HUGHES TH-55

OPERATOR'S MANUAL

Compiled, Edited and Published By

Southern Airways of Texas, INC.

For

THE U. S. ARMY PRIMARY HELICOPTER SCHOOL

Southern Airways of Texas, INC.

FORT WOLTERS, TEXAS 76067

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This Operator's Manual has been published for the use of all pilots and students at the U.S. Army Primary Helicopter School, Fort Wolters, Texas. It is the purpose of this manual to furnish a source of general information concerning the TH-55A, its components and characteristics, and be used as a supplement to the maintenance and flight training publications now being furnished by the USAPHS.

It is with great appreciation and gratitude that the following are recognized for their cooperation and contributions toward compiling and editing this manual:
Office of the Director of Training, USAPHS
Mr. John Seimos, Technical Representative, Hughes Aircraft

It is our hope that this manual will give you a more thorough understanding of the TH-55 and aid you in accomplishing the USAPHS mission.

R. L. Thomas

Raymond L. Thomas
General Manager
Southern Airways of Texas, Inc.

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CHAPTER 1

INTRODUCTION

Section I

Scope

IMPORTANT

In order to obtain complete information and derive maximum benefits from this manual, it will be necessary to read this chapter thoroughly.

1-1. Scope. This manual was written and issued expressly for pilots and student pilots operating the Army Model Hughes TH-55A identified by the following serial numbers: 64-18001 through 67-18401.

Section II

General

1-2. The purpose of this manual is to supply you with the latest information and performance data derived from flight test programs and operational experiences. In addition to related material referenced herein, the study and use of this manual will enable you to perform assigned missions and duties with maximum efficiency and safety.

1-3. It is NOT the intent or function of this manual to teach the pilot or student how to fly. Basic flight principles and elementary instructions are not included. The contents of this manual will provide you with a general knowledge of the TH-55A, its flight characteristics, and specific normal and emergency operating procedures.

1-4. The Appendix is a list of references applicable and available to the pilot. The list includes official publications directly applicable to the Operator's Manual. All references in the text are reflected in this appendix.

1-5. The Index lists, in alphabetical order, every important subject under the topic which may be significant to the pilot. The listing is not a repetition of paragraph titles, but an extensive listing of subjects which will aid the pilot in his use of this manual.

1-6. The Table of Contents, in the front of the manual, includes the chapters and sections as they are arranged in the manual. A brief description of each chapter is provided in Section I of the applicable chapter.

1-7. Notes, Cautions, and Warnings are used to emphasize important and critical instructions and are detailed as follows:

NOTE

An Operating procedure, condition, etc., which is essential to highlight.

CAUTION

An operating procedure, practice, etc., which, if not strictly observed, may result in damage to or destruction of equipment.

WARNING

An operating procedure, practice, etc., which if not correctly followed, will result in personnel injury or loss of life.

1-8. Revisions to this manual shall be published when necessary to add, delete, revise or change. Frequency of revisions will be based on factual data accumulated as a result of maintenance experience, field studies, flight tests, equipment improvement recommendations and other communications pertaining to the manual and its requirements. The direct reporting of errors, omissions and recommendations for improving this publication by the individual user is authorized and encouraged. Reports will be sent to the Standardization Office, Southern Airways of Texas, Inc.

Hughes TH-55A Primary Trainer (fig. 1-1)

Hughes TH-55A Primary Trainer (fig. 1-2)

CHAPTER 2

DESCRIPTION

Section I

Scope

2-1. Scope. This chapter describes the Hughes TH-55A and all of its systems and controls which contribute to the physical act of flying the aircraft. Auxiliary equipment is discussed in other chapters of the manual as listed.

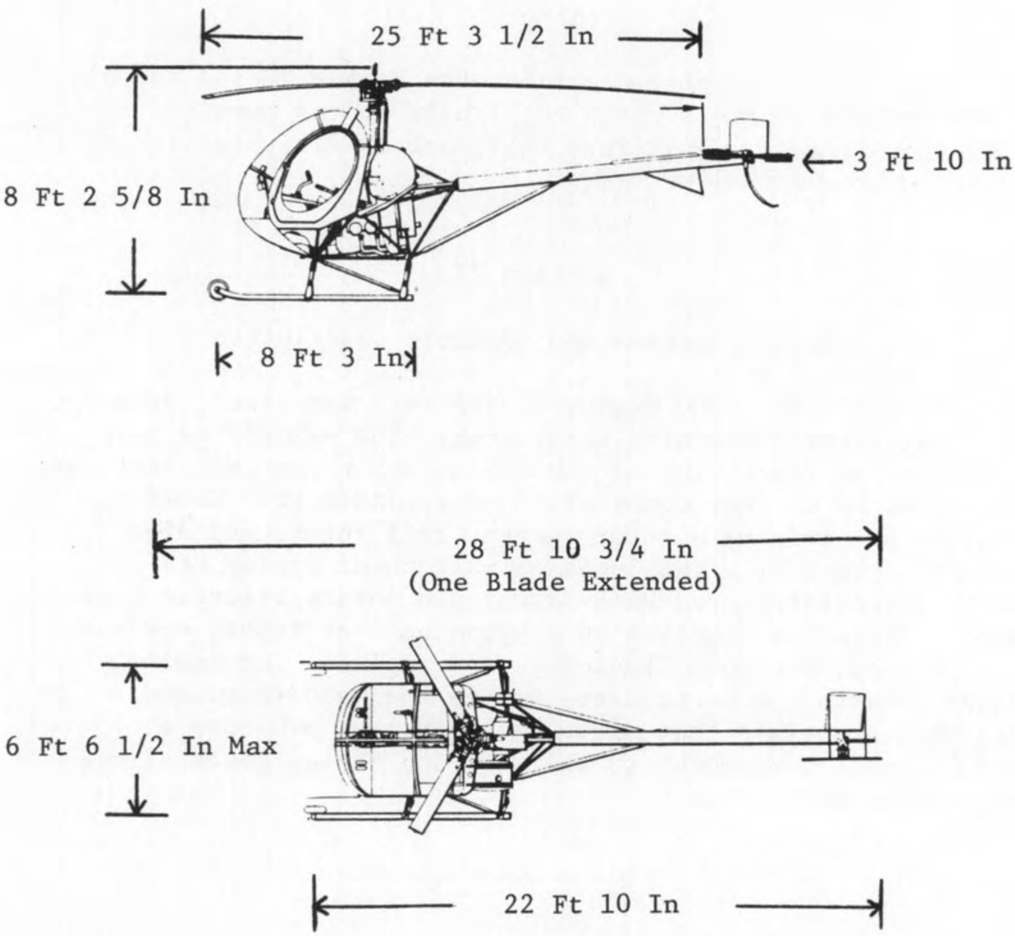
Section II

Aircraft Systems and Controls Description

2-2. THE AIRCRAFT. The Hughes TH-55A is a two place, side-by-side, dual control training helicopter. The pilot's seat is located on the right side of the cabin, while the left seat can be occupied by an instructor pilot or a passenger. The aircraft has a single main rotor system, tail rotor, and oleo suspended skid gear. The 3-bladed main rotor system has a fully articulated head with adjustable rotary-friction type dampers. Power is supplied by a Lycoming 4-cylinder, horizontally opposed, wet sump, fuel injected engine. The engine, mounted beneath the rotor mast, drives the main rotor and tail rotor through a belt drive assembly that provides a means of power engagement to the ring and pinion gears of the main transmission.

CAUTION

The aircraft is designed to be flown solo from the right seat only.



TH-55A Dimensions (fig. 2-1)

2-3. Dimensions.

Main Rotor Diam.	25 ft. 3-1/2 in.
Height (overall)	8 ft. 2-5/8 in.
Tail Rotor Diam. Low Speed Blade	3 ft. 10 in.
Maximum Length (one blade extended forward)	28 ft. 10-3/4 in.
Skid Width	6 ft. 6-1/2 in.

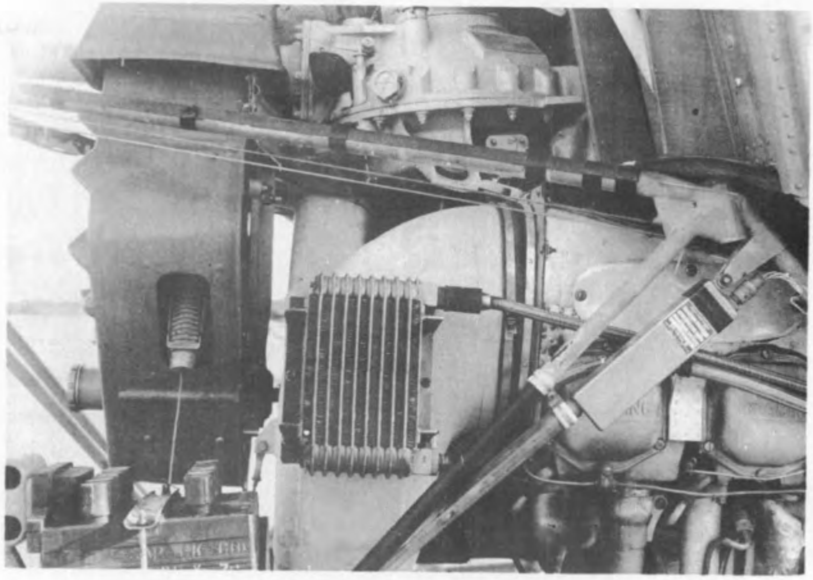
2-4. Weight.

Design Gross Weight	1670 lbs.

2-5. ENGINE, ENGINE CONTROLS & INSTRUMENTS. The TH-55A is powered by the Lycoming HIO-360-B1A four cylinder, direct drive, horizontally opposed, fuel injected, air cooled engine rated at 180 horsepower. The engine is mounted horizontally and is located directly under the main rotor drive shaft at the approximate center of gravity.

2-6. Engine Cooling. The cooling system is attached to the engine and forms part of the power plant assembly. Cooling is accomplished by a system consisting of an impeller assembly, scroll assembly, shroud, oil cooler and ducting. The air is drawn by the impeller into the scroll and forced through the shroud into the cylinder baffles for engine cooling. A portion of the cooling air is directed to the oil cooler.

2-7. Engine Oil System and Oil Cooler. The engine has a wet sump, pressure oil system with an 8 quart capacity. The system incorporates an oil filter screen, air intake rise, various pipe connections, a chip detector, an oil temperature sensor and an oil pressure sending unit. The oil cooler is a radiator type and uses air flow for cooling. The unit is attached to the scroll on the right side of the aircraft and cooling air is directed from the impeller through the cooler core into the atmosphere.



Oil Cooler Location (fig. 2-2)

Fuel Tank - Fibreglass Wrapped for Safety (fig. 2-3)

2-8. Fuel System. The LYC-HIO-360-B1A has a Bendix pressure injected fuel system with a servo control, fuel tank, tank sump drain, fuel shut-off valve, electric booster pump, engine-driven fuel pump, a filter with drain located in the lowest part of the system and necessary plumbing. The fuel shut-off valve is located on the console to the left of the mixture control and operates vertically; full down is ON -- full up is OFF. Fuel is gravity fed from the tank to the electric booster pump, through the filter and to the inlet side of the engine-driven fuel pump. The engine-driven pump functions when the engine is operating and delivers a constant flow of fuel under regulated pressure to the servo control. Dry filtered air is supplied to the fuel injector through an air induction system located under the cockpit floor. The system includes a filter housing, dry air filter, flexible ducting and assorted attaching hardware.

2-9. Fuel Injection Control System. The fuel injection control system consists of the servo control, flow divider (rosette fitting), fuel nozzles and related plumbing. The servo control consists of a servo valve controlled by differential air and fuel diaphrams, a venturi throat, and a throttle valve. An automatic mixture control is incorporated to compensate for changes in density altitude. The servo control operates by measuring the air flow through the throttle body of the servo valve regulator and uses this measurement to operate a servo valve within the control. This regulated fuel pressure established by the servo valve is used to control a distributor valve assembly, which, then schedules fuel flow in proportion to air flow. Fuel from the servo control is metered into the flow divider (rosette fitting), chambered into four channels and, then, to individual fuel nozzles in each cylinder.

2-10. Throttle. The twist-grip throttle is located at the forward end of the collective pitch stick. The throttle is turned to the left (away from the pilot) to increase engine RPM and to the right (toward the pilot) to decrease engine RPM. The throttle control linkage is synchronized with the collective pitch under normal stable conditions to increase throttle automatically as pitch is increased (and vice versa) which will help maintain constant RPM. Since, under maneuver conditions, the RPM tends to decrease as the collective pitch is increased (and vice versa), the pilot must manually coordinate the throttle and collective pitch to insure constant RPM settings. A throttle friction ring is located adjacent to and immediately behind the throttle grip and friction is applied by turning the ring to the left. To prevent engine overspeed during start, a micro-switch is installed in the throttle mechanism. The starter switch will not engage the starter until the throttle is closed sufficiently to actuate the micro-switch.

CAUTION

The throttle linkage is not equipped with an override cam in the full OFF position. The throttle is equipped with an override spring installed at the throttle bellcrank. Therefore, as an example, during a touchdown autorotation, the throttle must be turned to the right (OFF position) and held well into the override spring throughout the pitch application to prevent a sudden power surge.

2-11. Mixture Control. The mixture control regulates the fuel-air mixture to the fuel injector system. The control is located between the Fuel Shut-Off valve and the Cabin Heat controls on the console. The control travels vertically from the Idle Cut-Off position (full UP) to the Full-Rich position (full DOWN). A position lock button is located on top of the mixture control knob and must be depressed to actuate the control.

NOTE

Although manual leaning of the mixture can be accomplished, it is NOT recommended.

NOTE

When the engine is shut down, the mixture control must be placed in the Idle Cut-Off (full UP) position to prevent gravity siphoning of fuel.

2-12. Priming. The engine may be primed for starting by momentarily placing the mixture control in the Full-Rich position. The fuel is fed through the injector directly into the cylinders.

2-13. Ignition System. The ignition system is a dual magneto type with shielded harness and plugs. A starter vibrator is installed to provide high voltage, pulsating DC current to the left magneto during starting.

2-14. Ignition (MAG) Switch. The magnetos are controlled by a key-type ignition switch located on the horizontal console just below the fuel shut-off valve. The switch has OFF, L, R, and BOTH positions for the purpose of testing the ignition system or grounding out the magnetos.

2-15. Starter Switch. The starter switch which electrically engages the starter motor is located on the forward end of the pilot's collective pitch stick. To engage the starter, the battery switch must be ON, the clutch must be disengaged (switch full aft, clutch light ON), the throttle must be in the closed position to actuate the micro-switch (2-10) and the starter switch depressed.

2-16. Engine Instruments and Indicators. All of the engine instruments and indicators are mounted on the horizontal console and the instrument panel. The following instruments are mounted forward on the console:

A. The ENGINE OIL PRESSURE GAGE displays oil pressure in pounds per square inch. It is electrically operated receiving its impulse from the sending unit mounted in the oil system.

B. The ENGINE OIL TEMPERATURE INDICATOR displays oil temperature in degrees Centigrade. It operates electrically by means of a thermal switch installed in the engine oil pressure screen housing.

C. The FUEL QUANTITY GAGE depicts fuel quantity in U.S. gallons. It functions electrically in conjunction with a variable resistance sender activated by a float arm in the fuel tank.

D. The FUEL PRESSURE GAGE depicts fuel pressure in pounds per square inch. It operates electrically to measure fuel pressure at the servo control of the fuel injector system.

E. The CYLINDER HEAD TEMPERATURE GAGE measures temperature in degrees Centigrade by means of an electric current from a thermal switch installed in the No. 4 cylinder.

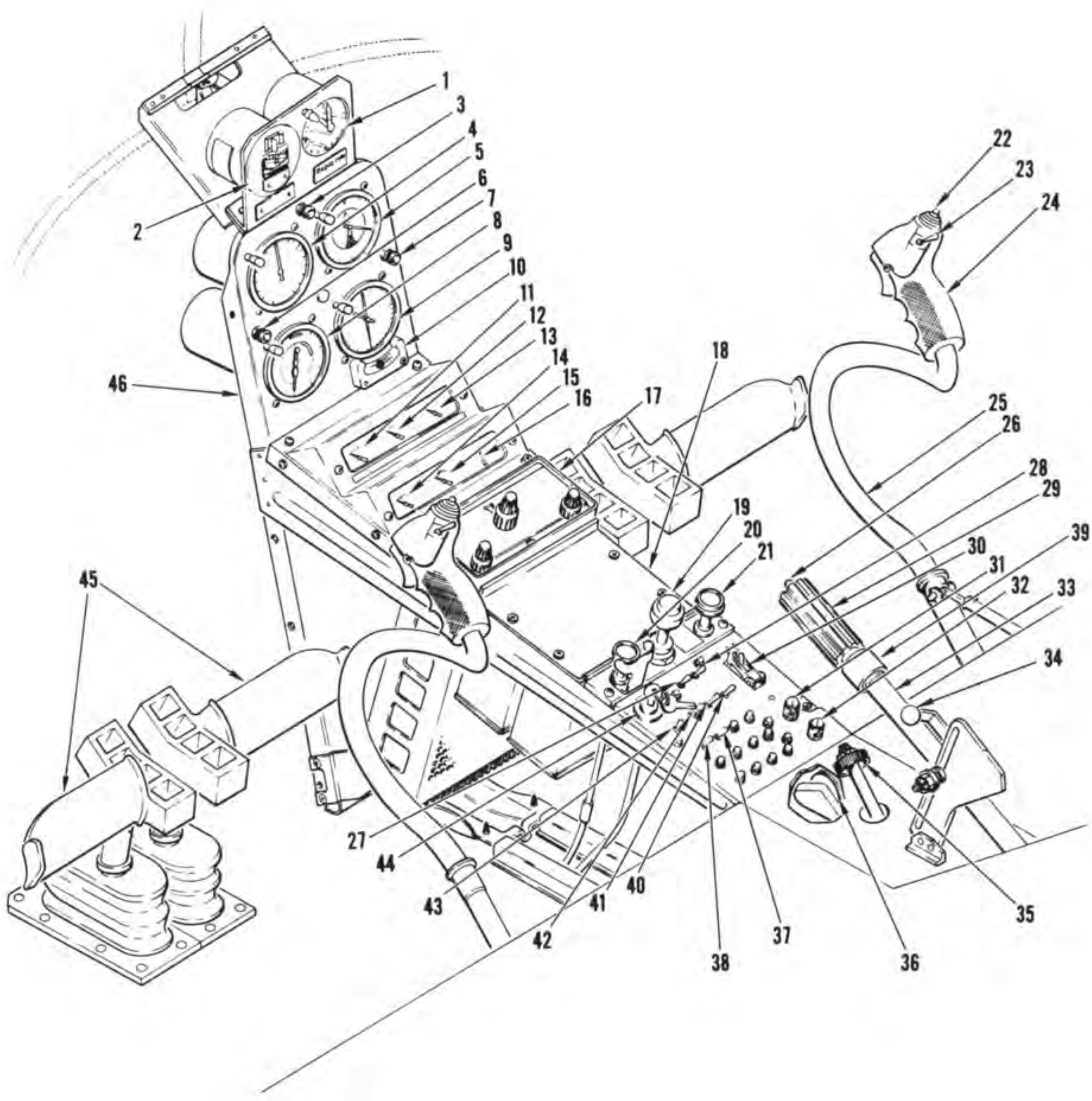
2-17. The following instruments and indicators are located on the instrument panel:

A. DUAL TACHOMETER. The engine and rotor tachometers are combined on a single indicator with concentric scales calibrated in engine RPM (outer scale) and rotor RPM (inner scale). One

COCKPIT ARRANGEMENT
(fig. 2-4)

1. Clock (not installed)
2. Compass
3. Fuel Low Warning Light (25 gallon tank)
4. Airspeed Indicator
5. Altimeter
6. Chip Det Light
7. Gear Box Warning Light
8. Dual Tachometer
9. Manifold Pressure Gage
10. N/A
11. Fuel Quantity
12. Fuel Pressure
13. Cylinder Head Temp.
14. Engine Oil Pressure
15. Oil Temp.
16. Ammeter
17. Receiver-Transmitter
18. N/A
19. Fuel Shut-Off Valve
20. Mixture Control
21. Cabin Heat Control
22. Cyclic Trim Switch
23. Landing Light Switch
24. Cyclic Stick Grip
25. Cyclic Stick
26. Starter Switch
27. Radio Switch
28. Fuel Boost Pump Switch
29. Throttle
30. Clutch Switch
31. Panel Lights Control
32. Console Lights Control
33. Collective Pitch Stick
34. Collective Friction
35. Lateral Cyclic Friction
36. Longitudinal Cyclic Friction
37. Battery Switch
38. Gen/Alt Switch
39. Throttle Friction
40. Beacon Lights Switch
41. Position Lights Switch
42. Panel Lights Switch
43. Trim Circuit Breaker
44. Magneto Switch
45. Tail Rotor Control Pedals
46. Instrument Console

Key to Figure 2-5



Cockpit Arrangement (fig. 2-5)

needle is marked R to indicate rotor RPM and the other is marked E indicating engine RPM. The indicator is mechanically connected to the rotor and engine assemblies through flexible cables.

B. MANIFOLD PRESSURE GAGE. The manifold pressure gage is a direct reading instrument and measures the engine manifold pressure in inches-of-mercury (Hg.). It is connected by tubing and hose to the engine intake manifold.

