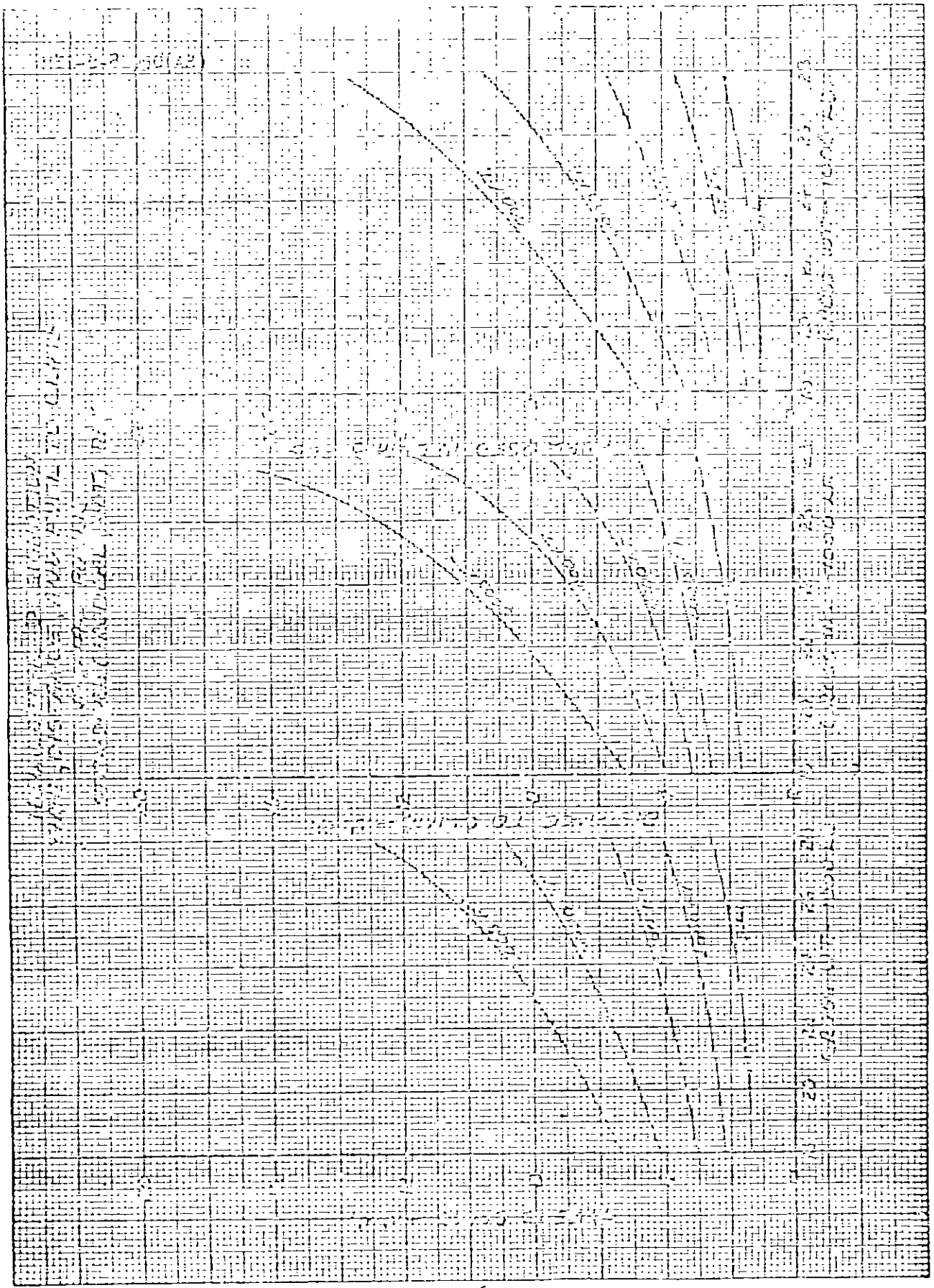


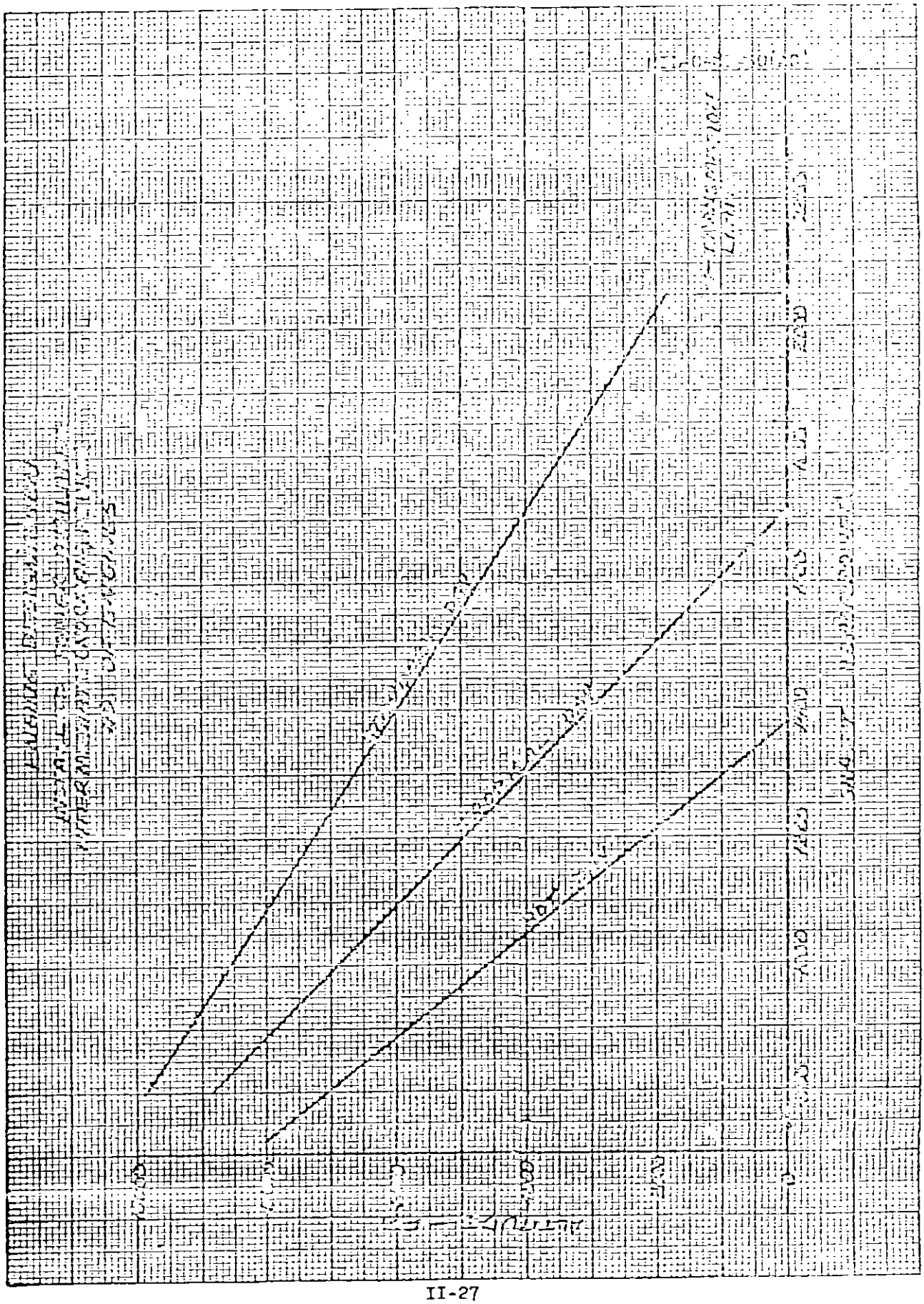


