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Navion

OPERATION MANUAL

FOURTH EDITION

JANUARY, 1950

RYAN AERONAUTICAL COMPANY
Lindbergh Field, San Diego 12, California

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Foreword

This manual covers the operation of both the 1950 DeLuxe and Utility 205 model Navions; therefore, certain information contained herein is not applicable to the Utility 205 and may be disregarded when the manual is used in connection with this model.

Introduction

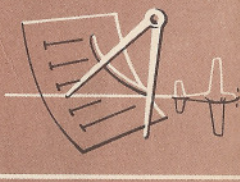
This manual is issued as a pilot's guide for the operation of the Ryan Navion. Every effort has been made to present the material in a clear and convenient manner, to enable the pilot to use the manual as a ready reference. It is hoped that all pilot's – regardless of previous experience – will read the entire manual thoroughly.

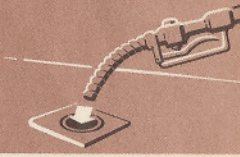
Any desired section of the book can be readily selected by turning to the black page edgings which are in line with the index headings.

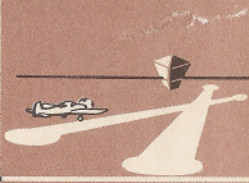
Your cooperation in reporting any problems concerning operation and maintenance of the Ryan Navion is solicited. Reports of such problems may be made to the nearest Navion Distributor or Dealer, any Ryan Field Service Representative who may be in your territory, or they may be sent directly to the Airplane Service Department, Ryan Aeronautical Co., San Diego, California. Reports such as these are an important factor in rendering prompt and efficient service, and in improving the design of our airplane.

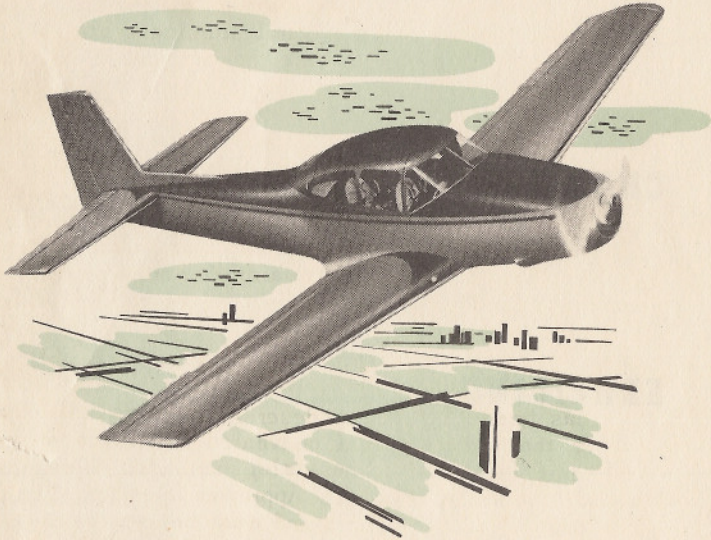
RYAN AERONAUTICAL CO.

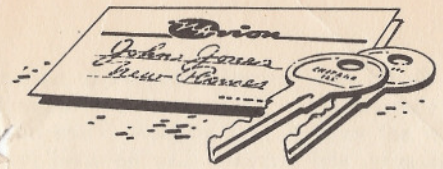
Airplane Service Department











Your Airplane . . .

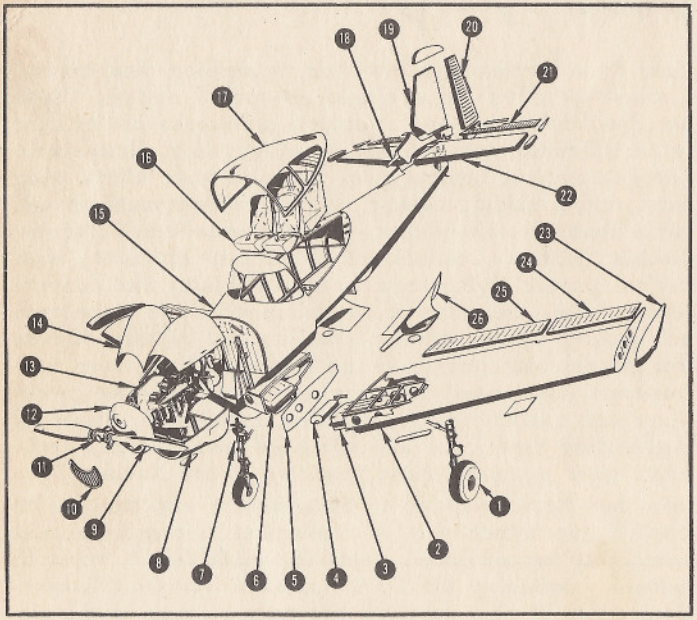
Your Ryan Navion is a low-wing, four-place, dual-control airplane powered by a single air-cooled engine. Clean aerodynamic design and structural sturdiness are evident in the all-metal, semi-monocoque construction. Retractable faired-in tricycle landing gear, steerable nose wheel, wing flaps, cabin sliding canopy, engine exhaust mufflers and cabin heater combination, and smartly upholstered interior, combine features reminiscent of military efficiency with modern private flying requirements of luxury and convenience. Safety and ease of control in all flight maneuvers are ensured by the inherent stability and balance of control forces characteristic of the airplane. High power, performance, and speed are supplied by the reliable power plant and variable pitch propeller installation. Years of engineering experience and advanced manufacturing technique have produced these qualities in the Navion. This book has been compiled to describe the airplane and to provide the owner with a convenient reference manual containing recommended operating methods. A separate manual, containing the CAA Approved Operating Limitations only, is also supplied and must be kept in the airplane at all times.

TYPES OF OPERATION

Categories

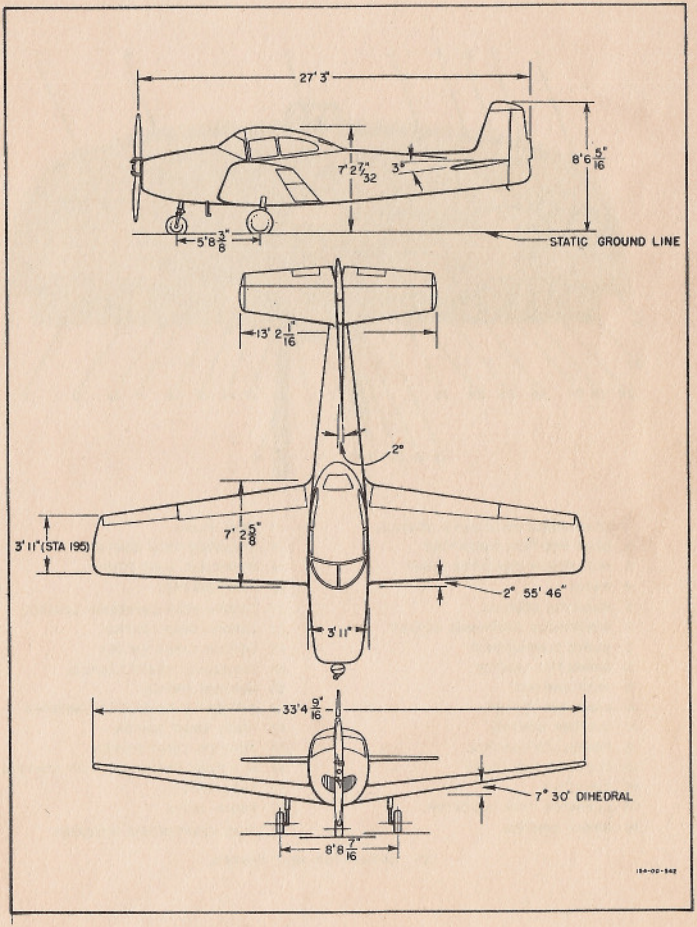
The Navion is designed for use in two categories, normal and utility. When operated in the normal category, the air-

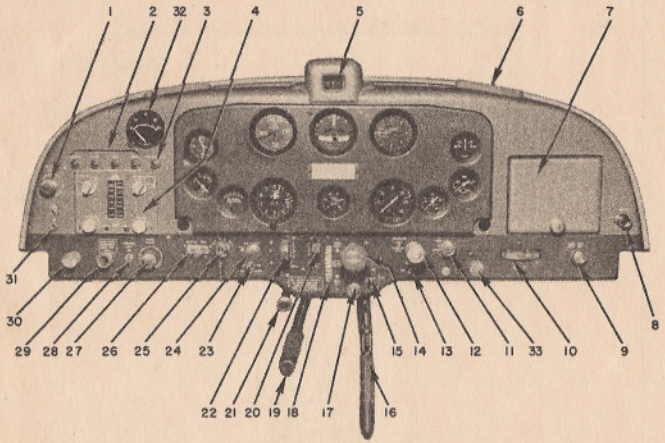
plane may be flown as a private transport in nonscheduled passenger or cargo flights. Maximum gross weight for such operation must not exceed 2750 pounds. When operated in the utility category, the airplane may be used for all normal and for limited acrobatic flight, including such maneuvers as are commonly used in pilot training (with the exception of snap or inverted maneuvers and spins). Max-



— KEY —

1 Main Landing Gear
2 Left Wing
3 20-Gallon Fuel Tank
4 Accumulator Fuel Tank
5 Center Rib
6 20-Gallon Fuel Tank
7 Nose Landing Gear
8 Engine Mount
9 Propeller
10 Nose Cowl Grill
11 Propeller Hub
12 Nose Cowl
13 Engine and Accessories
14 Engine Cowl
15 Fuselage
16 Front and Rear Seats
17 Sliding Canopy
18 Empennage Fillets
19 Vertical Stabilizer
20 Rudder
21 Elevator
22 Horizontal Stabilizer
23 Wing Tip
24 Aileron
25 Wing Flap
26 Wing-to-Fuselage Fillets


27' 3"
7' 2 7/32"
3°
8' 6 5/16"
5' 8 3/8"
STATIC GROUND LINE
13' 2 1/16"
2°
3' 11" (STA 195)
7' 2 5/8"
2° 55' 46"
3' 11"
33' 4 9/16"
7° 30' DIHEDRAL
8' 8 7/16"



1 GEAR INDICATOR LIGHTS CONTROL
2 GEAR POSITION INDICATORS
3 HYD. POWER INDICATOR LIGHT
4 RADIO
5 MAGNETIC COMPASS
6 WINDSHIELD DEFOGGING OUTLET
7 GLOVE COMPARTMENT
8 CIGARETTE LIGHTER
9 HEAT CONTROL
10 CABIN AIR CONTROL
11 MIXTURE CONTROL
12 PROPELLER CONTROL
13 ELECTRIC FUEL PUMP
14 THROTTLE
15 ELEVATOR TRIM INDICATOR
16 BRAKE CONTROL
17 COWL FLAPS
18 ELEVATOR TRIM CONTROL
19 HYDRAULIC HAND PUMP
20 FLAP CONTROL
21 LANDING GEAR EMERGENCY CONTROL
22 LANDING GEAR CONTROL
23 LANDING LIGHT SWITCH
24 HYDRAULIC POWER CONTROL
25 IGNITION SWITCH
26 BATTERY & GENERATOR SWITCHES
27 PANEL LIGHT SWITCH
28 POSITION LIGHT SWITCH
29 HYD. FLUID EMERG. SHUT-OFF CONTROL
30 FUEL PRIMER
31 RADIO JACKS
32 HEAD TEMPERATURE INDICATOR
33 CARBURETOR HEAT CONTROL

imum gross weight for operation in the utility category is 2350 pounds, the useful load consisting of pilot, student pilot (in front seat only), two parachutes, fuel and oil, and no baggage.

Contact and Instrument Flight—Day and Night

The airplane may be easily fitted for all types of flight. The basic airplane is equipped for flight in compliance with instrument flight rules, day; and may also be operated under contact flight rules, night, for hire within a 3-mile radius of the airport of take-off. Installation of the flare kit and gyro panel kit equips the airplane for unlimited contact and instrument night flight for hire.

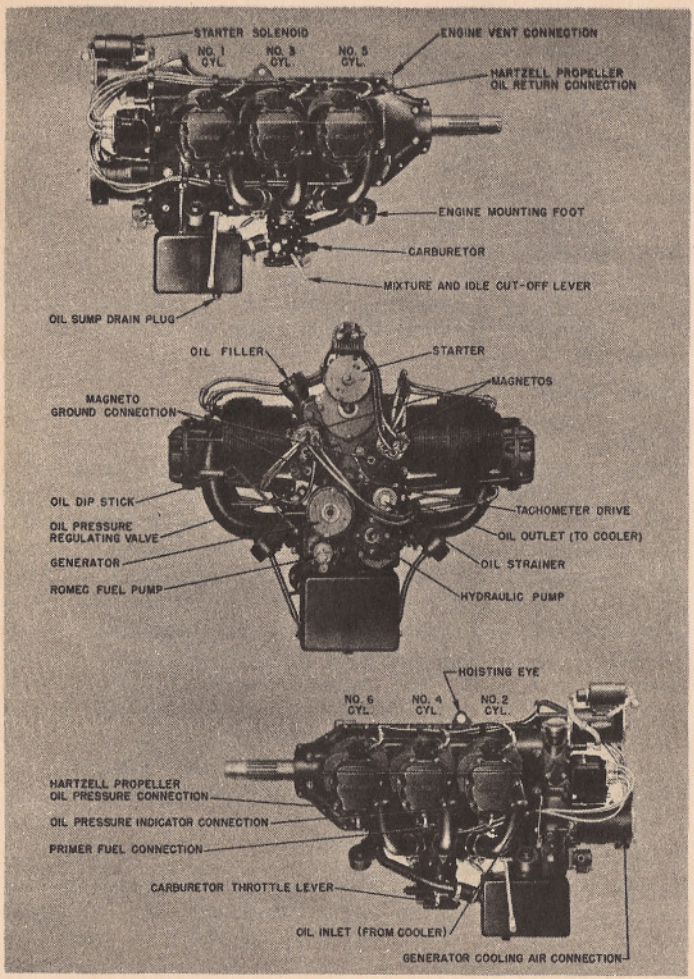
POWER PLANT

Engine

Power – performance – safety – speed are characteristics assured the Navion by the new Continental engine, Model E–185. It is a six-cylinder, overhead-valve, air-cooled, horizontally opposed, direct-drive engine, having a piston displacement of 471 cubic inches and a compression ratio of 7 to 1. The engine drives a variable pitch propeller at 2300 rpm (185 horsepower) for maximum continuous power at sea level, or 2600 rpm (205 horsepower) for one minute maximum at take-off. The engine firing order is 1-6-3-2-5-4. Engine equipment consists of two magnetos providing dual ignition; a Bendix-Stromberg, pressure-injection type carburetor equipped with an idle cut-off device; an electric starter; and an engine-driven generator, hydraulic pump, and fuel pump.

Propeller

To secure maximum and most efficient performance from the engine under all operating conditions, the Navion is equipped with either a Hartzell or an Aeromatic variable-pitch propeller.

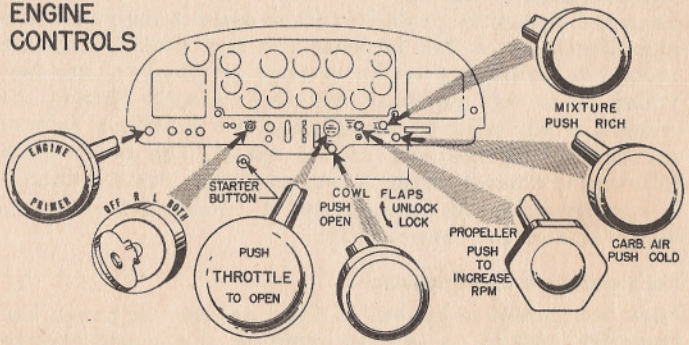

STARTER SOLENOID
NO. 1 CYL.
NO. 3 CYL.
NO. 5 CYL.
ENGINE VENT CONNECTION
HARTZELL PROPELLER OIL RETURN CONNECTION
ENGINE MOUNTING FOOT
CARBURETOR
MIXTURE AND IDLE CUT-OFF LEVER
OIL SUMP DRAIN PLUG
OIL FILLER
STARTER
MAGNETOS
MAGNETO GROUND CONNECTION
OIL DIP STICK
OIL PRESSURE REGULATING VALVE
GENERATOR
ROMEC FUEL PUMP
TACHOMETER DRIVE
OIL OUTLET (TO COOLER)
OIL STRAINER
HYDRAULIC PUMP
HOISTING EYE
NO. 6 CYL.
NO. 4 CYL.
NO. 2 CYL.
HARTZELL PROPELLER OIL PRESSURE CONNECTION
OIL PRESSURE INDICATOR CONNECTION
PRIMER FUEL CONNECTION
CARBURETOR THROTTLE LEVER
OIL INLET (FROM COOLER)
GENERATOR COOLING AIR CONNECTION

The Hartzell Hydro-Selective propeller is controllable through the entire range of engine speeds. Changes in pitch are accomplished by action of a hydraulically actuated propeller control cylinder on the engine nose, and counterweights attached to the blades at the propeller hub. Forward movement of a push-pull control panel directs engine oil pressure to decrease the pitch (increase rpm), of the propeller blades. When the oil pressure is relieved (by opposite movement of the cockpit control) and the oil drains out of the cylinder, centrifugal force acting on the counterweights rotates the blades to increase pitch.