C. CHIP DETECTOR LIGHT. This amber light illuminates when the chip detector in the engine oil system or the main rotor transmission detects metal particles warning the pilot of possible malfunction or impending failure of either component. This is a press-to-test indicator.

NOTE

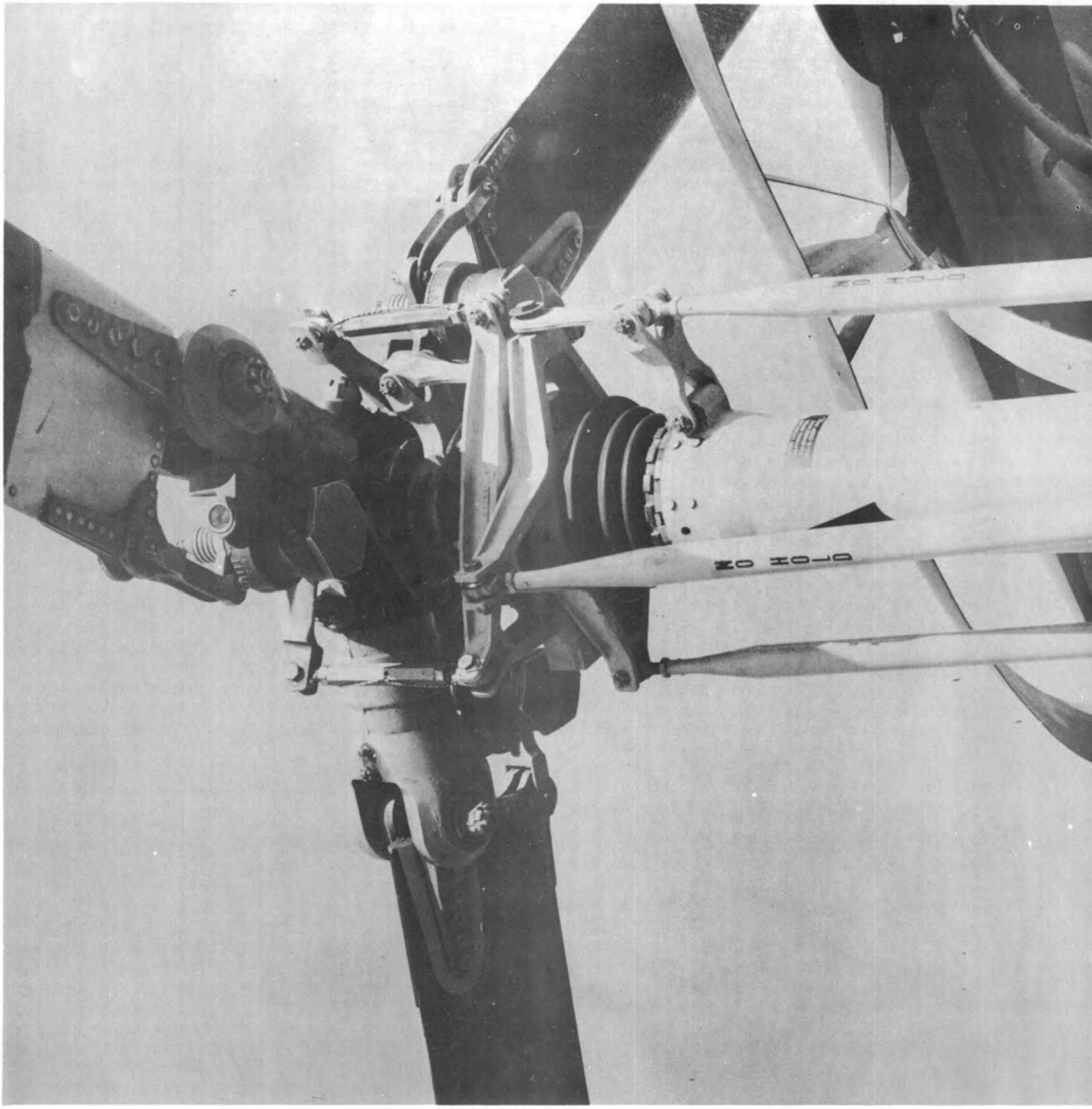
If the aircraft is equipped with a 25 gallon fuel tank, an amber Fuel Low Warning Light will be installed on the instrument panel. This press-to-test indicator will illuminate when there is 1.8 gallons of fuel remaining.

2-18. ROTOR SYSTEM. The rotor system consists of a main rotor system, anti-torque tail rotor system, and a main rotor speed indicator.

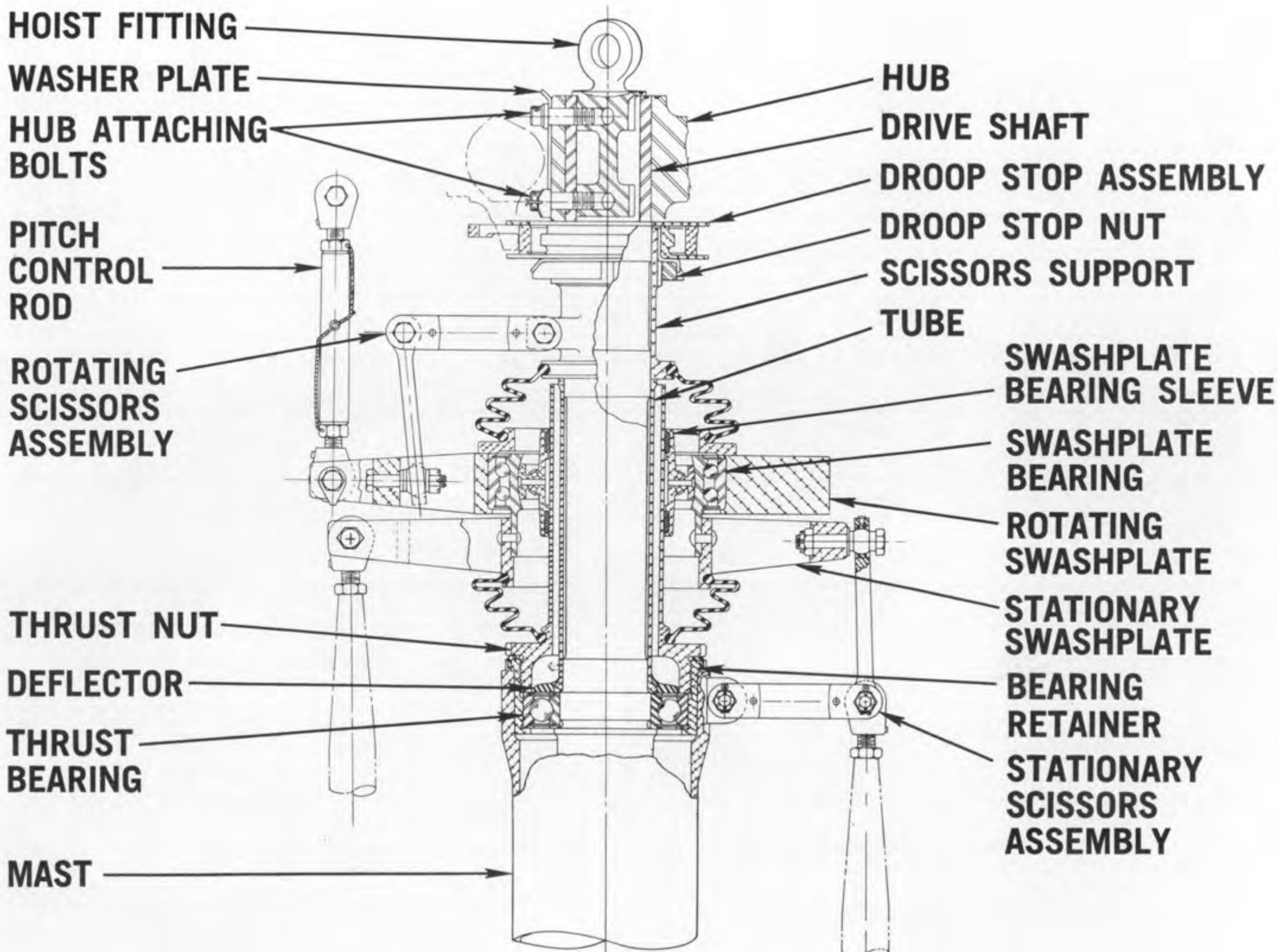
2-19. Main Rotor. The 3-bladed fully articulated main rotor is mounted on and driven by the rotor drive shaft of the main rotor transmission. The three blades are individually attached through the hub assembly, pitch bearing assemblies and main rotor dampers so that each has freedom to flap, lead, lag and feather. Pitch and cyclic changes are transmitted from the control system through the swashplate assembly on the main drive shaft to the main rotor blades.

2-20. Tail Rotor. The tail rotor system consists of a drive shaft, drive shaft damper, a speed-increasing gear box and tail rotor assembly. The 2-bladed variable pitch tail rotor is mounted on the output shaft of the gear box and functions to control heading and counteract main rotor torque through the use of the anti-torque pedals.

2-21. Rotor Speed Indicator. The main rotor speed is depicted on the Dual Tachometer (2-17.A).



Main Rotor Head (fig. 2-6)



MAIN ROTOR & SWASHPLATE ASSEMBLY

(fig. 2-7)

2-22. POWER TRAIN SYSTEM. The power train system transmits engine power to the main rotor and tail rotor. The system consists of a belt drive transmission, clutch control, linear actuator, main rotor transmission and a tail rotor gear box. A chip detector light and a transmission warning light are installed on the cockpit instrument panel which allows the pilot to monitor the main rotor transmission operation.

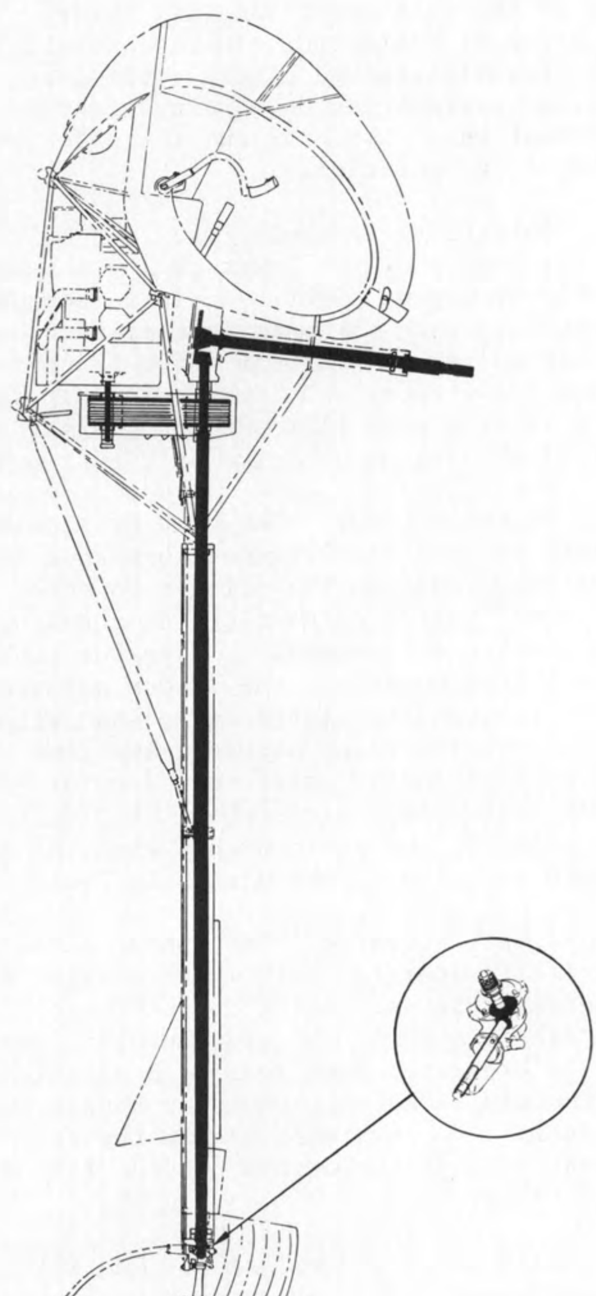
2-23. Belt Drive Transmission. The belt drive transmits power from the engine driven lower pulley assembly to the upper pulley assembly by way of eight V-belts. The upper pulley assembly is connected to both the main transmission and tail rotor drive shaft. An idler pulley in the belt drive is operated as a clutch to disengage the upper and lower pulleys. The upper pulley incorporates a sprag clutch that permits the main rotor to drive the tail rotor if the engine or drive belt system becomes inoperative.

2-24. Clutch Control. The belt drive clutch control installation consists of electrical connections to a CLUTCH control switch and warning light on the pilot's console, a linear actuator, and a cable and pulley to connect the actuator to the clutch spring on the belt drive assembly. When the CLUTCH control switch is at the ENGAGE position, the linear actuator retracts transmitting tension through the clutch cable and spring to the idler pulley. The idler pulley moves outboard applying tension to the V-belts which provide engine power to the rotor systems. The clutch warning light illuminates when the clutch is not engaged or is being engaged, and extinguishes when the clutch switch is in the HOLD position or the clutch is fully engaged.

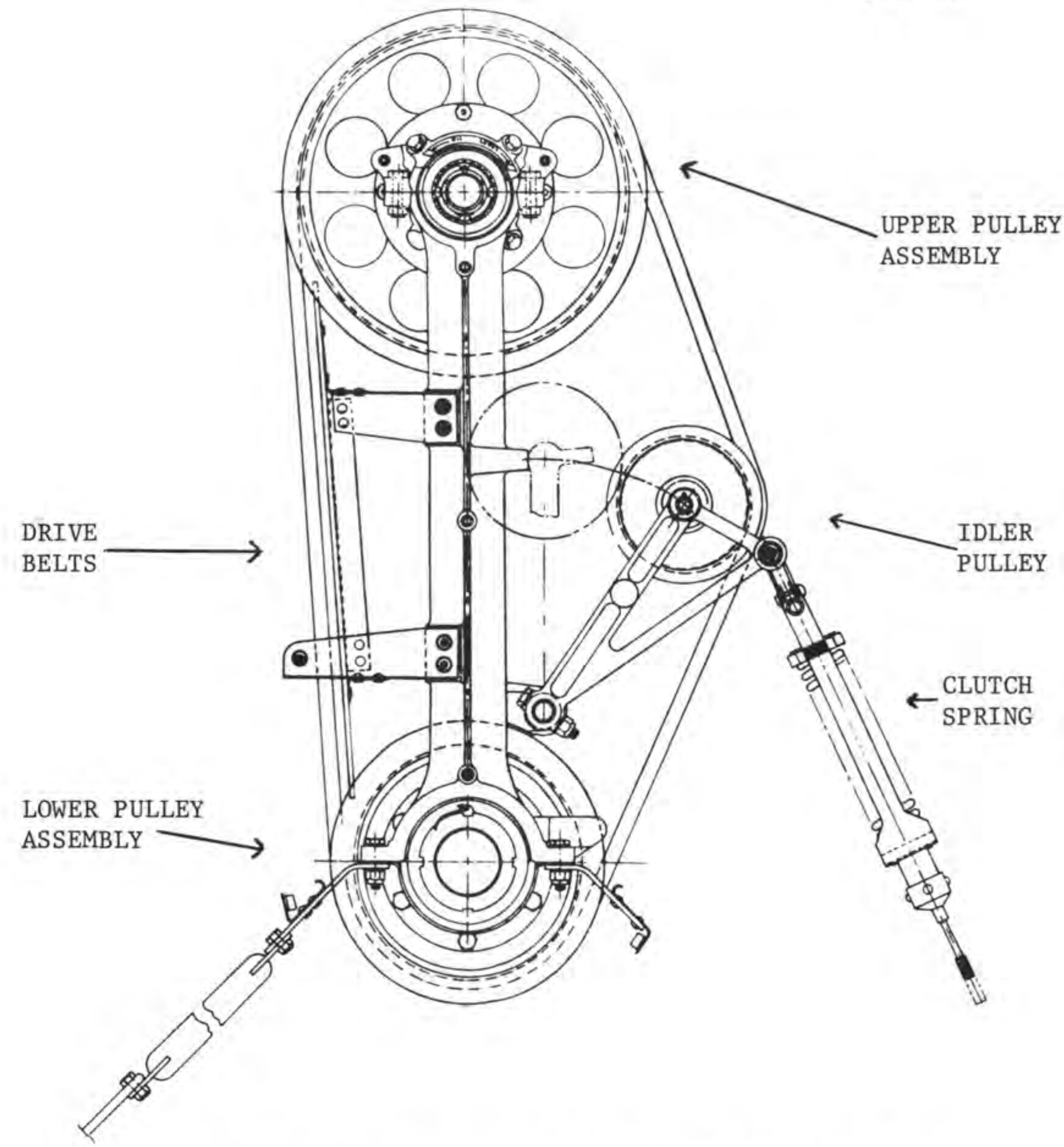
2-25. Linear Actuator. The linear actuator is a motorized electrically operated unit which engages or releases the clutch through a cable and spring connection to the idler pulley. It is attached to the right side tubular frame and the actuator cable is protected from wear by a plastic tubular shield. The unit contains a 24 volt-DC motor that drives a retractable and extendable arm. Switches within the case limit travel of the arm and internal components provide filtering to lessen radio interference.

2-26. Main Rotor Transmission. The main rotor transmission delivers power from the engine through the belt drive system to the main rotor at a 6:1 RPM ratio. In the TH-55A, the main rotor transmission is a ring and pinion design. The transmission has its own 3-quart oil sump and is pressure lubricated by a self-contained oil pump through lines cast into the magnesium housing. A screen in the oil filter cup prevents large foreign particles

POWER TRAIN INSTALLATION



(fig. 2-8)



V-BELT TRANSMISSION SYSTEM
VIEW LOOKING FORWARD

(fig. 2-9)

from being deposited into the gear case when adding oil. Screens are also provided in the rotor drive shaft coupling to prevent foreign particles from entering the case through the mast. A breather is attached to the upper gear case to provide ventilation and a dipstick for checking oil level is located on the right rear of the case. The transmission case also houses the rotor tachometer drive, oil pressure and temperature sensors and a chip detector.

2-27. Tail Rotor Gear Box. The tail rotor gear box, a right-angle speed-increasing transmission mounted at the aft end of the tailboom, supports and drives the tail rotor. The gear box which is internally splash lubricated is equipped with its own housing, a combined breather-filler and a combined magnetic chip detector and self-closing valve at the rear underside of the housing. (The chip detector does not have a cockpit indicator.)

2-28. Chip Detector Light. Re. Paragraph 2-17.C.

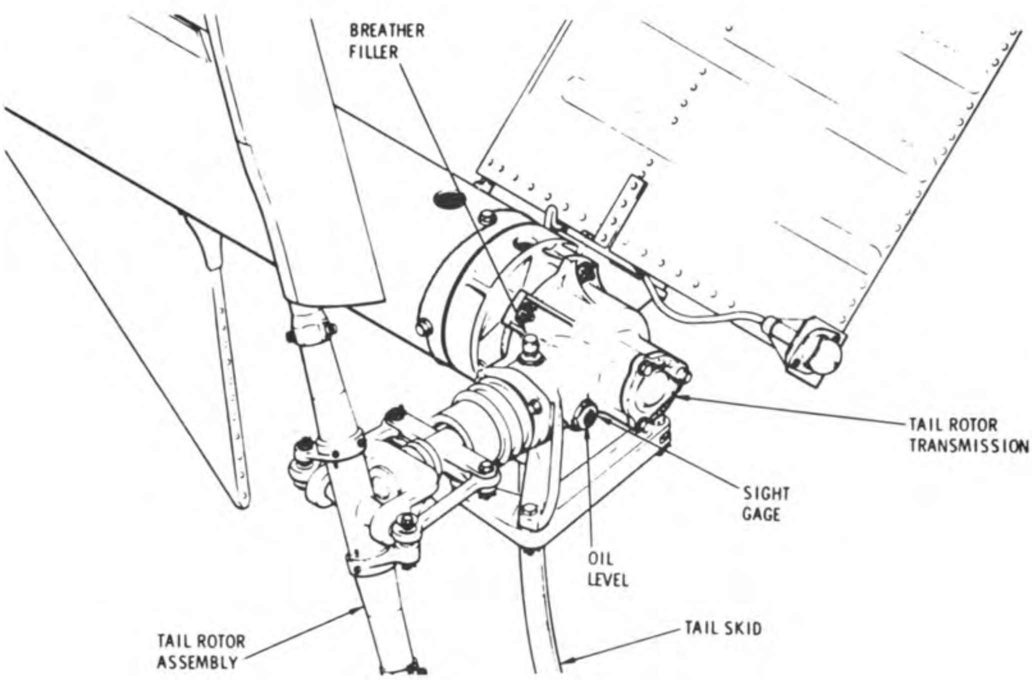
2-29. Transmission Warning Light. This is a red warning light located on the instrument panel. It illuminates when the sensor in the transmission signals that the oil TEMPERATURE has EXCEEDED 235°F (+ or - 10°F) or that the oil PRESSURE has dropped BELOW 2-1/2 psi (+ or - 1/4 psi).

2-30. ELECTRICAL POWER SUPPLY. Power required to operate the various units of electrical equipment is supplied by the 24 volt DC electrical system. The source of power may be the battery, the alternator, or an external power supply.

