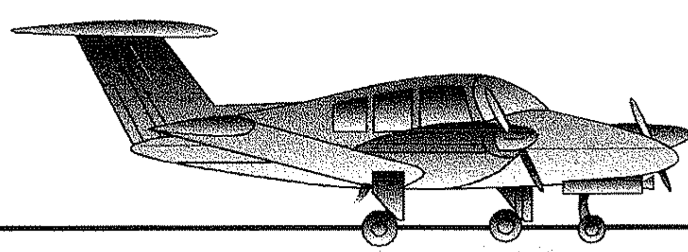
Basic Aviation Safety



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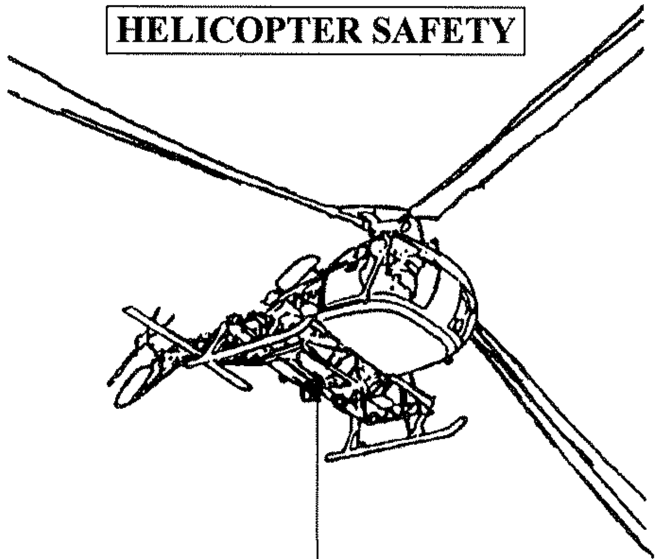
BASIC AVIATION SAFETY

CONTENTS

HELICOPTER SAFETY



GENERAL SAFETY PRECAUTIONS

- Operations will comply with the applicable general safety rules for operations and practices prescribed in the Agency manual and Federal, State and OSHA standards.

- Upon arrival and prior to flight, check pilot and aircraft data cards.

- The pilot is responsible for the safety of the aircraft and passengers at all times.

- Request a briefing from the pilot concerning safety features of the aircraft.

    - Location of first-aid kit and survival equipment.
    - Operation and location of fire extinguisher.
    - Emergency electrical and fuel shut-off.
    - Operation of doors and seat belts.
    - No smoking.
    - Emergency procedures.

- Brief the pilot prior to mission, on intent, known hazards, and other pertinent data.

- A flight plan is required for all flights.

- Permit only necessary flights, with authorized passengers and necessary cargo.

- Report aircraft mishaps as soon as possible.

SAFETY AROUND HELICOPTERS

- Approach and depart helicopter from the side or front in a crouching position, in view of the pilot.

- Approach and depart on the down slope side (to avoid main rotor).

- Approach and depart in pilot's view (never toward the tail rotor).

- Use a chin strap or carry hard hat when working around main rotor.

- Carry tools horizontally, below waist level (never upright or over shoulder).

- Fasten seat belt upon entering helicopter and leave buckled until pilot signals to exit. Fasten seat belt behind you before leaving.

- Use the door latches as instructed; be cautious around moving parts or plexiglass.

- Keep landing areas clear of loose articles that may "fly" in the rotor downwash.

- Do not throw items from the helicopter.

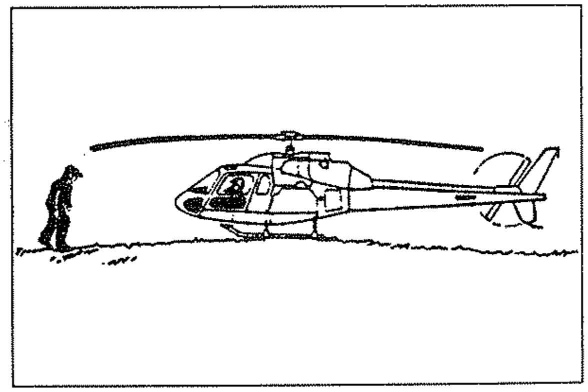
- Provide wind indicators for take-off and landings; back to the wind, arms extended in front of body.

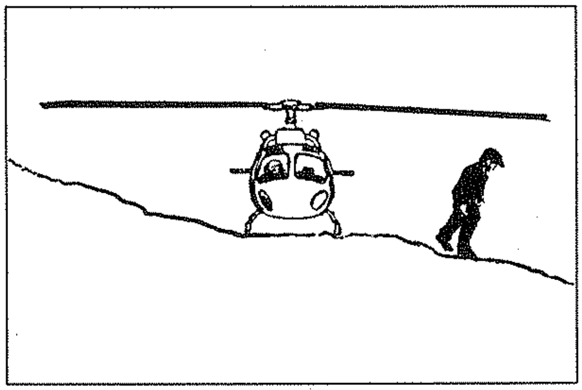
- Eye and hearing protection should be worn when working close to helicopters.

- Secure all items on the helicopter. Provide the pilot with accurate weights and types of baggage or cargo being transported.

SAFETY AROUND HELICOPTERS

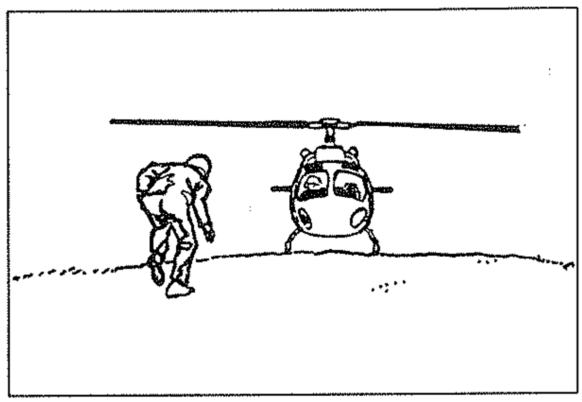
Approach and depart helicopter from the side or front in a crouching position, in view of the pilot.

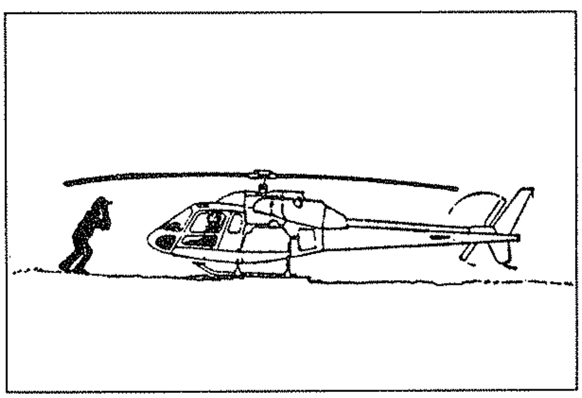




Approach and depart on the down slope side (to avoid main rotor).