NOTE

In the event of a propeller diaphragm rupture during flight, pull propeller control "OUT" to full decreased rpm position to prevent leakage of engine oil from propeller control element.

The Aeromatic propeller effects pitch changes automatically thru a balance of the aerodynamic forces acting upon the propeller blades and the counter-acting forces of counterweights. Some propellers are equipped with a manual control to override the counter-weight forces and prevent



the propeller pitch from increasing as altitude is gained. To allow automatic increase and propeller pitch (decrease rpm) pull the propeller control aft. This will affect the propeller pitch only when the airplane is in flight.

ENGINE CONTROLS

Throttle

The throttle, conveniently mounted at the center of the control panel, is the conventional push-to-open type. A friction-adjusting nut is located on the control shaft in such a position that when the palm of the hand is on the throttle knob, the fingers rest on the nut. Adjustment of the nut prevents creeping of the throttle, allows for individual setting to desired throttle friction, and facilitates making fine changes in throttle position. Turning the nut clockwise increases friction; counter-clockwise decreases friction. A microswitch in the throttle linkage at the carburetor operates the landing gear warning horn when the throttle is retarded and the gear is not down and locked.

Propeller

The propeller control is located to the right of the throttle.

For Operation of Hartzell

When the control is pushed in flush against the panel, the propeller is set at full increase rpm (low pitch); when the control is pulled out to the extreme aft position, the propeller is at full decrease rpm (high pitch). Setting the control at any point between these two positions selects the desired intermediate engine speed. The blade pitch follows the control instantly and precisely, and the change in rpm is reflected immediately. A friction-adjusting nut is provided on the control shaft.

For Operation of Aeromatic

When the control is pushed in flush against the panel, the propeller control is set to override the counterweight

forces and maintain the propeller at low pitch (high rpm). When the control is pulled out to the extreme aft position propeller pitch control is fully automatic, as determined by the balance of aerodynamic forces on the propeller blades, which attempt to decrease pitch (increase rpm), and counterweight forces, which attempt to increase pitch (decrease rpm). Any intermediate position of the control limits the high pitch (low rpm) setting of the propeller only; the further aft the control the higher pitch (lower rpm) attainable by the propeller under conditions of reduced throttle or increased altitude. Depress the control handle center button before pushing or pulling the control. Vernier rpm adjustment is obtainable by rotating the control handle.

Mixture

Richness of the fuel-air mixture at the carburetor is determined by manual setting of the mixture control located on the control panel to the right of the throttle. The control is released for adjustment fore and aft by turning the knob counter-clockwise, and is locked in the selected position by turning the knob clockwise. When the control is pushed in to its most forward position, the mixture is full rich. Pulling out the control leans the mixture. When the control is pulled full out, the engine is stopped immediately by an idle cut-off device, at the carburetor, which cuts off the flow of fuel. To avoid reaching the idle cut-off position inadvertently during flight, the control should never be extended more than one inch. By close observation of the tachometer while leaning the mixture, the most desirable fuel-air ratio for a given altitude can be secured. As the mixture is leaned, the engine rpm will increase to a peak and then start to decrease and a roughness of engine operation will be noted. When the decrease is noted, the mixture should then be enriched to the position which gives maximum rpm. Normally, the control should be at full rich for all take-offs and landings; however, when the airplane is operated from an airport of above 5,000 feet altitude, the

mixture should be leaned as necessary to secure best engine power.

Carburetor Heat

The Navion is equipped with a non-icing carburetor; however, under certain atmospheric conditions, carburetor heat may be desirable for smoother engine operation. To provide this heat, warm air is secured from a shroud around the left exhaust muffler and ducted to the carburetor air mixing chamber. A valve, incorporated in the mixing chamber, selects either hot or cold air (filtered ram air) as determined by the position of the carburetor heat control located on the control panel, below and right of throttle. Normally, carburetor heat is not required and the control should be off to insure availability of maximum power. However, when low outside air temperatures are encountered, heat may be used as necessary to maintain the mixture temperature in the range required for engine smoothness. Under extreme conditions, if the carburetor air filter screen should be obstructed by ice (as indicated by an unaccountable drop in engine rpm), use of carburetor heat provides an alternate source of air.

Cowl Flaps

The cowl flaps are operated by a push pull control, located below the throttle. They must be open during all ground operations, take-off and climb. Their opening may be adjusted during flight to control engine operating temperature by turning control counter-clockwise to unlock and pushing to open or pulling to close. The control is turned clockwise to lock cowl flaps in desired position.

Primer

Operation of the primer pump supplies raw fuel directly to the engine intake manifold during the starting procedure. The pump plunger handle is located at the extreme left side of the control panel. When pushed full in and turned counter-clockwise, the plunger is freed for pumping action. It is locked when pushed in and turned clockwise.

Starter

Safety and convenience are provided by a direct-cranking electric starter. A foot-operated switch, mounted forward and above the pilot's rudder pedals, actuates the starter-motor.

Ignition

The ignition system consists of two impulse-type magnetos, radio-shielded ignition wiring, 12 spark plugs, and an ignition switch. The impulse drives incorporated in the magnetos give an intensified spark for easy starting and automatic spark retard during engine cranking. The ignition switch, located on the left side of the control panel, provides a means of checking the proper functioning of each magneto and of grounding the system when the engine is not operating, as well as providing a lock to prevent operation of engine or aircraft by unauthorized persons.

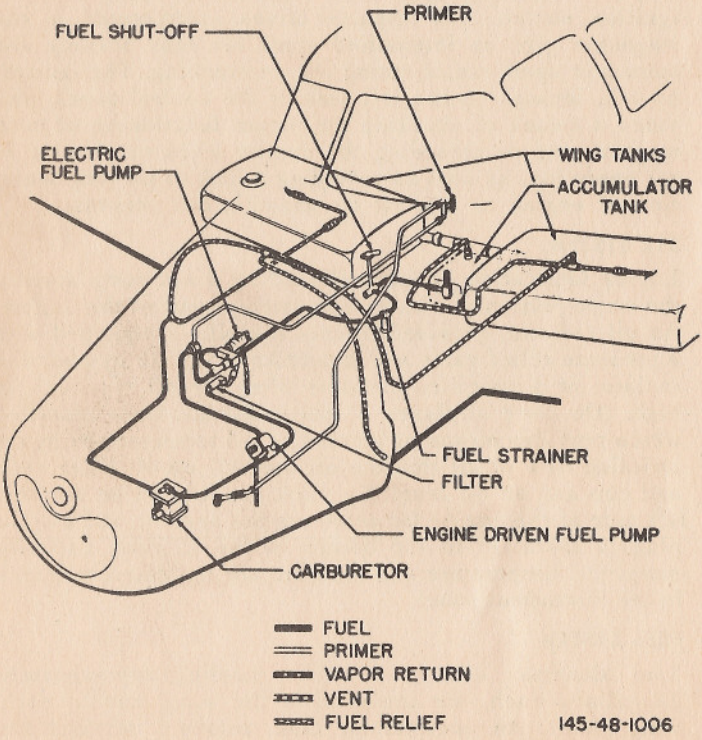
OIL SYSTEM

Engine lubrication is accomplished by a wet-sump system, the major portion of which is an integral part of the engine. An oil radiator, provided to cool the oil, is equipped with a pressure relief valve which permits the oil to by-pass the radiator at a specified pressure when the oil viscosity is high. (On some airplanes a shutter kit has been installed which provides means of increasing oil temperatures by restricting flow of air thru the oil cooler). An oil filler neck and cap and an oil level dip stick are located on the rear left side of the engine for servicing the system; and a drain plug is installed in the bottom of the 10-quart capacity sump. Oil temperature and pressure are indicated by gages in the instrument panel.

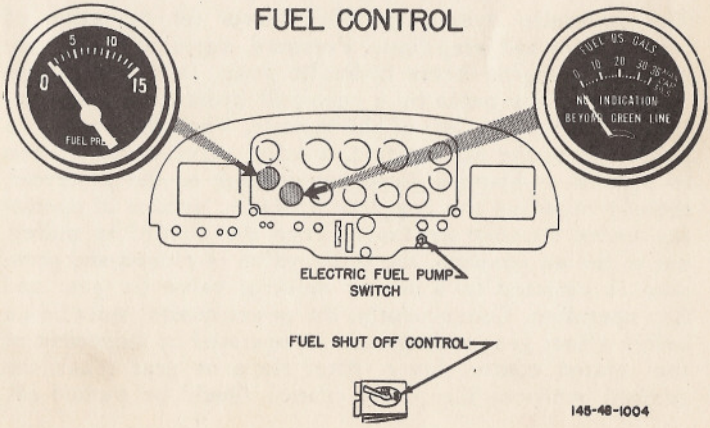
FUEL SYSTEM

Two aluminum alloy fuel tanks, holding approximately 20 gallons each, are installed in the wing, one in each wing panel. An accumulator tank, mounted between the two tanks and interconnected with each, has a capacity of

approximately ¾ gallon. Fuel from both large tanks is gravity fed into the accumulator, the capacity of which is sufficient to ensure an adequate supply of fuel to the engine during all flight maneuvers. From the accumulator, fuel is supplied to the carburetor by an engine driven vane type fuel pump, the output of the pump being sufficient for



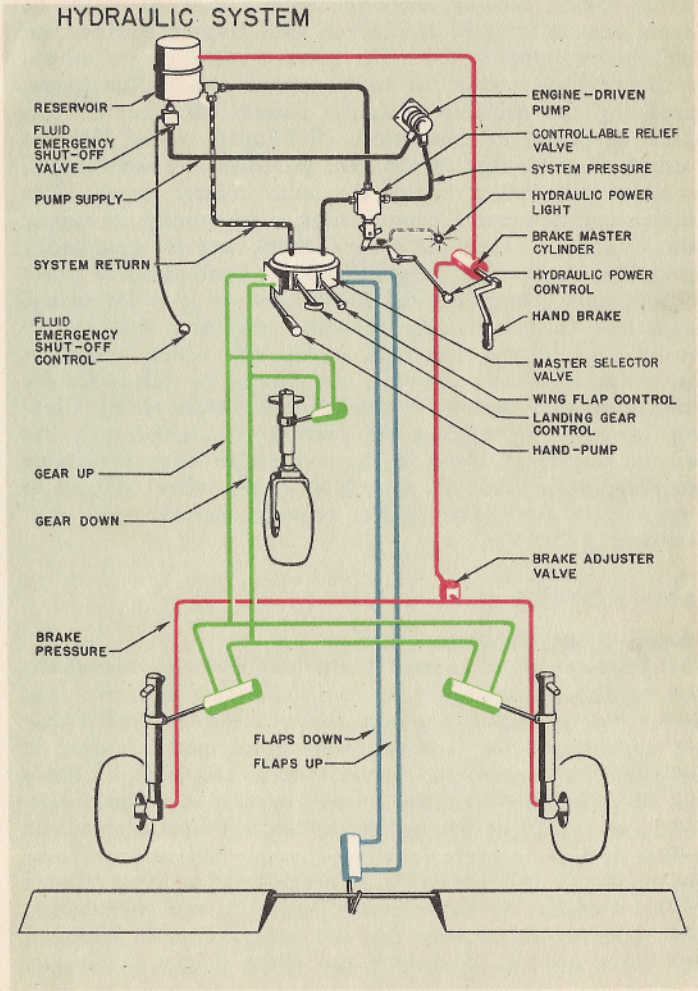
all engine operation. An electric fuel pump is installed to supply an auxiliary fuel pressure source for take-offs and landings; or to supply continuous emergency fuel pressure in event of engine fuel pump failure. The switch for this pump is located to the right of and slightly below the throttle on the control panel. A fuel shut-off valve, in the line from the accumulator to the engine, is operated by a shut-off control located on the floor between the front seats and in normally left on. This control is used to shut off the fuel supply in an emergency. The hand primer secures fuel at the fuel line firewall fitting and pumps it directly to the intake manifold. An electric fuel level transmitter, mounted in the left tank, registers fuel quality on a gage in the instrument panel. The gage indicates the total fuel in wing tanks up to 36 gallons. As the total capacity of the tanks is 39½ gallons, the gage will show a drop in fuel level only after approximately 4 gallons have been consumed. Both wing tanks are filled simultaneously through a filler neck in the right tank, accessible on the right wing panel. The tanks are vented by an interconnecting line with an outlet on the right side of the fuselage.



Airplanes which have had either the baggage compartment type or underseat type auxiliary fuel tank kit installed; should have a placard on the control panel giving limitations and operational procedures. The baggage compartment type of auxiliary fuel tank employs a gravity feed to replenish fuel in the main tanks. Do not transfer this fuel until the main tanks contain **15 gallons or less** fuel; then while flying level, pull the control handle at the right of the control panel and allow the auxiliary fuel to drain into the wing tanks. The underseat type of auxiliary tank feeds directly into the fuel system through a three-way valve located on the floor between the pilot and co-pilot. However, as the carburetor vapor return line returns approximately 3 gallons of fuel per hour to the main fuel tanks, **do not** turn the three-way valve to "AUX" (auxiliary fuel tank) until the main fuel tanks indicate below 30 gallons. When changing from "MAIN" to "AUX" or back again on the three-way valve, turn the electric fuel pump on for at least 30 seconds before and after switching fuel source selection.

HYDRAULIC SYSTEM

The hydraulic system provides power for operation of landing gear and wing flaps. Pressure, supplied to the system by an engine-driven hydraulic pump, is manually controlled from the cabin by a push-pull hydraulic power control located to the left of the throttle. When the control is pushed in to the **off** position, a relief valve in the system is opened to by-pass pump output back to the reservoir, thereby relieving the complete hydraulic system of operating under constant pressure. When the control is pulled out to the **on** position, the relief valve is closed and pressure is directed to a master selector valve for gear and flap operation. Consequently, the power control must be **on** before either gear or flaps can be operated by movement of the related control lever. After flaps or gear reach the desired position, the power control should be pushed **off**

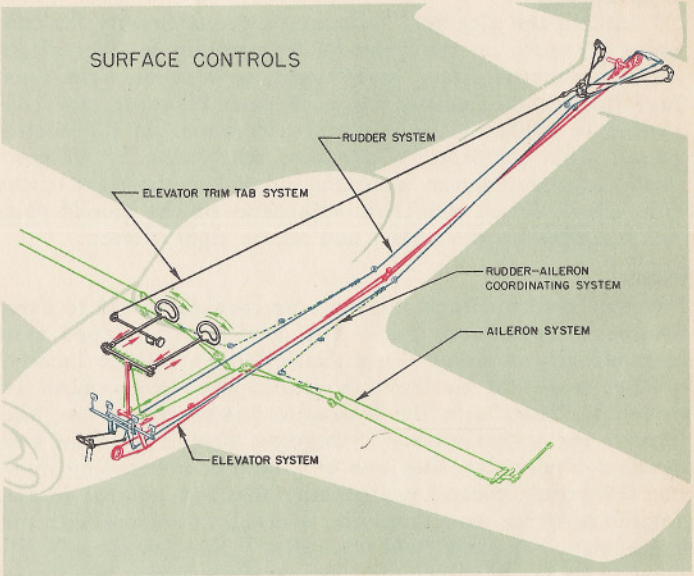

HYDRAULIC SYSTEM
RESERVOIR
FLUID EMERGENCY SHUT-OFF VALVE
PUMP SUPPLY
SYSTEM RETURN
FLUID EMERGENCY SHUT-OFF CONTROL
ENGINE-DRIVEN PUMP
CONTROLLABLE RELIEF VALVE
SYSTEM PRESSURE
HYDRAULIC POWER LIGHT
BRAKE MASTER CYLINDER
HYDRAULIC POWER CONTROL
HAND BRAKE
MASTER SELECTOR VALVE
WING FLAP CONTROL
LANDING GEAR CONTROL
HAND-PUMP
GEAR UP
GEAR DOWN
BRAKE ADJUSTER VALVE
BRAKE PRESSURE
FLAPS DOWN
FLAPS UP

except during landing when the control may be pulled on before gear is lowered and left on until flaps are raised and airplane is stopped. When the power control is pulled on, an amber light above the radio control panel illuminates, reminding the pilot to push the control off after the desired operation is completed. (Brilliancy of the light is controlled, with that of the gear position indicator lights, by a reostat switch below the radio control panel). The master selector valve also houses a hand-pump to supply power to the system for ground check and for emergency operation of gear and flaps. When the hand-pump is used, the hydraulic power control must be on as it is for normal operation; otherwise, the pressure produced will be relieved back to the reservoir. A shut-off valve, located at the outlet from the reservoir, is operated by the hydraulic fluid emergency shut-off control on the control panel. Closing this valve by pulling the control will immediately cut off the supply of fluid to the system in case of engine fire. Hydraulic fluid for operation of the wheel brakes is supplied to the master brake cylinder directly from the reservoir.