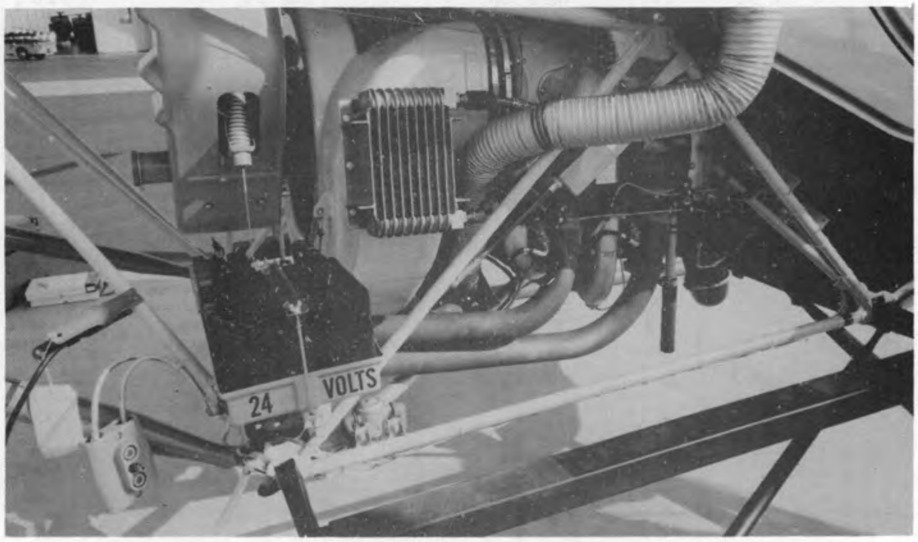
2-31. Battery. The battery has a 24 volt out-put with a 17 ampere capacity and is operated by a BAT switch on the console. It provides power for starting the engine and serves as an emergency source of power if the generator fails during flight. The battery is secured to the right aft fuselage struts and is connected to the electrical system by a quick-disconnect fitting. An external power fitting is located underneath the battery installation.

2-32. Alternator. A belt-drive 28 volt-70 ampere alternator is located on the left side of the aircraft beneath the cooling shroud. The alternator charges the battery and provides current for all electrical loads during flight. The alternator will not operate until the GEN/ALT switch on the pilot's console is placed in the ON position.

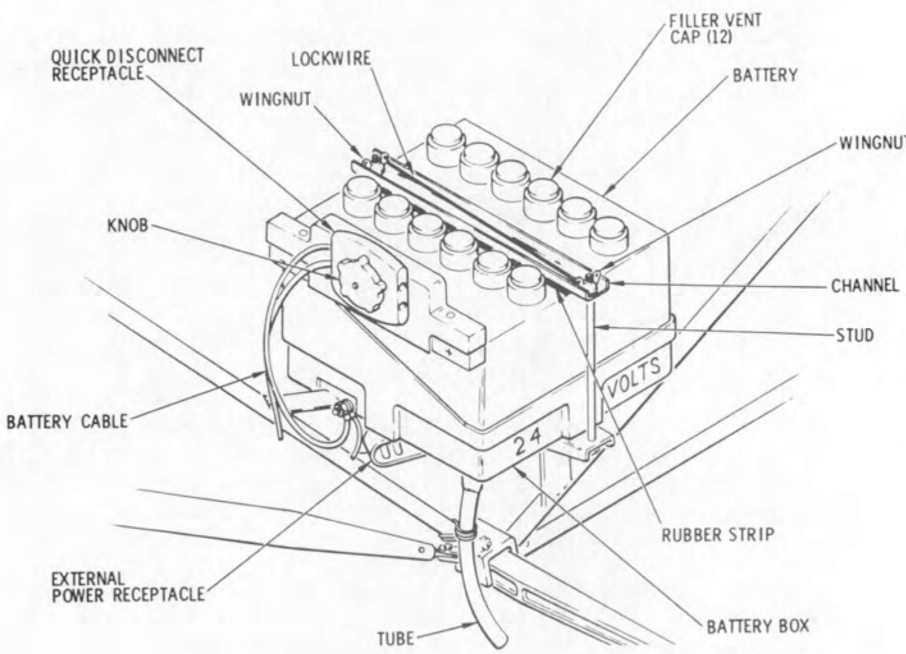
Tail Rotor Gear Box (fig. 2-10)



Tail Rotor Assembly Diagram (fig. 2-11)



Battery Location (fig. 2-12)



Battery Illustration (rig. 2-13)

2-33. Ammeter. The ammeter located on the pilot's console, indicates the flow of current, in amperes, from the alternator to the battery or from the battery to the aircraft electrical system.

2-34. Circuit Breaker and Fuses. A circuit breaker, located on the pilot's console, is provided for the cyclic trim system. Fuses are located on the lower portion of the pilot's console and serve the following systems: Fuel Boost, Clutch, Radio, Heater, Instrument Lights, Beacon Lights, Landing Light, Panel Lights and Position Lights. Spare fuses are located on a panel beneath the pilot's collective pitch stick.

2-35. FLIGHT CONTROLS. The helicopter is controlled in flight by the collective pitch control stick, cyclic control stick, throttle and tail rotor pitch control (anti-torque) foot pedals. These controls are installed at both pilot's and instructor's stations.

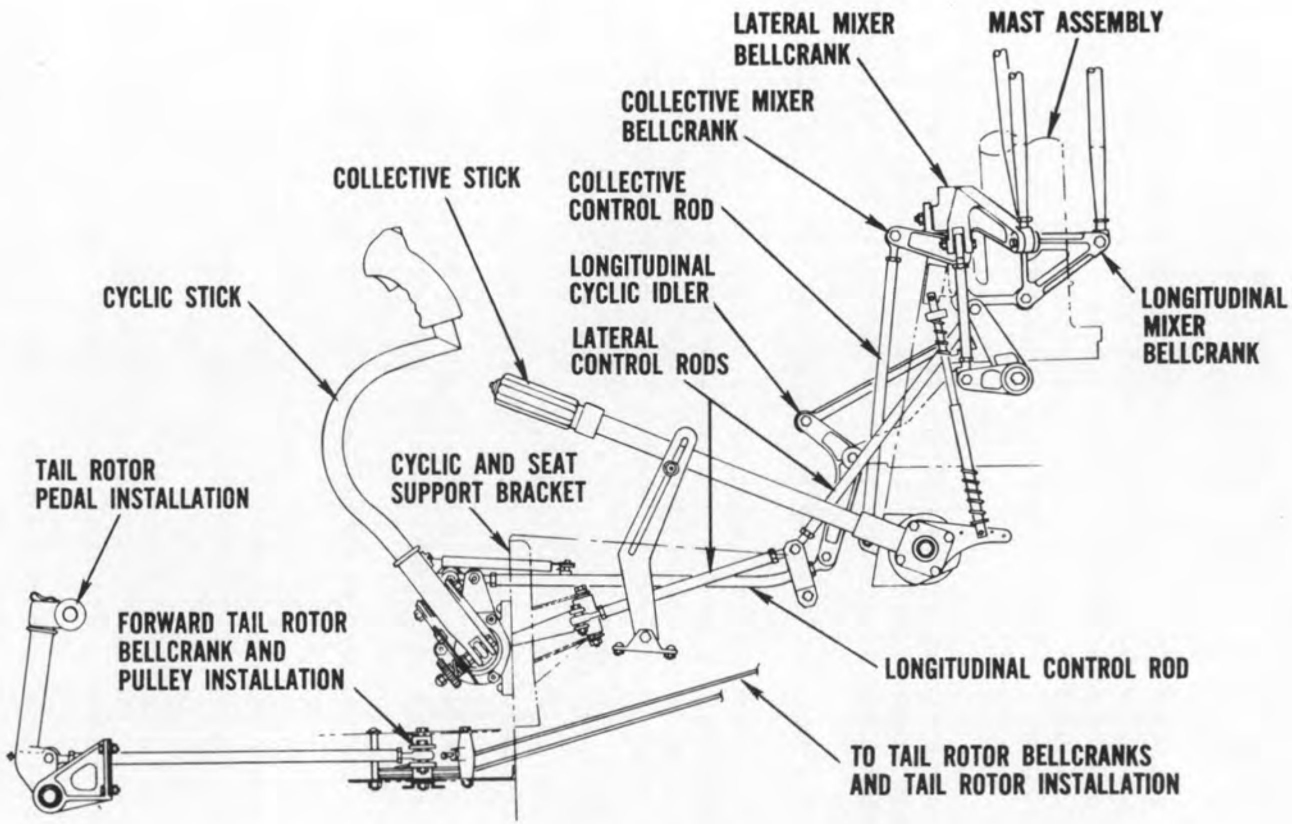
2-36. COLLECTIVE PITCH CONTROL. The collective pitch stick is mounted horizontally on the left-hand side of each seat. The pilot causes the aircraft to climb or descend by raising or lowering the collective pitch stick. When the collective pitch is raised, the pitch of all three main rotor blades is increased simultaneously and to the same degree. (The pitch of the blades is decreased in the same manner as the control is lowered.) The throttle control is incorporated in the collective pitch stick.

2-37. Throttle. The throttle is described in paragraph 2-10.

2-38. Collective Friction. A collective friction lever is located on the aft portion of the pilot's collective control stick. Friction may be applied by moving the lever aft and released by moving the lever forward.

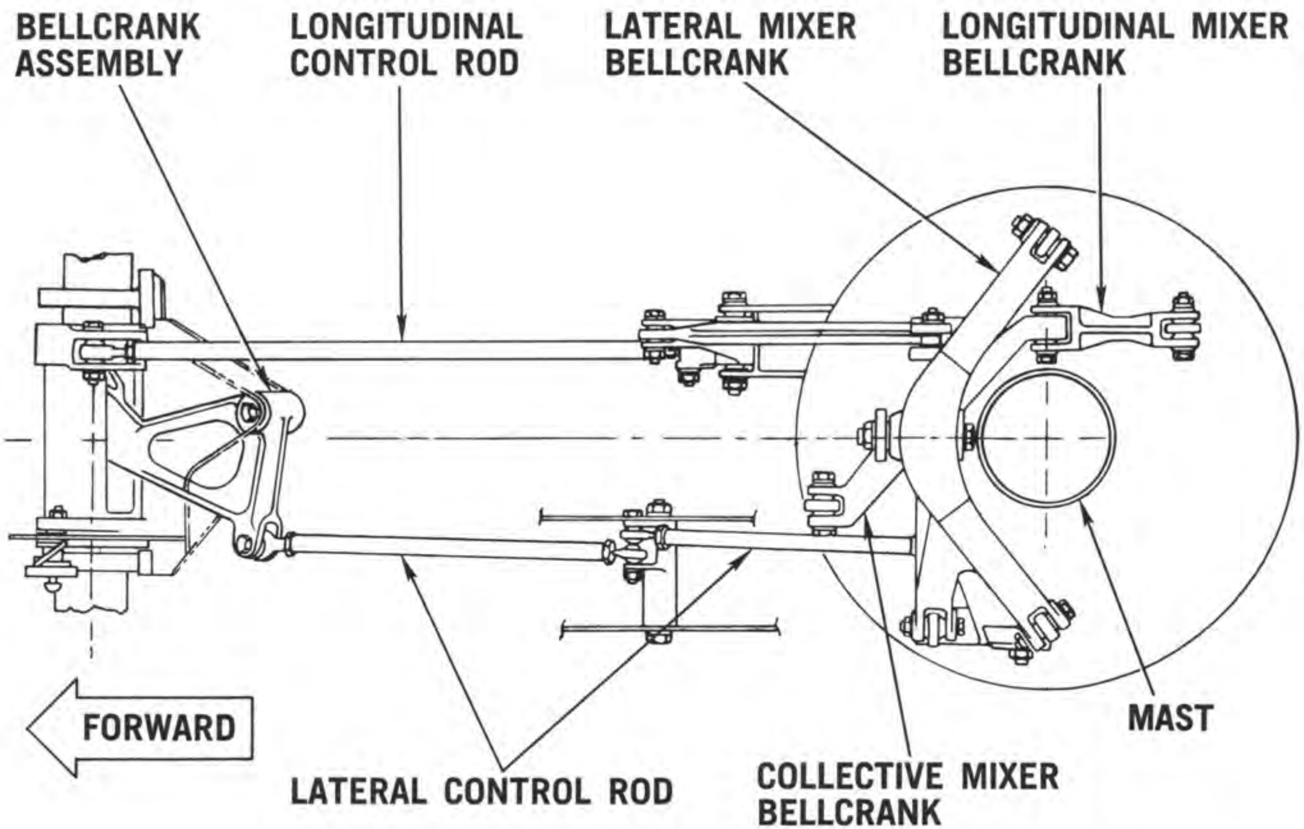
2-39. Collective Hold-Down. (Mechanical Lock). A spring-loaded hook in a guide attached to the pilot's seat structure holds the collective pitch stick at minimum pitch when the hold-down assembly is engaged. The hold-down assembly is hooked to an attachment point on the seat structure in the stowed position.

2-40. Collective Bungee. A spring bungee is incorporated into the collective pitch system and is located on the aft end of the left-hand collective pitch stick. The spring bungee neutralizes the effect of in-flight forces on the collective pitch.



FLIGHT CONTROLS
(SIDE VIEW)

(fig. 2-14)



FLIGHT CONTROLS INSTALLATION
TOP VIEW

(fig. 2-15)

2-41. CONTROL MIXER AND SWASHPLATE. The control mixer, located forward on the mast assembly just above the main rotor transmission, combines the operations of the cyclic stick and the collective pitch stick. The control mixer transmits these control movements through a system of bellcranks, rods and linkages up to the swashplate. The swashplate, mounted directly beneath the main rotor head, moves vertically to change pitch of the rotor blades and tilts to change the rotor disc plane controlling the direction of flight.

2-42. CYCLIC CONTROL. The pilot uses the cyclic control stick, installed on the torque tube support in front of each seat, to control the tilt of the rotor disc from the horizontal plane. The rotor disc can be tilted at any point during the 360 degree rotation. Longitudinal control is induced by fore and aft cyclic movement and lateral control, by movement to the left or right. Therefore, the aircraft can be held in a stationary hover, moved sideward, rearward, or into forward flight. The cyclic grip is equipped with a four-way cyclic trim switch, an intercom radio switch and a landing light switch. (A limited number of aircraft have the landing light switch installed on the cyclic stick below the cyclic grip.)

2-43. Cyclic Friction. Two cyclic friction controls, lateral and longitudinal, are installed in the system. These controls are used to keep the cyclic centered and the main rotor level while the aircraft is in a static position. The longitudinal friction control is located on the pilot's cyclic torque tube. Turning the control knob forward increases friction and aft decreases friction. The lateral friction control is located aft of the pilot's console and just left of the collective pitch stick. Turning the knob clock-wise increases friction and counter-clockwise decreases it.

2-44. Cyclic Trim. Lateral and longitudinal cyclic trim is installed in the system to help minimize cyclic forces due to in-flight loading. A four way cyclic trim switch is located on top of the cyclic stick grip. This switch controls the electrically operated trim motors. Unsymmetrical control pressures may be balanced (trimmed off) by moving the cyclic trim switch in the direction of the pressure. The switch will stop the trim movement and self-center when released.

2-45. TAIL ROTOR CONTROL. The tail rotor is controlled and directional changes are made through the use of the anti-torque pedals located in the forward area of the cockpit. The system consists of the pedals attached to a torque tube, push rods into a forward bellcrank, a cable and pulley system to an aft bellcrank, and a tail rotor control rod to the tail rotor pitch-change assembly.

2-46. FLIGHT INSTRUMENTS. The flight instruments are located on the vertically mounted instrument panel. These instruments include an airspeed indicator, altimeter and compass. The airspeed indicator and altimeter are operated through a pitot-static system. The pitot tube is located in the nose of the aircraft just below the center of the windshield. The static pressure source is located between the fuel tank and the vertical seat back.

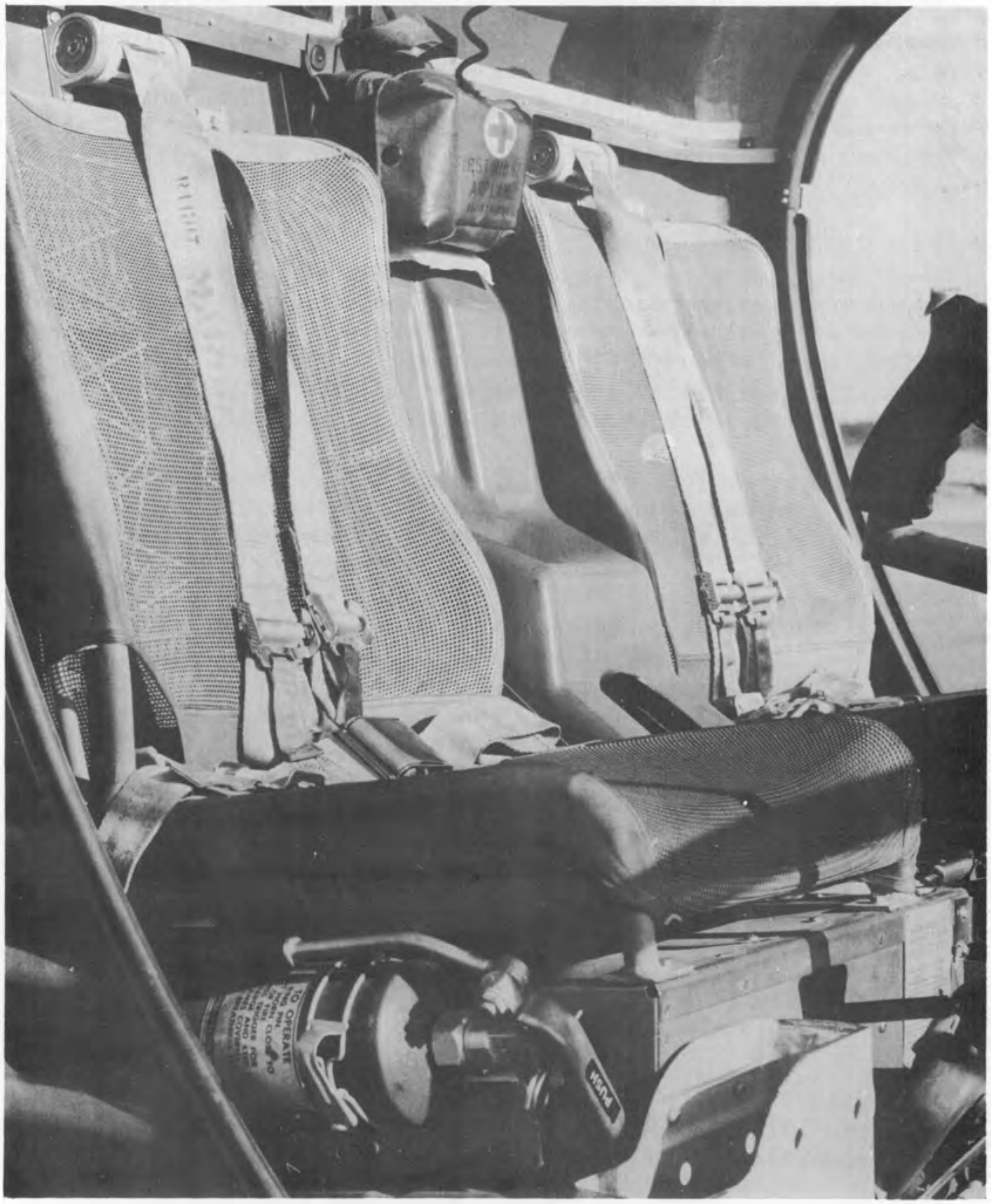
2-47. Airspeed Indicator. The airspeed indicator measures the differential between impact air at the pitot head and static air pressure. The measurement is indicated in nautical miles per hour (knots).

2-48. Altimeter. The altimeter indicates the height of the aircraft above sea level and is operated by the static system. The instrument can be manually re-set for deviations from standard sea level barometric pressure by turning a knob on the lower left of the altimeter case. The barometric pressure scale is located on the face of the instrument and is graduated in inches-of-mercury.

2-49. Compass. The magnetic compass indicates the heading of the aircraft in relation to magnetic north. It is a direct indicating compass and shows the heading by means of a floating card element that is read against a fixed reference line. The oil used in the compass helps dampen the card oscillation.

2-50. EMERGENCY EQUIPMENT. A portable fire extinguisher is installed on the seat structure adjacent to the right-hand pilot's seat. Operating instructions are printed on the extinguisher. A first aid kit is installed inside the cabin on the bulkhead between the pilot seats.

2-51. CABIN ENCLOSURE. The cabin area is enclosed within a composite windshield and canopy structure formed from transparent plastic and supported by metal framing secured to the basic airframe. The enclosure covers the cabin from the aft bulkhead to the cabin floor in front of the anti-torque pedals.



Cockpit View Shows the Location of the Fire Extinguisher, Safety Kit and the Seat Belt-Shoulder Harness Installation: (fig. 2-16)

2-52. Cabin Doors. Two forward-opening doors are provided, one on each side of the cabin. The forward edge of each door in hinged to the cabin frame and a mechanical latch is provided at the aft edge of each door. The doors may be removed for warm weather operations.

CAUTION

Care must be taken in handling the cabin doors especially during strong winds or near the rotor wash of another helicopter. An open unattended door can sustain damage to the hinges and the plexiglass due to a sudden gust of wind.

2-53. Seat Belts and Shoulder Harness. Each seat is provided with a seat belt and shoulder harness arrangement. The seat belt is adjustable and is secured across the lap by a snap-lock buckle. The shoulder harness consists of two adjustable straps with fittings to be secured into the seat belt buckle. The shoulder harness is fitted into an inertia reel which self-locks with a 2-g. pull. There is no mechanical locking lever installed.