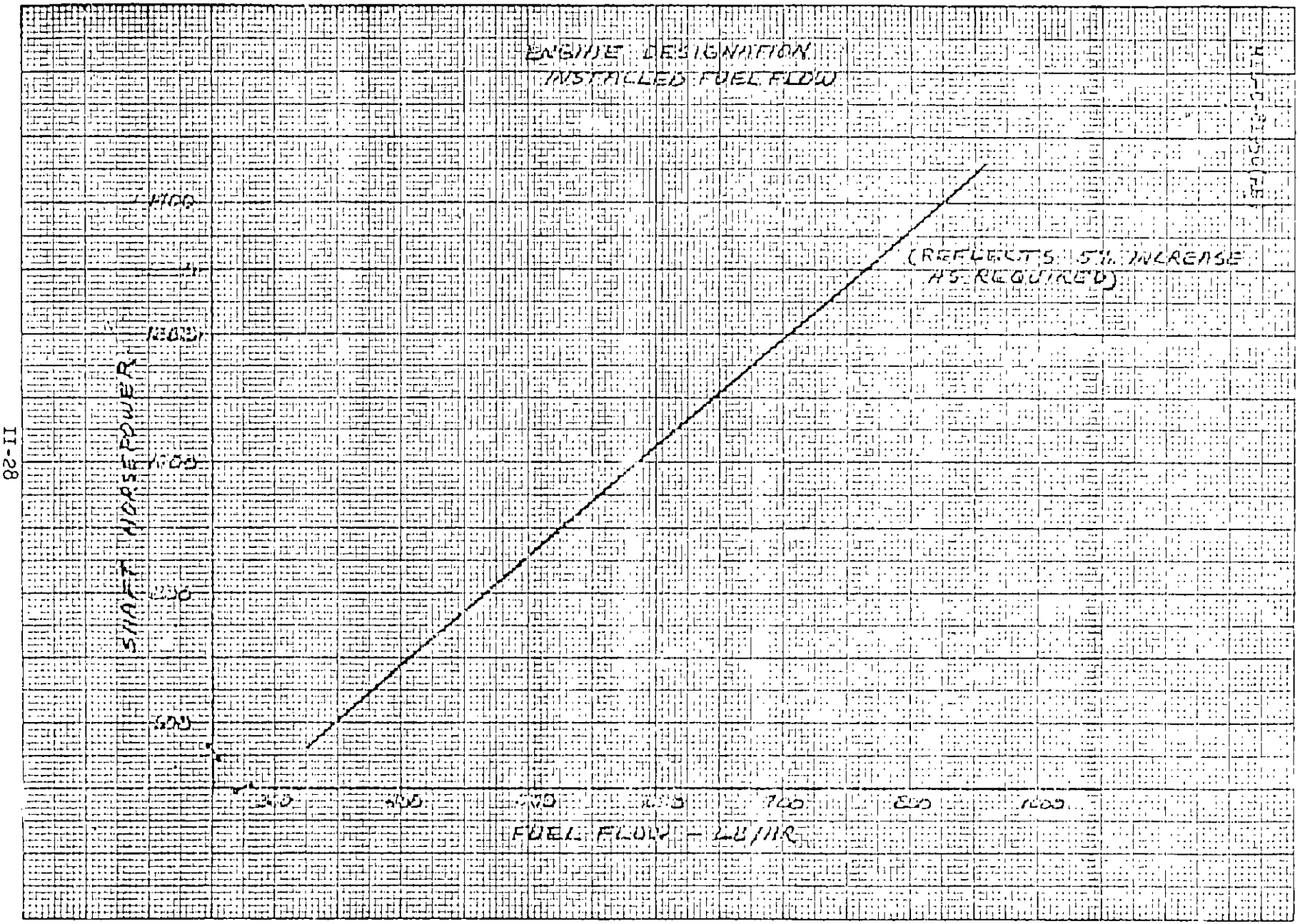


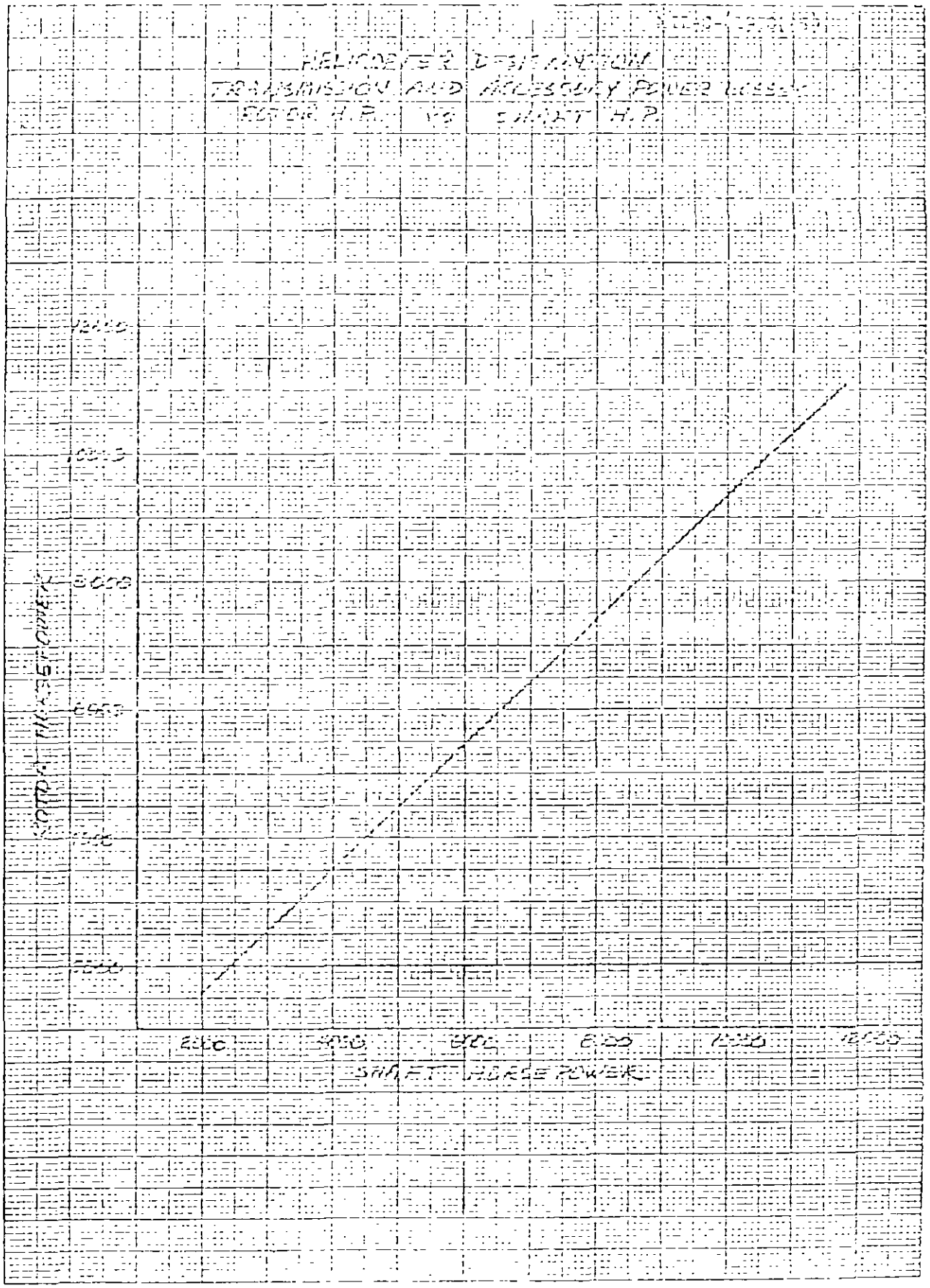
HELICOPTER DESIGNATION
FORWARD FLIGHT RATE OF CLIMB
NORMAL POWER
STANDARD (TROPICAL, HOT) DAY