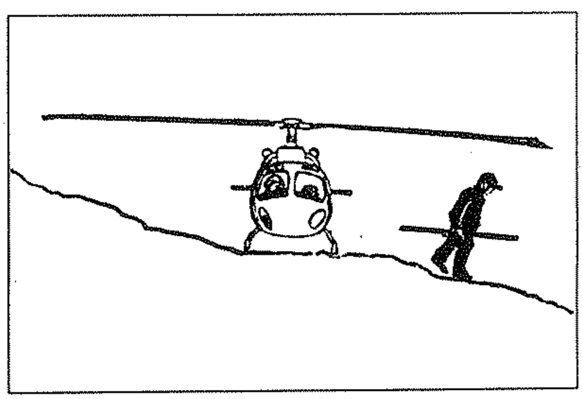
Approach and depart in pilot's field of vision (never towards the tail rotor).





Use a chin strap or secure hard hat when working around main rotor.

Carry tools horizontally, below waist level (never upright or over shoulder).



SAFETY AROUND HELICOPTERS

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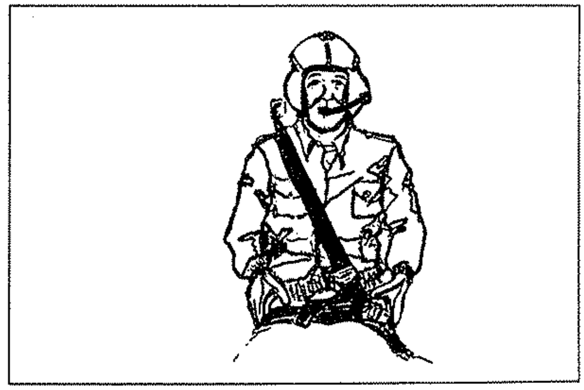
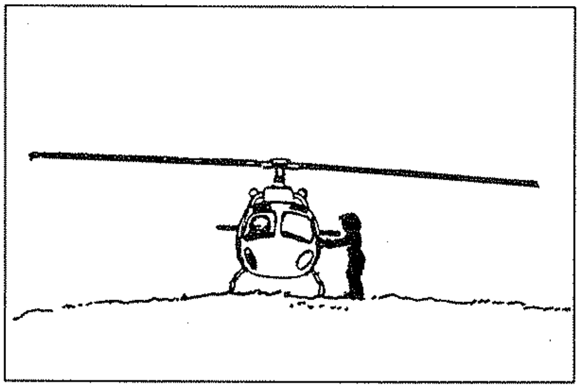
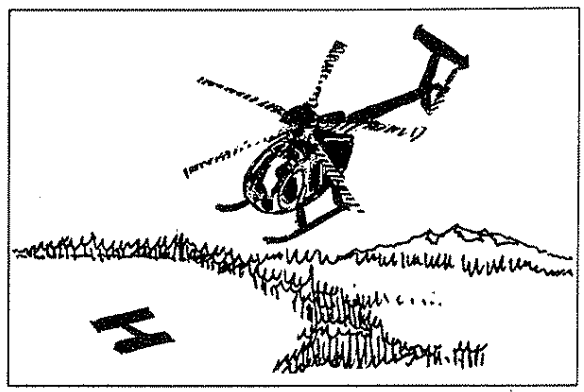
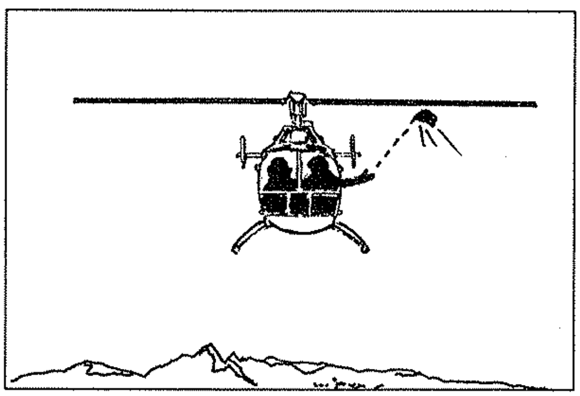




Use the door latches as instructed; caution should be exercised around moving parts or plexiglass.

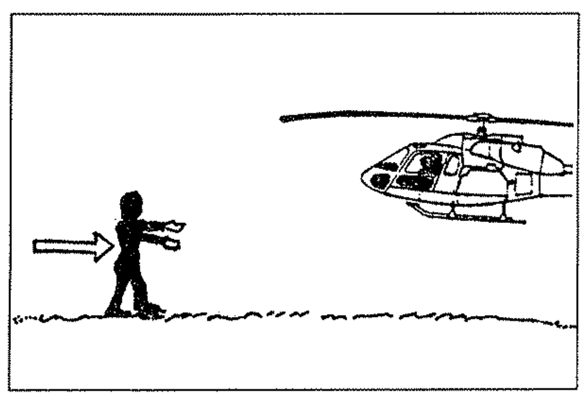
Keep landing areas clear of loose articles that may "fly" in the rotor downwash.





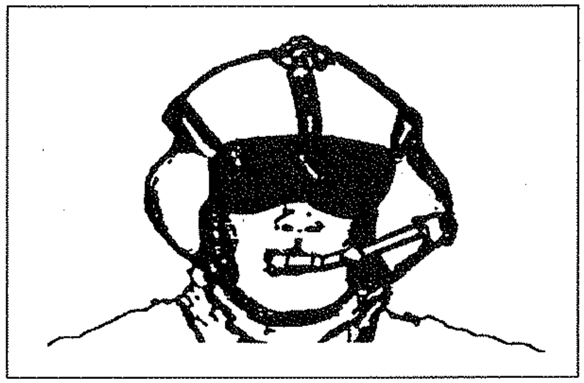
Do not throw items from the helicopter.

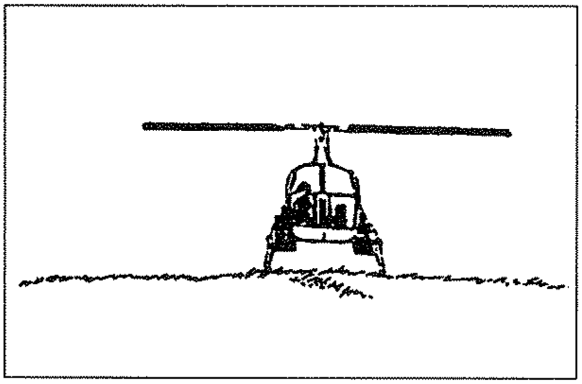
Provide wind indicators for take-off and landings, back to the wind, arms extended in front of body.



SAFETY AROUND HELICOPTERS

Eye and hearing protection should be worn when working in close proximity to helicopters.





Secure items internally and externally on the helicopter. Provide the pilot with accurate weights and types of baggage or cargo to be secured.

IN-FLIGHT EMERGENCY

- Pilot declares emergency.
- Seat belts snug.
- Protective clothing in use.
- No smoking.
- Keep away from flight controls.
- Secure loose gear.
- Note emergency exits.
- Wait until all motion ceases before exiting

AERIAL HAZARDS

- Use a hazard map of known hazards.
- Look for hazards and alert the pilot.
- Stay above 500 feet AGL whenever possible.
- Do not fly during poor visibility. (half-mile minimum visibility)
- Do a high level reconnaissance before descending below 500 feet AGL.