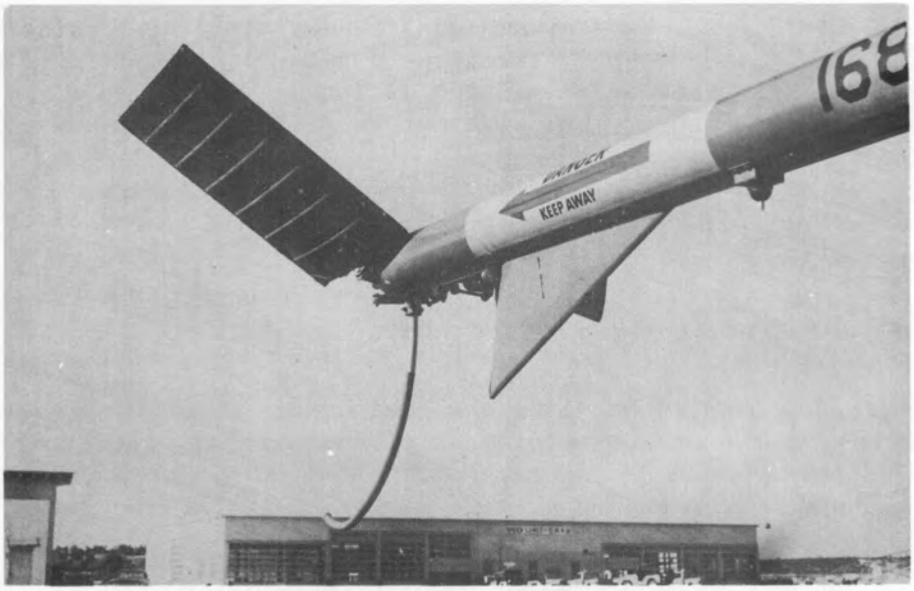
Section III

Aircraft Structures

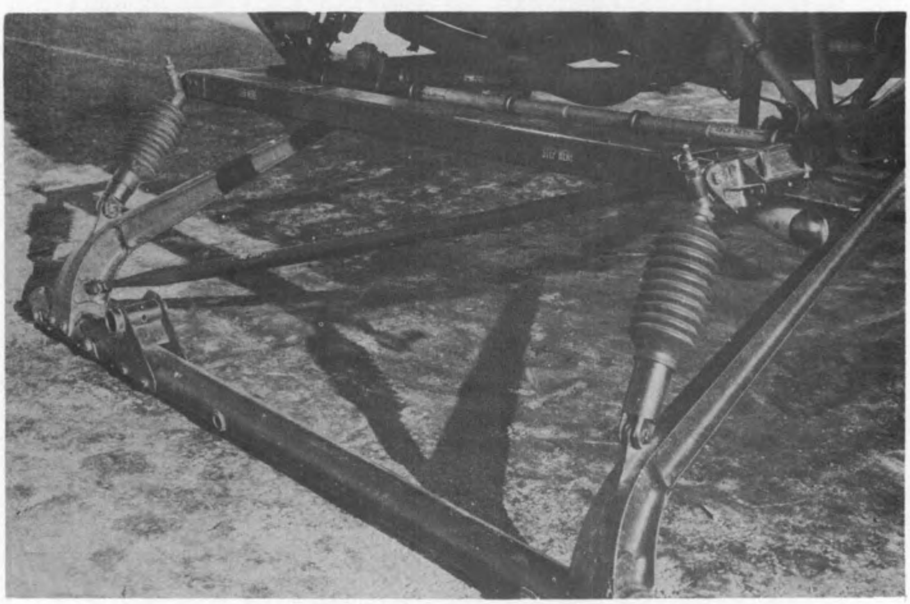
2-54. Center Frame Section. The center frame section is a tubular steel space frame type. The frame supports all major structural and drive train components of the aircraft.

2-55. Landing Gear. The landing gear consists of forward and aft cross beams attached through four air-oil dampers to the left and right landing gear skids. These oleo struts are installed between the cross beams and skid assembly to cushion landings. Heavy duty skid shoes are installed to help extend skid life.

2-56. Tailboom. The tailboom is an aluminum alloy tube attached at the forward end to a frame assembly. The boom is supported by two struts attached to the lower center frame section and to the boom at the saddle mount fitting.



Vertical Fin and Horizontal Stabilizer (fig. 2-17)



Landing Gear (right side) (fig. 2-18)

2-57. Tail Skid. The tail skid is secured to the underside of the tail rotor gear box adapter and helps protect the tail rotor from damage in tail-low landings.

2-58. Horizontal Stabilizer. The horizontal stabilizer is attached to the right rear of the tailboom at a +33 degree dihedral angle and a +10 degree angle of incidence. The stabilizer tends to add longitudinal stability in forward flight.

2-59. Vertical Fin. The vertical fin is attached to the underside of the tailboom and tends to stabilize yaw in forward flight.

2-60. Canopy Slat. The canopy slat extends across the canopy top and is elevated by support brackets. It is secured at either end and the center by attaching hardware. The slat is designed to modify airflow over the cabin and improve the Dutch Roll tendency (yaw and longitudinal pitch effect) in forward flight.

Rear view shows Canopy Slat and supports (fig. 2-19)

CHAPTER 3

AVIONICS

Section I

Scope

3-1. This chapter covers the ARC 524M radio installation and operating procedures.

Section II

Description and Controls

3-2. The ARC 524M is a VHF transceiver installed on the pilot's console. It permits two-way voice, air-to-air, air-to-ground and cockpit communications. The unit has digital tuning and is operated by a radio master switch on the console and a combination ON-OFF Volume Control on the set. The unit is also equipped with a squelch control to suppress back-ground noise.

3-3. The frequency range is from 136.0 through 149.95. The radio may be tuned through its various frequencies by a dual knob located in the center of the set. The lower knob is used to change the portion of the major frequency; such as, 141; and the upper knob is used to set the portion of the frequency decimal number; such as, .45.

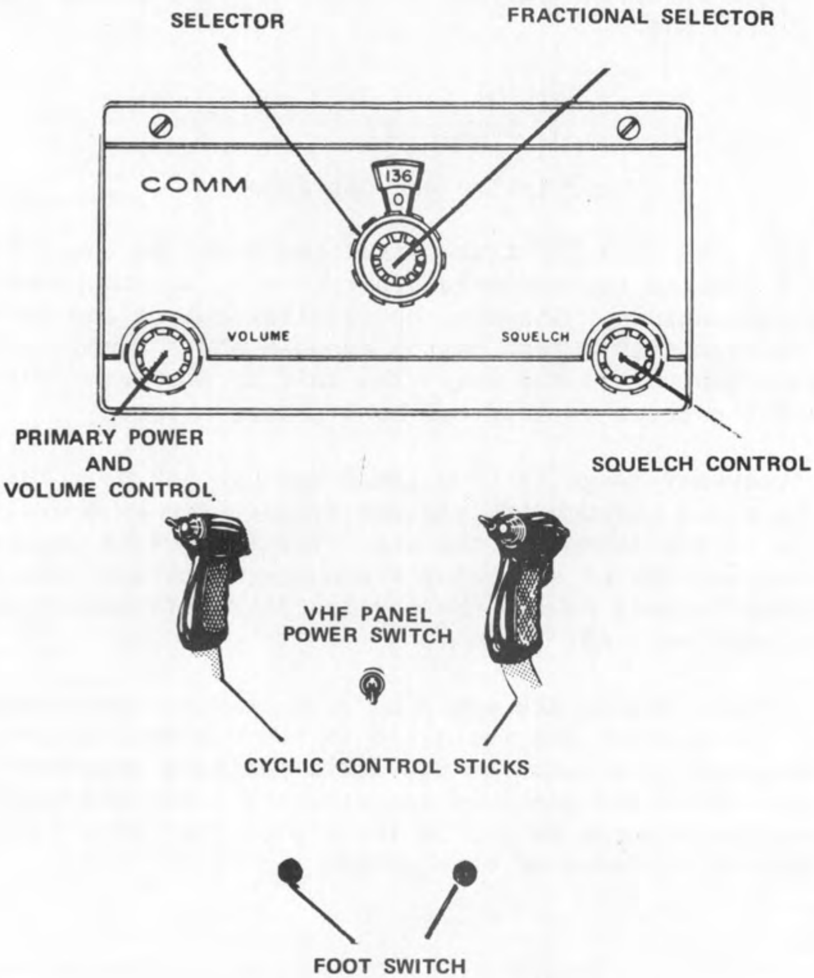
3-4. Both cyclic sticks are equipped with trigger-type transmit switches. The switches are installed in the OFF-Monitor position and are depressed to actuate -- the first position operates the intercom and the second position operates the radio transmitter. A foot-operated intercom switch is located on the cabin floor near the console in front of each pilot.

NOTE

The radio receiver cannot be monitored while the intercom switch is depressed.

NOTE

Some proficiency aircraft have the low band ARC 524A transciever installed. The frequencies available are from 118.0 through 135.95 to comply with FAA facilities on navigational flights.



ARC 524M Radio (fig. 3-1)

CHAPTER 4

AUXILIARY EQUIPMENT

Section I

Scope

4-1. Scope. This chapter includes the description and operation of equipment not directly contributing to flight, but which enables the aircraft to perform certain specialized functions.

4-2. Auxiliary equipment includes heating and ventilating provisions, lighting system, main rotor tie-down equipment and the anti-overspeed device.

Section II

Heating and Ventilating System

4-3. HEATING SYSTEM. The cabin enclosure is heated by an exhaust manifold heater installation. The system consists of a muffler jacket assembly, heater blower, heater valve assembly, two plenums, ducting and miscellaneous connecting items. The heater blower, located on the right side of the outer cabin wall, forces warm air from the muffler jacket, mounted over the exhaust, through ducting, the heater valve and into the cabin through right and left plenums. The HEAT control knob operates the heater valve to regulate the cabin air temperature. The knob moves vertically with the full down position being OFF. The heater blower automatically energizes when the battery switch is turned ON.

NOTE

The heater assembly is removed for warm weather operations.

CAUTION

During flight, the heater blower must be operating when the heater assembly is installed to prevent overheating of the muffler jacket.

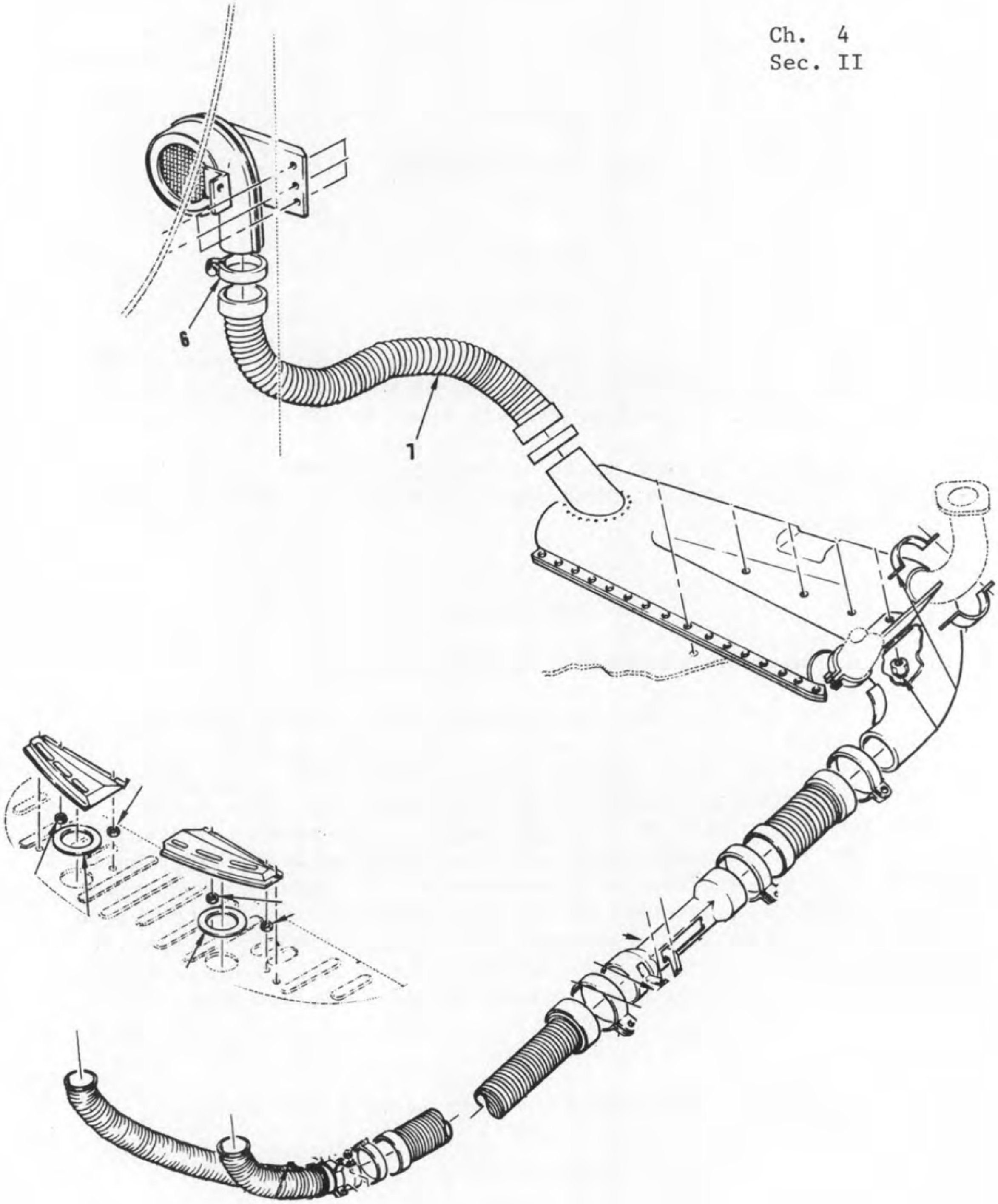


Diagram of Heating System (fig. 4-1)

4-4. Defrosting. The heater may be used for defrosting and defogging since the heater outlets are installed on the cabin floor in a position to distribute warm air over the windshield.

4-5. Ventilation. Fresh air is allowed to enter at the cabin floor through a vent installed in the nose of the aircraft. The cabin doors are equipped with push-out vents for further ventilation.

Section III

Lighting System

4-6. LIGHTING SYSTEM. The TH-55A lighting system consists of individually lighted flight instruments, console lighting, interior utility or map lights, two rotating beacons, a landing light, position lights and cockpit mounted control switches. The system is operated by the 28V-DC electrical system and is protected by circuit breakers and fuses.

4-7. Instrument Lighting. Flight instrument lighting is provided by individual red shielded lamps mounted on the panel. Console lighting is surface-reflected around each instrument, the radio frequency window, and switch panel. The lights are controlled by switches and rheostats located on the console.

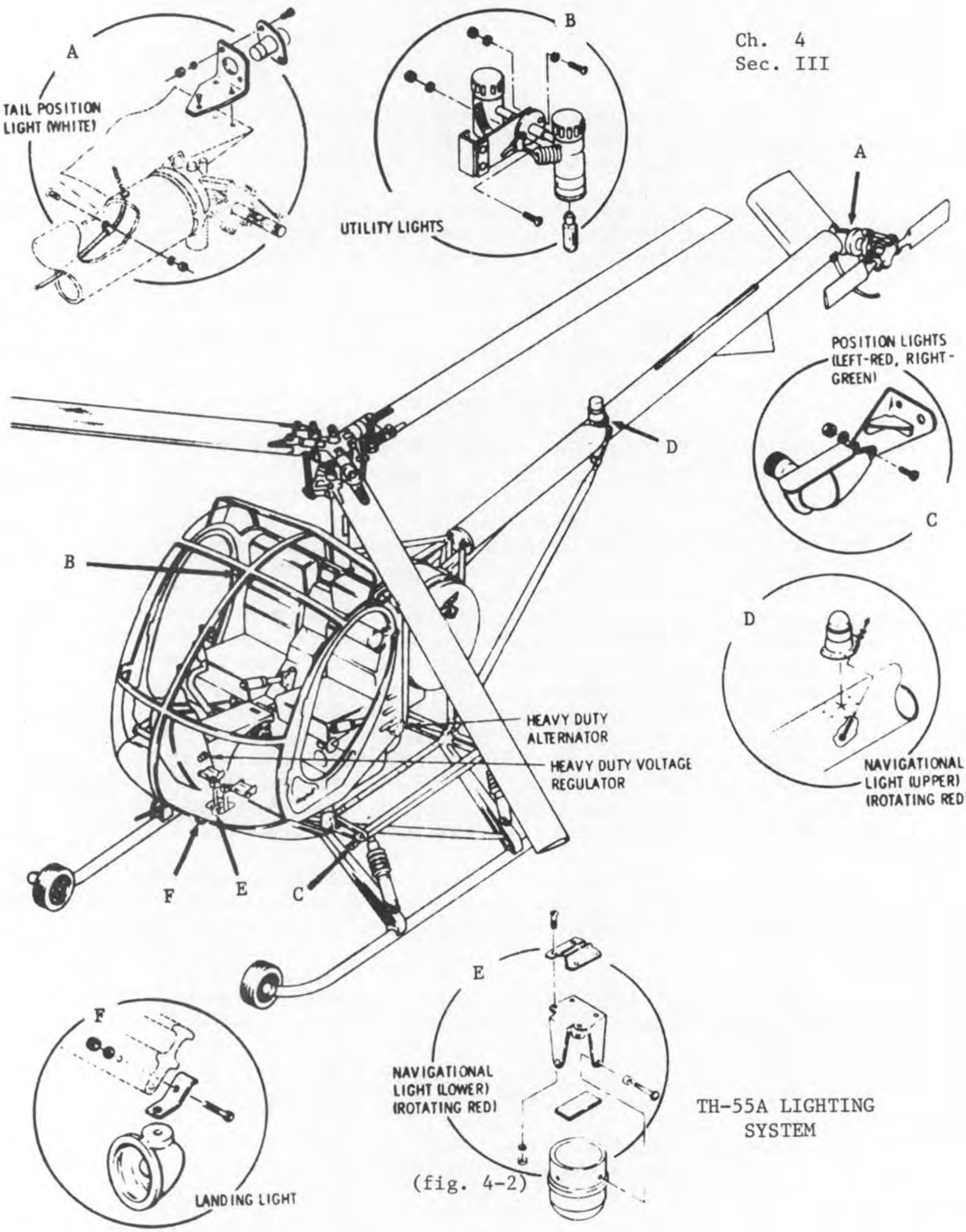
4-8. Map Lights. Two map lights are mounted between the pilot seats on the overhead cabin frame. Each has individual ON-OFF and intensity control on the light and the light may be changed from white to red by turning the lens holder.

4-9. Rotating Beacons. Two red rotating beacons are installed; one aft on the tail boom and the other on the forward landing gear cross beam. The beacons are controlled by one switch on the console.

4-10. Landing Light. The landing light is mounted on the aft landing gear cross beam. It is controlled by a toggle switch on each cyclic grip.

NOTE

A few aircraft are equipped with a single landing light switch located on the pilot's cyclic stick below the cyclic grip.



TH-55A LIGHTING
SYSTEM

(fig. 4-2)

4-11. Position Lights. Standard red, green and white position lights are installed on the aircraft. The red light is mounted on the forward left landing gear support, the green light, on the right landing gear support, and the white light is mounted on the aft end of the tailboom. The lights are controlled by a switch on the console.

Section IV

Miscellaneous Equipment

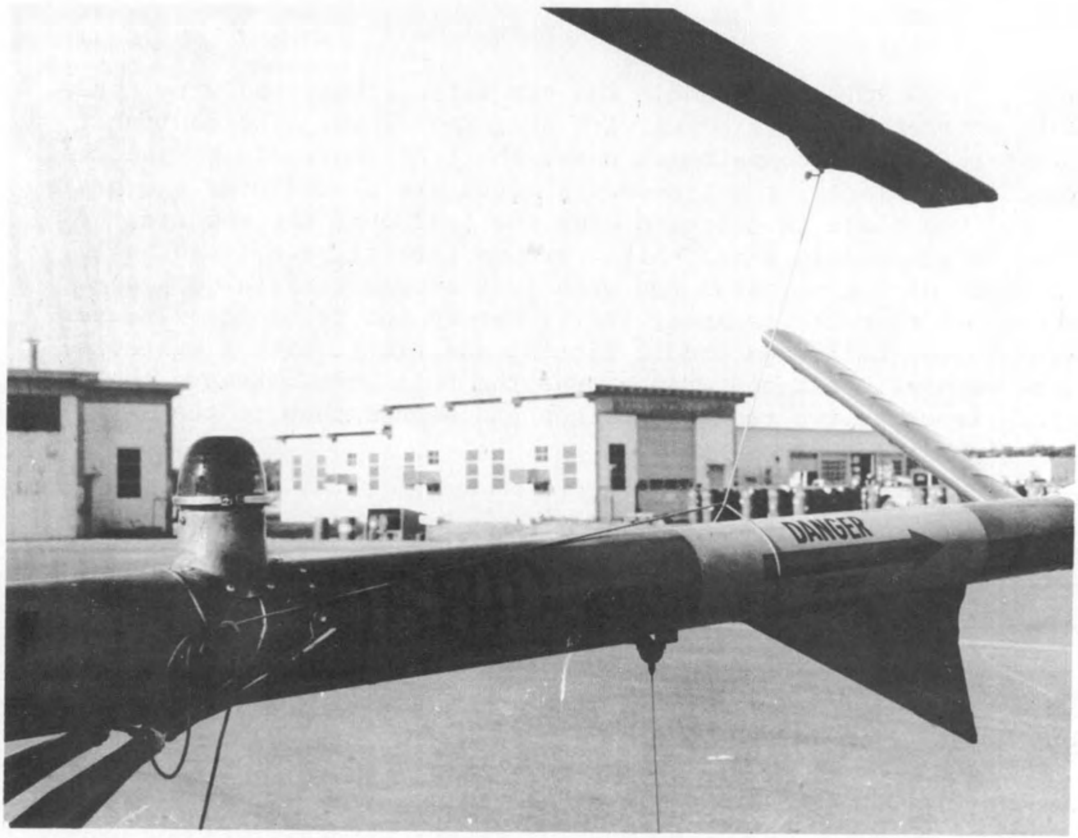
4-12. MAIN ROTOR TIE-DOWN. The aircraft is equipped with three main rotor-tie-down sleeves with securing lines. The equipment is stored in the compartment under the left seat. To secure the main rotor blades, the tie-down sleeves are placed over the blade tips. One blade is centered over the tailboom; the securing line is wrapped in a half-hitch around the tailboom immediately in front of the vertical fin with just enough tension to place the droop stop at its lower limit; extend the remaining line forward to the tail boom saddle fitting and tie it with a suitable knot with at least one wrap around the tail boom. Remove the slack from the two remaining lines and secure them to the left and right front oleo struts.