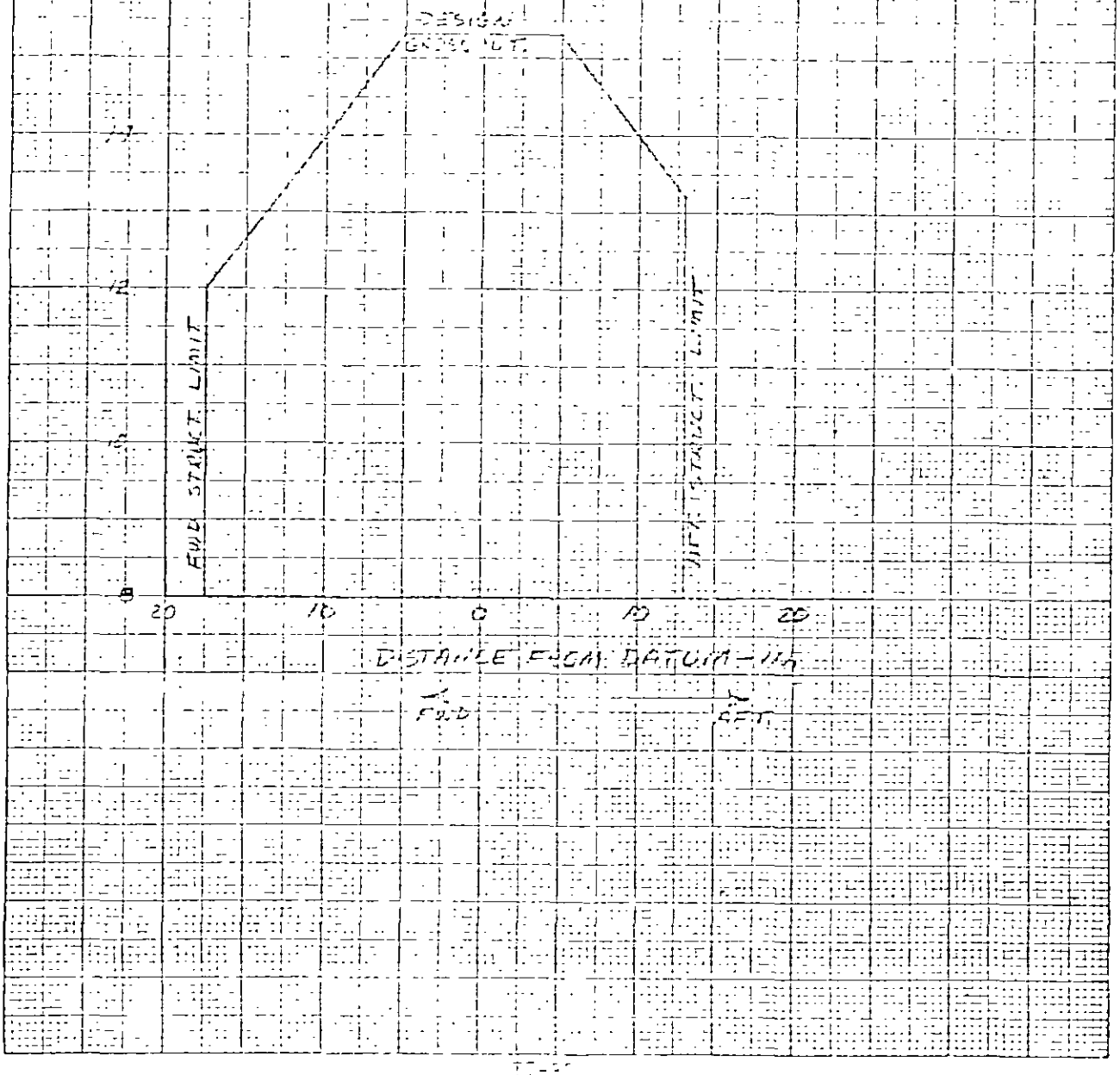


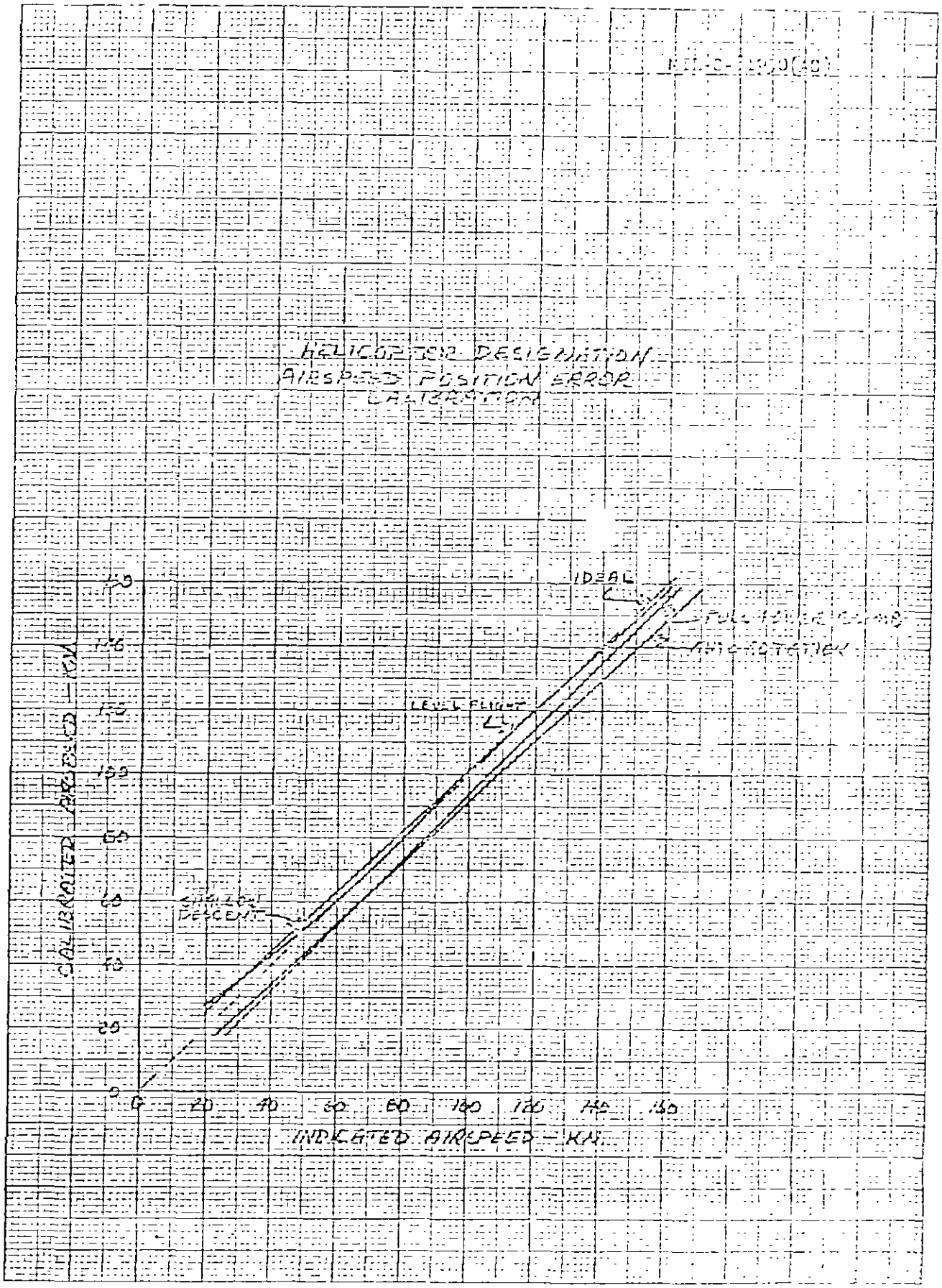






HELICOPTER DESIGNATION
CENTER OF GRAVITY ENVELOPE





APPENDIX III

SAMPLE SAC CHART

INDEX

81

Preparing Activity
NAVY - AS

Project No. 7530-N178

COVER PHOTOGRAPH

STANDARD AIRCRAFT CHARACTERISTICS

HELICOPTER DESIGNATION

CONTRACTOR NAME

CATEGORY

SECURITY CLASSIFICATION

IDENTIFICATION NUMBER

NAVAL AIR SYSTEMS COMMAND
NAVY DEPARTMENT

DESCRIPTIVE ARRANGEMENT

NAVAL AIR SYSTEMS COMMAND
NAVY DEPARTMENT

ARMAMENT AND TANNAGE

DESIGNATION

SECURITY CLASSIFICATION

DATE

IDENTIFICATION NUMBER | SECURITY CLASSIFICATION | CATEGORY

POWER PLANT

No. & Model:
Manufacturer:
Engine Spec. No.:
Type:

Gear Reduction Ratios
Engine Speed Decreaser:
Main Rotor:
Tail Rotor:

RATINGS

	SHP	RPM	ALT
Intermediate			
Maximum Continuous			

ELECTRONICS

MISSION AND DESCRIPTION

DEVELOPMENT

DIMENSIONS

Main Rotor
Diameter:
Disc Area:
Blade Area:
No. of Blades
Length
Maximum:
Blades and Tail Folded:
Height
Maximum:
Blades and Tail Folded:
Width
Blades Folded:
Trend:

WEIGHTS

Loading	Weight	L.F.
Empty		
Basic		
Operating		
Design		
Combat		
Overload		
Maximum Takeoff		
Maximum Landing		

FUEL AND OIL

FUEL

Gal.	No. & Type of Tanks	Location:

Fuel Grade:
Fuel Spec:

OIL

Engine (Gal.)
Spec:
Transmission (Gal.)
Spec:

ORDNANCE

ACCOMMODATIONS

Crew (mission):
Cabin Size Clearance:
Length
Width
Height
Usable Volume
Rescue Hatch Dimensions:
Provision for Troop Seats:
Provision for Litters:
Rescue Hoist Capacity:
Cargo Hook Capacity:
Dead Weight Cargo Floor Limit for L.F. (lb./Ft.^{2})
Max. Cargo Weight: (lb.)

DATE | SECURITY CLASSIFICATION | DESIGNATION

PERFORMANCE SUMMARY

TAKE-OFF LOADING CONDITION		(1) CLEAN	(2) BASIC	(3) TYPICAL	(4) TYPICAL	(5) FERRY
TAKE-OFF WEIGHT	lb.					
Fuel internal/external (JP-5)	lb./lb.					
Payload	lb.					
Disc loading	lb./sq. ft.					
Vertical rate of climb at S.L.	fpm.					
Absolute hovering ceiling (OGE)	ft.					