PRECAUTIONS DURING REFUELING

- Helicopter engine must be shut off and rotor blades stopped. (unless helicopter has enclosed refueling system).
- Helicopter and fuel containers must be bonded.
- No passengers onboard.
- Smoking and unauthorized personnel are prohibited within 50 feet.

SUMMARY

- Check approval of pilot and aircraft data cards.
- Pilot has final say - don't push.
- If in doubt, stop flight.
- Be alert for aerial hazards.
- Designate a manager and maintain control of operation.
- Report mishaps to local aviation manager.

HELICOPTER CAPABILITIES AND LIMITATIONS

AERODYNAMICS

Lift is accomplished by the rotation of two or more rotor blades, each having a cross section similar to that of an airplane wing. As this "wing" moves through the air, spinning on an engine-driven shaft, lift is generated.

The amount of lift generated by the rotor system is adjusted by changing the pitch or angle of attack, at which the blades bite into the air. *(Fig. 1)*

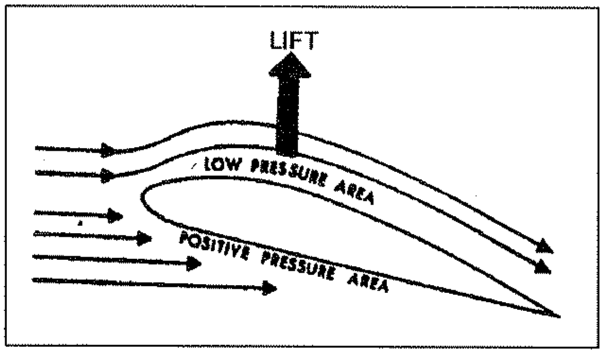


Fig. 1

If you extend your hand out the window of a speeding car and move the angle of your hand up from a horizontal position, you can feel the lift produced as the angle is increased. A rotor blade or wing works the same way.

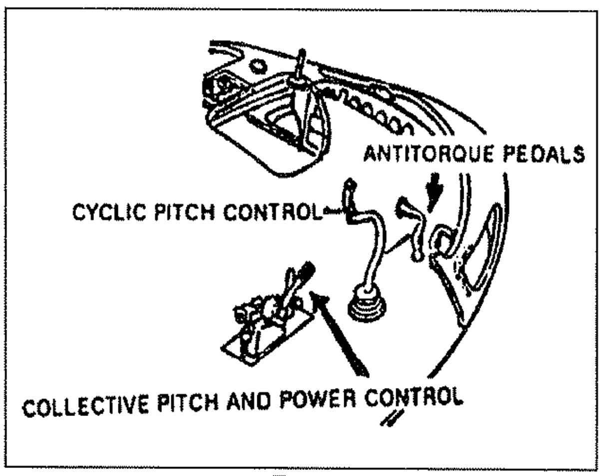


Fig. 2

The pilot controls the helicopter with four primary flight controls. *(Fig. 2)*

Power must be integrated into the system to compensate for drag and maintain constant rotor r.p.m. Pitch changes and power requirements to the rotor system are provided by a flight control called the **"collective"**. This refers to the collective, or mutual, effect of this control on each individual blade.

The **collective pitch control** lever is generally located to the left of the pilot and moves in a simple up and down motion. For turbine-engine helicopters, the collective lever is pulled up, and angle of attack is increased. A fuel governor provides more fuel to the engine which increases power. This maintains constant rotor r.p.m. and lift is generated.

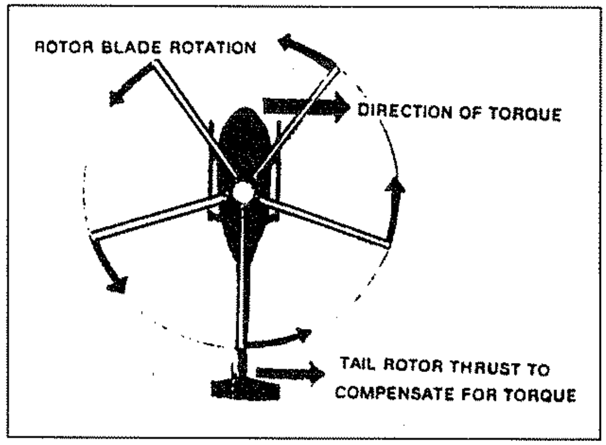


Fig. 3

The **two floor pedals**, connected to the tail rotor allow the pilot to vary the amount of thrust in the opposite direction to the main rotors rotation. *(Fig 3)*

Torque is the equal and opposite reaction to rotational motion of the main rotor blades. Anti-torque control is essential for helicopter flight because it prevents the helicopter from spinning out of control. On most helicopters this is accomplished by an anti-torque rotor, or tail rotor. Without an anti-torque rotor the helicopter would spin in the opposite direction of the main rotor system.

By maintaining tail rotor thrust equal to main rotor torque, the helicopter will hold a hover. While in a hover, the anti-torque pedals allow the pilot to change a heading to any direction. So what does all of this mean? In some situations, (out-of-ground effect hover, maximum performance, or certain wind conditions) the maximum thrust provided by the tail rotor is unable to counteract torque generated by the main rotor. An uncontrollable turn is the result. What started as a capability is now a limitation.

The fourth primary flight control is the **cyclic control stick**, or "**cylic**". The cyclic is controlled by the pilot's right hand. The purpose of the cyclic pitch control is to tilt the tip path-plane in the direction that horizontal movement is desired. The rotor disk tilts in the direction that pressure is applied to the cylic.

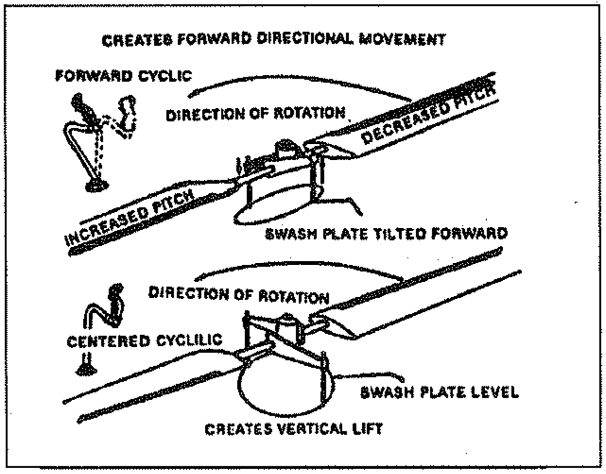


Fig. 4

The cyclic pitch control produces changes in pitch to each blade individually. (Fig. 4) If the pilot moves the cyclic forward, the pitch of each blade is increased as it sweeps toward the tail of the helicopter. As each blade swings forward, toward the nose of the aircraft pitch is flattened. The result is that each blade produces more lift as it swings to the rear than when it swings ahead. Lift-thrust force is produced in the rear pushing the aircraft ahead. This principle occurs whenever the cyclic is moved allowing the pilot lateral and roll control of the helicopter.