CAUTION

Do not bend the main rotor blades by putting excessive tension on the securing lines.

Always tie down all three main rotor blades when securing aircraft.

4-13. ANTI-OVERSPEED UNIT. An anti-overspeed unit to prevent engine overspeed is installed in the throttle linkage mechanism on the right side of the aircraft adjacent to the fuel injector control. The Hartzell unit consists of a propeller governor, a hydro-mechanical unit using engine oil pressure and is designed to cause automatic throttle retardation any time the engine RPM reaches 3050 ($\pm$ 25) RPM.



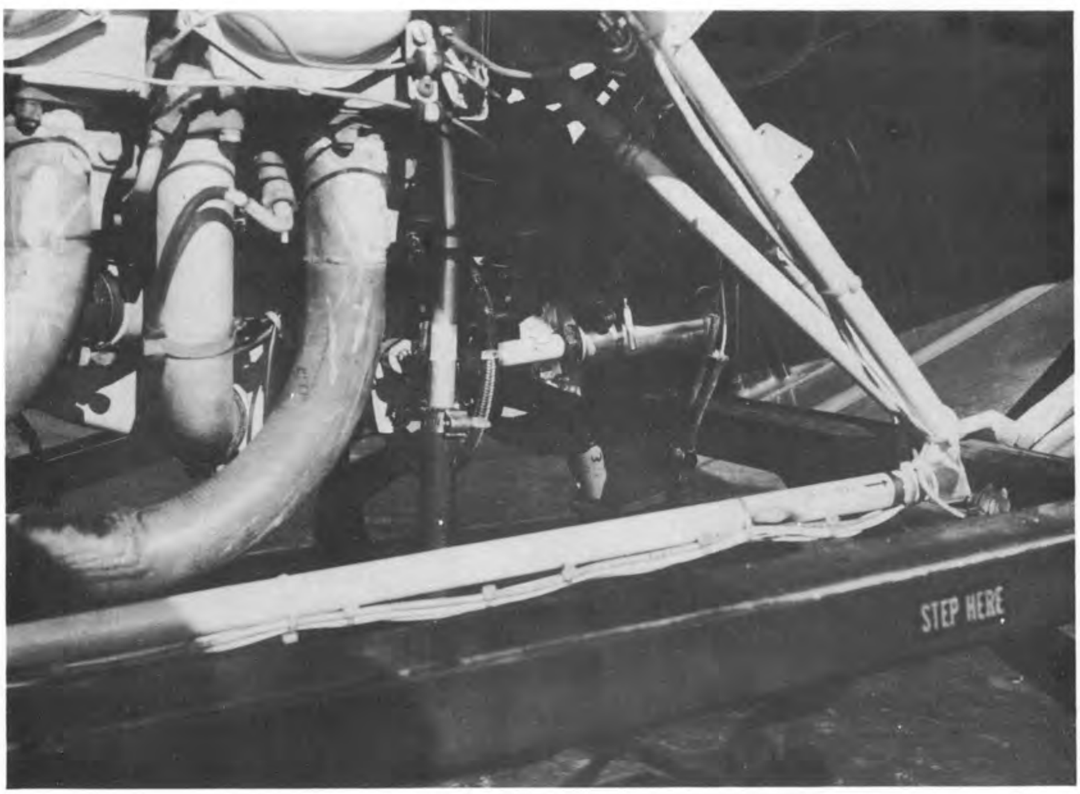
Aft Blade Tie-down (fig. 4-3)

CAUTION

When the anti-overspeed device engages at the SET limit, the RPM will be reduced immediately in direct proportion to the speed with which the throttle is advanced. At the same time, an immediate left yaw will occur as the device reduces RPM.

WARNING

The anti-overspeed device will NOT prevent engine overspeeds due to quick-starts.



Location of Anti-Overspeed Device (fig. 4-4)

CHAPTER 5

FLIGHT CHARACTERISTICS

Section I

Scope

5-1. Scope. General helicopter flight characteristics and those characteristics unique to the TH-55A are detailed in this chapter.

Section II

General

5-2. HELICOPTER GENERAL. The flight characteristics of single rotor helicopters are very similar. All controls; cyclic, pedals, pitch and throttle; must be coordinated properly in order to maintain stability of control in all maneuvers. The main noticeable differences are in the power available for maneuvering and the type of rotor system whether semi-rigid or fully articulated. The fully articulated system corrects the dissymmetry of lift through a flapping hinge at the blade root while the semi-rigid system depends on a tetering head to correct dissymmetry of lift.

5-3. When the helicopter moves from hovering to forward flight, less power is required to maintain altitude as speed increases, until a speed of approximately 45 to 50 knots is attained. Increased power will again be necessary as the helicopter is accelerated beyond this speed. This peculiar flight characteristic is due to the effect of induced air flow through the main rotor, which results in an overall increase in left with an increase in airspeed. However, as the airspeed is increased above 45 to 50 knots, the power required to overcome drag is more than enough to off-set the increased lift and additional power is necessary to maintain altitude.

5-4. High forward speed of a helicopter is limited by factors other than power.

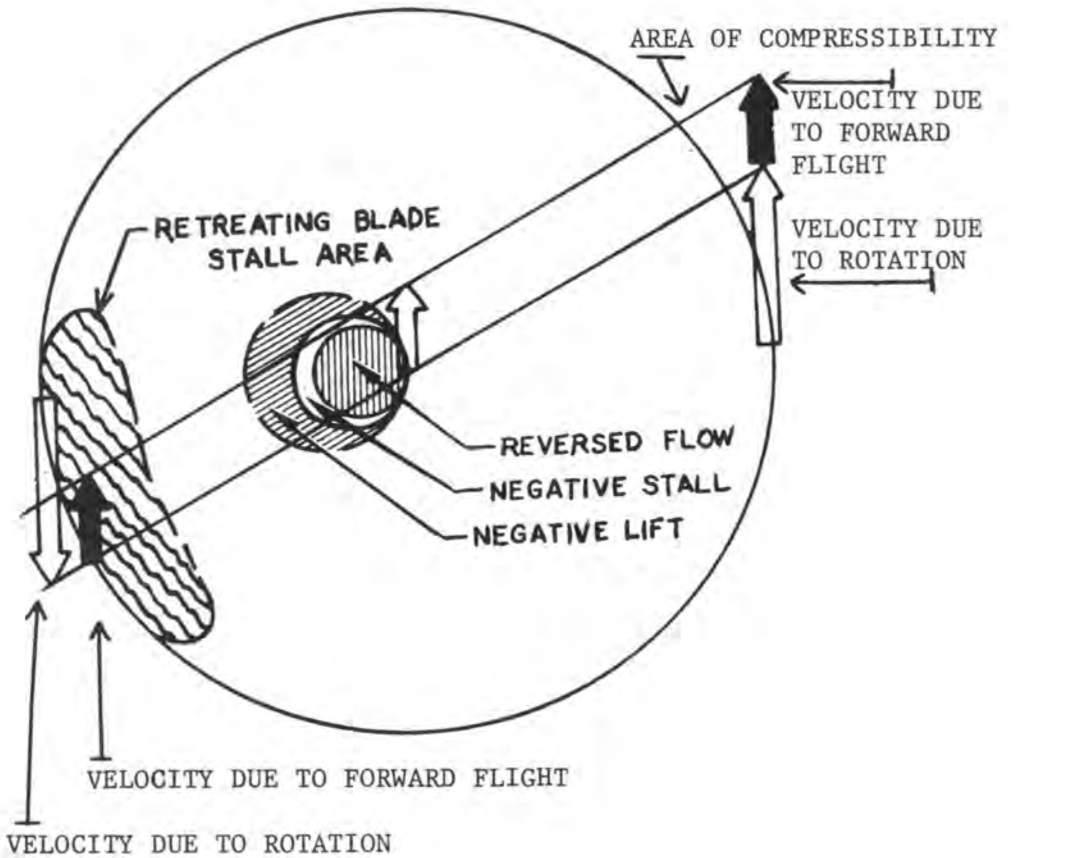
A. Retreating Blade Stall. This stall results when the angle of attack of the blade exceeds the stall angle of attack of the blade section. This condition occurs in high speed flight at the tip of the retreating blade since, in order to develop the same lift as the advancing blade, the retreating blade must operate at a greater angle of attack. If the blade pitch is increased or the forward speed increased, the stalled portion of the rotor disc becomes larger with the stall progressing in toward the hub from the tip of the retreating blade. Retreating blade stall can be initially recognized by erratic stick forces and rotor roughness. Each of the blades of a three-bladed rotor will stall as it passes through the stall region and create a vibration with three beats per rotor revolution. Continuing evidence of retreating blade stall is a nose pitch-up tendency which can become uncontrollable if the stall is allowed to become severe.

1. Each of the following conditions or combinations thereof results in a high angle of attack on the retreating blade and may contribute to retreating blade stall: high airspeed, low rotor RPM, high gross weight, high density altitude and accelerated flight with high load factors. Turbulence, gusty winds and abrupt control movements associated with high airspeed can also contribute to retreating blade stall.

2. Recovery from a stalled condition can be affected only be decreasing the blade angle of attack below the stall angle. This can be accomplished by one or a combination of the following; decrease collective pitch, decrease airspeed, increase rotor RPM, and decrease severity of accelerated maneuver or control deflection.

3. If the stall is severe enough to result in nose pitch-up, forward cyclic to attempt to control pitch-up is ineffective and may aggravate the stall since forward cyclic results in an increase in blade angle of attack on the retreating blade.

B. Compressibility. Compressibility Effects occur when the advancing blade tip speed nears the speed of sound due to the total sum of the helicopter forward speed plus the advancing blade tip speed. At normal speeds, the flow of air across the advancing blade is influenced by pressure disturbances well ahead of the airfoil and pressure and velocity changes occur smoothly across the blade. As the tip speed approaches the speed of sound, the air begins to compress and a compression wave is formed at the leading edge of the airfoil. All changes in air flow pressure and velocity will take place sharply and abruptly. Compressibility Effects on a helicopter cause rotor roughness vibration, cyclic feed-back, undesireable structural twisting of the blade, and increased power requirements to maintain rotor RPM.



(Illustration Depicting Rotor Flow Conditions in Forward Flight)

1. The following operating conditions represent the most adverse conditions from the standpoint of compressibility: high airspeed, high rotor RPM, high gross weight, high density altitude, low temperature and turbulent air.

2. The similarities in the critical conditions for retreating blade stall and compressibility should be noted; but one basic difference must be appreciated - compressibility occurs at HIGH RPM while retreating blade stall occurs at LOW RPM.

C. Blade Loading. A third factor which contributes to creating a limit is high loading of the blades and results in the aircraft directional movement becoming sluggish and lagging the control movements.

5-5. Settling With Power. Conditions likely to cause settling with power are typified by a helicopter in a vertical or very steep power descent of at least 300 feet per minute and with a relatively low airspeed. Any time a helicopter is allowed to enter settling with power, the situation could become critical. However, the critical rate depends on load, rotor RPM, density altitude, forward speed and angle of descent. Under settling with power conditions, the rotor system is descending through turbulent air which has just been accelerated downward. Reaction of the turbulence on the rotor blades at high angles of attack creates a stalled area at the hub which progresses outward along the blade as the rate of descent increases. If collective pitch is increased to stop the high rate of descent, the stalled area of the rotor disc will be increased, thus, aggravating the situation and increasing the rate of descent. The recovery from settling with power can be accomplished by increasing the forward speed, maintaining proper RPM and reducing collective pitch - altitude permitting.

Section III

TH-55A Flight Characteristics

5-6. ROTOR SYSTEM. The TH-55A has a low inertia rotor system.

A. In powered flight, this low inertia rotor system should present no unusual problems to the pilot. However, excessive and abrupt upward collective movements without proper throttle coordination can cause serious rotor RPM decay. This condition could become critical at low altitude and slow forward speed. If proper low RPM Recovery techniques are used, recovery should be effected without great difficulty.

B. The principle difference between a low inertia and high inertia rotor system is in stability of rotor RPM while transitioning from powered flight to power-off flight. During any delay in the transition to power-off flight, the high inertia system has the tendency to remain nearer the original rotor RPM while the rotor RPM in a low inertia system tends to decay more rapidly. Rotor RPM can also be regained more rapidly in a low inertia system than in a high inertia system.

WARNING

One important factor to remember in operating the low inertia rotor system is to prevent excessive loss of rotor RPM by the immediate proper positioning of the collective pitch stick as a power loss or failure occurs.

C. During power-off landings, the collective pitch stick must be held in its proper position. (Re. Emergency Procedures) until the proper altitude for pitch application is reached. If the pitch application is too HIGH, ABRUPT or EXCESSIVE, the rotor inertia will be wasted and further pitch application may have little or no effect in cushioning the aircraft to the ground.

WARNING

Many autorotative landing accidents can be attributed to high, abrupt or excessive pitch applications resulting in premature loss of rotor inertia.

5-7. ATTITUDE CHARACTERISTICS. Attitude is controlled by the cyclic stick. However, the attitude of the TH-55A in forward flight is always effected by the movement of the collective pitch stick. As power is reduced, the forward rotor disc area loses lift and causes the nose to pitch down. As power is applied, additional lift is gained and the nose will pitch up. Therefore, for proper coordination; as collective is <u>decreased</u>, <u>aft cyclic</u> must be applied to maintain a pre-determined attitude, and, as collective is <u>increased</u>, <u>forward cyclic</u> must be applied.

5-8. In and Out of Trim Conditions. The aircraft is in proper trim if the pilot has the proper pedal setting, is making good his ground track and the aircraft is level laterally. Any time improper pedal settings are used, the aircraft is said to be out of trim and will slip sideward through the air.

5-9. Effect of Improper Trim on Attitude.

A. In Powered Flight.

1. Normal Descent. In a normal descent, the pilot must use aft cyclic to maintain attitude and right pedal for proper trim. As power is reduced without application of proper cyclic and pedal, the nose will start to pitch down and begin a rolling yaw to the left. The misapplication of pedal causes the nose to yaw, turning the rotor disc from its line of flight and, in sequence, the fuselage will roll and the nose will pitch down. If cyclic is applied toward the original flight path to correct the rolling motion, the ground track can be maintained but the aircraft will still be slipping sideward through the air in an out of trim condition. The proper recovery is the application of sufficient right pedal for the amount of power reduced and aft cyclic for attitude control.

2. Normal Climb. Entering a normal climb from a cruise, the pilot must use forward cyclic pressure to maintain attitude and left pedal for trim. As power is applied, without application of proper pedal and cyclic, the nose will pitch up and begin a rolling yaw to the right. The misapplication of pedal causes the nose to yaw turning the rotor disc from its line of flight and, in sequence, the fuselage will roll and due to application of power and improper cyclic, the nose will pitch up. Proper left pedal to stop the rolling yaw and forward cyclic sufficient to maintain proper attitude will effect recovery.

3. Normal Cruise. The aircraft is designed to fly straight and level with a near neutral pedal setting. If either pedal is applied and held, the nose will yaw turning the rotor disc from its line of flight, the fuselage will begin to roll in the direction of the pedal applied and the nose will pitch down. The use of neutral or opposite pedal should stop the rolling yaw and proper cyclic control will bring the aircraft back to straight and level flight. As power is reduced, the forward rotor disc area loses lift and causes the nose to pitch down. The use of neutral or opposite pedal should stop the rolling yaw and proper cyclic control will bring the aircraft back to straight and level flight.

B. In Power-Off Flight.

1. Use of Left Pedal or Insufficient Right Pedal. The use of left pedal or insufficient right pedal in power-off flight will cause an immediate rolling yaw to the left and the nose to pitch down.

2. Excessive Right Pedal. The use of excessive right pedal in power-off flight will cause the nose to yaw to the right and pitch up slightly.

NOTE

As left pedal is applied, the yaw turns the rotor disc to the left of the line of flight and projects the tail boom to the right of the line of flight. Impact pressure and positive forces, in autorotative descent, on the large surface area and high dihedral angle of the horizontal stabilizer increase the rate at which the nose will pitch down and roll to the left.

As excessive right pedal is applied, even though the yaw turns the rotor disc out of the line of flight (Re. Paragraph 5-9. A.3.), it projects the tail boom to the left and, in autorotative descent, the pitching down of the nose is stopped by negative forces on the horizontal stabilizier causing the nose to pitch up slightly.

WARNING

If any of the conditions in paragraph 5-9 are allowed to persist, the Vne could be exceeded by the excessive nose low attitude and the flight condition could progress to a critical state.

5-10. NOSE TUCK. A critical state of flight can result from poor pilot technique upon entering power-off flight.

When entering a forced landing or an autorotation, the pilot must apply aft cyclic and right pedal as power loss occurs or collective is lowered. Due to the fact that lift is lost in the forward rotor disc area as power is reduced, the nose will drop at a rate in direct proportion to the speed at which the power is reduced. If the throttle is cut rapidly, the engine quits suddenly or the collective placed down abruptly, the nose will pitch down at a rapid rate. The nose will also yaw to the left rapidly under this condition. If the pilot fails to use aft cyclic to prevent the initial pitch-down of the nose and he fails to use right pedal to prevent the left yaw, the aircraft will enter a nose tuck condition. The loss of power will cause the nose to pitch down initially. The yaw will turn the rotor disc to the left of the line of flight and initiate the roll. As the yaw begins, the tail boom is projected to the right and, due to impact pressure and positive forces on the high dihedral angle and large surface area of the horizontal stabilizer, the speed at which the nose pitches down and the fuselage rolls to the left is greatly increased. If this condition is allowed to progress, the nose will tuck, Vne will be exceeded and recovery will be difficult.

WARNING

If incorrect control applications are applied, such as; left pedal and forward cyclic, at the entry of an autorotation or forced landing, severe nose tuck will occur immediately.

5-11. NOSE TUCK - RECOVERY. Recovery from nose tuck should be initiated by application of right pedal to stop the rolling yaw and bring the aircraft back to a trimmed condition. Then, aft cyclic should be applied to begin bringing the nose up toward the proper attitude. If power is available, initiate a power recovery. The application of collective pitch will restore additional lift to the forward rotor disc area and help bring the nose up. (If power is NOT available, the loss of rotor RPM by applying collective pitch would be detrimental to a successful power-off landing.)

WARNING

The pilot should begin corrective action IMMEDIATELY upon recognizing a nose tuck sequence to effect recovery as quickly as possible and to prevent a critical state.

5-12. TRANSLATING TENDENCY. The helicopter has a tendency to move to the right in the direction of tail rotor thrust when hovering. In aircraft with semi-rigid rotor systems, this tendency is overcome by the rigging of the main rotor or installing a slight tilt in the main rotor mast. In the TH-55A with a fully articulated main rotor system, the pilot must overcome this translating tendency by application of left cyclic pressure.

NOTE

During the latter portion of an approach, this translating tendnecy will be seen and felt as the airspeed falls below translational lift speed. As the aircraft slows, it will begin to drift to the right and the pilot must begin to correct with left cyclic pressure to maintain ground track.

During a takeoff, the translating tendency will be overcome as the airspeed is increased and the pilot must begin to remove the left cyclic correction to maintain ground track.

5-13. EFFECTS OF CROSS WIND (Hovering Flight). In either a left or right cross wind, the aircraft has the tendency to weathervane (the nose of the aircraft will tend to turn into the wind). However, with the wind from the right side, the aircraft will not only weathervane but, additionally, the nose will have the tendency to pitch down as it turns due to impact pressure on the horizontal stabilizer. This tendency is pronounced when the forward speed is below that of translational lift and the aircraft is in a forward slip.

5-14. VIBRATIONS. The following are vibrations usually encountered during normal flight operations.

5-15. Normal Vibrations. Some vibrations in the TH-55A are normal and should be considered acceptable.

A. During rotor engagement, while the rotor RPM is increasing, a slight ground rock will be felt until the dampers rephase. If the ground rock is continuous, it is not normal and may indicate: low oleo struts, rotor dampers out of phase, undampened lead-lag, or action due to damper wear or damper arm bearing wear.

B. There will be a slight engine vibration felt in the cabin floor, seat structure, controls and airframe.

C. A slight momentary lateral vibration is felt during autorotative power recovery when pitch and power are applied rapidly.

5-16. Vertical Vibration. This is a low frequency vibration felt as a vertical bounce, caused by the main rotor blades not tracking properly. The vibration is transmitted to the pilot through the seat, airframe, and sometimes feedback in the flight controls. The condition can also be caused by worn, stiff or dry flapping hinge bearings or pitch bearing cases.