Max. rate of climb at S.L.	fpm.					
Service ceiling	ft.					
Speed at S.L.	kn.					
Max speed/altitude	kn./ft.					
O.E.I. Service ceiling	ft.					
Min. speed (O.E.I.)	kn.					
Max. speed (O.E.I.)	kn.					
Combat radius	n. mi.					
Mission time	hrs.					
Average cruising speed	kn.					
Cr ising altitude	ft.					
Range	n. mi.					
Average cruising speed	kn.					
Cruising altitude	ft.					
Maximum endurance	hrs.					
Endurance speed	kn.					
Endurance altitude	ft.					

NOTES

IDENTIFICATION NUMBER | SECURITY CLASSIFICATION | CATEGORY

MISSION SUMMARY — ALTERNATE LOADINGS

		CLOSE SUPPORT		ATTACK							
		→		→							
EXTERNAL STORE LOADING	T.O.G.W.	COMBAT RADIUS n. mi.	MISSION TIME hr.	COMBAT RADIUS n. mi.	MISSION TIME hr.						
○											
○											
○											
○											
○											
○											
○											
○											
○											

NOTES

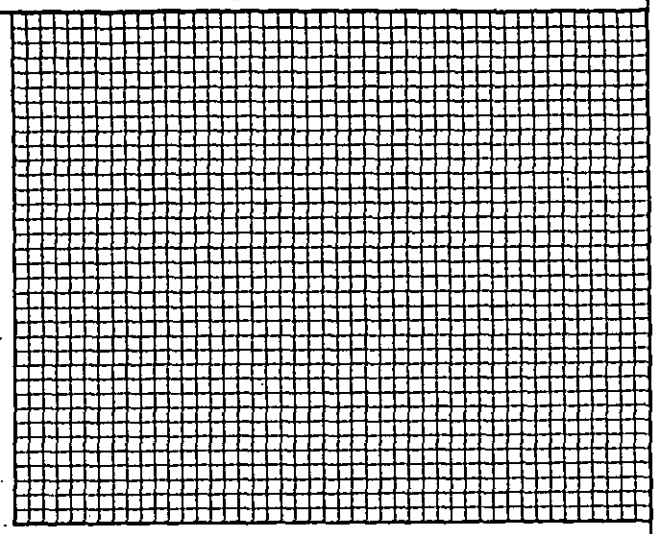
DATE | SECURITY CLASSIFICATION | DESIGNATION