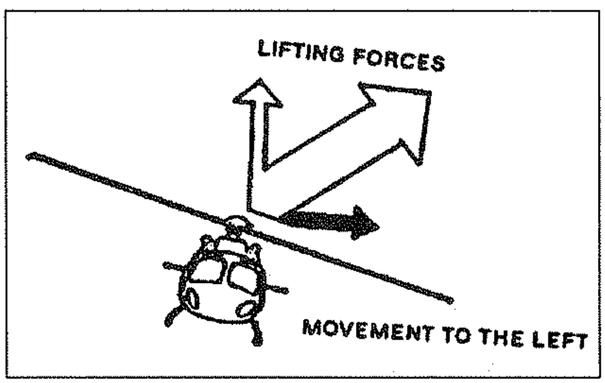


Fig. 5

To hover and move to the left, pitch is changed to each blade, producing more thrust as it swings to the left. (Fig.5) A sideward force is produced, pushing the helicopter in that direction.

To move to the right, the rotor blades are unbalanced and more thrust is produced over the right side of the helicopter. (Fig. 6)

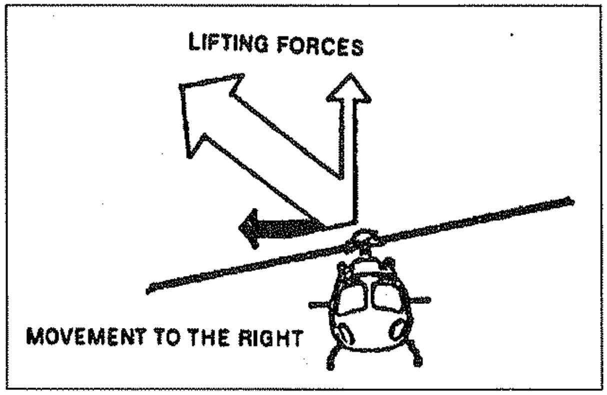


Fig. 6

HELICOPTER PERFORMANCE

GROUND EFFECT - is a condition of improved rotor system performance encountered when the helicopter is hovering near the ground. The apparent result is increased lift or decreased power requirements. As a helicopter user, this provides the capability to transport a heavier payload.

HOVER-IN-GROUND- EFFECT (HIGE) is achieved when the helicopter is hovering less than one-half the rotor diameter distance from the ground. In a hover, the rotor blades move large volumes of air from above the rotors down through the system. The ground interrupts the airflow under the helicopter, this reduces downward velocity of the air and produces an outward airflow pattern.

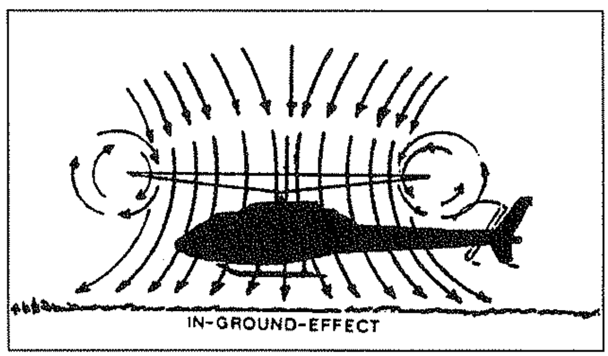


Fig. 7

Simplified, a cushion of air has been created between the ground and the helicopter, lift is increased and power requirements reduced. (Fig 7) Maximum ground effect is accomplished over smooth, level surfaces. Hovering over tall grass, rough terrain, or water dissipates this cushion and may reduce or eliminate ground effect.

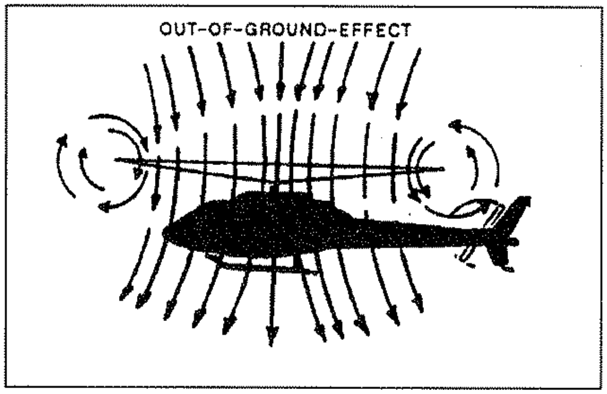


Fig. 8

HOVER-OUT-OFGROUND-EFFECT (HOGE) occurs when the helicopter exceeds about one-half the rotor diameter distance from the ground, and the cushion of air disintegrates. (Fig 8) To maintain a hover, the helicopter is now power dependent. This situation will occur when the terrain does not provide sufficient ground effect base, or when performing external load work. Maximum performance is required and payload may have to be reduced.

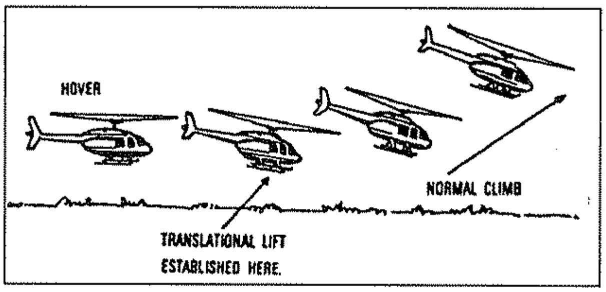


Fig. 9

We should understand the capabilities and limitations presented by ground effect when choosing a landing site.

When planning a helicopter project, the safety and efficiency of the operation will be enhanced by selecting landing areas that allow the pilot to approach into the wind and hover-in-ground-effect. Normal take-off and landings are initiated by bringing the helicopter up to a in-ground-effect hover and translating the aircraft into forward flight. (Figs. 9 & 12)

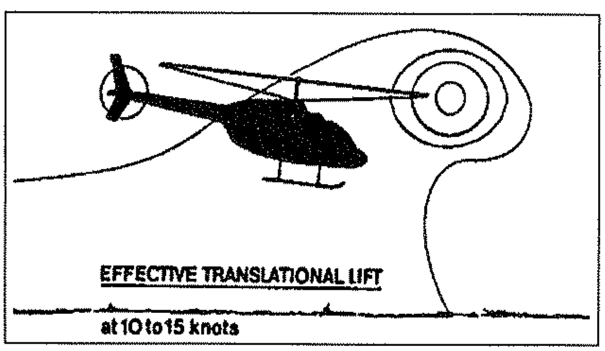


Fig. 10

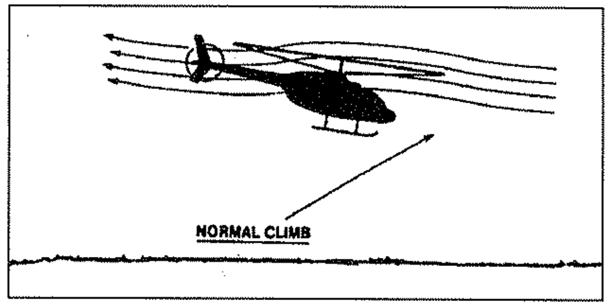


Fig. 11

Additional lift is gained as the helicopter moves from the turbulent air created from hovering, to undisturbed, "clean" air which moves through the rotor system as the helicopter increases airspeed.