5-17. Lateral Vibration. This low frequency vibration is generally encountered in high power settings and autorotation. The pilot will feel this vibration as a lateral bounce along the longitudinal axis of the aircraft. The condition is usually caused by improperly adjusted or faulty main rotor dampers.

5-18. Medium and High Frequency Vibrations. These vibrations at the lower frequency range are identifiable by a rapid definite beat and, at the higher frequency, as a buzzing or tingling sensation. The possible causes of these vibrations are many and varied. Beginning with the lower frequency, the following could cause medium to high frequency vibrations: tail rotor drive shaft damage, engine malfunction (all frequencies of vibrations possible), improper alignment or lubrication of lower coupling shaft, condition and operation of tail rotor damper block, excessive runout of transmission pinion shaft, loose exhaust manifolds, rough or worn pulley bearings, unbalanced impeller or scroll rubbing, loose rear engine mounts, excessive runout of input or output tail rotor gear box shafts, out of balance tail rotor blade assembly, incorrect tension of clutch actuator cable, loose tail skid or fin, worn or loose components in tailboom or skid gear structure, and excessive wear of bearings in the tail rotor assembly.

CAUTION

Any vibration that is not normal should be reported to maintenance personnel as soon as possible.

CHAPTER 6

NORMAL PROCEDURES
and
CREW DUTIES

Section I

Scope

6-1. Scope. This chapter gives references for step-by-step procedures in accomplishing a flight under normal conditions.

Section II

General

6-2. Normal flight procedures, checklists and crew duties may be found in the USAPHS Primary Flight Training Manual (PFTM) and addendums.

CHAPTER 7

OPERATING LIMITATIONS

Section I

Scope

7-1. Scope. This chapter covers all important limitations that must be observed during normal operations, together with related restrictions peculiar to this aircraft.

Section II

Limitations

7-2. LIMITATIONS. This section contains limitations for normal operation of the TH-55A. Limitations which are delineated in the instrument markings illustrations are not necessarily repeated in the text.

7-3. Crew. Minimum crew is one pilot - right seat only. Maximum crew is two persons.

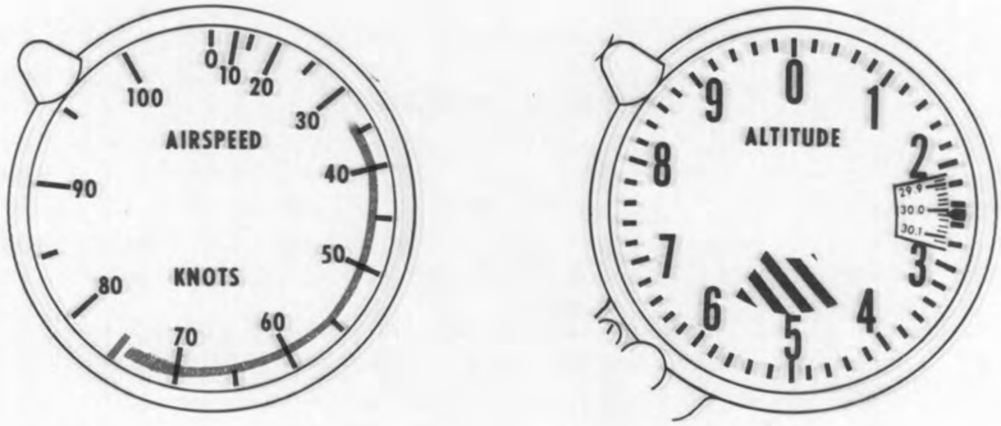
7-4. Instrument Markings. Every instrument that indicates an operating limit is illustrated.

7-5. Engine Limitations. RPM limitations are depicted in the illustrations.

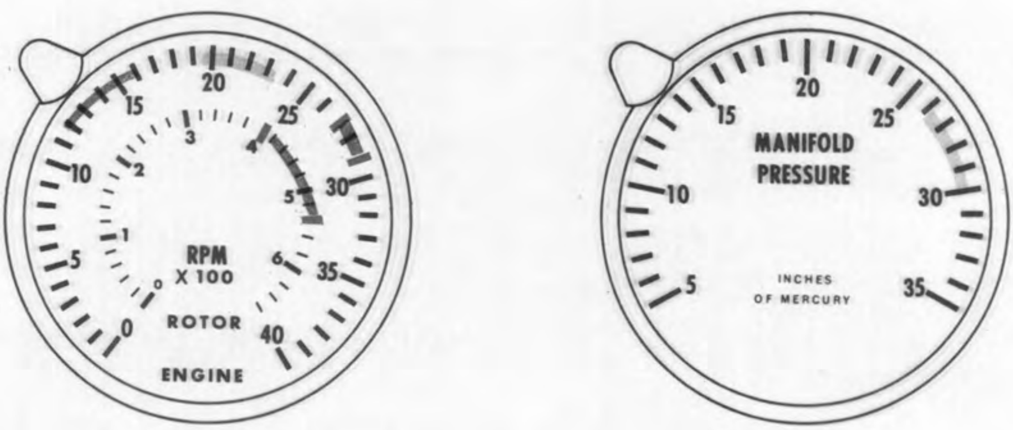
7-6. Rotor Limitations. Rotor RPM limitations are depicted in the illustrations.

WARNING

Rotor RPM (inner scale-dual tachometer) during powered flight is restricted to the range indicated by the engine RPM red-line outer scale markings 2700 to 2900 RPM (approximately 440 to 485 rotor RPM). During autorotation, rotor RPM is restricted to the range between the two red line limitations on the inner scale (400 to 540 rotor RPM).



Vne 75 Knots at Sea Level
Red Line - 75 Knots
Green Arc - 35 to 75 Knots



ENGINE - Red Lines 2700 & 2900 RPM
Idle - 1200 to 1600 RPM
Yellow Arc (Impeller Resonance) -
1950 to 2350 RPM
Overspeed (Engaged) - 3201 RPM
Overspeed (Disengaged-Shortshaft
Inspection) - 2000 RPM
ROTOR - Red Lines 400 & 530 to 540 RPM
Green Arc - 400 to 530 RPM
Overspeed - 540 RPM

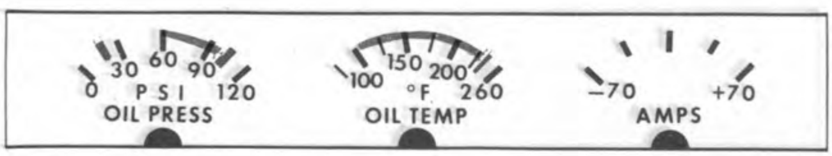
Flight Instruments and Limitations (fig. 7-1)

ALTITUDE	0	2000	4000	6000	8000	9000	10000
V_{NE} KNOTS	75	73	71	67	59	55	51

Fuel Grade - 91/96 thru 115/145
Max. Flt. Time - Check Local Regs.

Red Lines-14 & 30 psi
Green Arc-14 to 30 psi

Red Line - 500°F
Yellow Arc - 450 to 500°F
Green Arc - 230 to 450°F



Red Lines - 25 & 100 psi
Green Arc - 60 to 100 psi
On Start - 25 psi in 30 sec.
Cold Weather Start- visible rise in 30 sec.

Red Line - 245°F
Green Arc - 104 to 245°F

Engine Gages and Limitations (fig. 7-2)

7-7. Airspeed Limitations. The maximum indicated airspeed (Vne) is 75 knots at sea level.

7-8. Controls. The TH-55A is especially sensitive to control pressures due to its light weight and immediately responsive rotor system.

WARNING

ABRUPT CONTROL MOVEMENTS, INCLUDING RAPID AND REPETITIVE PEDAL REVERSALS ARE PROHIBITED TO AVOID EXCESSIVE STRESSES IN THE STRUCTURE. This, in no way limits normal control applications.

7-9. Prohibited Maneuvers.

A. Flight under instrument conditions without proper instrumentation.

B. Aerobatic flight.

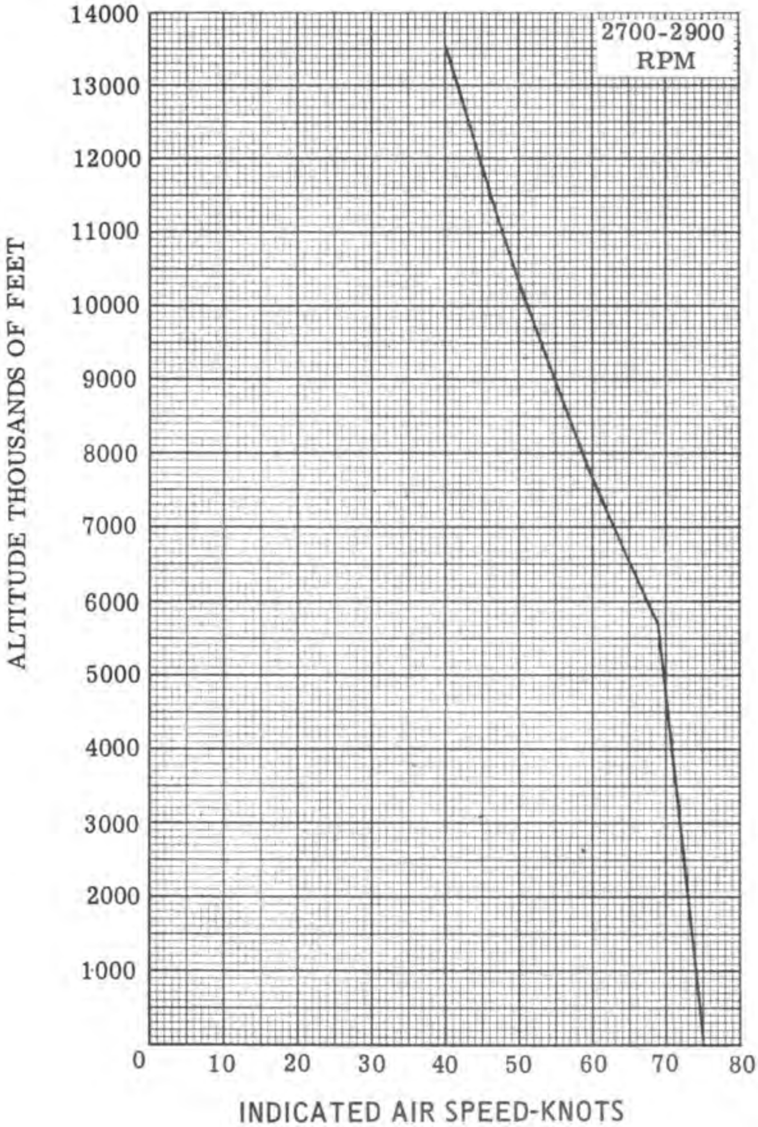
7-10. Center of Gravity Limits.

A. Forward - 95 inches.

B. Aft - 100 inches.

7-11. Weight Limitations. Design gross weight is 1670 lbs. Basic weight and operating weight varies with equipment and crew. (Re. Weight and Balance).

7-12. Blade Dampers. Lower limit is 4 1/2 and upper limit is 5 on the damper gage. All dampers should be set between the 4 1/2 and 5 limits.



Vne Limitations Chart (fig. 7-3)

CHAPTER 8

EMERGENCY PROCEDURES

Section I

Scope

8-1. Scope. This chapter describes procedures to be followed in meeting most emergencies that could be encountered.

Section II

General

8-2. ENGINE. In the event of power loss or engine failure, the two factors most likely to affect the success of an autorotative landing are the altitude and airspeed at the time of the emergency. The main characteristics of power loss or engine failure, other than an engine sound change, are a sudden drop of engine and rotor RPM, a left yaw resulting from a reduction of torque effect and the total or partial lack of throttle response.

WARNING

Avoid flight at altitude and airspeed combinations from which a safe autorotative landing would be difficult in the event of power failure. (re. Pg. 7 Ch. 11)

8-3. PARTIAL POWER CONDITIONS. Under partial power conditions, the engine may operate with relative smoothness at reduced power, or it may operate roughly and erratically with intermittent power surges.

A In a condition where the engine may be operated smoothly with a power reduction, the pilot may elect to proceed with a power approach to a favorable landing area using slightly higher than normal approach airspeed. The pilot must be prepared for complete engine failure throughout the approach.

WARNING

Immediately following a power loss, decrease the collective pitch to maintain rotor RPM, apply right pedal and use aft cyclic pressure to maintain proper attitude. Then, make your decision.

B. If partial power loss is accompanied by severe engine roughness or power surges, immediately close the throttle and execute autorotative landing procedures.

WARNING

During the situation in paragraph B, above, the throttle should be kept closed into the override spring during the landing to prevent a sudden and hazardous yaw should the engine abruptly recover power.

8-4. ENGINE FAILURE. The following action should be taken during the indicated emergencies.

A. Engine Failure During Take-off --- below 10 feet.

CAUTION

All engine failures at low altitude require the pilot's maximum division of attention and immediate reaction.

(1) Maintain Necessary Control:

a. Collective - maintain pitch setting until just prior to ground contact; then increase pitch as required to cushion landing.

b. Cyclic - level the flight attitude; maintain ground grack.

c. Pedals - right pedal initially; keep skids in line with touchdown path.

(2) Engine Shutdown:

a. Fuel valve - OFF

b. Battery switch - OFF

c. Ignition switch - OFF

d. Prepare to fight fire.

B. Engine Failure During Take-off --- 10 to 500 feet.

(1) Maintain Necessary Control:

a. Collective - minimum pitch - FULL DOWN (altitude permitting).

b. Cyclic - use aft cyclic pressure to maintain attitude.

c. Pedals - right pedal initially to maintain heading for landing into the wind (altitude and terrain permitting).

CAUTION

Full down collective pitch may not be adviseable at very low altitudes, however, the pitch should be decreased to at least an intermediate position to minimize rotor RPM loss, but without excessively increasing the rate of descent.

(2) Accomplish Shutdown.

C. Engine Failure in Flight - 500 feet/or above.

(1) Maintain Necessary Control:

a. Collective - minimum pitch - FULL DOWN.

b. Pedals - right pedal for proper aircraft trim and heading control.

c. Cyclic - maintain 45 to 50 knot attitude/airspeed; trim as desired; maintain ground track; prepare for landing in a favorable area as near into the wind as possible.

(2) Accomplish Shutdown.

8-5. Engine Shutdown During Flight. The engine should never be shut down during flight except in the case of mechanical failure or fire.

8-6. Engine Air-Start. The TH-55A has no air-start capability.

8-7. ENGINE-OUT (AUTOROTATIVE) LANDINGS.

A. Preparation. During engine-out procedures, the pilot must put the collective pitch FULL DOWN (altitude permitting), use a sufficient amount of right pedal to counteract the reduced torque effect, use aft cyclic pressure to prevent excessive nose low attitude, choose a suitable landing area and prepare for landing. (In addition, the fuel valve, mixture control, magneto switch and battery switch should be turned OFF --- time permitting).

CAUTION

Turns should be completed by 100 feet above the terrain.

B. Prior to 25 to 35 feet.

(1) Collective - FULL DOWN.

(2) Cyclic - 45 to 50 knot attitude - maintain ground track.

(3) Pedals - skids aligned with touchdown path.

C. At 25 to 35 feet begin deceleration.

(1) Collective - FULL DOWN.

(2) Cyclic - apply aft pressure to raise nose of aircraft to begin deceleration - maintain ground track.

(3) Pedals - skids aligned with touchdown path.

The amount of deceleration will depend upon the wind direction/ velocity, density altitude, terrain and touchdown speed desired.

D. 4 to 8 feet above the ground.

(1) Collective - begin initial pitch application by raising collective.

(2) Cyclic - deceleration attitude - maintain ground track.

(3) Pedals - skids aligned with touchdown path.

E. After initial pitch application.

(1) Cyclic - forward to level aircraft.

(2) Collective - continue to apply pitch as necessary to cushion aircraft to the ground.

(3) Pedals and Cyclic - maintain heading and ground track.

F. After touchdown.

(1) Cyclic - maintain ground track and sufficient forward pressure to keep rotor disc tilted away from the tailboom.

CAUTION

Too much forward cyclic during the ground run will put excessive weight forward on the landing gear causing the skids to dig into the landing surface.

WARNING

Never use aft cyclic during pitch application or ground run.

(2) Pedals - maintain heading.

CAUTION

Care should be used when landing with a strong left cross-wind. Since the right pedal loses effectiveness as the rotor RPM decreases, the pilot may not have sufficient right pedal to maintain heading during ground run.

(3) Collective - when sufficient pitch has been applied to cushion the landing, the collective should be maintained stationary until the ground run is completed.

CAUTION

HARD SURFACE LANDINGS ONLY - If the touchdown speed is very fast, and it is the pilot's judgement that the aircraft may run off the lane; the collective may be lowered smoothly to help shorten the ground run.

Section III

Tail Rotor

8-8. TAIL ROTOR FAILURE. Tail rotor or drive system failure during hover or forward flight will be indicated by a sudden yaw to the right and simultaneous loss of directional control. Immediate action must be taken to maintain directional control, as the torque effect will cause the aircraft to rotate to the right around its vertical axis. Closing the throttle will eliminate the torque and tend to stop the rotation; lateral cyclic may be applied to make small changes in the heading.

8-9. Tail Rotor Failure in Flight. Prepare for autorotative landing.

A. Throttle - Closed.

B. Collective - FULL DOWN

C. Cyclic - minimum 40 knots - lateral pressure may be used to help control direction.

D. Power- cautious application of power may be made if necessary to lengthen glide, after directional control has been established. If the surface is sufficiently smooth, forward speed at the time of ground contact is desireable.

WARNING

Never apply power during the actual landing operation. Keep throttle fully closed into the override spring to prevent power-surge yaw during touchdown.

8-10. Tail Rotor Failure in a Hover. When tail rotor control is lost during a hover, the aircraft will begin to turn to the right and the rate of turn will increase rapidly due to the torque effect of a high power setting. Immediate action must be taken.

A. Cyclic - maintain level attitude and prevent drift.

B. Throttle - CLOSED into override spring.

C. Collective - maintain position; then complete a hovering autorotation by increasing the pitch to cushion the landing.

Section IV

Power Train Failure

8-11. POWER TRAIN FAILURE. A loss of power drive to the rotor system while the engine continues to operate normally is indicated by a surge of the engine tachometer needle past the rotor needle with a subsequent rotor decay. The cause could be either the failure of the idler pulley bearing or the failure of the linear actuator. To correct the situation, the pilot should lower the collective pitch FULL DOWN and establish autorotative procedures. The pilot may attempt to rejoin the engine and rotor tachometer needles while the collective pitch is in the FULL DOWN position. When the needles join, power may be applied and a powered approach continued. If the engine needle goes past the rotor needle, the pilot should close the throttle and continue the autorotation.

Section V

Ground Resonance

8-12. GROUND RESONANCE. The TH-55A is susceptible to ground resonance due to its having a fully articulated main rotor system. Ground resonance is a vibration set up between the aircraft with its rotor turning and the ground. It occurs when unbalanced forces in the rotor system cause the aircraft to rock on its landing gear at or near its natural frequency. With all parts operating properly, the design of the aircraft is such that the landing gear oleos and rotor blade dampers will, by energy dissipation, prevent the resonance from building up to dangerous proportions. The following conditions can cause ground resonance:

A. Improper inflation of oleos.

B. Defective main rotor dampers.

C. Operation at high power settings with the aircraft very light on the gear.

WARNING

Ground resonance, if allowed to build, can cause destruction of the aircraft. The onset is very rapid and requires immediate corrective action.

8-13. Recovery from Partial Ground Resonance.

A. During Engagement. If ground resonance begins during rotor engagement, immediately disengage the system, shut down the engine and check for cause.

B. Partial Ground Contact. Recover by taking off to a hover if at sufficient RPM. If RPM is too low for take-off, lower the collective FULL DOWN, close the throttle and shut down the engine.

Section VI

Fire

8-14. FIRE. The following procedures should be followed if a fire occurs.

8-15. Engine Fire During Starting.

A. Mixture - Idle Cut-Off.

B. Starter button - continue to depress starter button to try to draw fire through the engine.

C. Ignition Switch - BOTH

D. If fire spreads, release the starter, pull the fuel valve OFF, turn all electrical switches OFF, exit the aircraft and fight fire with the extinguisher.

CAUTION

Do not attempt to restart the engine until the cause of the fire has been determined, and a restart is considered safe.

8-16. Engine Fire During Flight. Immediately enter autorotation and prepare for a power-off landing. If altitude permits accomplish the following:

A. Fuel Valve - OFF

B. Mixture - IDLE CUTOFF

C. All electrical switches - OFF

Do not restart engine.

8-17. Electrical Fire. Circuit breakers and fuses help prevent fire in the electrical system caused by short circuit. If an electrical fire should start, however, turn the battery and alternator switches OFF, land as soon as possible and investigate. Do not fly the aircraft until deficiency is corrected.

Section VII

Fuel System

8-19. FUEL SYSTEM. A decrease in fuel pressure could be caused by a faulty fuel pressure gage, electrical failure, a dirty fuel filter, excessively low fuel quantity, blocked fuel tank vent or malfunction of both the electrical and engine-driven fuel pumps.

8-20. If fuel pressure decreases, check the fuel quantity gage for fuel remaining and the electrical system for malfunction. If fuel pressure continues to drop, land as soon as possible and investigate. During the descent, prepare for engine failure due to fuel starvation.