MIL-C-81950(AS)

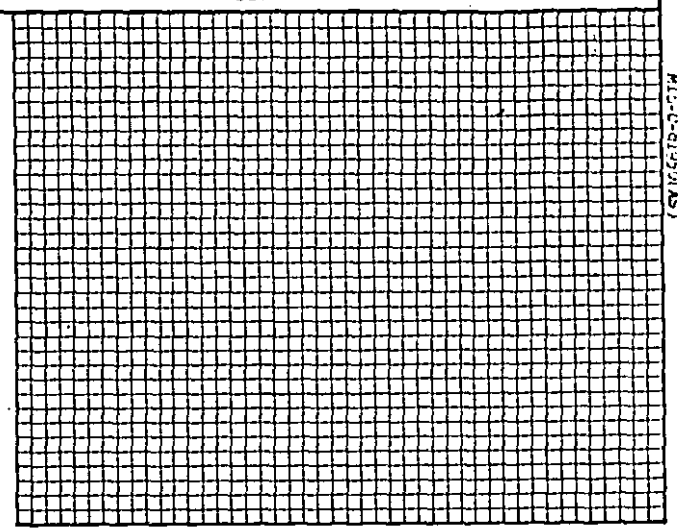
89

CATEGORY SECURITY CLASSIFICATION IDENTIFICATION NUMBER

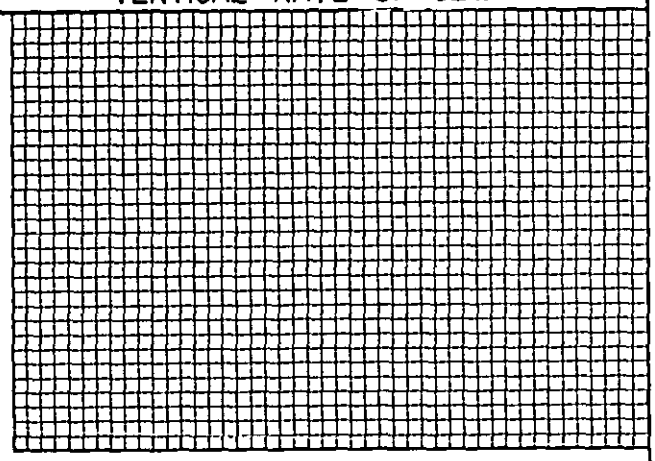
SPEED



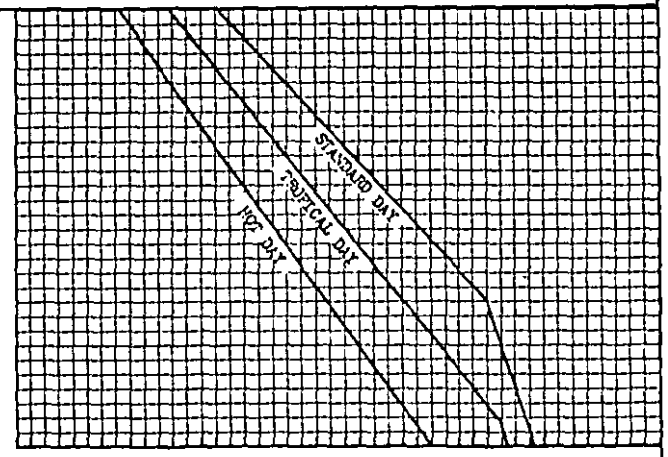
CLIMB



VERTICAL RATE OF CLIMB



HOVER CEILING



LOADING CONDITION COLUMN NUMBER

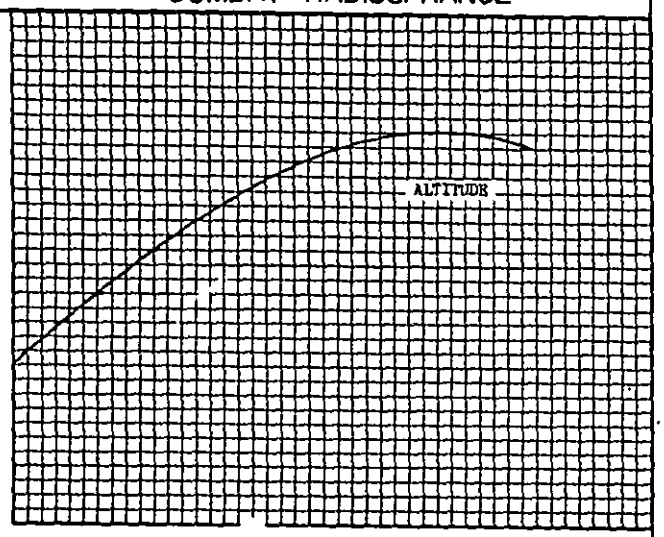
DESIGNATION SECURITY CLASSIFICATION DATE