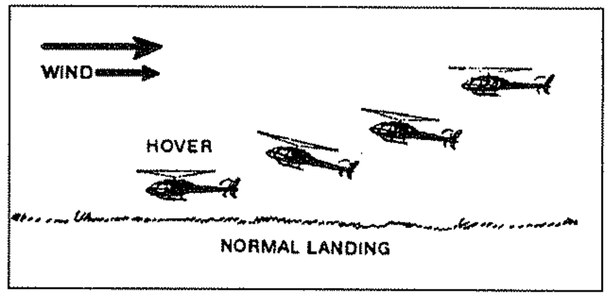


Fig. 12

Rotor system efficiency is increased when entering horizontal flight, reducing power requirements and increasing a safety margin. This is defined as translational lift and occurs when the helicopter approaches 15 to 18 m.p.h. indicated airspeed. (Fig. 10) Translational lift will also be produced when the helicopter is hovering with a 15 m.p.h. steady headwind. As you can see, a steady headwind can benefit the pilot.

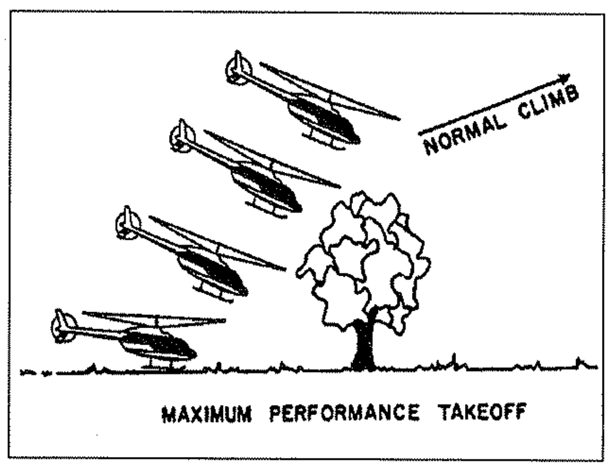


Fig. 13

On many occasions, a maximum performance take-off or landing must be accomplished. This occurs when the

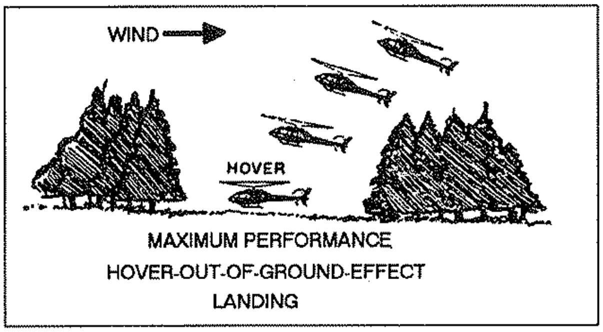


Fig. 14

helicopter hovers-out-of-ground-effect, before or after translational lift. (Figs. 13 & 14)

In this situation, the helicopter is totally power dependent and the margin of safety is significantly reduced. When possible, avoid confined areas, or large obstructions that require the pilot to use maximum power for extended periods.

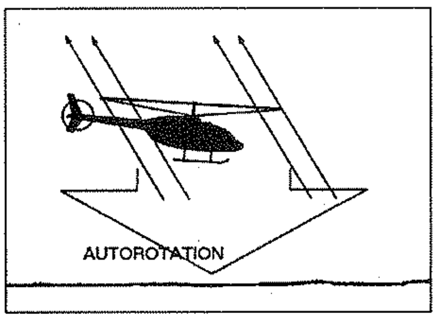


Fig.. 15

AUTOROTATION is a nonpowered flight condition in which the rotor system maintains flight r.p.m. by reversed airflow. (Fig. 15) It provides the pilot a means of safely landing the helicopter after an engine failure or other mechanical emergency.

Helicopters have a freewheeling unit in the transmission which automatically disengages the engine from the rotor system in the event of a failure. This allows the main rotor to rotate freely.

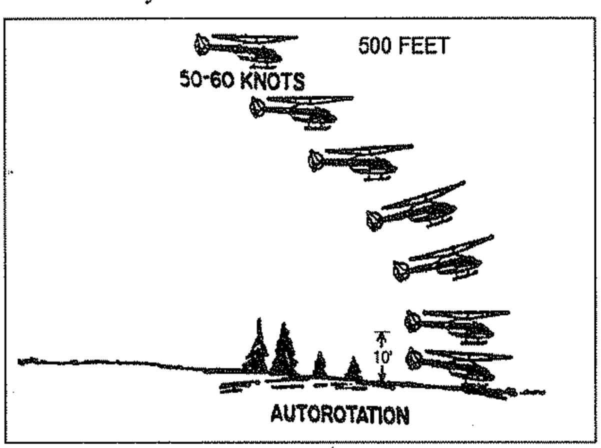


Fig. 16

When the helicopter is powered by the engine, airflow is downward through the rotors. During an autorotation airflow is upward, "windmilling" the rotor blades as the helicopter descends. (Fig. 15) The pilot maintains constant rotor r.p.m. by changing pitch to the blades as the aircraft continues descent. As the helicopter approaches a landing site, the pilot flares the aircraft by moving the cyclic back, and gently lifting the nose. This slows the forward airspeed and rate of descent.

Before touchdown, the helicopter is leveled and the pilot utilizes the stored-up blade inertia to cushion the helicopter on to the ground. The autorotation is complete. (Fig. 16)

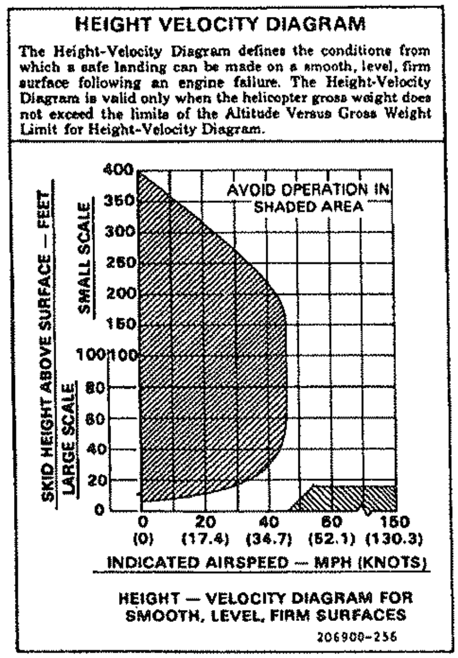


Fig. 17

In the flight manual for each helicopter type is a chart which provides necessary information to complete a safe autorotation. This is a height-velocitv curve, indicating the comparative combination of airspeed and altitude required to accomplish a safe autorotation (for most light helicopters, 350 to 450 feet above ground level at zero airspeed). (Fig 17) By flying low-level, or performing extended hovers, we are dramatically reducing our safety margin and limiting the pilot's options.