Section VIII

Electrical System

8-21. ELECTRICAL SYSTEM FAILURE. There is no warning light in the cockpit to indicate alternator failure. However, if the alternator fails during flight, the battery acts as an emergency power source for the electrical system.

NOTE

Additional EMERGENCY PROCEDURES may be found in the USAPHS Primary Flight Training Manual (PFTM).

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

CHAPTER 9

WEATHER OPERATION

Section I

Scope

9-1. Scope. The function of this chapter is to provide information relative to aircraft operation under extreme weather conditions and in dusty or sandy environments.

Section II

Instrument and Night Flying

9-2. INSTRUMENT FLIGHT. Instrument flight in this aircraft is prohibited unless special flight instrument package is installed.

9-3. NIGHT FLYING. Normal operating procedures apply to night flying.

WARNING

Night flying can be safely conducted only when a visible horizon is evident.

Section III

Cold Weather Operation

9-4. GENERAL. Operation of the aircraft in cold temperatures is basically in accordance with normal procedures and limitations. There are, however, certain fundamental problems associated with operation in low ambient temperatures, and it is the purpose of this section to discuss additional precautions that will contribute to safe and efficient operation in low temperatures.

9-5. PRE-FLIGHT INSPECTION. Normal pre-flight procedures will apply with additional special attention given the following:

A. All Aircraft Surfaces. If ice and snow are present, this must be removed completely from all surfaces of the aircraft; especially the main rotor blades, tail rotor blades, all rotating parts and the cabin plexiglass.

WARNING

Frost accumulation on the main and tail rotor blades can result in distortion of the airfoil shape which will cause serious deterioration of lift and control.

B. Drainage and Vent Lines. Ascertain that all drainage and vent openings are clear of ice and snow.

C. Landing Gear. Be sure that skid gear is not frozen to the ground.

D. Flight Controls. Be certain that all control rods, rod-end bearings, control mixer, swashplate, main rotor head and tail rotor controls are free of ice, snow and moisture that could freeze in flight.

E. Windshield and Canopy. Ice, snow or vision restricting moisture must be removed from the windshield and canopy prior to flight.

CAUTION

Care must be taken when removing ice, snow or moisture from the windshield and canopy and all other aircraft surfaces to prevent cracking or scratching of the plexiglass or other surface damage. Use only a soft cloth to clean the plexiglass area and follow maintenance guidance for removal of frost, snow, ice or moisture from other surfaces and areas.

9-6. COCKPIT CHECK. In addition to the normal cockpit check, special attention should be given the following:

A. Flight Controls. Operate each control through full range of travel. Investigate any indication of interference, roughness or extreme stiffness.

NOTE

At very low temperatures, a slight stiffness of controls is considered normal due to changes in viscosity of the controls lubricant.

B. Engine Controls. Operate each engine control through full range of travel to assure freedom of motion.

C. Cabin Heat. Operate the cabin heat control through full travel. Check all cabin ventilators for freedom of adjustment.

D. Instrument Check. If possible, perform the instrument check with an external power supply.

NOTE

The aircraft battery has an inherent voltage drop when it is inactive at low temperatures.

E. Engine Starting. Start the engine in accordance with normal procedures. If at all possible, use an external power supply.

9-7. HOVERING AND TAXIING. Avoid prolonged hovering or taxiing in powdery snow. The blowing snow, as a result of rotor wash, will reduce visibility to a dangerous level.

9-8. Use caution when taxiing, taking off or landing on an ice covered surface.

9-9. DURING FLIGHT. Forward speed has a pronounced effect on the stabilized operating temperatures of the engine and transmission. If difficulty is experienced in maintaining minimum operating temperatures, reduce airspeed.

9-10. Descent. Avoid prolonged descents at high forward speed and/or low power settings to minimize excessive cooling.

9-11. RAIN. Other than reduced visibility, normal operation in light to moderate rain for short periods offers no particular problem. Operation in heavy rain should be avoided due to a great reduction in visibility and the probability of water erosion damage to the leading edges of the main and tail rotor blades.

9-12. DRY SNOW. Normal procedures may be followed for operation in dry snow. If visibility is decreased, discontinue operation.

9-13. WET SNOW, FREEZING RAIN, ICE, FOG, SLEET OR HAIL. Deliberate operation in these conditions should be avoided. If precipitation in these forms is encountered in flight, land immediately if at all possible.

WARNING

Ice accumulation on the main and tail rotor blades can result in distortion of the airfoil shape which will cause serious deterioration of lift and control.

Section IV

Dusty and Hot Weather Operations

9-14. OPERATION IN DUST OR SAND. Avoid excessive hovering in dusty and sandy areas. The blowing dust and sand caused by the rotor wash can reduce visibility and cause clogged filters and eventual damage to lubricated moving parts.

9-15. HOT WEATHER. Normal procedures apply during hot weather. Use caution during periods of high density altitude and high humidity.

Section V

Turbulence and Thunderstorm Operation

9-16. TURBULENCE. Flight in turbulent conditions can become precarious and should be avoided. If light turbulence is encountered, the airspeed should be reduced to help lessen the impact effect of the turbulence. In cases of severe turbulence, the airspeed should be reduced to approximately 30 to 40 knots, and the pilot should land the aircraft as soon as practical.

9-17. THUNDERSTORMS. Flight in or near thunderstorms should be avoided.

9-18. STRONG OR GUSTY WINDS. (Re. paragraph 9-16.) Strong and gusty winds are most hazardous during rotor engagement and disengagement due to the fact that the main rotor blades could flex into the tail boom. During strong or gusty wind conditions, the aircraft should be parked with the right rear quartering into the wind. The wind flow over the right rear quarter of the aircraft should cause the blade to fly higher over the tail boom, thus preventing blade contact and damage.

WARNING

Rotor Wake or Vortex turbulence from other aircraft can also be a hazard to a slow turning rotor. The pilot should wait a few minutes before engaging or disengaging the rotor system when operating under these conditions, especially when heavier aircraft are operating near-by.

CHAPTER 10

WEIGHT AND BALANCE

Section I

Scope

10-1. Scope. This chapter provides data required for computation of weight and balance for loading an individual aircraft. The data to be inserted on charts and forms are applicable only to the individual aircraft.

10-2. Weight and balance terms are defined and charts and procedures are explained.

Section II

General

10-3. The charts and forms may change from time to time but the principle on which they are based will not change. The forms currently in use are the DD 365 series. The aircraft manufacturer inserts all identifing data and completes one weight and balance clearance Form F at time of delivery.

10-4. The aircraft must be weighed periodically as required by pertinent directives when major modification or repairs are made; when pilot reports unsatisfactory flight characteristics (nose or tail heaviness); and when the basic weight data contained in the records are suspected to be in error.

10-5. The pilot has available the current basic weight, moment and index when applicable. Accordingly, this chapter contains weight and balance definitions; explanation of, and samples of Chart C, Basic Weight and Balance Record, DD Form 365C (the source of the basic weight and moment); Chart E, Loading Data, Charts and Graphs; and a practical example of a loading problem, using Chart C and Weight and Balance Clearance Form DD Form 365F.

Section III

Definitions

10-6. WEIGHT DEFINITIONS. The basic weight of the aircraft is that weight which includes all fixed operating equipment and trapped fuel and oil, to which it is only necessary to add the variable or expendable load items for the various missions.

NOTE

The basic weight of the aircraft varies with structural modifications and changes in the fixed operating equipment. The term basic weight, when qualified with a word indicating the type of mission, such as basic weight for observation, basic weight for evacuation, etc., may be used in conjunction with directives stating what the equipment shall be for these missions.

10-7. Operating Weight. The operating weight of the aircraft is the basic weight plus those variable items which remain substantially constant for the type mission. These items include oil, crew, crew's baggage, emergency and extra equipment that may be required.

10-8. Gross Weight. The gross weight is the total weight of the aircraft and its contents.

10-9. BALANCE DEFINITIONS. Reference datum is an imaginary vertical plane from which all horizontal distances are measured for balance purposes.

10-10. Arm. Arm, for balance purposes, is the horizontal distance in inches from the reference datum to the cg. of a given item. Arms may be determined from the aircraft diagram in Chart E.

10-11. Moment. Moment is the weight of an item multiplied by its arm. Moment divided by a constant is generally used to simplify balance calculations by reducing the number of digits.

10-12. Average Arm. Average arm is the arm obtained by adding the weights and adding the moments of a number of items and dividing the total moment by the total weight.

10-13. Basic Moment. Basic moment is the sum of the moments of all items making up the basic weight. When using data from an actual weighing of the aircraft, the basic moment is the total moment of the basic aircraft with respect to the reference datum.

10-14. Center of Gravity (CG). Center of gravity is the point about which the helicopter would balance if suspended. Its distance from the reference datum is found by dividing the total moment by the gross weight of the helicopter.

10-15. CG Limits. CG limits are the extremes of movement to which the cg can travel without making the helicopter unsafe to fly. The cg of the loaded helicopter must be within these limits at takeoff, in the air and on landing.

Section IV

Chart Explanations

10-16. Chart C (DD Form 365C) - Basic Weight and Balance Record. Chart C is a continuous history of the basic weight and moment resulting from structural and equipment changes in service. At all times, the last weight and moment/constant entries are considered the current weight and balance status of the basic aircraft. At time of new aircraft delivery, the basic weight and moment/constant are entered on this chart. Any change or modification which is caused by a specific order should carry a reference to the order number and date which authorized the change. Corrections to Chart C data shall be made under the following conditions:

A. Whenever equipment is added to, or removed from the helicopter.

B. Whenever previously unrecorded equipment changes are revealed by a complete inventory.

C. Whenever structural changes are made to the helicopter to accommodate additional equipment.

D. When reweighing the helicopter.

10-17. Chart E (DD Form 365E), Loading Data. (See figure 12-2.) The loading data provided in Chart E is intended to provide the basic information necessary to solve a loading problem. Weight and moment/constant are obtained from the loading tables for all variable load items and are added to the current basic weight and moment/constant (from Chart C) to obtain the gross weight and moment. The cg of the loaded aircraft is obtained by locating the gross weight and moment figures in the appropriate columns of the Center of Gravity Table. If the aircraft is loaded within the forward and aft cg limits, the moment figure will fall numerically between the limiting moments (diagonal lines A and B). The first effects on the cg caused by the in-flight expenditures of fuel or cargo may be checked by subtracting the weights and moments of such items from the take-off gross weight and moment and then checking the new moment against the CG table, (diagonal lines A and C). This check is necessary to determine whether the cg will remain within limits for the duration of the contemplated flight.

Section V

Weight and Balance Clearance Form F, DD Form 365F

10-18. WEIGHT and BALANCE CLEARANCE FORM F, DD FORM 365F. Form F is the summary of the actual disposition of load in the helicopter. It records the balance status of the helicopter step by step. It serves as a work sheet on which to record weight and balance calculations and any corrections that must be made, to insure that the helicopter will be within weight and cg limits.

10-19. A DD Form 365F is kept on file for each aircraft by the Maintenance Department. The instructions and procedures for completing a proper Form F are as follows:

A. Insert the necessary identifing information at the top of the form. In the blank spaces of the Limitations Table, enter the gross weight and CG restrictions.

B. (Ref. 1). Enter the aircraft basic weight and index or moment/constant from Chart E.

C. (Ref. 2). Enter the amount of weight and moment of oil.

D. (Ref. 3). Enter the number, weight and moment of crew. Use the actual weights if available.

E. (Ref. 4). Weight and moment of crew baggage.

F. (Ref. 5). N/A

G. (Ref. 6). Weight and moment of additional emergency equipment as applicable.

H. (Ref. 7). Weight and moment of any extra equipment.

I. (Ref. 8). Enter the sum of the weights and moments for Ref. 1 through Ref. 7 inclusive, to obtain operating weight.

J. (Ref. 9). Enter the number of gallons, weight and moment of takeoff fuel.

K. (Ref. 10). N/A

L. (Ref. 11). Sum of the weights and moments for Ref. 8 through Ref. 10 inclusive, to obtain Total Aircraft Weight.

M. Determine the Allowable Load based on takeoff or landing by use of the Limitations table in the upper left-hand corner of the form, as follows:

1. Enter the Allowable Gross Weight for takeoff and landing.

2. Enter the Total Aircraft Weight (from Ref. 11). Estimate the fuel to be aboard at time of landing and enter the Operating Weight plus Estimated Landing Fuel Weight.

3. Subtract the above weights from the respective allowable gross weight to obtain the respective allowable loads. The smallest of these allowable loads is the Allowable Load, and represents the maximum amount of weight which may be distributed throughout the helicopter without exceeding the limiting gross weight.

N. (Ref. 12). N/A

O. (Ref. 13). Enter Total Aircraft Weight. Enter total moment/constant. Check figures to ascertain that gross weight has not been exceeded and that moment/constant is within CG limits.

P. (Ref. 14). Used for necessary corrections.

Q. (Ref. 15). Enter the Takeoff Condition (corrected) weight and moment/constant.

R. (Ref. 16). Refer to the CG table in Chart E and determine the takeoff CG position. Enter this value.

S. (Ref. 17). Estimate the weight of fuel to be expended before landing. Enter expended fuel weight and moment/constant.

T. (Ref. 18). To be used for Air Supply Loads to be dropped before landing.

U. (Ref. 19). To be used for Miscellaneous items to be expended before landing.

V. (Ref. 20). Enter the difference in weights and moment/constant between Ref. 15 and the total of Ref. 17, 18, and 19.

W. (Ref. 21). Refer to the CG table in Chart E and determine the estimated landing CG. Enter the value opposite Estimated Landing CG.

X. The necessary signatures must appear at the bottom of the form.

WEIGHT AND BALANCE CLEARANCE FORM F
TRANSPORT
(USE REVERSE FOR TACTICAL MISSIONS)

Cross Reference RAF Form 2670 RCAF Form F. 115 C 80M 5-61 (6797)

FOR USE IN T.O. 1-1B-40 AN 01-1B-40 & TM 55-405-9

DATE	AIRCRAFT TYPE	FROM	HOME STATION
3 July 70	TH-55A		Ft. Wolters
MISSION/TRIP/FLIGHT/NO.	**SERIAL NO.**	**TO**	**PILOT**
Training	67-X1701R (sample)		

LIMITATIONS

CONDITION	TAKEOFF	LANDING	LIMITING WING FUEL
[1] ALLOWABLE GROSS WEIGHT	1670	1670	
TOTAL AIRCRAFT WEIGHT (*Ref. 11*)	1603		
OPERATING WEIGHT PLUS ESTIMATED LANDING FUEL WEIGHT		1423	
OPERATING WEIGHT (*Ref. 8*)			1423
ALLOWABLE LOAD (*Ref. 12*) (use *SMALLEST figure*)	67	247	
[3] PERMISSIBLE C. G. TAKEOFF	FROM 95.0	TO (% *M.A.C. or IN.*) 100.0	
[4] PERMISSIBLE C. G. LANDING	FROM 95.0	TO (% *M.A.C. or IN.*) 100.0	
[2] LANDING FUEL WEIGHT	18 lbs.		

REF	ITEM	WEIGHT	[1] INDEX OR MOM/
1	BASIC AIRCRAFT (*From Chart C*)	1008	101778
2	OIL (2 Gal.)	15	1365
3	CREW (*No.*) 2	400	33560
4	CREW'S BAGGAGE		
5	STEWARD'S EQUIPMENT		
6	EMERGENCY EQUIPMENT		
7	EXTRA EQUIPMENT		
8	OPERATING WEIGHT	1423	136703
9	TAKEOFF FUEL (30 Gal.)	180	19260
10	WATER INJ. FLUID (Gal.)		
11	TOTAL AIRCRAFT WEIGHT	1603	155963

REMARKS

10% Fuel left on landing

12 DISTRIBUTION OF ALLOWABLE LOAD (PAYLOAD)

COMPT	UPPER COMPARTMENTS PASSENGERS NO.	WEIGHT	CARGO	COMPT	LOWER COMPARTMENTS PASSENGERS NO.	WEIGHT	CARGO
A							
B							
C							
D							
E							
F							
G							
H							
I							
J							
K							
L							
M							
N							
O							
P							
FWD	BELLY						
AFT	BELLY						

TOTAL FREIGHT	
TOTAL MAIL	
COMPUTER PLATE NUMBER (*If used*)	

[1] *Enter constant used.*
[2] *Enter values from current applicable T.O./TM*
[3] *Applicable to gross weight (Ref. 15).*
[4] *Applicable to gross weight (Ref. 18).*
[5] *Ref. 9 minus Ref. 17.*

CORRECTIONS (*Ref. 14*)

COMPT	ITEM	CHANGES (+ or −) WEIGHT	[1] INDEX OR MOM/
TOTAL WEIGHT REMOVED		−	−
TOTAL WEIGHT ADDED		+	+
NET DIFFERENCE (*Ref. 14*)			

REF	ITEM	WEIGHT	INDEX OR MOM/
13	TAKEOFF CONDITION (*Uncorrected*)	1603	155963
14	CORRECTIONS (*If required*)		
15	TAKEOFF CONDITION (*Corrected*)	1603	155963
16	TAKEOFF C. G. IN % M. A. C. OR IN.	97.3	
17	LESS FUEL	162	17334
18	LESS AIR SUPPLY LOAD DROPPED		
19	MISC. VARIABLES		
20	ESTIMATED LANDING CONDITION	1441	138629
21	ESTIMATED LANDING C. G. IN % M. A. C. OR IN.	96.2	

COMPUTED BY (signature) SIGNATURE

WEIGHT AND BALANCE AUTHORITY (signature) SIGNATURE

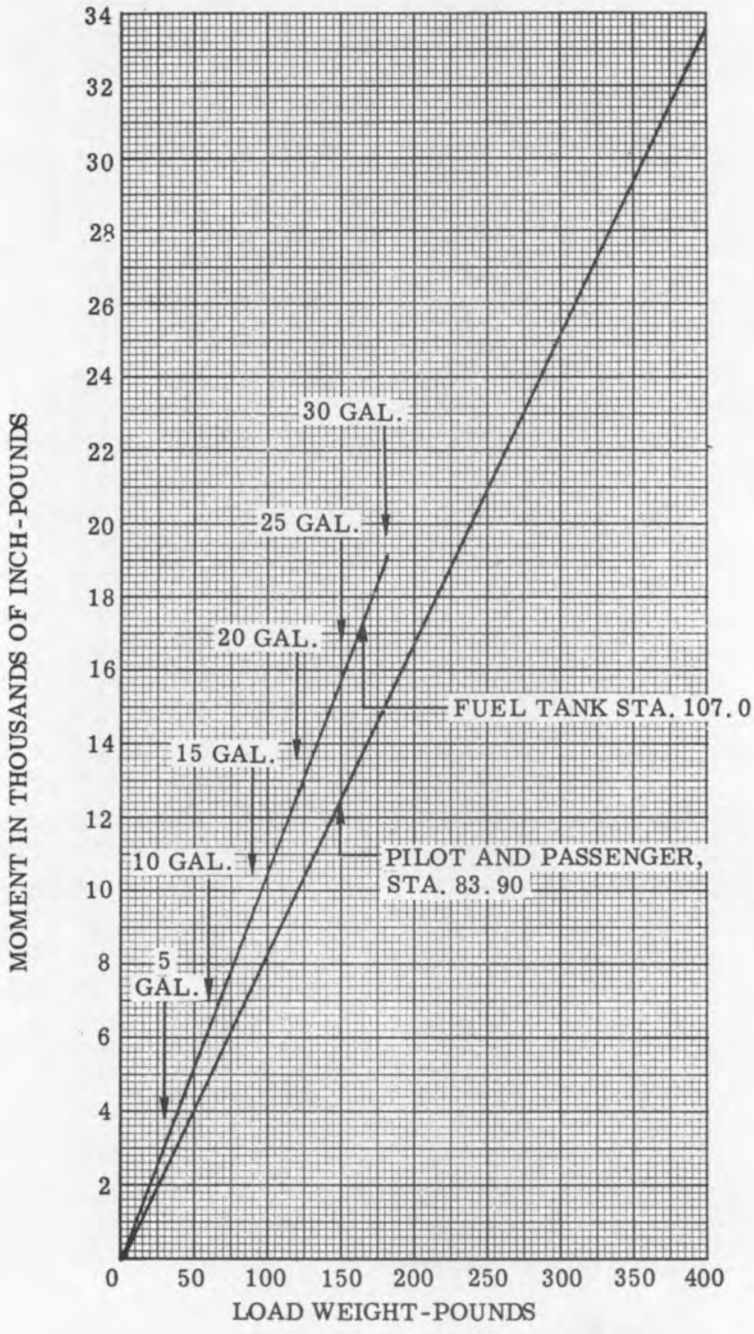
PILOT (signature) SIGNATURE

NOTE.—THIS TRANSPORT CLEARANCE FORM HAS RESULTED FROM TRIPARTITE AGREEMENT AND NO FURTHER CHANGES MAY BE MADE TO IT WITHOUT PRIOR CONSIDERATION BY TRIPARTITE AUTHORITIES.