FLIGHT CONTROLS

Primary Flight Controls

The primary flight control surfaces (ailerons, elevators, and rudder) are operated by dual, side-by-side wheel and rudder type controls. The Navion may be flown from either set of controls; or if a non-pilot passenger is riding in the right front seat, the control wheel and rudder pedals can be removed. While the control system is entirely conventional—wheel governing aileron and elevator action, and pedals governing rudder action—a rudder-aileron coordinating system is included as a safety feature to impart added lateral stability to the airplane during certain maneuvers. This connection between the two controls is so arranged that when force is applied to the rudder pedals for maneu-



vering the airplane to right or left, a limited movement of the ailerons will be automatically accomplished. Normal coordinated movement of the flight controls is still required of the pilot, who will notice the effect of the system only in the balance of control forces, which is characteristic of the Navion in all maneuvers.

Static Balance of Primary Control Surfaces

The ailerons are statically balanced within a maximum allowable unbalance of 4 inch-pounds. This balance must be maintained if repairs become necessary or even if the surfaces are repainted. The rudder and elevators are not statically balanced; however, in the event of repair to a surface, the static unbalance must not exceed 47 inch-pounds (rudder) or 25 inch-pounds (each half elevator).

Trim Tabs

"Trimming the airplane" eliminates the necessity for constant pressure on the controls to maintain a given flight attitude such as climb, level flight, or descent. Trim tabs, installed in the trailing edge of each elevator, are controlled in flight by the elevator trim wheel on the control panel. The condition of elevator trim (nose up or nose down) is shown by an indicator located to the right of the trim wheel. Fixed trim tabs, adjustable on the ground only, are installed on the rudder and on the right aileron.

Flaps

For precision landings flaps are an invaluable aid to even the most experienced pilot. The Navion is equipped with hydraulically actuated flaps controlled by a lever located at the center of the control panel. When the control is moved to **down** with the hydraulic power control **on**, the flaps lower approximately 45 degrees. Should the flaps fail to operate normally, they can be raised or lowered by leaving the power control **on**, placing the flap control in the desired position, and supplying hydraulic pressure with the hand-pump. For short field take-offs, ½ flap (maximum) will greatly reduce take-off run. To set flap, place handle in down position until ½ flap mark is visible on flap over L/H wing trailing edge, then stop flap by placing handle in neutral position.

LANDING GEAR

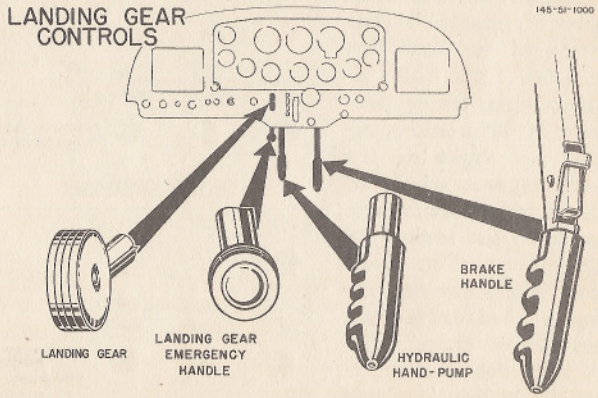
Hydraulic Operation

The Navion is equipped with retractable, faired-in, tricycle landing gear, which is retracted and extended by means of hydraulic operating cylinders. When retracted, the main gear pivots inboard and aft into the wing panels. The nose gear pivots aft, and when retracted, the wheel extends slightly from the wheel well in the bottom of the fuselage.

Both the main and nose gear assemblies are held in the up position by mechanical locks which are released when the gear control handle is moved to the down position with hydraulic power control **on.** When extended, the gear is locked by past-center lock mechanisms held in place by spring bungees.

Gear Controls

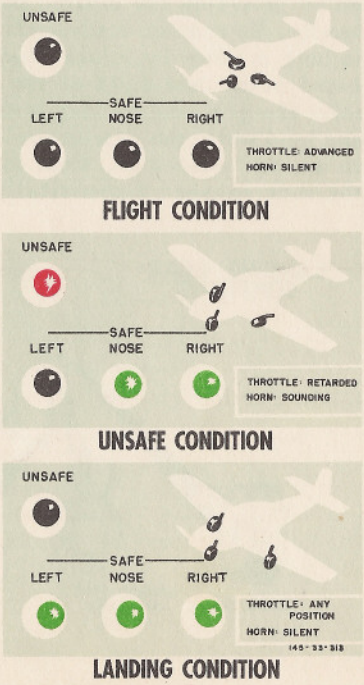
The gear control handle, mounted in the center of the control panel, has two positions, **up** and **down.** With the hydraulic power control **on**, the gear is retracted or extended by selecting the desired position with the gear control handle. To prevent inadvertent gear retraction, the control is held at **down** by a lock which is released by a lever located below and right of the control handle. In order to raise the gear, the locking lever must be pushed to the left and held while the gear control handle is pulled out, raised to **up**, and pushed in. When the handle is moved to down, the lock engages automatically. If the gear fails to lower



normally; leaving the control handle in the **down** position (with hydraulic power control **on**), and pushing the **landing gear emergency handle** (located below the control panel in line with the normal gear control) will free the assemblies from the up-locks, and the gear will be forced to the down and locked position by the spring bungees. If the gear fails to retract normally, the control handle should be left at **up**, the hydraulic power control **on**, and pressure supplied by use of the hand-pump located below the panel.

Gear Position Indicators

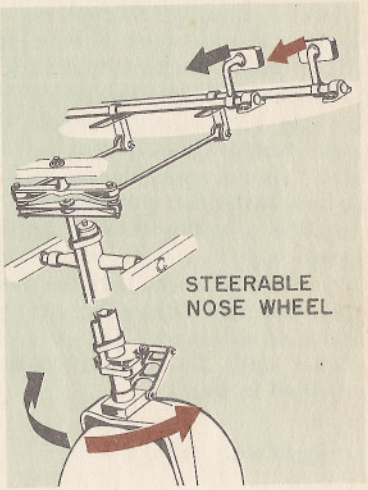
No pilot is proud of a belly landing—not even a good one. The Navion owner can be assured that his gear is "down and locked" for landing by checking the gear position indicators located at the left side of the control panel. Three green lights, one for each gear, give a constant visual indication of the condition of the gear. Each light illuminates when its respective gear is down and locked. One red light on the panel illuminates when the gear is in any position other than down and locked, or up and locked. The green indicator lights can be dimmed by a rheostat switch located below them. (The switch also controls brilliancy of the hydraulic power light.) Spare lamps for the



indicators are stowed in clips behind the control panel, just beneath the indicators. Additional indication of unsafe gear condition is provided by a warning horn which sounds when the throttle is retarded to idling position, and the gear is not down and locked for landing.

Steerable Nose Wheel

A steering mechanism on the nose wheel, directly connected to the rudder pedals, makes taxiing the Navion as simple as driving an automobile. Turning the airplane to right or left is accomplished by pressure on right or left pedal—exactly as comparable pedal action in the air directs the airplane's flight. Full pedal depression turns the nose wheel approximately 20 degrees left or right of center. When pedal pressure is released, the wheel is automatically aligned by castering action.



Gear Assembly and Tires

To absorb the jar of heavy landings and rough ground handling, each gear assembly incorporates an air-oil shock strut having a 7-inch stroke. Incorporated with each strut are landing gear fairings which open and close automatically with gear operation. Type III tires and tubes are used on all wheels, the main gear uses size 7.00-8 and the nose gear size 6.00-6.

Tail Skid

A spring-leaf tail skid is mounted on the bottom of the

fuselage, at the aft end, to protect the tail in the event of a tail-low landing.

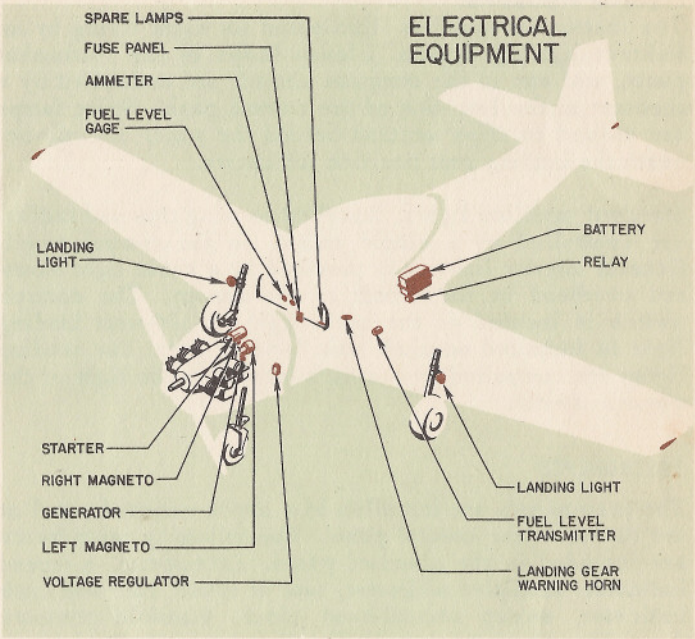
WHEEL BRAKES

Smooth, dependable braking action is provided by hydraulic brakes installed on each main gear wheel. Hayes-Goodrich expander-tube type brakes are installed on the airplane. The brakes employ hydraulic fluid pressure to expand a flexible tube which forces the brake blocks against a drum to provide braking friction. A hand lever, mounted below the control panel, within easy reach from either of the front seats, controls the master brake cylinder which supplies hydraulic pressure to the brake units. The brakes operate simultaneously, applying equal force to the two main wheels as the control is pulled aft. They are locked for parking by pulling the same control to its extreme aft position and depressing the thumb trigger on the upper surface of the lever. They are released by pulling aft on the lever until the trigger disengages and the lever can be pushed forward.

ELECTRICAL SYSTEM

Power Supply

The 12-volt, direct-current electrical system is supplied with power by an engine driven generator of 15-volt, 25-ampere capacity. A combined voltage regulator and reverse-current relay is provided with the generator. A 12-volt, 34-ampere-hour storage battery, installed on the left side of the baggage compartment, serves as a stand-by and supplies power to the electrically operated units when the generator is not operating. Battery and generator switches are located at the left side of the control panel. A bar, installed across the two switches, is provided to turn them off simultaneously; but they may also be operated individually. Battery current is indicated on an ammeter installed



in the instrument panel. All of the electrical circuits (except the starter) are protected by circuit breakers which are located on a panel hinged to the lower edge of the left side of the control panel (below the ignition switch). Push circuit breakers when necessary to reset. The cigarette lighter is equipped with a special replaceable fuse located on the back of the lighter assembly. Electrically powered units on the Navion include the starter, lights, instruments, electric fuel pump, cigarette lighter, radio, and flares, when installed.

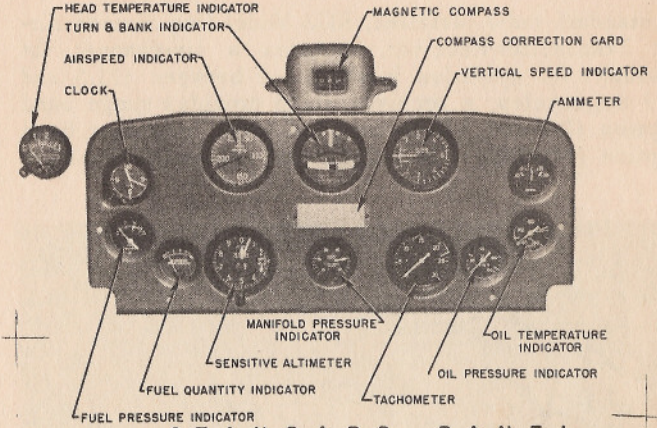
Lighting Equipment

The instrument panel is illuminated for night flying by an indirect lighting system. Eleven lamps in the instrument panel, and one in the compass shroud, are controlled by a rheostat at the left side of the control panel. Spare lamps are stowed in clips secured behind the panel directly beneath the landing gear position indicators.

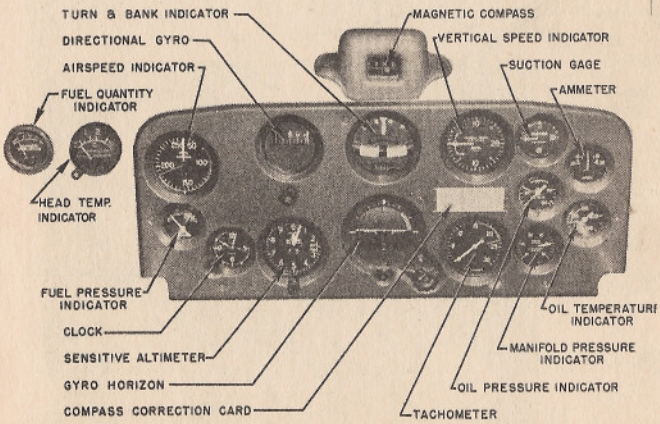
Standard position lights, installed on wing tips and rudder, are controlled by a single switch on the control panel. General interior lighting is provided by a cabin light mounted overhead at the center of the canopy. The control switch is located on the cabin light. A 100-watt landing light is installed on each main landing gear. The landing lights are controlled by a switch located to the right of the magneto switch.

INSTRUMENTS

The instruments are installed in a shock-mounted panel at the center of the control panel. The following instruments are included in the standard panel. Tachometer, airspeed indicator, sensitive altimeter, rate of climb, turn and bank indicator, sweep second-hand clock, manifold pressure gage, gages for oil temperature, oil pressure, fuel pressure, fuel quantity and ammeter. A magnetic compass is mounted above the instrument panel at the center of control panel and an outside air temperature gage is mounted in the dome area above windshield. Coded color markings on airspeed indicator and engine instruments indicate limitations and operating ranges. The white lines on the instruments must be aligned with corresponding marks on the panel for accurate indications. Space provisions have been made in the standard panel for the addition of gyro instruments to make a gyro panel if desired, the change requiring only a new reflector panel with the additional holes.



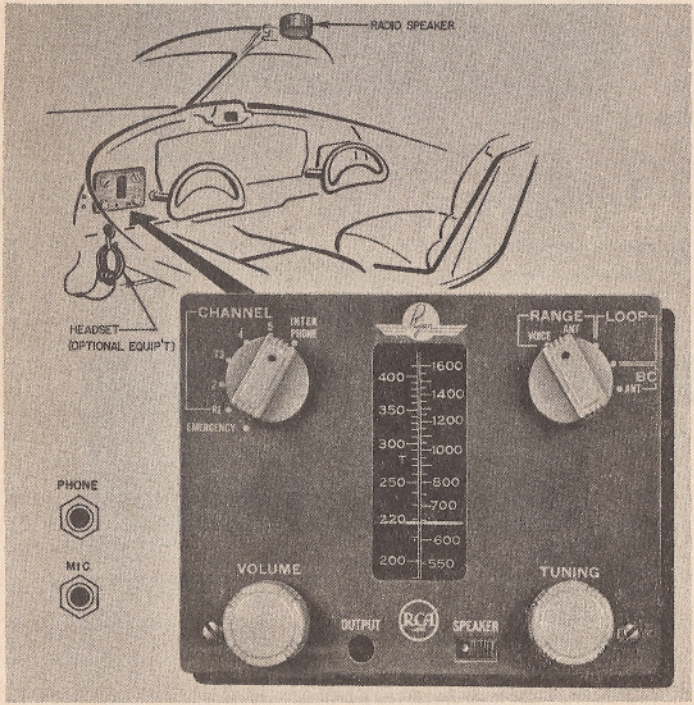
STANDARD PANEL



GYRO PANEL

RADIO

The standard radio installed, RCA Model One Sixteen Aircraft Transmitter-Receiver, includes a six-channel vhf transmitter for operation in the range between 121.5 and 122.9 megacycles, a receiver which provides range band reception (200-400 kilocycles), standard broadcast band reception (540-1600 kilocycles), and reception of marker



beacon signals (75 megacycles). For receiving standard broadcast or range signals, a fixed-wire antenna is installed in the airplane. The set may also be used with a loop antenna. For transmission a whip antenna is installed on the tail cone just aft of the canopy. An additional whip antenna installed underneath the airplane fuselage is for marker beacon reception. The radio controls, easily accessible to the pilot at the left of the control panel, include conventional volume-on switch, a receiver selector switch, a tuning knob, and a transmitter channel selector switch. The receiver band switch selects the type of reception desired either range, range voice, or broadcasting stations. The transmitter channel selector switch selects the channel for transmission. For towers, select channel 3; for radio range stations select 1; and emergency is used when necessary. Marker beacon signals are automatic and are received on range antenna and both loop positions of the receiver selector switch, but not on the range voice or broadcast antenna switch positions. There is no volume adjustment on marker reception. On the range and voice filter suppresses the range signals sufficiently to clarify voice reception from stations where simultaneous voice and range signals are emitted. Two jacks for junction of the microphone and headset cords are located to the left of the radio panel. The microphone is stowed in a clip mounted on the left side of the cabin. Satisfactory operation of the transmitter is indicated by the sidetone heard in the speaker. The loud speaker is installed overhead for general reception.