DENSITY ALTITUDE refers to a theoretical air density which exists under standard conditions at a given altitude. By definition, **density altitude is pressure altitude corrected for temperature and humidity**. It can have a profound effect on aircraft performance. Air, like other gases and liquids, is fluid. It flows and changes shape under pressure. Air is said to be "thin" at higher elevations. There are fewer air molecules per cubic foot at 10,000 feet than at sea level. At lower elevations, the rotor blade is cutting through more dense air, which provides additional lift and increased performance. There are **three factors that affect density altitude in varying degrees, atmospheric pressure, temperature, and to some degree, humidity.**

The lower the pressure at a given elevation, the less dense the air. Helicopter performance is decreased. To determine the pressure altitude at a given location, use the altitmeter in the helicopter. Have the pilot adjust the altimeter to 29.92 Hg, the standard sea level atmospheric pressure. (Fig. 18) The altimeter converts barometric pressure to pressure altitude. The most dramatic influence on density altitude is temperature. The same volume of air contained in one cubic foot, at a low temperature, will expand two or three times as temperature rises. (Fig. 19)

> ***Standard conditions at sea level are:*** *Atmospheric pressure-29. 92 in. of Hg (inches of mercury) at 59 degrees F. (15 Degrees C.) Atmospheric pressure decreases approximately 1 inch per 1000 foot increase in altitude. The average temperature decrease per 1, 000-foot-increase in altitude is 3.5 degrees F. (2 degrees C.)*

Fig. 18

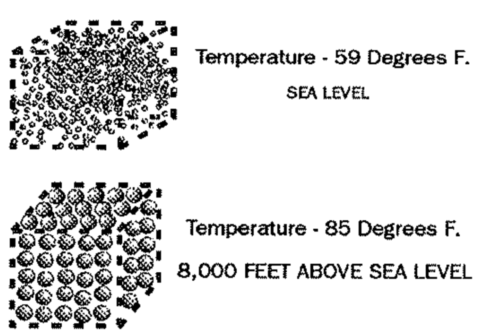


Fig. 19

There are fewer air molecules, because of expansion, in a given space so the air has become less dense. The rotor blades have less air to grab and performance is decreased. The same is true with an airplane wing. To compensate for loss of lift, power requirements must be increased, thus providing a limitation to the aircraft. It is important to note that high density altitudes may be present at low elevations on hot days. High moisture content will also increase density alititude, but to a minor degree. When planning a helicopter project, we can see the importance of starting early in the morning when temperatures are cool, and maximizing the performance of the aircraft.

WEIGHT AND BALANCE

All helicopters are designed for certain load limits and balance conditions. The pilot is responsible for seeing that weight and balance limitations are not exceeded before takeoff. We can help the pilot by providing accurate weights of passengers and cargo.

Three kinds of weight must be considered by the pilot; **empty weight, useful load, and gross weight**.

- **Empty weight** is the total weight of the helicopter including all fixed equipment, oil, hydraulic fluid, and coolant. This does not include fuel or the pilot.

- **Useful load (payload)** is the weight of the pilot, passengers, cargo, and fuel.

- **Gross weight** is the empty weight plus the useful load.

Maximum gross weight is the maximum weight that the helicopter can weigh and safely fly at sea level on a standard day. This is certificated by the Federal Aviation Administeration for each helicopter type. Although a helicopter is certified for a specified maximum gross weight, it will not safely perform with this load in all conditions. It may be required to "download", by removing some cargo, passengers, or less fuel in the helicopter. Such conditions would include high density altitude, takeoffs and landings in rough terrain, or confined areas. Of the three major factors influencing the performance of a helicopter (density altitude, wind, and gross weight), the pilot can control only the gross weight. The pilot can determine the gross weight by referring to the computed gross weight charts in the performance section of the flight manual.

The charts are computed for hover-in-ground effect (HIGE) (Fig. 20) and hover-out-of-ground effect (HOGE). (Fig. 21) If the outside air temperature (OA.T.) and pressure altitude is known, or at least estimated closely, the pilot plots them on the chart. The chart gives a computed gross weight calculated for H.I.G.E. or H.O.G.E. This is the computed gross weight that can be used for that specific temperature and altitude, for takeoffs and landings. Computing the gross weight can be an effective planning tool to transport cargo to various locations under particular conditions, and enhance the safety and efficiency of an operation. Bureaus and Services in the DOI, with wildland fire responsibility, utilize Departmental helicopter load calculations (OAS-67) prior to any flight. The form provides an allowable payload by utilizing computed gross weights, and affords a safety margin (Fig. 22).