IDENTIFICATION NUMBER

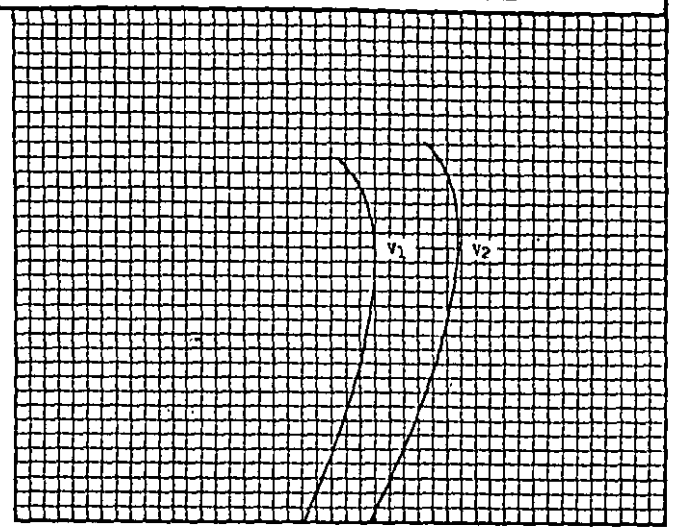
SECURITY CLASSIFICATION

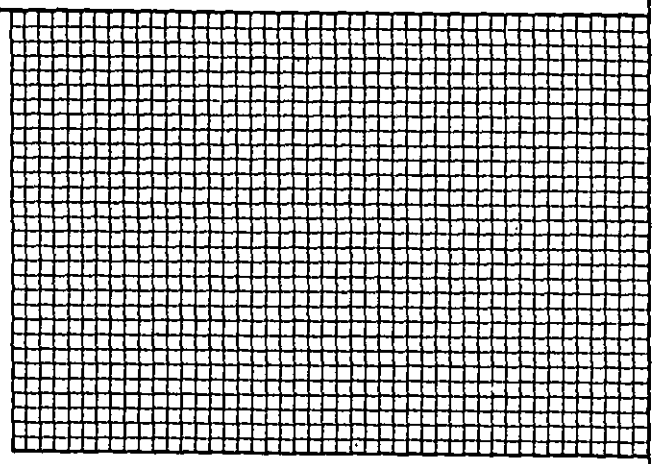
CATEGORY

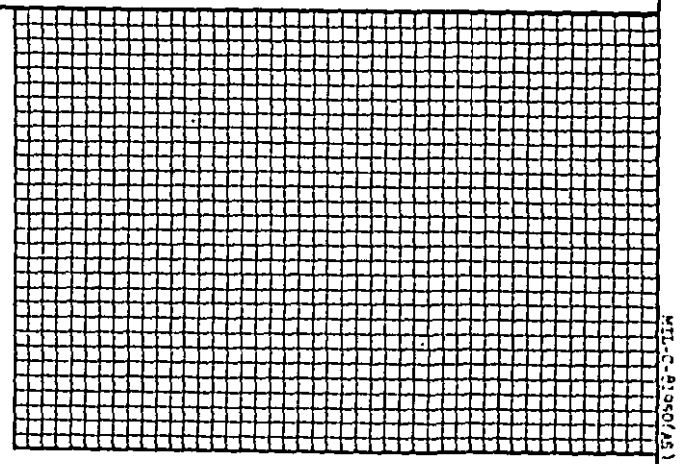
COMBAT RADIUS/RANGE



COMBAT RADIUS/RANGE







LOADING CONDITION COLUMN NUMBER

DATE

SECURITY CLASSIFICATION

DESIGNATION

MIL-C-81950(AS)

CATEGORY | SECURITY CLASSIFICATION | IDENTIFICATION NUMBER

STORE LOADING

SIMPLIFIED DRAWING OF HELICOPTER
SHOWING STORE STATIONS

STORE	STATION 1	STATION 2	STATION 3				
	NO. OF STORES CARRIED ON EACH STATION						

DESIGNATION | SECURITY CLASSIFICATION | DATE

IDENTIFICATION NUMBER | SECURITY CLASSIFICATION | CATEGORY

NOTES

LOADING CONDITION COLUMN NUMBER

DATE | SECURITY CLASSIFICATION | DESIGNATION