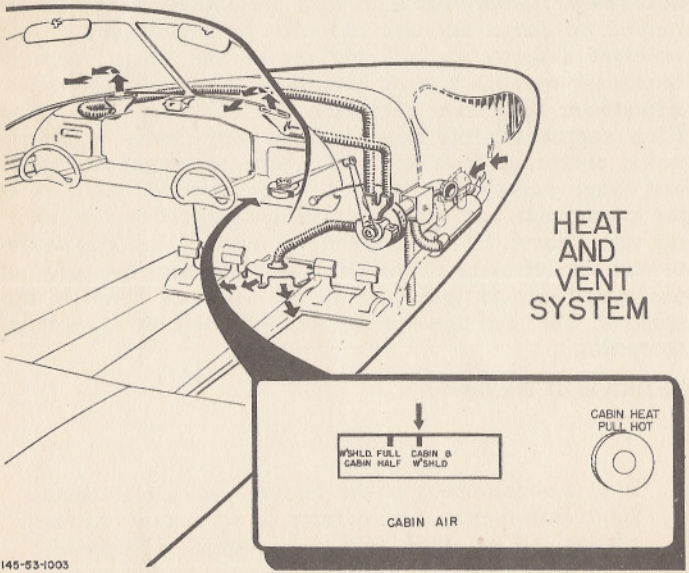
Operation of the Radio

NOTE

It is a requirement of the Federal Communications Commission that the operator of an aircraft transmitting station, such as this one, must be licensed. It is necessary to obtain a Restricted Radiotele-

phone Operator's license and an aircraft Station License.

1. Turn on battery switch.
2. Rotate volume switch from **off**; select type of operation; then allow set to warm up for one minute.
3. With tuning knob, select desired frequency on dial.
4. Adjust volume control for desired output.
5. To transmit select channel desired, press microphone button and speak directly into microphone.
6. The radio is turned **off** by rotating volume control counter-clockwise to **off**.



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CABIN VENTILATION AND HEAT

To provide cabin ventilation, ram air obtained from a scoop on the right engine cowl, is routed through ducts to outlets in the cabin and below each windshield panel. Adjustable air deflectors are installed at the top of the windshield to direct flow of ventilating air into the cockpit. An air distributing control, on the control panel below the glove compartment, permits selection of the volume of air, and directs airflow to the windshield or cabin, or to both simultaneously. The system may also be used for windshield defogging. Incorporated with the ventilating system is an exhaust heater supplying warm air by opening or closing the mixing valve located forward of firewall. The operating control is located on the right side of control panel, below the glove compartment door. By pulling the control to an intermediate position, any desired mixture of ram and heated air may be admitted into the cabin.

CABIN ENCLOSURE

The plexiglas windshield and sliding canopy of the cabin enclosure afford excellent visibility to pilot and passengers. A beaded metal section, attached to the inside aft portion of the canopy, forms a convenient shelf behind the rear seat. An external handle on the canopy contains a keyhole for locking the canopy from outside. When the canopy is closed, the handle engages with a latch at the top of the windshield. Rotating the canopy handle clockwise releases the latch and permits the canopy to be opened. As long as the handle is held in the unlocked position, the canopy may be moved freely along the enclosure sill. Releasing the handle permits the canopy to be locked in one of two open positions. This is accomplished by means of a spring-loaded lockpin in the canopy frame which snaps into detents in the enclosure sill. A similar handle inside the cabin permits identical operation from within. For opening

the canopy in flight, another handle (located on the cabin floor forward and right of the pilot's seat) is provided. Pulling this handle, after first unlocking the canopy, slides the canopy back to the full open detent stop.

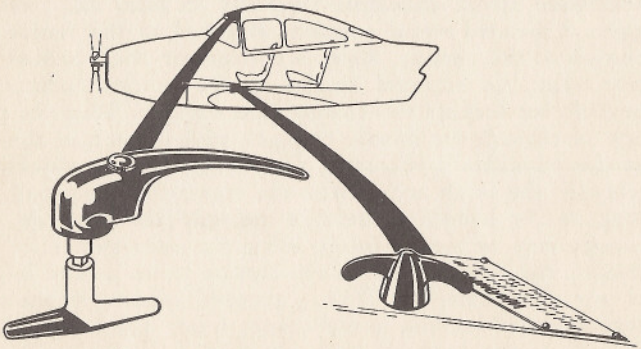
CABIN INTERIOR

Upholstery

An all-wool, flame resistant barkweave and broadcloth with nogahyde trim, in a variety of colors, covers the seats and side panels of the cabin. The canopy is lined with a cotton fabric. Carpeting covers the floor and the scuff boards at the sides of the cabin. Snap-down fasteners on the carpeting facilitate its removal.

Seats

Frames for the seats and backrests are constructed of tubular steel. The cushioning covering the springs, backs, and armrests is foam rubber with cotton padding. Seat belts for each occupant are securely attached to the seats. To provide added comfort, an armrest is provided on either side of the rear seat with a fold down armrest in the center. The



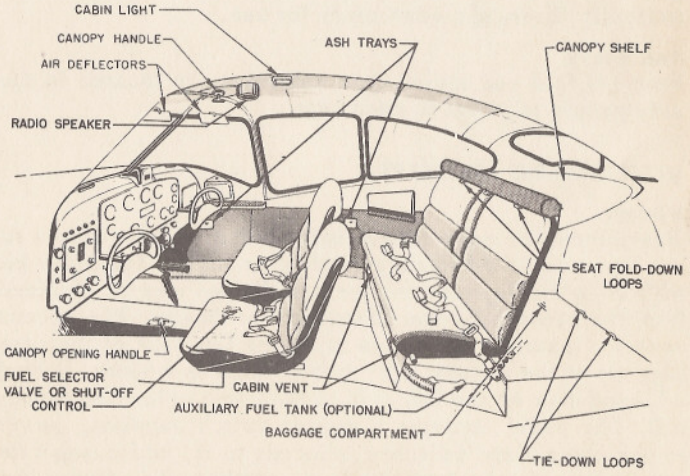
CANOPY OPERATING HANDLES

front seats are mounted on tracks and may be released for movement fore and aft by lifting a lock handle located on the inboard side of each seat. To provide access to the baggage compartment, the back of the rear seat may be folded forward by pulling up on the trip levers on the aft side of the backrest.

Either a seat or back-type parachute may be used in the front seats when the cushions are removed. Two hooks, securing the back cushion to the backrest, are released when the cushion is lifted. Unscrewing two wing nuts, at the front of the seat frame, permits the seat cushions to be lifted out.

Baggage Compartment

The 20 cubic foot baggage compartment, located behind the rear seat, is easily accessible on the ground and in



flight. The shelf attached to the aft end of the canopy covers the compartment when the canopy is closed, and the back of the rear seat must be drawn forward to gain access to the compartment in flight. Tie-down rings and straps are provided in the compartment for holding baggage in place. Baggage must be securely tied down at all times.

MISCELLANEOUS FURNISHINGS

Glove Compartment
Located at the right side of the control panel, the glove compartment provides stowage space for small articles. The door is locked closed by a push-button catch which is opened by a plunger-type release.

Cigarette Lighter
A lighter is located on the control panel at the right of the glove compartment. It is pushed in to heat, and will automatically disengage when ready for use.

Ash Trays
Four (4) fold out sealed type ash trays are located in the side panels adjacent to each seat.

MISCELLANEOUS EQUIPMENT

Flares
Provisions are made for the installation of three flares for use in case of emergency landing at night. The flare kit with complete instructions for installation may be obtained from the nearest Navion Distributor or Dealer. The access door for inserting the flares is on the left side of the fuselage aft of the canopy. The switch panel is mounted behind a hinged door on the left side of the cabin below the canopy sill. The panel contains a master switch supplying power to the three flare switches adjacent to it, and a separate safety lock for each of the four switches. To release the flares, unlock the master switch and move it to on. Then

unlock the desired flare switch and turn on to release. After landing, it is desirable to throw the master switch to **off** in order to render inoperative the flares that have not been released.

Engine and Aircraft Log
An engine log and an aircraft log are provided in each airplane.

Step and Handgrip
A step, mounted forward and below the leading edge of the left wing panel, and a handgrip, just forward of the left windshield, are provided for access to the Navion cabin.

Walkway
The upper surface of the left wing panel is reinforced at the inboard end to serve as a walkway.

Flying the Navion

This manual is written to help the pilot familiarize himself with the Navion operational procedures. Although the airplane has many features of larger and more complex aircraft, learning a few basic sequences will make the operation of the Navion extremely simple; and will increase greatly the pleasure and profit of Navion operation.

NOTE

All airspeeds quoted in this manual as "mph" are indicated airspeeds (IAS); that is, the values read directly from the airspeed indicator.

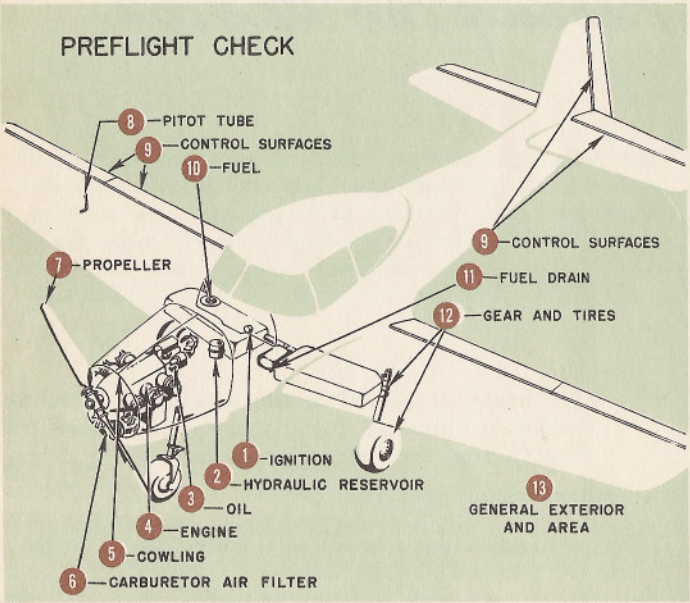
BEFORE ENTERING AIRPLANE

Prior to flight, make a brief but thorough check of the airplane and power plant. Inspect with a critical eye; be sure that the over-all ship is ready for flight, that all controls are functioning properly, and that all equipment is operable. Enlarge upon the items listed below as you deem necessary, but always follow a definite sequence to avoid for-

getting some important check. The extent of the preflight check is dependent on when the daily inspection (refer to Servicing) was accomplished.

Preflight Inspection

1. Ignition–Be sure ignition switch is **off.**
2. Hydraulic Reservoir–Check hydraulic fluid level and security of filler cap.



3. Oil–Check oil level and security of filler cap.
4. Engine–Check engine installation for security of attachment and proper condition of units. Examine for leakage or burning.
5. Cowling–Fasten the cowling securely.
6. Carburetor Air Filter–Examine filter for cleanliness and freedom from obstructions.
7. Propeller–Examine for security of installation. Check for nicks, cracks, and oil leakage. Wipe blades clean.
8. Pitot Tube–Remove pitot tube cover, and be sure tube opening is clear.
9. Control Surfaces–Check all flight control surfaces for freedom of movement.
10. Fuel–Remove filler cap, and visually check fuel quantity in tanks, and replace cap securely.
11. Fuel Drain; periodically, depending on the fuel supply used–drain a small amount of fuel from accumulator tank, to remove collection of water and sediment.
12. Gear and Tires–Check oleo strut extension. Check brake lines for security. Inspect lines for possible leakage. Check tires for pressure and freedom from cuts. Check nose gear steering linkage for tightness.
13. General Exterior and Aera–Examine the airplane for any obvious damage. Examine airplane for cleanliness. (Examine each wing tip and the empennage.) Be sure the area around and under airplane is clear of obstructions and loose equipment.

ENTERING THE CABIN

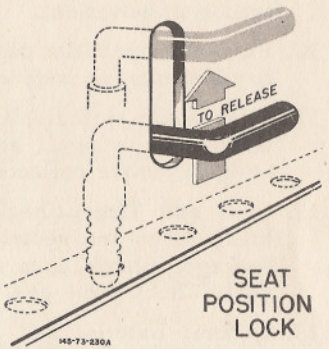
NOTE

Do not enter or leave cabin while engine is running.

1. Enter airplane from leading edge of left wing, using step and handhold provided.
2. Unlock and slide back canopy.

AFTER ENTERING CABIN

1. Examine cabin and baggage compartment for loose objects.
2. Set brakes.
3. Fasten seat belt.
4. Adjust seat so that rudder pedals can be reached through full travel.
5. Check ignition and radio switches off; then turn generator and battery switches on.
6. Check that landing gear control handle is down and make sure the green landing gear position lights are illuminated.



7. Set clock and altimeter.
8. Check flight controls for free and proper movement. Observe corresponding movement of control surfaces.

NOTE

It may be noticed, while checking aileron movement, that the control wheel returns to neutral when released. This condition is normal and is caused by the spring connection between aileron and rudder systems. Rudder action is more easily checked while taxiing, because linkage (between rudder pedals and nose wheel) for ground steering prevents free movement of the pedals when the airplane is not in motion.

STARTING ENGINE

CAUTION

When wind conditions are strong or gusty, always head airplane into wind before engine starting or warm-up. A quartering tail wind is particularly hazardous, because it may lift one wing and gear enough to damage propeller.

1. Push carburetor heat control in *(off).*
2. Open cowl flaps (full).
3. Push mixture control in (full rich).
4. Push propeller control in to increase rpm (low pitch).
5. Crack throttle approximately ¼ inch open.
6. Check fuel level on gage. Check fuel shut-off control on.
7. Press foot starter. Turn electric fuel pump **on**. Allow engine to turn over 3 or 4 revolutions and then turn ignition switch to **both**. If engine fails to start, repeat the foregoing with the mixture control in idle cut-off position. When engine starts, return mixture control to the rich position.

NOTES

* In extremely cold weather, the foregoing procedure can be supplemented by priming the engine 4 or more strokes before starting.

* The electric fuel pump should not be left on more than 5 seconds without pulling mixture control in to idle cut-off position, until engine starts, after which mixture control should be returned to the rich position.

* Always release foot control as soon as the engine catches. If engine dies after initial start, do not re-engage starter until propeller stops rotating.

8. Leave electric fuel pump on until engine is running smoothly.
9. After running at 800 rpm for at least one minute gradually increase throttle to obtain 1200 rpm for engine warm-up.
10. Check oil pressure. If not up to 10 psi within 30 seconds, stop engine and investigate.
11. Maintain an engine speed of 1200 rpm until oil temperature reaches a minimum of 105°F. Some of the warm-up time may be used in taxiing to take-off point.

NOTE

Do not run engine at high rpm any longer than necessary to reach minimum warm-up temperature.

DIFFICULT STARTS

Flooded Engine

If the engine is flooded during an attempt to start, turn ignition switch **off**, pull mixture control to idle cut-off, and push throttle full open. Crank engine with starter until it is believed to be clear. Make subsequent start as follows:

1. Crack throttle approximately ¼ inch open.
2. Push mixture control in (full rich).
3. Press foot starter, then turn ignition switch to **both**.
4. Turn **on** electric fuel pump until engine runs smoothly.

Cold Weather Starting (Hartzell Propellers)

1. Make sure wing flaps are up and hydraulic power is on.
2. Push mixture control in (full rich).
3. Press foot starter, then turn ignition switch to **both**.
4. Turn **on** electric fuel pump until engine runs smoothly.

Cold Weather Starting (Hartzell Propellers)

When operating under conditions of extreme cold (32° F or below), it is advisable to start and stop engine with propeller in high pitch (control full out). If propeller is left in low pitch under such conditions, oil in the propeller actuating cylinder may congeal before the next engine start, making it difficult for the propeller to change pitch. After starting in high pitch, wait until oil pressure reaches 40-50 psi and oil temperature indicates a definite rise before moving control to low pitch position.

TAXIING

1. Make sure wing flaps are up and hydraulic power is on.

2. Release parking brakes and depress either right or left rudder pedal to turn in the desired direction. With full rudder deflection, the Navion will pivot on a point about halfway inboard of the wing tip.
3. The nose wheel is inherently stable and will maintain a straight course (except as affected by torque) when the rudder pedals are in a neutral position.
4. To slow down or stop, retard throttle and apply brakes as necessary.