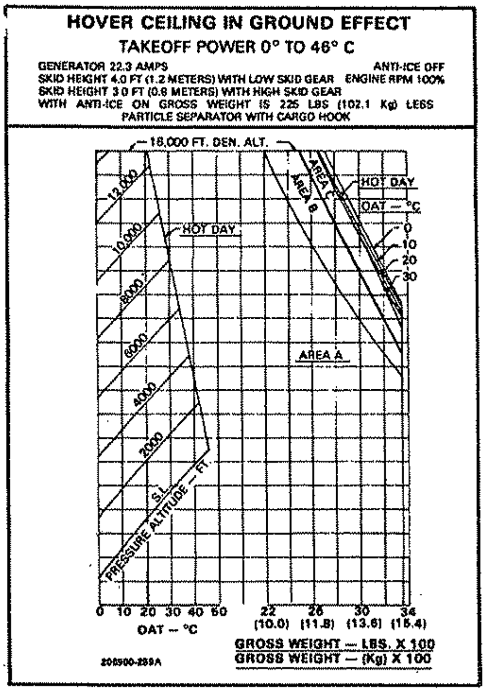


Fig. 20

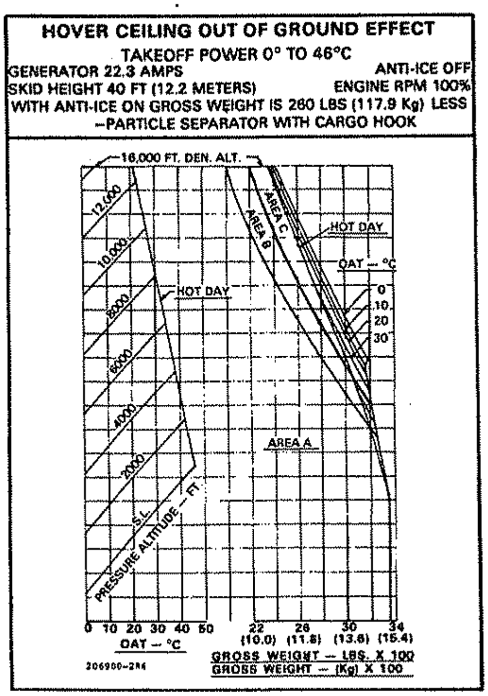
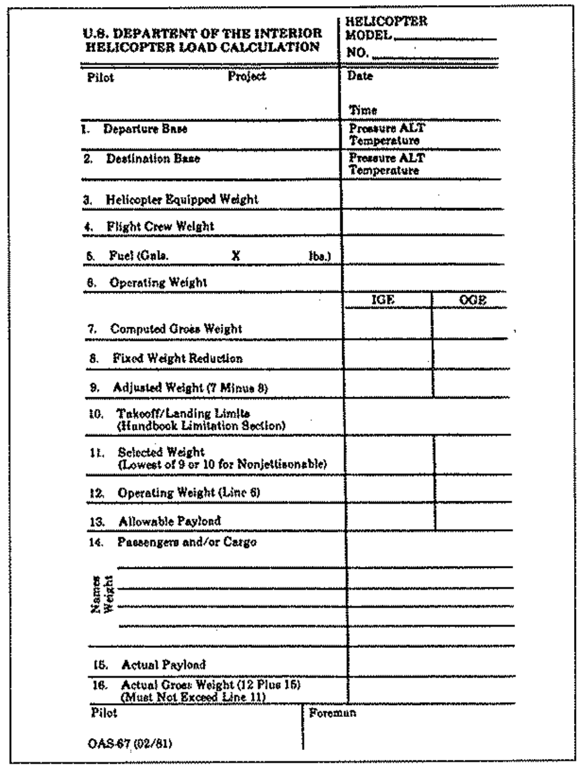


Fig. 21

In conjunction with determining the gross weight of the helicopter, the pilot must consider how the load is balanced within the center of gravity limitations of the aircraft.

Center of gravity (CG) is the point where the helicopter is in balance and most of the weight is concentrated. **Draw an imaginary line through the center of the rotor mast, from the top of the mast to the bottom of the helicopter. This would be the center of gravity.** *(Fig. 23)* Ideally, the helicopter should be in perfect balance. The fuselage will



U.S. DEPARTMENT OF THE INTERIOR
HELICOPTER LOAD CALCULATION

HELICOPTER MODEL ________
NO. ________

Pilot | Project | Date | Time

1. Departure Base | Pressure ALT / Temperature
2. Destination Base | Pressure ALT / Temperature
3. Helicopter Equipped Weight
4. Flight Crew Weight
5. Fuel (Gals. X lbs.)
6. Operating Weight

	IGE	OGE
7. Computed Gross Weight		
8. Fixed Weight Reduction		
9. Adjusted Weight (7 Minus 8)		
10. Takeoff/Landing Limits (Handbook Limitation Section)		
11. Selected Weight (Lowest of 9 or 10 for Nonjettisonable)		
12. Operating Weight (Line 6)		
13. Allowable Payload		

14. Passengers and/or Cargo

Names
Weight

15. Actual Payload
16. Actual Gross Weight (12 Plus 15) (Must Not Exceed Line 11)

Pilot | Foreman

OAS-67 (02/81)

Fig. 22

remain horizontal in hovering flight, with no cyclic pitch control required. **Center of gravity is located directly under the rotor mast, the helicopter hangs horizontal.**

If the center of gravity is too far behind the mast, the helicopter hangs with a nose up attitude. If the center of gravity it too far forward, the nose tilts down. *(Fig. 24)* **Out of balance loading makes control more difficult and decreases maneuverability.** Cyclic control is restricted opposite to CG location. Cargo should be loaded as close to the center of gravity as possible.

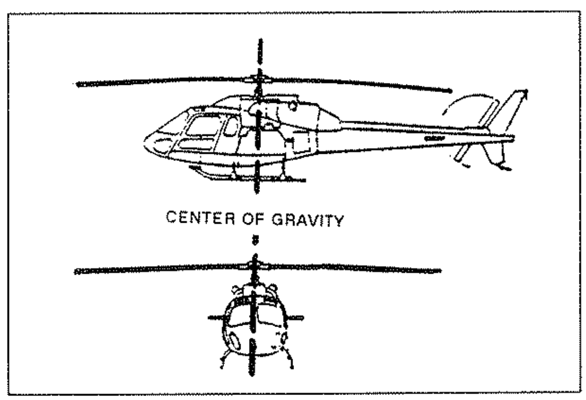


Fig. 23

When loading cargo laterally, or side to side, try to keep the weight evenly distributed. *(Fig. 25)* Let the pilot know what passengers or cargo are being loaded and where. **Cargo must be secured, inside the helicopter and in the external load baskets.**

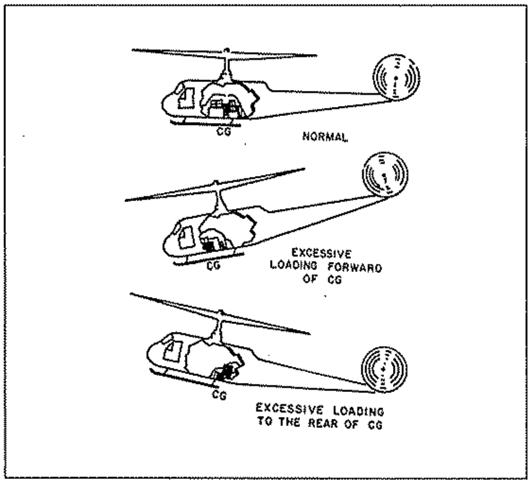


Fig. 24

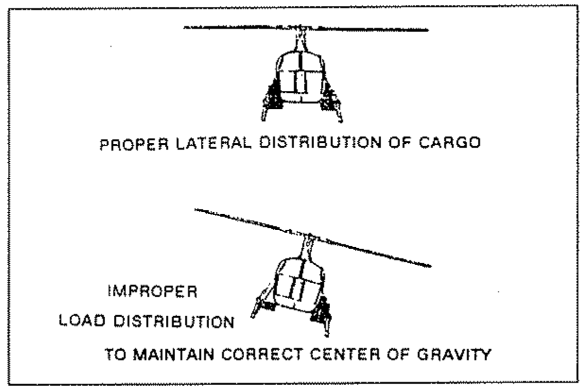


Fig. 25

The majority of human-error accidents are related to the fact that helicopters are flown in unusual and difficult situations where the margin for error is small and the penalty can be great. By understanding flight characteristics and knowing when a capability is changing to a limitation we will become better helicopter managers and active participants in aviation risk management.

<u>REYMOND'S MAINTENANCE LAWS OF MOTION</u>

- All pilots have money.
- If it isn't broken don't fix it.
- It is easier to grind more off than put some back.
- If you have time to do it again, you had time to do it properly the first time.
- It is easier to fix aircraft on the ground than in the air.
- If you screw around with it long enough, it'll break.
- When faced with an insurmountable task, read the instructions.
- Quality: You may purchase top-quality oats for your horse - or buy oats that have already been through another horse.
- You can find a helping hand on the end of each of your arms.
- It is not impossible to do it wrong.

by Ed Reymond

PERSONAL PROTECTIVE EQUIPMENT

Personal Protective Equipment (PPE) consists of, clothing and equipment that provide protection to an individual in a hazardous environment. It is required by Departmental policy that crew members and passengers will wear the following appropriate complement of PPE for preplanned "**special use**" activities.