DD FORM 1 SEPT 54 365F

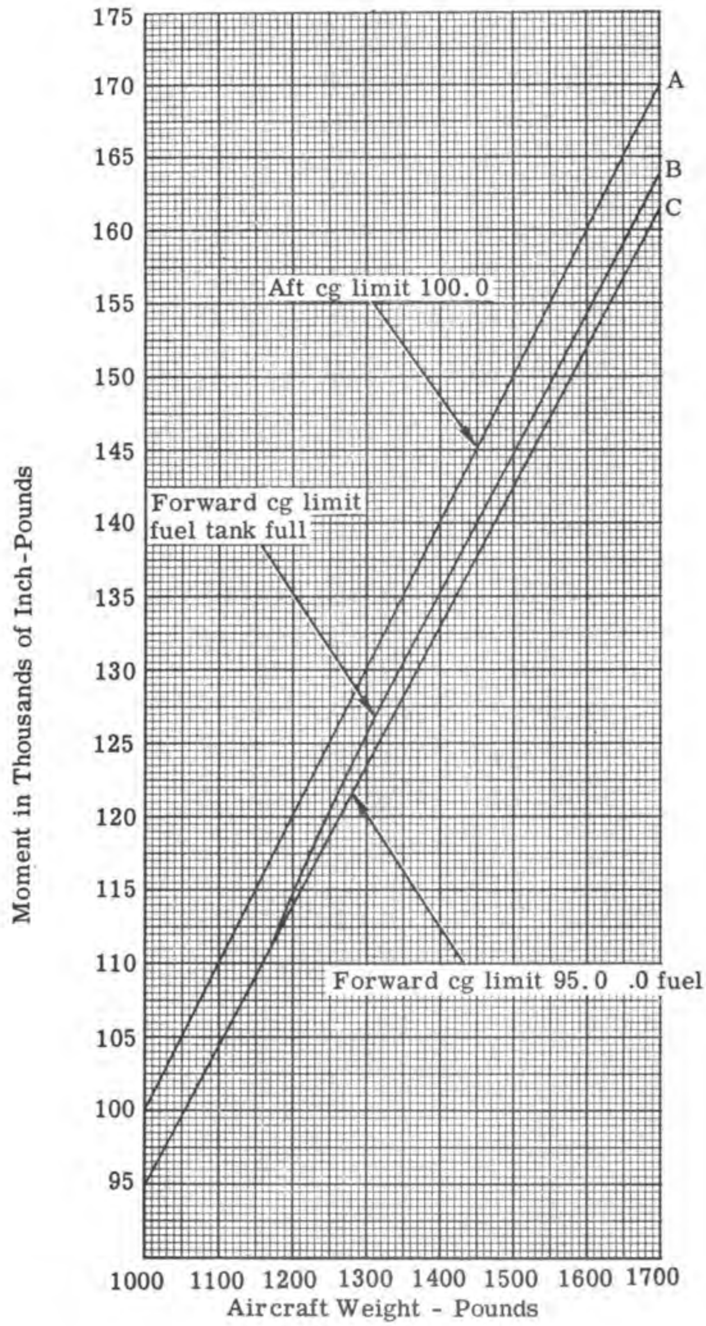
Sample DD Form 365F (fig. 10-1)

CHART E



Loading Chart (fig. 10-2)

CHART E



Center of Gravity Chart (fig. 10-3)

Chart E

TYPICAL SERVICE LOADS

1. Instruction Flight

ITEM	WEIGHT (LBS)	MOMENT
Weight	1008.7	101,778
Oil	15.0	1,365
Instructor	200.0	16,780
Student	200.0	16,780
Min. Fuel (10%)	18.0	1,926
Gross Wt. Min. Fuel	1441.7	138,629
Fuel - Balance	162.0	17,334
Gross Wt. T/O	1603.7	155,963

2. Solo Flight

ITEM	WEIGHT (LBS)	MOMENT
Weight Empty	1008.7	101,778
Oil	15.0	1,365
Student	200.0	16,780
Min. Fuel (10%)	18.0	1,926
Gross Wt. Min. Fuel	1241.7	121,849
Fuel - Balance	162.0	17,334
Gross Wt. T/O	1403.7	139,183

(fig. 10-4)

Chart E

MISCELLANEOUS DATA

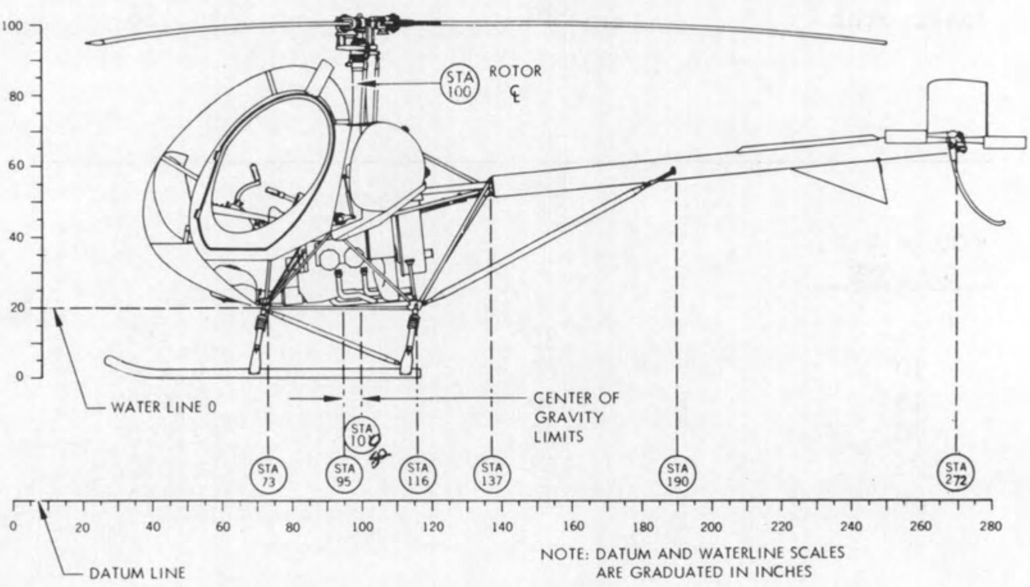
	WEIGHT (LBS)	MOMENT
Student	150	12,585
	160	13,424
	170	14,263
or	180	15,102
	190	15,941
	200	16,780
	210	17,619
Instructor	220	18,458

FUEL - U.S. GALLONS		
5	30	3,210
10	60	6,420
15	90	9,630
20	120	12,840
25	150	16,050
30	180	19,260

ENGINE OIL U.S. GALLONS		
2	15	1,365

(fig. 10-5)

CHART E



Balance Diagram (fig. 10-6)

CHAPTER 11

PERFORMANCE DATA

Section I

Scope

11-1. Scope. The charts and tables contained in this chapter are intended to provide you with the latest available operating information.

11-2. The data shown on these charts originates from flight test programs and operational experience gained through actual use of the aircraft. A description of each chart and its use is included.

Section II

Chart Description

11-3. DENSITY ALTITUDE DATA. Density altitude in terms of pressure altitude and temperature are given in chart form. An example of how to use the data is described on the chart.

11-4. Density altitude is an expression of the air in terms of height above sea level; hence, the less dense the air, the higher the density altitude. For standard conditions of temperature and pressure, density altitude is the same as pressure altitude. As temperature increases above standard for any altitude, the density altitude will also increase to values higher than pressure altitude. A high density altitude effects the performance of both the main rotor and the engine.

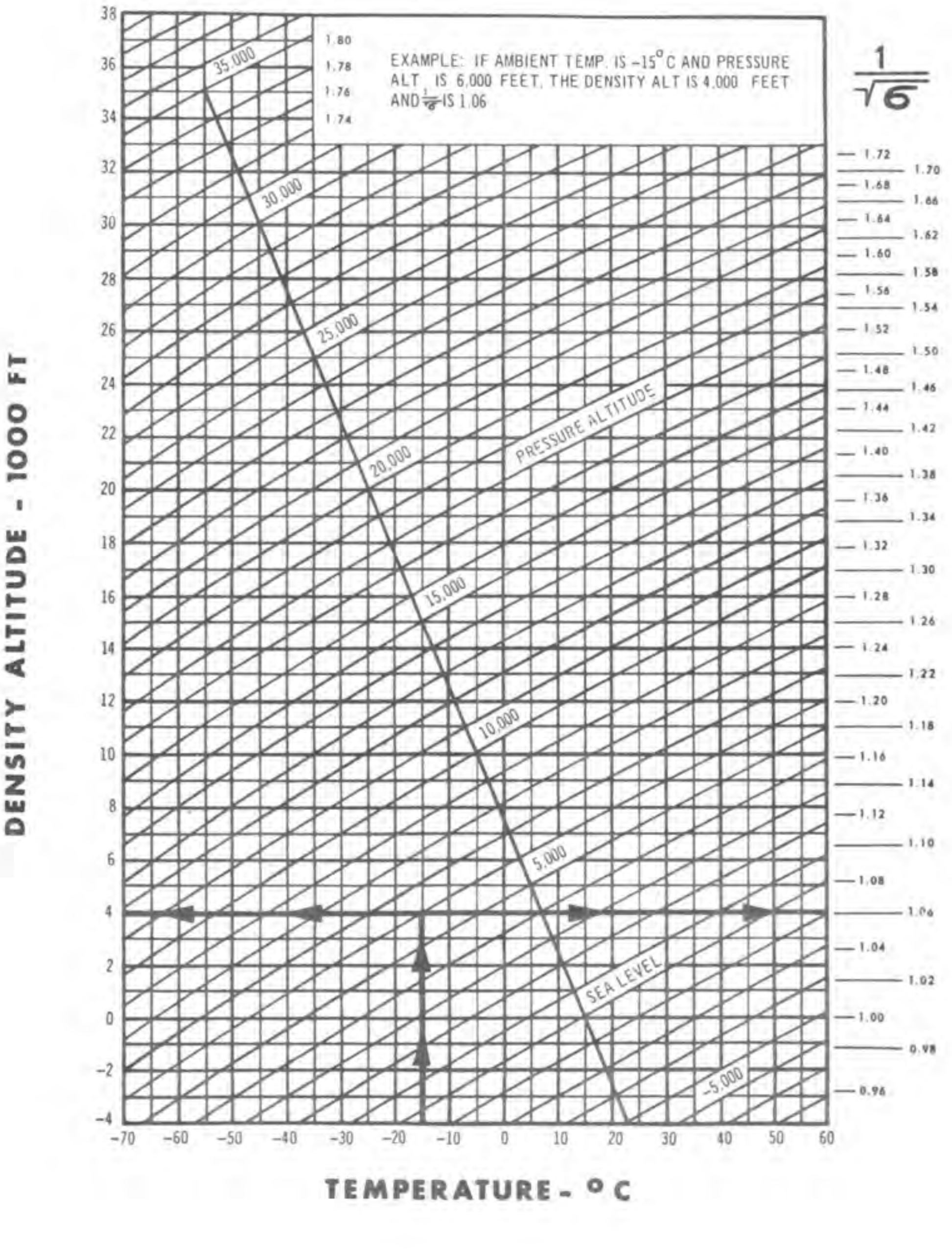
11-5. When density altitude is high, less lift is developed by the rotor system for any given power setting than at the standard conditions. A given volume of air at high density altitude provides less oxygen for combustion in the cylinders, decreasing volumetric efficiency and reducing power output of the engine below the output for standard conditions. When both temperature and relative humidity are high, the volumetric efficiency of the engine is reduced even more, due to the water vapor displacing an equal amount of air in any given volume. When low temperatures prevail, relative humidity has little effect on helicopter performance.

11-6. TEMPERATURE CONVERSION. A Centigrade-Fahrenheit temperature chart is included. The chart reads left or right to convert to the proper temperature. Interpolation must be made in some cases.

11-7. HOVER CEILING. A chart depicting hover ceiling (skid height 3 feet) versus temperature and showing various aircraft weights is included. To interpret the chart, find the temperature, read up the chart to the applicable weight and find the pressure altitude on the left side of the chart.

11-8. AIRSPEED CALIBRATION. Two airspeed calibration charts are included, one for the 25 gallon fuel tank installation and one for the 30 gallon fuel tank.

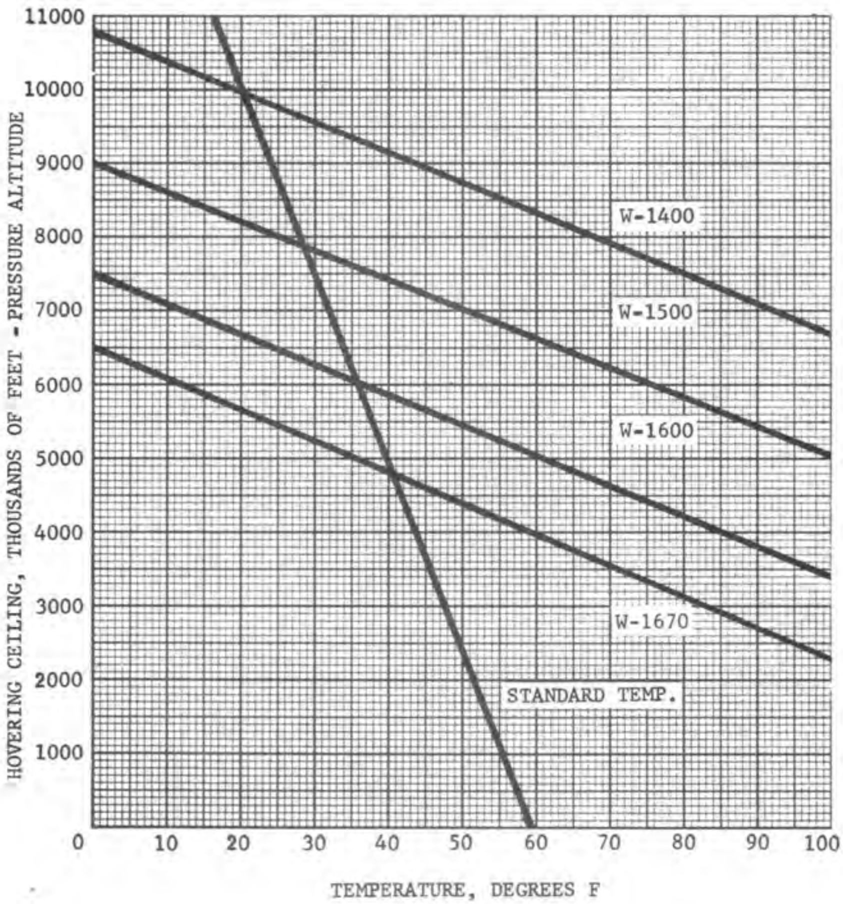
11-9. ALTITUDE vs. AIRSPEED (Height-Velocity) CURVE. This chart is included to depict airspeed-altitude avoidance areas. The chart is self-explanatory.



Density Altitude Chart (fig. 11-1)

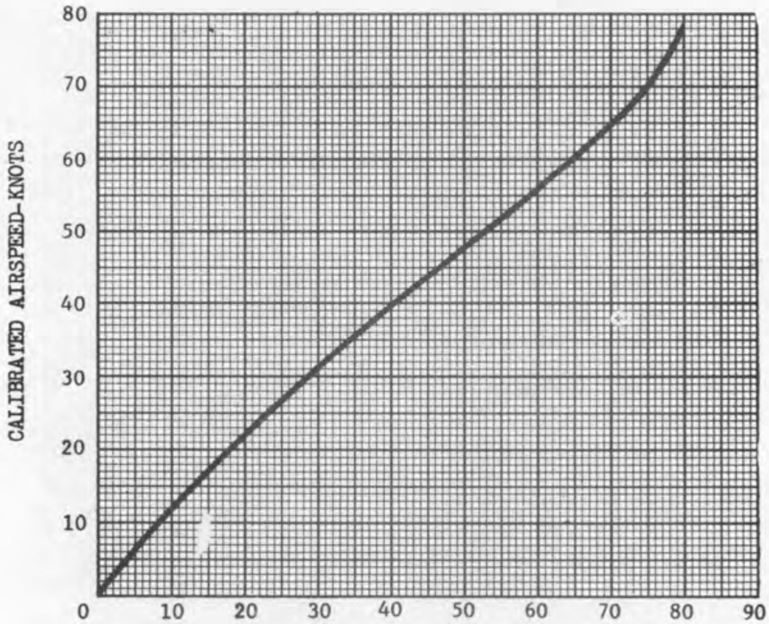
CENTIGRADE	FAHRENHEIT
-50°C	-58°F
-45°C	-49°F
-40°C	-40°F
-35°C	-31°F
-30°C	-22°F
-25°C	-13°F
-20°C	- 4°F
-15°C	+ 5°F
-10°C	+14°F
- 5°C	+23°F
0°C	+32°F
+ 5°C	+41°F
+10°C	+50°F
+15°C	+59°F
+20°C	+68°F
+25°C	+77°F
+30°C	+88°F
+35°C	+95°F
+40°C	+104°F
+45°C	+113°F
+50°C	+122°F

Temperature Converstion Chart (fig. 11-2)

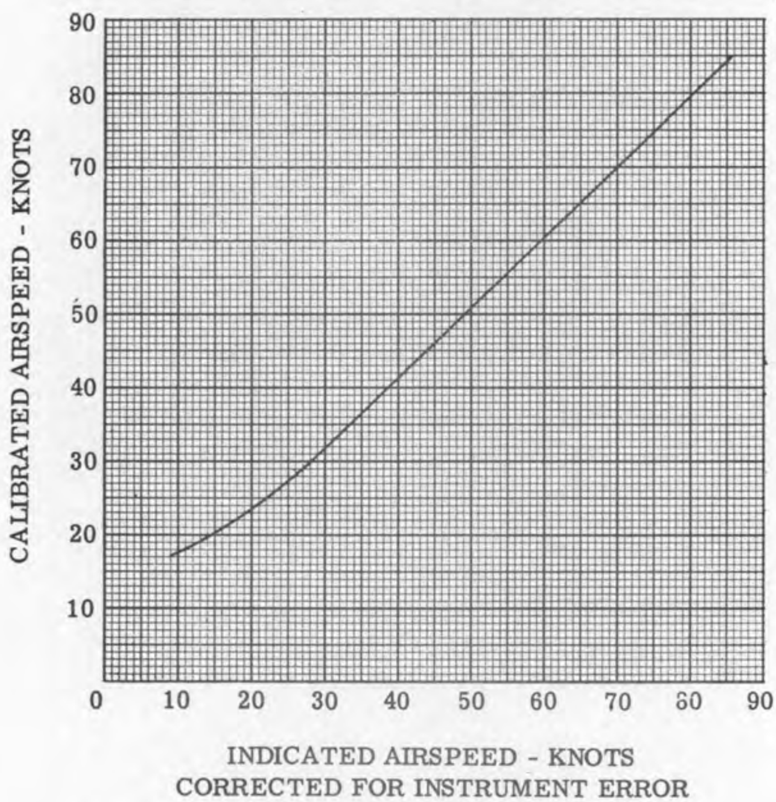


Hovering Ceiling v.s Temperature, Skid Height 3 Feet (fig. 11-3)

25 GAL
TANK



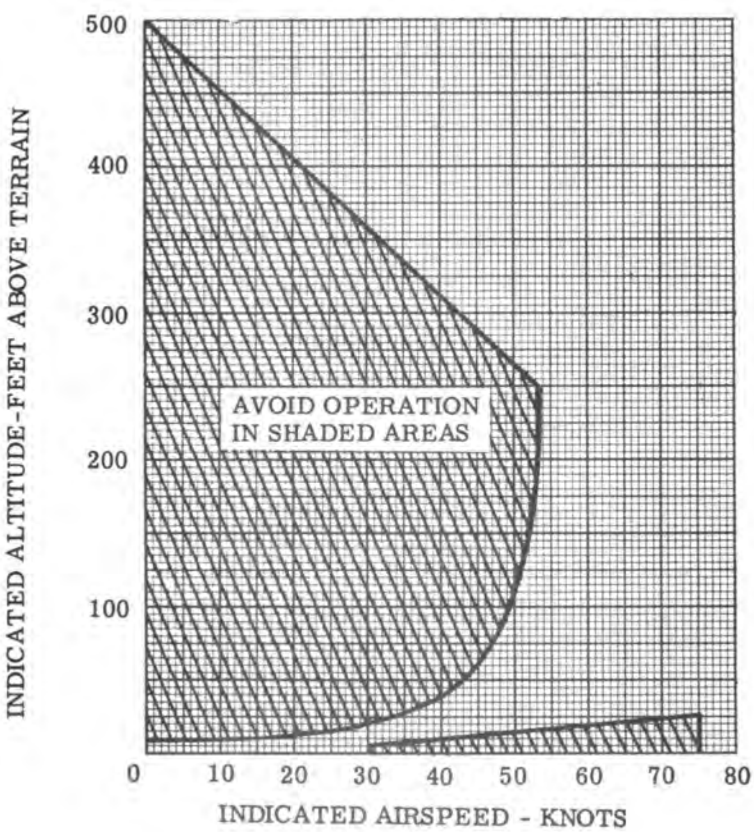
30 GAL
TANK



Airspeed Calibration Charts (fig. 11-4)

Determined under the following conditions:

1. Hard Surface
2. Calm Wind
3. Sea Level
4. Max GW, 1670 lbs.
5. 2900 RPM



Airspeed vs. Altitude Chart (Height - Velocity) (fig. 11-5)

A

APPENDIX

REFERENCES

The following publications were used as references in preparation of this Operator's Manual:

USAPHS Primary Flight Training Manual (PFTM)

TM 1-260 - Principles of Rotary Wing Flight

Hughes Handbook of Maintenance Instructions (HMI)

Hughes Service Training Manual

Hughes Owners Manual

Operator's Manual - AVCO LYCOMING - 0-360 series engines

Fundamentals of Fixed and Rotary Wing Aerodynamics
DA-04-225-AVI-1734

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COMPILED AND EDITED BY

THOMAS A. WRIGHT, JR.

FLIGHT INSTRUCTOR
SOUTHERN AIRWAYS OF TEXAS, INC.