TAKE-OFF

Before Take-Off (Engine and Controls Check)
After taxiing to take-off position, set brakes and make the following complete check:

1. See that mixture control is in (full rich position) and cowl flaps are full open.
2. Advance throttle to 1700 rpm (propeller control in full increase rpm) and check instruments for desired readings as shown by Instrument Dial Markings. Check ammeter for reading between 2 (minimum) and 23 (maximum) amps.

NOTE

Under certain operating conditions (when outside air temperatures are low, or heavier oil is used), the oil pressure may exceed the specified desired operating range without damage to the engine.

3. Turn electric fuel pump **on.**
4. Check each magneto for drop-off. (75 rpm maximum).
5. Check operation of carburetor heat system by pulling control full out and noting drop in engine rpm with heat on. Then push control in (off position).
6. Hartzell: Pull propeller control and note drop in rpm.

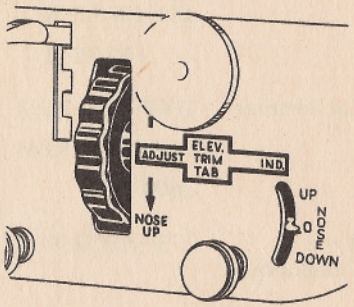
INSTRUMENT DIAL MARKINGS

Airspeed	59-100 MPH	White arc - Flap Operating Range
	75-160 MPH	Green arc - Normal Operating Range
	160-190 MPH	Yellow arc - Caution
	190 MPH	Red Line - Do Not Exceed
Tachometer	1600-2300 RPM	Green arc - Normal Range
	2300-2600 RPM	Yellow arc - Caution
	2600 RPM	Red Line - Do Not Exceed
Head Temperature	273° C (525° F)	Red Line - Do Not Exceed
Fuel Pressure	10 PSI	Red Line - Minimum
	12-14 PSI	Green arc - Normal Range
	15 PSI	Red Line - Maximum
Oil Pressure	30 PSI	Red Line - Minimum
	40-65 PSI	Green arc - Normal Range
	95 PSI	Red Line - Maximum
Oil Temperature	105° F	Red Line - Minimum
	110 - 175° F	Green arc - Normal Range
	215° F	Red Line - Maximum

Push propeller control to full increase rpm. Aeromatic control full in.

7. For take-off from an airport below 5,000 feet, mixture control should be in full rich position; however, if take-off is being made from an airport above that altitude, the mixture should be leaned to secure maximum power.

8. With full throttle (10-20) seconds maximum) check engine rpm:– (propeller control at low pitch) 2200-2300. (Aeromatic 2450-2550)



9. Pull throttle to 1000 rpm.

10. Check hydraulic power control and leave on for take-off. Check power light on.

11. Check hydraulic system by operating flaps. Return control to up for take-off, or if desired ½ flaps (maximum) may be used for take-off.

12. Set elevator trim tab 0° to 5° nose down.

Normal Take-Off

1. Make sure take-off area is clear; then release parking brakes and head airplane down runway.

2. Start take-off run, advancing throttle to full open (2600 rpm maximum on take-off for one minute), reducing to 2300 rpm for maximum continuous power.

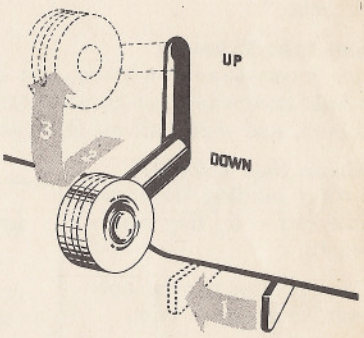
3. Maintain directional control by use of rudder pedals.

4. At a speed of approximately 55 to 60 mph, raise nose wheel from ground by applying gentle back pressure to

the control wheel. At 70 mph, very slight additional back pressure will cause the airplane to take-off.

NOTE

If the nose wheel is allowed to skip along the ground, light "kicks" on the rudder pedals will be felt as the nose wheel attempts to straighten itself. When partial flaps are used on take-off, pull control to lift airplane off at approximately 5 to 10 mph less air speed than without flaps.



5. When definitely airborne, release lock and move landing gear control to **up**. (Hydraulic power control must be **on**). Check to see that all gear position lights are out, as indication that gear is up and locked.

NOTE

As the nose gear retracts, the friction brake in the nose wheel well may cause a slight odor of burning rubber. This condition is normal and should not alarm the pilot. However; if nose wheel is not allowed to remain on runway any longer than necessary it will not be so noticeable.

6. Raise flaps, if used, at approximately 80 to 90 mph, then push hydraulic power control **off**.
7. Turn electric fuel pump **off** after gaining approximately

1000 feet altitude.

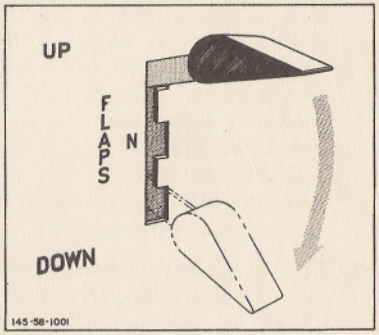
8. Maintain an airspeed of at least 80 mph during initial climb.

Cross-Wind Take-Off

For a cross-wind condition, use normal take-off technique, but hold nosewheel on ground until an airspeed of 70 mph is attained, and then pull off more sharply.

Minimum Run Take-Off

1. Lower landing flaps for take-off – (½ flap maximum).
2. Set elevator tab for normal nose down trim.
3. In position for take-off, set brakes and run up engine to full throttle.
4. Hold control wheel slightly back and release brakes. Take-off at approximately 60 mph.



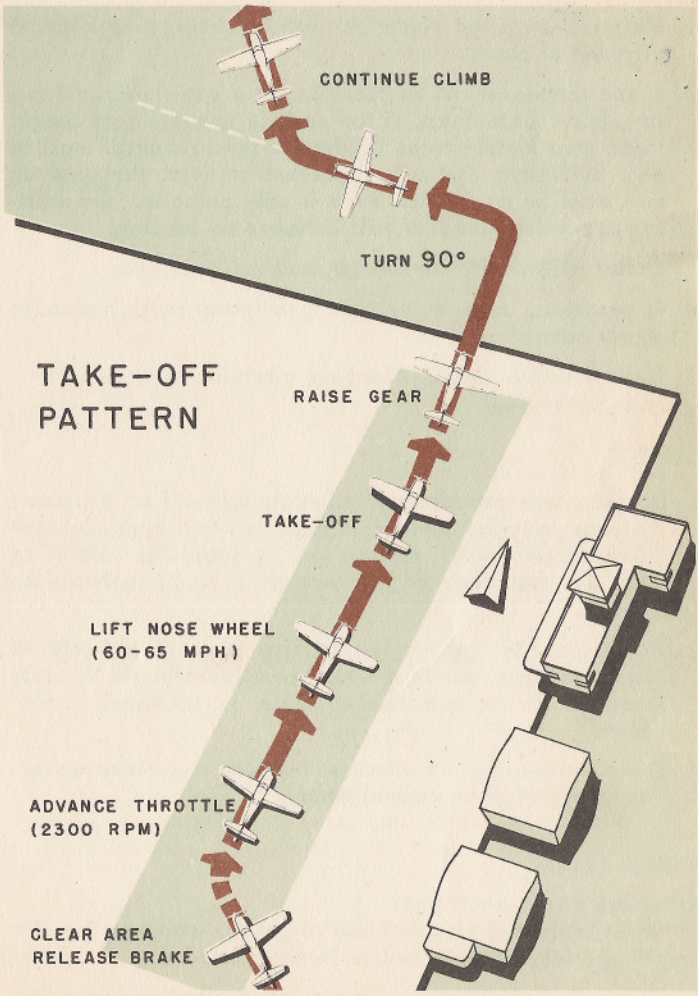
5. During initial climb hold airspeed of 70 mph for best obstacle clearance.

CAUTION

This procedure should be used only under emergency conditions and when the air is smooth. Under no circumstances should the airspeed be permitted to drop below 70 mph.

Engine Failure During Take-Off

If the engine should fail immediately after take-off, act quickly as follows:


CONTINUE CLIMB
TURN 90°
TAKE-OFF PATTERN
RAISE GEAR
TAKE-OFF
LIFT NOSE WHEEL (60-65 MPH)
ADVANCE THROTTLE (2300 RPM)
CLEAR AREA RELEASE BRAKE

1. Maintain airspeed above 80 mph by depressing nose of airplane at once.
2. If the terrain ahead is suitable for a wheels-down landing, leave gear down. If the surface appears very rough, raise gear handle to **up** (hydraulic power control must be **on**). Sufficient hydraulic pressure to start the gear up may still be available. Even if only unlocked and starting to retract, the gear will collapse on landing.
3. Turn fuel shut-off control **off**, and cut switches.
4. If possible, lower flaps with hand-pump (with hydraulic power control **on**).
5. Land straight ahead, changing direction only enough to miss obstacles.

CLIMB

1. Initial climb immediately following take-off at full throttle with propeller control in (full increase rpm), for one minute, after which reduce rpm by propeller control to 2200 rpm and manifold pressure to 26 to 27 inches with throttle.
2. For most efficient engine cooling and highest rate of climb, the best climbing speed is approximately 95 mph. Detailed climb performance data is provided under Charts.
3. During climb, adjust elevator trim tab to relieve unnecessary pressure on control wheel.

DURING FLIGHT

Trimming For Level Flight

For best indicated airspeed and to get the airplane "on the step", the following procedure is recommended:

1. Climb an additional 200 feet above desired cruising alti-

tude, and allow that additional altitude to be slowly dissipated in a slightly nose-low attitude while trimming.

2. Slowly reduce throttle to desired manifold pressure.
3. Adjust trim tab to a slightly nose-low attitude.
4. Slowly reduce propeller control to desired rpm.
5. As the airspeed is increased the rpm will have a tendency to increase. Reset propeller control to desired rpm; reset throttle to desired manifold pressure and adjust tab for "hands-off" level flight.

Engine Operation

1. Lean mixture to obtain maximum rpm consistent with smooth engine operation for the selected throttle setting.

CAUTION

Lean mixture slowly and do not pull control beyond one inch during flight. If advancing or retarding throttle after leaning results in rough engine operation or over heating, readjust mixture control.

2. If fuel pressure drops below normal, turn electric fuel pump on.
3. Adjust engine cowl flaps as necessary to maintain desired engine operating head temperature.

Engine Failure During Flight

In case of engine failure during flight, immediately establish a normal gliding speed. (The glide ratio of the Navion is approximately 12 to 1 at an airspeed of 80 mph). Quickly check all engine controls and switches to make sure the failure did not result from some inadvertent movement. If the engine cannot be started, select a suitable field and prepare for an emergency landing as follows:

1. Turn fuel shut-off control off and cut all switches.
2. Make sure seat belt is securely fastened.

3. If the landing area selected appears relatively smooth, and there is sufficient time and altitude to properly plan an approach, pull hydraulic power control on and lower the landing gear, using the hand-pump if necessary. If there are any indications of stumps, ditches, rough or muddy ground, keep the gear up. There is less chance of injury in making a belly landing.

4. Plan approach to emergency field as for a normal landing.

5. To lower flaps, pull hydraulic power control on, move flap control to down, and use hand pump. (If propeller is windmilling, the engine-driven hydraulic pump may supply sufficient pressure to operate flaps).

6. If necessary to prevent overshooting, the airplane can be effectively sideslipped. Be sure to maintain an airspeed above 85 mph (flaps up) or 70 mph (flaps down), and recover with ample altitude to establish a normal glide.

Flight Characteristics

Designed specifically to fulfill the needs and desires of the private plane owner, the flight characteristics of the Navion combine safety and ease of control with speed and maneuverability. All control forces are normal and well balanced, requiring only gentle pressures to execute any maneuver. The airplane is extremely stable, handling well even in rough air. A remarkable amount of aileron control down to minimum operating speeds is provided by the unusual wing design. The rudder-aileron coordinating system imparts added lateral stability, a feature particularly noticeable at low speeds where many light planes exhibit a lack of aileron control "feel" – not normally provided by the low pressures acting on control surfaces of light planes at low speeds. By so doing, the system does not eliminate normal coordination of controls, but rather makes normal coordination easier.

MANEUVERS

Normal Category

When the Navion is operated in the normal category, all acrobatics, including spins, are unauthorized. The most severe maneuver to be executed is a steep turn to a maximum of 60-degree bank.

Utility Category

The following listed maneuvers have been demonstrated in flight tests and are approved when the Navion is operated in the utility category (maximum weight—2350 lb). No other maneuvers are authorized.

MANEUVER	ENTRY SPEED
Steep turns (up to 60° only)	110-150 mph
Chandelles	140-160 mph
Lazy 8's	130-150 mph

Stalls (except whip stalls)—straight flight, power off

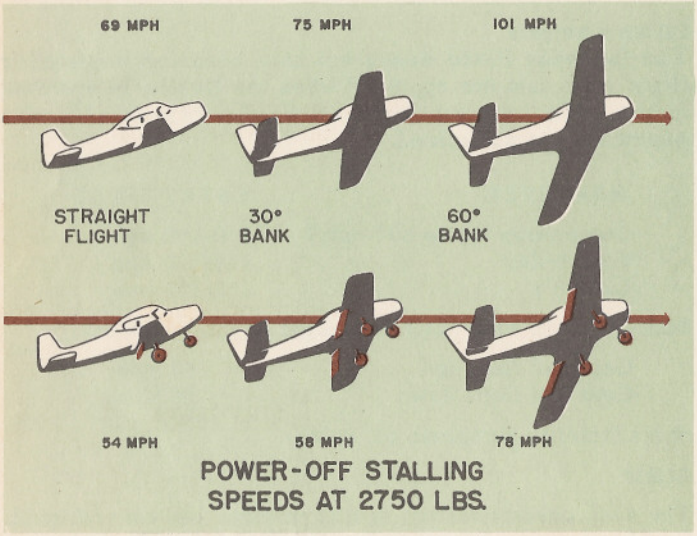
Gear and flaps up	64 mph
Gear and flaps down	50 mph

Spins (refer to paragraph on Spins)

Stalls

The stall characteristics of this airplane are conventional. Power-off stalls are exceptionally smooth; stalls with power on are somewhat more sensitive. Aileron control remains very effective throughout the stall. In power-off stalls there is sufficient warning before the stall breaks. The airplane will pitch straight forward with no tendency to roll or yaw. With gear and flaps up in a power-off stall, a slight tail buffet is noticed preceding the break. A normal recovery is effected by applying forward elevator and additional power. When approaching a power-on stall (with gear and flaps up) the tail begins to buffet at approximately 4 mph before the stall breaks. Recovery can be made with little loss in alti-

tude by lowering the nose when the airplane begins to pitch. Power-on stalls (gear and flaps down) require a nose-high attitude and hard right rudder to prevent yaw. The wings must be kept fairly level before the stall breaks to prevent the airplane from rolling. When the airplane pitches, the nose will drop quickly and a normal recovery can be made.



POWER-OFF STALLING SPEEDS AT 2750 LBS.

Spins

Spins are not authorized when the airplane is operated in either category. Weight limitations for such operation locate the center of gravity ahead of 25 per cent MAC. With this center of gravity position, the airplane does not spin but enters a diving spiral which is accompained by tail buffeting and rapid increase of speed. If such a spiral is entered inadvertently, effect recovery by neutralizing controls.

Intentional spins are not authorized when the airplane is operated in the normal category; however, should a spin be

entered inadvertently, recovery can be effected immediately by applying opposite rudder and forward elevator. If the airplane is flown in the normal category with a center of gravity position ahead of 25 per cent MAC, instead of spin, the diving spiral with accompanying tail buffet will occur.

APPROACH AND LANDING

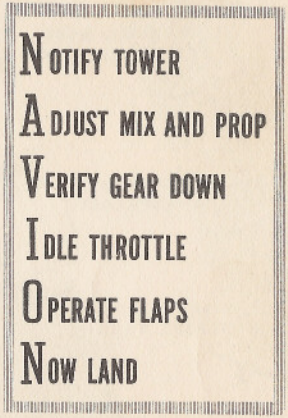
Normal Landing

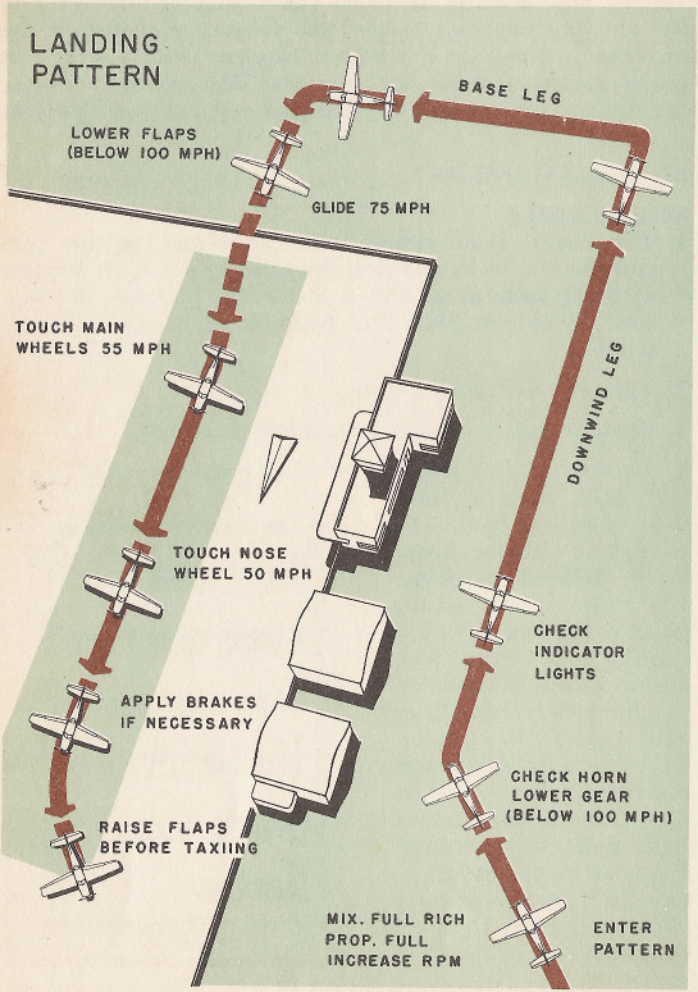
1. For landing at an airport below 5,000 feet, mixture control should be in full rich position; however, if landing is being made at an airport above that altitude, the mixture should be placed in position to secure maximum power.

2. Turn electric fuel pump on.

3. Push propeller control in (full increase rpm).

4. Entering traffic pattern, retard throttle and check landing gear warning horn; then advance throttle enough to silence horn. When airspeed is below 100 mph, pull hydraulic power control on and move landing gear control handle to down. (Leave hydraulic power control on until landing is completed). Check to make sure that green gear position lights are on, and that red light is off. If green landing gear position indicators fail to light, retard throttle again to check condition of indicator lamps, replacing with spares if necessary.




LANDING PATTERN
BASE LEG
LOWER FLAPS (BELOW 100 MPH)
GLIDE 75 MPH
TOUCH MAIN WHEELS 55 MPH
DOWNWIND LEG
TOUCH NOSE WHEEL 50 MPH
CHECK INDICATOR LIGHTS
APPLY BRAKES IF NECESSARY
CHECK HORN LOWER GEAR (BELOW 100 MPH)
RAISE FLAPS BEFORE TAXIING
MIX. FULL RICH PROP. FULL INCREASE RPM
ENTER PATTERN

NOTE

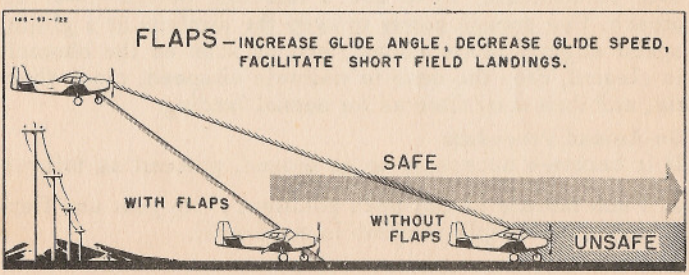
Should landing gear fail to lower normally, turn hydraulic power "OFF" and push Landing Gear Emergency Handle "DOWN". Hold Handle "DOWN" until all three green landing gear position lights are "ON". If landing gear fails to lock down, yaw airplane to lock main wheels and bring airplane to near stall while working rudder pedals to lock nose wheel.

Since it is desirable to have hydraulic power "ON" when landing and taxiing, after above procedure has been completed, the Landing Gear Control Lever should be placed in the "GEAR DOWN" position and hydraulic power turned "ON". If landing gear will not stay down and locked, turn hydraulic power "OFF", repeat above emergency procedure and land with hydraulic power "OFF". If flaps are required for landing, they should be operated BEFORE hydraulic power is turned "OFF" to facilitate above emergency procedure.

5. Below 100 mph, lower flaps when desired (hydraulic power control **on**). Adjust elevator trim, and maintain a normal glide of 75 mph (flaps down).

NOTE

If flaps fail to lower normally, leave hydraulic power control **on**, flap control at **down**, and supply hydraulic pressure by use of the hand pump.



6. When desired, sideslips can be safely executed during approach with gear and flaps down. Keep airspeed above 75 mph. Recovery is normal.
7. Touch ground with main gear first (nose well up) at approximately 55 mph. As speed diminishes, lower nose wheel to ground.

NOTE

When winds are strong or gusty, land airplane faster with tail only slightly down.

8. Slowly apply brakes, if necessary, to shorten landing roll. Do not attempt to turn airplane too abruptly at high speeds.
9. Before taxiing to parking area, raise flaps. Turn hydraulic power control **off** after stopping airplane.

Cross-Wind Landing

Tricycle landing gear minimizes the difficulties associated with a cross-wind landing. On approach, use the normal procedure required to maintain a straight flight path and to strike the ground with minimum drift. Land faster, and lower nose wheel to ground as quickly as possible.

Minimum Run Landing

When brakes are used to stop the airplane following a full-flap, power-off approach, a very short landing roll is possible. An alternate technique, for a minimum run landing over an obstacle, is to use a full-flap, partial-power approach. Use enough power to keep the airplane at a gliding speed slightly below normal, and as soon as the obstacle is cleared, drop the nose to maintain airspeed, close throttle, and then start flare as for normal landing.

Go-Around Procedure

If it becomes necessary to go around, proceed as follows:

1. Push throttle to full open position. (With gear and flaps down, best angle of climb is at 65 mph).

2. Move landing gear control to **up** (hydraulic power control must be **on**).
3. When sufficient flying speed (80-85 mph) is attained, move flap control to **up**. (With gear and flaps up, best angle of climb is at 80 mph). When flaps are up, push hydraulic control **off**.

NOTE

Raise flaps as quickly as is safely possible in order to secure maximum climb performance. This is particularly important if the go-around occurs at a high altitude airport on a hot day when the airplane is heavily loaded.

4. On airplanes equipped with Hartzell propellers, reduce rpm with propeller control to 2300 rpm maximum continuous power.
5. Adjust elevator trim as necessary.

STOPPING ENGINE

1. Set brakes.

NOTE

When operating in sub-zero weather, do not set brakes. Snow or slush on warm brakes will melt and subsequently freeze.

2. Cool engine, before shut-down, by idling at 700 to 900 rpm for 2 to 3 minutes.
3. To stop engine, pull mixture control full out to idle cut-off. Leave mixture control in idle cut-off position until engine is again started.

4. When propeller stops spinning, turn ignition, generator and battery switches off.
5. Turn off radio.

BEFORE LEAVING AIRPLANE

1. Make sure all switches are off.
2. After leaving cabin, close and lock canopy.
3. Chock wheels. (If brakes are hot, release brake handle after chocking wheels).
4. Install cover on pitot tube.
5. Moor airplane if necessary.

Charts

The following charts are included to aid the pilot in determining a course of action when available take-off or landing distances are questionable or endurance is doubtful. The data contained in these charts are the result of extensive flight tests and careful calculation; and the charts are designed for easy interpretation. In the interest of safety, the figures are in every instance conservative and are clearly qualified with reference to the important variables of airplane gross weight, altitude of operation, and outside air temperature.

TAKE-OFF

Consider weight, altitude, temperature, type of runway, and wind conditions when using the Take-Off Chart. (Figures given are for no wind.) If it is necessary to interpolate (weight and altitude falling between those shown), use the higher altitude and higher weight with reasonable adjustment. The greater distance shown for each weight at each altitude includes the ground run plus the airborne distance required to clear a 50-foot obstacle. For example, if a take-off at 2350 pounds is made at a 3000 foot altitude airport bordered by a flat field, the necessary runway distance is 850 feet. If, however, a row of trees crosses the end of runway, 1700 feet is required.

NOTE

The values shown are for a normal take-off. Greatly improved performance can be achieved by use of minimum run take-off technique.

RATE OF CLIMB

Refer to the Rate of Climb Chart to estimate time required for climb to any selected flight altitude. A climb from sea level to 4000 feet with 2750 pounds gross weight on a standard day, for example, requires approximately 6.4 minutes (4000 ÷ 620 FPM = 6.45 minutes). All rates shown were computed at 95 mph with full throttle and 2300 rpm to give highest rate of climb and most efficient engine cooling.

RANGE

The Range Chart was prepared to aid in selection of the best power (RPM), indicated airspeed (IAS), and altitude for obtaining optimum range. To use the chart, determine the distance to be flown and altitude required by the terrain to be covered; then select the RPM and IAS (choice of three at each altitude shown on the chart) best suited to the particular flight. RPM is, of course, governed by the propeller control setting; IAS, by the throttle setting. Above 3500 feet, full throttle will probably be required to obtain desired IAS when using either 1900 or 2180 RPM. Inasmuch as the estimated ranges are determined by fuel consumption when in flight, carefully follow the leaning procedure outlined on the chart. If maximum range is not required or a particular altitude necessary, the power and altitude resulting in the best true airspeed (TAS) may be chosen. During the flight, favorable or unfavorable wind conditions may make it desirable to change from one power to another. Since fuel consumption in gallons per hour (GPH) at each power is supplied, the remaining range at the new power can be estimated.

CAUTION

For maximum engine life, do not cruise at IAS exceeding chart value for corresponding altitude and RPM.

NOTE

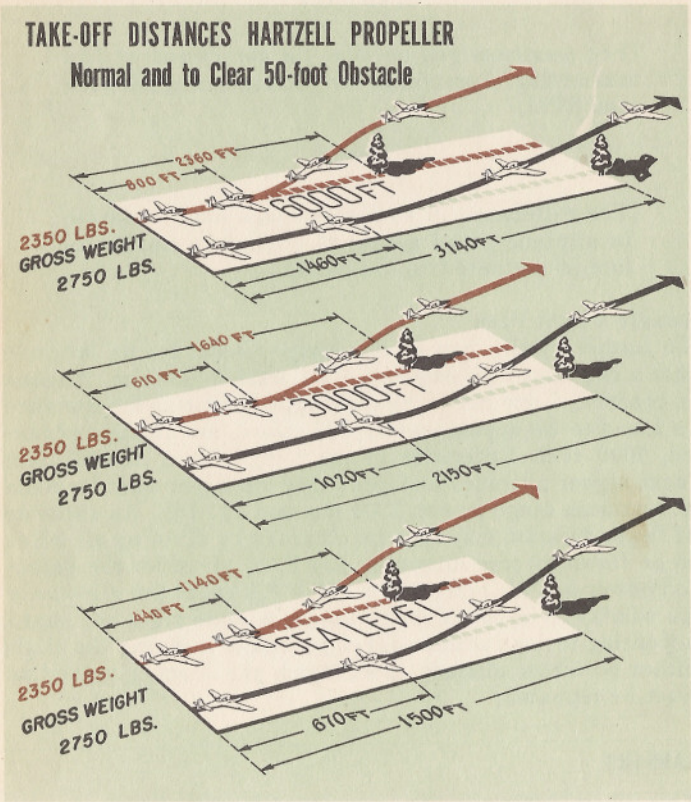
The difference in available range with variation in airplane gross weight is negligible and therefore is not noted on the chart.

Sample Flight Plan

To further clarify use of the Range Chart, let us suppose that a hop from Los Angeles, California to Tucson, Arizona is planned. From pertinent aeronautical charts, the distance is found to be approximately 475 miles, the altitude required, 5000 feet. Reference to the Range Chart at 6000 feet (next higher altitude) indicates that the flight must be made at maximum range power, 1700 rpm and 112 IAS. An estimate of flight duration may then be obtained by dividing air miles to be flown by true airspeed, 124 TAS, given for the selected power and altitude: 475 ÷ 124 = 3.8 hours (no allowance for wind). To secure desired range, mixture must be leaned according to instructions given on chart. If during the flight either power or altitude is changed, the leaning procedure must be repeated.

LANDING

This chart indicates the necessary landing distances for two weights at two altitudes, including both ground roll and obstacle clearance distances as similarly shown for take-off. Always consider airport altitude and temperature and make allowance for existing wind conditions when estimating required runway length. Chart values are computed at standard temperatures with no wind.



VARIABLE CONDITIONS AFFECTING TAKE-OFF DISTANCES

TEMPERATURE – ADD 3% FOR EACH 10°F ABOVE 60°F AT SEA LEVEL, 4% FOR EACH 10°F ABOVE 50°F AT 3000 FT. AND 5% FOR EACH 10°F ABOVE 40°F AT 6000 FT.

RUNWAY – ADD 5% FOR A SOFT SURFACE RUNWAY.

THE USE OF ½ FLAP FOR TAKE OFF WILL REDUCE GROUND RUN BY 20% AT SEA LEVEL TO 10% AT 6000 FT. SEE CHART, PAGE 11 OF C.A.A. LIMITATIONS MANUAL.

AIRSPEED AT 50 FT. OBSTACLE: 75 IAS FOR 2350 LBS., 81 IAS FOR 2750 LBS.

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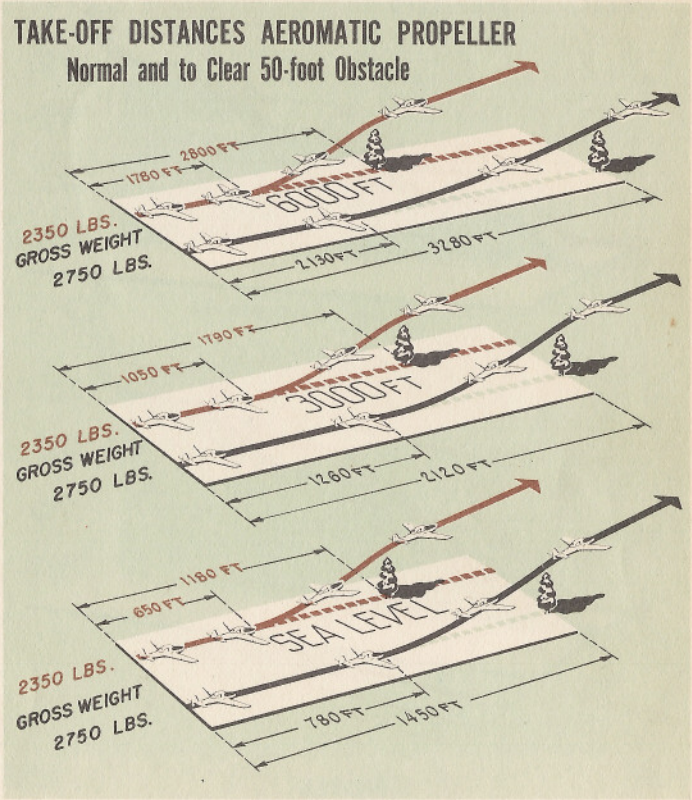

VARIABLE CONDITIONS AFFECTING TAKE-OFF DISTANCES

TEMPERATURE – ADD 3% FOR EACH 10° F ABOVE 60° F AT SEA LEVEL, 4% FOR EACH 10° F ABOVE 50° F AT 3000 FT. AND 5% FOR EACH 10° F ABOVE 40° F AT 6000 FT.

RUNWAY – ADD 5% FOR A SOFT SURFACE RUNWAY.

THE USE OF $\frac{1}{2}$ FLAP FOR TAKE OFF WILL REDUCE GROUND RUN BY 20% AT SEA LEVEL TO 10% AT 6000 FT. SEE CHART, PAGE 13 OF C.A.A. LIMITATIONS MANUAL.

AIRSPEED AT 50 FT. OBSTACLE: 75 IAS FOR 2350 LBS., 81 IAS FOR 2750 LBS.

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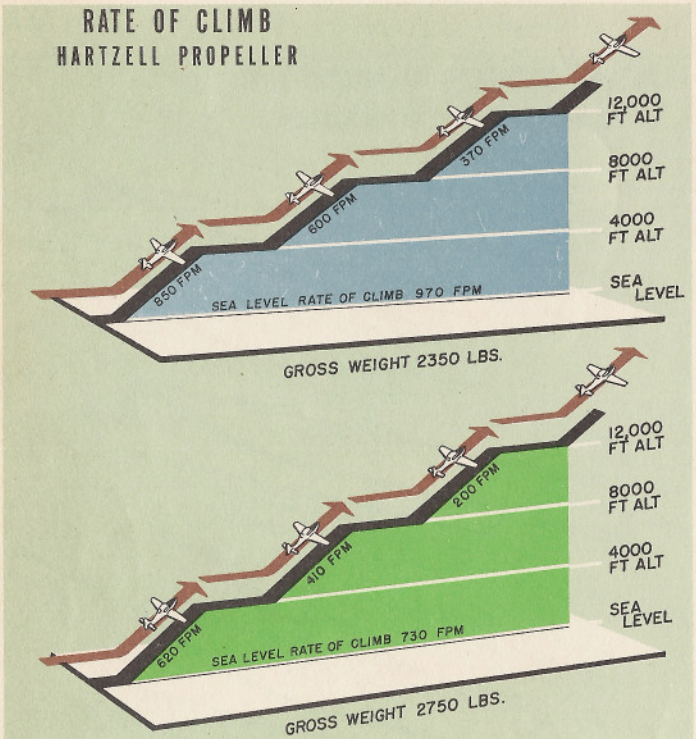
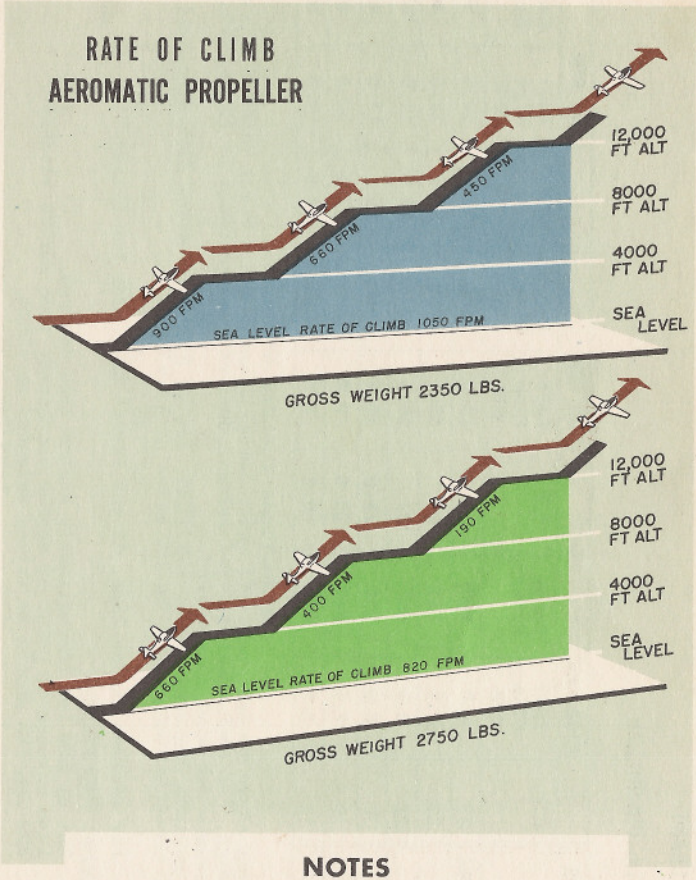


NOTES

Use full throttle. Do not exceed 2300 RPM.
Best climbing speed is 95 MPH IAS.
Rates of climb given are averages between altitudes indicated.
Subtract 30 FPM from rate of climb for each 10°F above standard temperature (60°F at sea level, 45°F at 4000 Ft, 30°F at 8000 Ft, and 15°F at 12,000 Ft).



NOTES

Use full throttle. Do not exceed 2300 RPM.

Best climbing speed is 95 MPH IAS.

Rates of climb given are averages between altitudes indicated.

Subtract 30 FPM from rate of climb for each 10°F above standard temperature (60°F at sea level, 45°F at 4000 Ft, 30°F at 8000 Ft, and 15°F at 12,000 Ft).

RANGE CHART

HARTZELL PROPELLER

ALTITUDE FEET	1700 RPM			1900 RPM			2180 RPM		
	M.P.	Fuel Flow GPH	Range Miles	M.P.	Fuel Flow GPH	Range Miles	M.P.	Fuel Flow GPH	Range Miles
SEA LEVEL	22	8.0	510	23	10.0	450	25	12.5	395
2000'	22	8.0	515	23	10.0	450	24.5	12.5	395
4000'	21	8.0	515	22	10.5	440	23.5	12.0	405
6000'	20	8.0	510	21.5	10.0	455	23	11.5	420
8000'	19.5	7.5	510	20.5	9.0	470	21.5	10.5	440
10000'	18	7.5	490	18.5	8.5	475	19.5	9.5	450

INSTRUCTIONS FOR USE OF CHART

1. Ranges shown include take-off and climb allowances and a 5-gal reserve after landing. For each addit'l 5-gal reserve desired, reduce range by 75 mi. Make allowance for wind as required.
2. For maximum cruising speed, 155 TIAS, fly at 3500 feet using 2225 RPM and full throttle. Range will be 380 miles at 13.5 GPH.

CAUTION

For maximum engine life, do not exceed 2225 RPM for cruise.

3. LEANING PROCEDURES
   a. Set up RPM (or IAS) slightly higher than desired.
   b. Lean mixture to point of engine roughness; then enrich slightly.
   c. RPM and IAS should be values selected on chart.

WARNING

If mixture is not leaned properly, ranges may decrease considerably, or engine may become overheated with subsequent reduction of life.

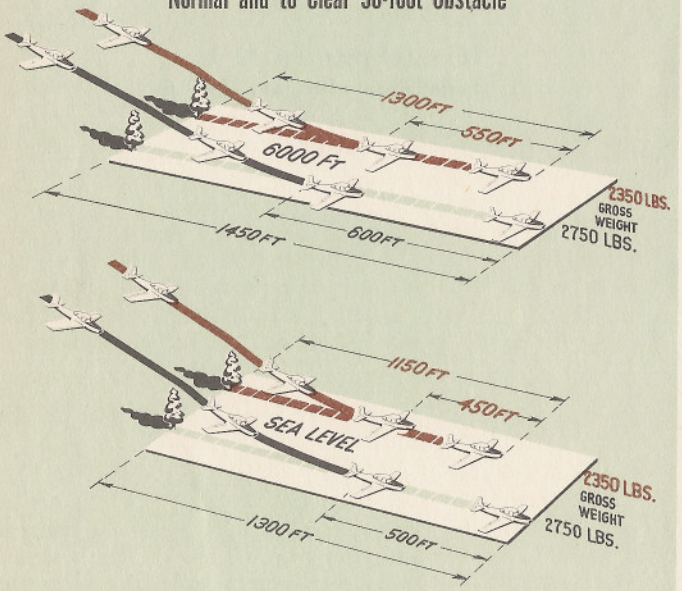
RANGE CHART

KOPPERS (AEROMATIC) PROPELLER

This information to be
furnished when available.

LANDING DISTANCES

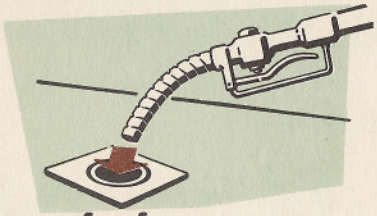
Hartzell Propeller
Normal and to Clear 50-foot Obstacle



VARIABLE CONDITIONS AFFECTING LANDING DISTANCES

TEMPERATURE–ADD 2% FOR EACH 10°F ABOVE 60°F AT SEA LEVEL, 40°F AT 6000 FT.

FLAPS AND BRAKES–DISTANCES SHOWN ARE FOR FULL FLAP LANDINGS WITH NORMAL APPLICATION OF BRAKES.



Servicing

The following information pertains to the normal servicing and inspection requirements of the airplane. More complete maintenance instructions may be obtained through your Navion dealer. The dealer will also supply detailed instructions for periodic inspections, including the 100-hour check required by the Civil Aeronautics Administration.

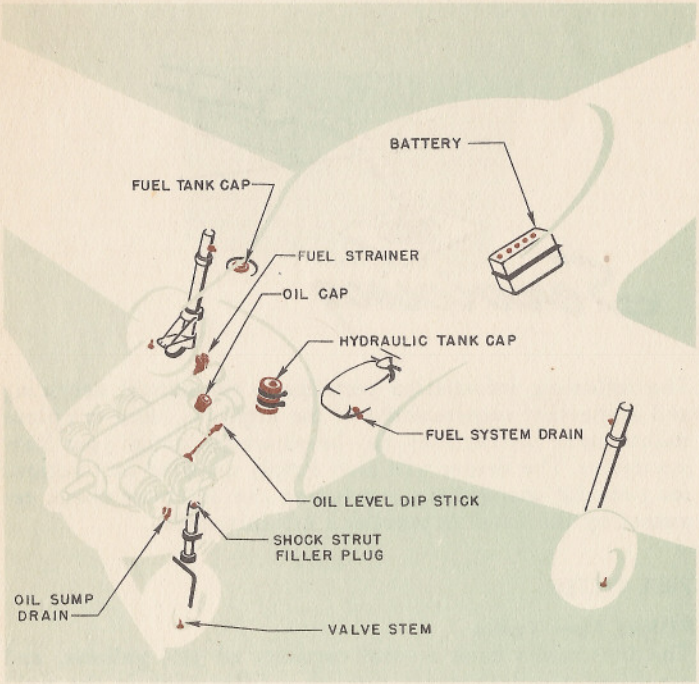
FUEL SYSTEM

Filling Fuel Tanks

The fuel tanks have a total capacity of 39½ gallons, and are filled simultaneously through a filler neck in the right wing panel. As the right tank may fill faster than the left, allow time for the tanks to level before replacing filler cap, thus making sure all tanks are completely filled. (Periodically drain water accumulation by means of petcock located on the accumulator tank and reached through an opening in the lower skin.) Use 80 octane aviation fuel (emergency alternate—01 octane aviation fuel).

NOTE

The airplane must be grounded (at nose gear or



FUEL- 80 OCTANE AVIATION FUEL (EMERGENCY ALTERNATE- 91 OCTANE AVIATION FUEL)

OIL- GRADE: SAE 40 OR 50
(GRADE DETERMINED BY OIL TEMPERATURE - SEE TEXT)

HYDRAULIC FLUID - SPEC. NO. AN-VV-O-366 OR AN3580
(SYSTEM AND SHOCK STRUTS)

BATTERY - DISTILLED WATER (HYDROMETER READING 1.275-1.300)

TIRE PRESSURE - MAIN, 25 PSI; NOSE, 30 PSI

SERVICING POINTS

other convenient point) during transmission of fuel.

Draining Fuel Tanks

A fitting in the bottom of the accumulator tank contains a combination fuel screen and tank drain. The fitting is accessible through an opening in the wing lower skin to the left of the center rib. To drain tanks, cut safety wire and remove drain plug and finger screen. The screen must be cleaned each time the tanks are drained. A petcock, adjacent to the drain plug, facilitates the periodically or daily, as required, draining of accumulated water from the fuel tanks.

Servicing Fuel Strainer

In addition to the strainer provided in the accumulator tank, Navions are equipped with strainer mounted on the right rear side of the nosewheel well. This strainer should be inspected regularly for accumulation of water and sediment. Service the strainer periodically by draining a small amount of fuel from the self-locking drain cock on the bottom of the strainer bowl. To remove the strainer for periodic cleaning, cut lockwire on bolt at bottom of bowl and loosen bolt. Pull bail to side and remove bowl. Empty bowl and clean thoroughly with gasoline. Brush strainer screen as necessary to remove accumulated dirt. Reinstall bowl, making sure that gaskets at head and base are in place; then tighten bolt and install lockwire.

CAUTION

The strainer bowl being glass, excessive tightening of bolt may crack glass.

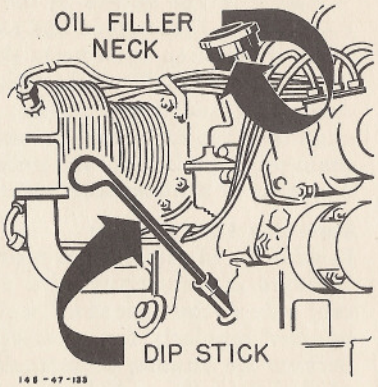
Another screen strainer is located just forward of the auxiliary electric fuel pump and pressure relief valve in lower R/H compartment aft of firewall gill opening. This screen

strainer should be removed and cleaned at every 25 hour inspection. To clean: cut safety wire; remove nut and screen; wash with gasoline; brush screen as necessary to remove accumulated dirt; reinstall and safety.

OIL SYSTEM

Checking Oil Level

Release the fasteners at left side of the engine cowling, and raise cowling. An oil level dip stick is located on the rear left side of the engine below the oil filler. Remove the dip stick, and check oil level against reference lines on stick. Add oil to the full mark.



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Adding Oil

Add aviation oil through oil filler located on the rear left side of the engine. Selection of the grade of aviation oil is based on average oil temperature as follows:

OIL GRADE	OIL OPERATING TEMP.
SAE 40	Below 120°F.
SAE 50	Above 120°F.

Draining Oil System

The oil system should be drained every 25 hours. Drain the oil sump, located at the aft end of the engine, by means of a drain plug on the bottom of the sump. The drain is reached through an access door in the bottom of the engine cowl. To complete draining of the system, oil remaining in the oil cooler must also be drained. Secure a two quart container, remove the plug from the lower inboard end of the cooler,

and drain the oil into the container. After draining the cooler, replace and lockwire the plug.

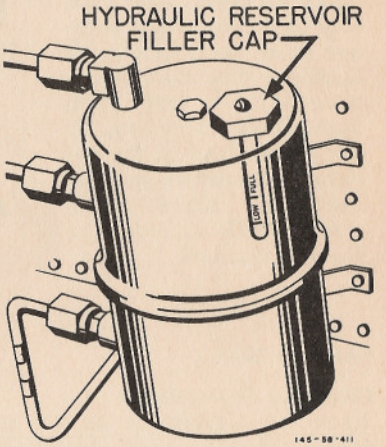
Filling Oil System

Fill the system through filler at rear left side of engine. Check oil level on dip stick, and if level is below full mark, add oil as necessary. After filling system, run up engine and again check level, adding oil as required to bring level to the full mark. The system capacity is approximately 10½ quarts.

HYDRAULIC SYSTEM

Checking Hydraulic Fluid Level

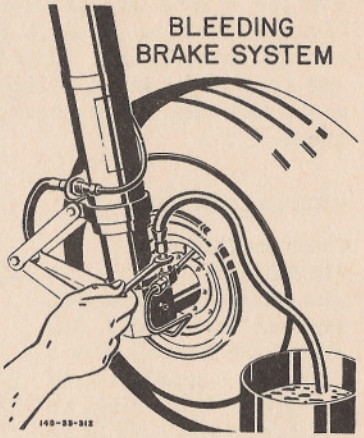
The hydraulic reservoir, mounted on forward left side of the firewall, has a capacity of approximately one quart. Raise engine cowling, remove dip stick attached to filler cap, and check fluid level against reference marks on stick. If fluid is below required level, add fluid (Specification No. AN-VV-O-366 or AN-O-366) through dip stick opening.



Bleeding Brake System

Failure of the brakes to hold may be an indication of air in the system. To eliminate the air, bleed each brake as follows: Remove cap screw from bleeder plug and attach bleeder hose. Place free end of bleeder hose in partially filled can of hydraulic fluid so that end of hose is covered. Apply maximum brake pressure; then loosen the bleeder

plug and allow fluid to run out until free of air bubbles. It may be necessary to repeat this procedure to eliminate all of the air. If so, tighten bleeder plug before releasing and reapplying brake pressure. After bleeding, tighten bleeder plug, remove hose, and replace cap screw. Then bleed line at the hose connection located in the wheel well. Loosen nut on line at the hose connection and apply brake pressure. Crack fitting loose for slight seepage of oil until free of air bubbles; then tighten nut and release brake pressure. During bleeding, do not allow fluid in the hydraulic reservoir to drop below the brake supply outlet. Refill reservoir as fluid is drained.



LANDING GEAR

Checking Shock Struts

When the airplane is loaded for flight, approximately 1½ inches of the piston should be showing on each landing gear shock strut. Rock the airplane two or three times to be sure the struts will not stick. To make sure the nose gear strut is properly inflated, raise the tail of the airplane from beneath the rear section of the fuselage; the strut should remain one inch from bottoming. Instructions for filling and inflating the shock struts are provided on a decal attached to each landing gear assembly.

Checking Tires
Main wheel tire pressure should be maintained at 25 psi, and nose wheel tire pressure at 30 psi.

BATTERY

The battery is located on the left side of the baggage compartment and should be checked at least every 10 hours. However, in warm climates it is advisable to check it daily. Remove battery cover, test water level, and take hydrometer reading. If hydrometer reading is less than 1.240, the battery must be recharged. When battery removal is required, disconnect wires and remove complete battery box, to prevent possible damage to airplane finish.

LUBRICATION

General
Careful and thorough lubrication of the Navion will protect the airplane and ensure prolonged satisfactory service. Specific lubrication points are illustrated in the Lubrication diagrams. Make sure the correct lubricants are used at the proper intervals. Apply lubricant sparingly; then wipe off excess grease. (The abrasive qualities of dirt and grit, which collect on oily surfaces, are detrimental to bearing surfaces). While lubricating, inspect the various parts closely and test them for looseness and general wear. If the airplane is being operated in extremely dusty conditions, clean and lubricate the parts more frequently.

Bearing Surface Lubrication
Excessive lubrication of bearing surfaces will attract dirt and grit. Therefore, bearing surfaces should be inspected to make sure only a thin film of oil is remaining after lubrication.

Shielded and Sealed Bearing Lubrication
Double shielded or sealed bearings are installed in all sur-

face control pulleys, aileron bellcranks, and in aileron, rudder, and elevator hinge fittings, and do not require lubrication at normal check periods. They are prelubricated by the manufacturer.

Engine Accessory Lubrication
All engine accessories have prepacked bearings which do not require repacking until the overhaul period.

Points That Require No Lubrication
Oilite bearings and control cables, or other lightly loaded slides need not be lubricated unless protection against corrosion is necessary.

Hartzell Propeller Lubrication
Every 50 hours, add light, tacky water repellent grease (Hartzell propeller lubricant or AN-G-5) as necessary.

CAUTION

Do not service propeller with a substitute grease and make sure propeller is not overlubricated.

Aeromatic Propeller Lubrication

Every 50 hours add lubricant (Aeromatic Lubricant 7F) as necessary to fill hub.

CLEANING

Cleaning Windshield and Cabin Windows
Flush plexiglas with clear water; then wash with an aluminum cleaner (either a neutral detergent or a silicate type alkaline cleaner) and water solution. Go over surface with bare hand to detect and remove dirt before it scratches the plastic surface. Rinse with clear water and then dry, preferably with a clean, damp chamois. However, a clean, soft cloth may be used for drying if care is taken not to rub the plastic after it is dry. Remove oil or grease by rubbing

lightly with a cloth wet with kerosene or naphtha.

CAUTION

Do not use acetone, benzene, carbon tetrachloride, gasoline, or window cleaning sprays, as these liquids may soften the plastic and cause it to crack.

After windshield and windows are dry and free of dirt, wax them with a good grade of commercial wax to prevent scratching and cracking. Apply the wax in a thin, even coat and bring to a high polish with a clean, soft, dry cloth.

Cleaning Airplane Exterior

Close cowling and canopy securely. Apply mild auto cleaner and water solution to all painted surfaces; then rinse with clean, fresh water. To remove stains and grease spots, use cleaning solvent or kerosene. Whenever painted surfaces become dull, brighten with a good grade of polish. Wax fuselage and wing surfaces with a self-polishing liquid wax.

Cleaning Upholstery

Clean the upholstery frequently with a whisk broom, clothes brush, or vacuum cleaner. Remove grease and oil stains by rubbing with a clean cloth wet with dry cleaning solvent (Federal Specification No. P-S-661). Use the solvent sparingly; never pour directly on the spot. Rub with a circular motion, starting outside the spot and working toward its center. Use a clean portion of the cloth after every few strokes. Do not use soap and water on upholstery. Doing so will destroy the flame resistant qualities of the material. Dry cleaning solvent does not affect the flame resistant treatment.

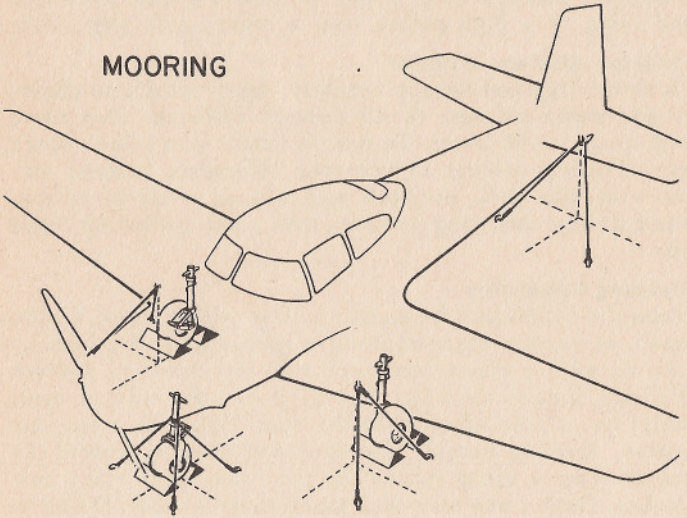
MOORING

A combination mooring and jacking fitting is installed in

each wing panel forward of the landing gear strut. The airplane is normally moored by attaching two lines from each fitting to ground stakes. It is tied down for emergency mooring as shown in the Mooring illustration.

CAUTION

When strong or gusty wind conditions are existent or forecast, park into wind if possible and always secure tail when mooring airplane.



CARBURETOR AIR STRAIGHTENING GRID

A grid is installed between the air mixing chamber and the carburetor. The grid straightens air flow through the carburetor to provide best carburetor performance.

CAUTION

To preclude danger of icing of the grid, the carburetor air filter must always be in place.

COLD WEATHER OPERATION

Propeller

When the airplane is operated in sub-zero weather, it is advisable to start and stop the engine with the propeller control pulled out in the full high pitch position on those airplanes equipped with Hartzell propellers. Stopping in high pitch retracts the propeller actuating cylinder and prevents the possibility of oil congealing in the cylinder at low temperatures. After starting in high pitch, wait until oil pressure reaches 40-50 psi and oil temperature indicates a definite rise before moving the propeller control to the low pitch position.

Brakes

When outside air temperatures are extremely low, do not set the brakes for parking. Snow or slush on warm brakes will melt and subsequently freeze.

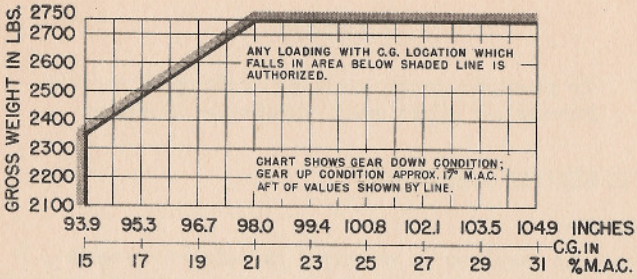
LOADING-GROSS WEIGHT AND C.G. LIMITATIONS

Normal Category

The maximum permissible loading of the airplane for given C.G. locations is shown in the following chart.

Utility Category

Maximum Permissible Gross Weight: 2350 lbs.
Forward C.G. Limit: 16% gear up; 15% gear down.
Aft C.G. Limit: 32% gear up; 31% gear down.



STORAGE

If the airplane is to remain idle for a period of two to seven days, it should be given the regular daily inspection and engine ground check at least every other day. On alternate days during this period, the propeller should be pulled through four revolutions. Information regarding temporary or extended storage instructions may be obtained through your Navion dealer.

DAILY INSPECTION

Before or after the day's flying, a daily inspection should be accomplished to see if any obvious defects have developed as a result of previous flight or during storage. This inspection includes the items checked during preflight, but is more comprehensive and detailed. Loose bolts and nuts, missing cotter pins, dirt accumulation, and fuel or oil leaks are typical defects that should be corrected before the airplane is flown. Service the airplane with fuel and oil; then proceed as follows:

Power Plant

1. Check engine installation for security of mounting, wiring hose connections, controls, accessories, and baffles.

2. Check fuel, oil, and hydraulic lines and fittings for leaks.
3. Inspect fuel strainer for water and sediment. Drain if necessary. (If metal bowl strainer is installed, drain daily as visual inspection is not possible).
4. Check engine proper for oil leakage.
5. Add hydraulic fluid if necessary.

Landing Gear

1. Check tires for cuts and bruises.
2. Check tires and struts for proper inflation.
3. Wipe strut pistons clean if dirt has accumulated.
4. Make sure that brake lines are secure. See that no leaks are evident.
5. Check wheel retainer nut cotter pins for security.
6. Check side braces and torque links for looseness or missing bolts or nuts.

Wings and Wheel Wells

1. Check wheel wells for security of hydraulic lines, mechanical linkage, and wiring.
2. Check for fuel or hydraulic leaks.
3. Check flap and aileron hinge bolts for looseness, or looseness, or missing cotter pins.
4. Check wing tips for loose or missing screws.
5. See that pitot tube opening is clear.

Fuselage and Empennage

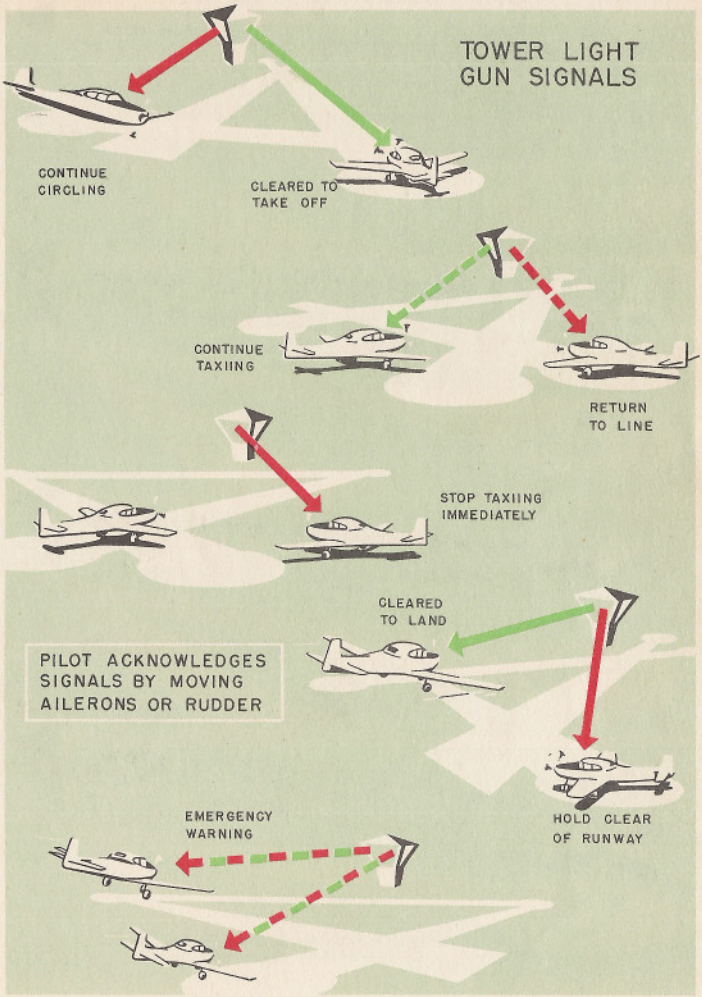
1. Check rudder, elevator, and trim tab hinge points for loose bolts or missing cotter pins.
2. Check trim tab cable attachments for security.

3. Check rudder cable attachments for security and safety.
4. Check stabilizer and control surface tips for loose or missing screws.
5. Check static plate openings to see that they are clear.
6. Check radio antenna for security of attachment and general condition.

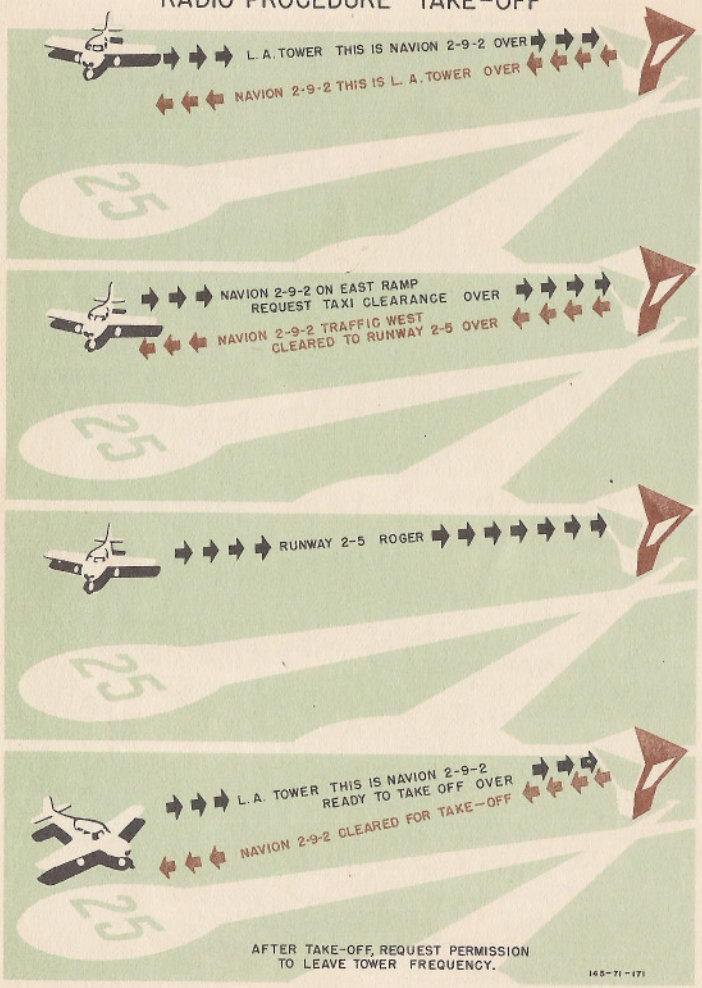
Cabin

1. Check windshield and window panels for obvious looseness or damage.
2. Check operation of canopy opening mechanism and lock.
3. Check hydraulic hand-pump operation by slightly lowering, then raising flaps.
4. Check specific gravity of battery, and add water if necessary (at least once a week or every 10 hours).

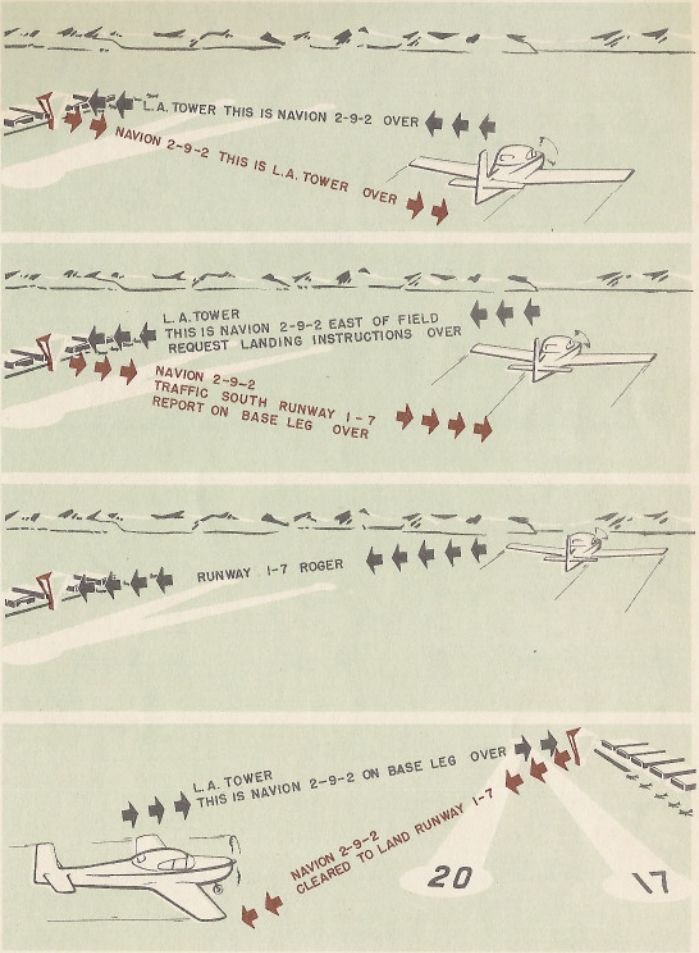
Traffic Aids



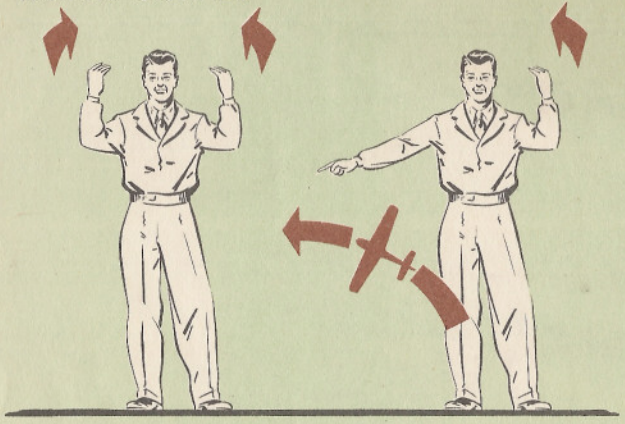
RADIO PROCEDURE TAKE-OFF



RADIO PROCEDURE —LANDING

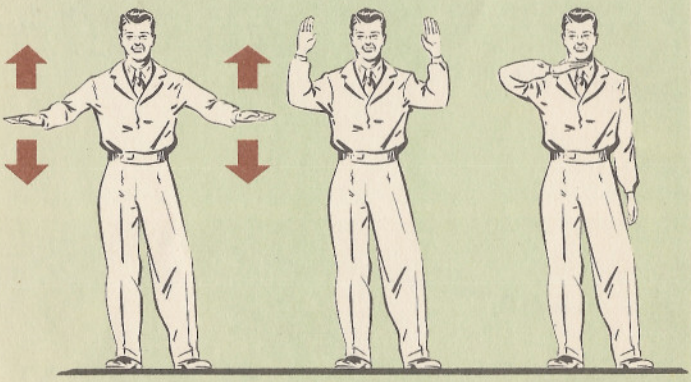


TAXIING SIGNALS



COME AHEAD

TURN (LEFT)



SLOW DOWN

STOP

CUT ENGINE