Aviator's Helmet must provide protection for the head, ears and temple. Must provide communications for the pilot and crew members.

Fire Resistant Clothing material must be polyamide, aramide (commonly referred to as "Nomex"), polybenzimidazole, Kevlar, or blends thereof. The length should be sufficient to eliminate exposure between the boots and nomex clothing.

Leather Boots which extend above the ankle.

Leather Gloves, or Nomex and Leather are required.

An FAA or U.S. Coast Guard Approved Personal Flotation device (PFD) is required to be worn on all single-engine flights over water beyond power-off gliding distance to shore. Aircraft will be equipped with pop-out or fixed floats. Personal flotation devices will be readily available to occupants of multi-engine land aircraft operating beyond gliding distance from shore.

When conducting fire-related water-dipping or snorkel operations, PFDs shall be worn by occupants aboard helicopter hovering over water sources such as ponds, streams, lakes, and coastal waters.

Anti-Exposure Suits must be worn in all single-engine aircraft and readily available to occupants of multi-engined aircraft when conducting extended overwater flights (Beyond 50 nautical miles from shore).

Exceptions to the PPE requirements for "special use" activities are:

-Fire resistant clothing for aerial agricultural applications.

-Fire resistant clothing and leather boots for overwater flights during vessel or offshore platform operations.

-Aviator's helmet requirements for fire crews being transported between designated landing sites or air attack supervisor operations above 500 feet AGL. *(Air attack supervisor operations involved in airtanker coordination operations require all personnel on board to wear PPE.)*

"Special Use" Activities are described as DOI programs which require special considerations due to their functional use. Situations in which special pilot qualifications, techniques, or special aircraft equipment are incorporated, personal protective equipment is required.

The following are considered "special use" activities:

- **External loads, Class B or C (slingloads, longline, water buckets, etc.)**
- **Night vision goggles**
- **Hoversites**
- **Helicopter rappelling/short-haul**
- **Animal herding**
- **Offshore navigation (vessel or platform landings)**
- **Flights conducted below 500 feet above ground level (AGL)**
- **Helicopter operations around a fire perimeter**
- **Helitack or initial attack**
- **Water/retardant application**
- **Aerial ignition application**
- **Animal tagging and eradication**
- **Paracargo**
- **Any takeoff or landing requiring special pilot technique due to terrain, obstacles, or surface condition.**

AVIATOR'S PROTECTIVE HELMET (FLIGHT HELMET)

Most government bureaus and agencies use flight helmets manufactured by the Gentex Corporation. The first model was the SPH4 (Sound Protective Helmet).

A unique feature of the helmet is that it integrates a floating suspension system that minimizes head injury from acceleration or deceleration forces.

The helmet is made in two sizes. Regular will fit hat sizes to 7 1/4 and extra-large, 7 1/4 and greater. If the helmet is exchanged with various personnel, it is suggested to purchase extra-large helmets.

To provide maximum protection, the helmet must be individually fitted and properly worn. Adjusting the helmet for proper fit is important. A loose fitting helmet is uncomfortable and can be dangerous. The helmet will stay properly positioned and provide maximum head protection during deceleration forces up to 6.0 G's

- **Before putting the helmet on, adjust the buttons or knobs on the earcups to fit in the depression behind the ear.** Earcups should be centered over the ear and apply sufficient pressure to minimize external noise.

- **The front edge of the helmet should be no more than 3/4-inch above the eyebrow.** To raise or lower it on the head, adjust the three web straps evenly, that are attached to the crown pad. This is the floating suspension system, and should be adjusted to keep the crown pad from touching the inside liner of the helmet. Check straps by pushing down with a fist on the crown pad.

- **The sweat band should be adjusted to fit snug and minimize head movement in the helmet.**

- **When wearing the helmet, attach the chin strap to the two lower snaps and pull snug.**

- **Tighten the nape strap in the back of the helmet so the Velcro/Nomex adjustments lay flat against the head.** The nape strap minimizes the possibility of the helmet coming off in the event of the head being thrown forward.

- **The visor should be in the down and locked position during takeoffs and landings.**

- **The microphone is noise cancelling. It should be amost touching the lips to maximize effectiveness.**

- **When not in use, store the helmet in a helmet bag.**

Gentex no longer manufactures the SPH 4. Instead, they redesigned the sound protective helmet, making it lighter in weight and replacing the floating suspension system with a preformed themoplastic liner (TPL). The TPL unit provides for easier fit, and allows for custom fitting if needed. Refer to manufacturer's instructions for proper fitting.

The helmet and liner still come in only two sizes, regular and extra-large, same as the SPH4.

Upgrades are available from the Gentex coorporation to convert the SPH4 head suspension system to a thermoplastic liner.

Many lives have been saved and serious injury prevented by wearing an aviator's protective helmet. It has been proven countless times that the aviator's protective helmet saves lives! In a crash situation, it is imperative to have some type of head protection.

FIRE RESISTANT CLOTHING

Helicopter safety and technology has improved immensely since the days of piston-driven engines. Although the turbine-engine helicopter provides increased reliability, there is still a potential for a post-crash fire. You can minimize this hazard by wearing fire resistant clothing. Nomex (polymid or aramid) material is the current standard utilized for fire resistant clothing.

WHAT YOU SHOULD KNOW ABOUT NOMEX

Nomex is an uncomplicated material, but it has been the subject of many questions, misconceptions, abuses, and just plain untruths.

THE MATERIAL

Nomex is a unique manmade material that is permanently fire retardant. Nomex is a registered trademark of a synthetic material developed by the DuPont Corporation. It is a type of nylon that will not melt and stick to the skin as other types of synthetic fibers do. **Because other synthetics such as nylon and dacron melt at about 300 degrees F., they should not be worn next to the skin.**

Crewmembers and passengers should remember that heat transfer through Nomex could be high enough to melt synthetic undergarments. Nomex is resistant to temperatures up to about 700 degrees F. and then begins to char and form a dry, brittle residue that can be brushed away when the heat source is removed. Nomex will not support combustion as other natural and manmade materials will. For example, if a flame is placed directly on cotton, nylon, dacron, etc., the materials will burn and continue to burn when the heat source is removed.

If your Nomex does become contaminated with flammable products, simply launder or dryclean it and the material will be restored to its original fire retardant state. At this time, there is no wear-out criteria established for Nomex. According to the U. S. Army Natick Research and Development Command, even thin Nomex provides protection.

CLOTHING FIT

Nomex clothing was designed to be worn rather loosely to provide an airspace between the fabric and the skin. This airspace acts as insulation from heat sources. Do not alter Nomex clothing, snugly fitted Nomex negates the effectiveness of the airspace.

STATIC ELECTRICITY

Tests for static electricity buildup were conducted at Wright-Patterson AFB on a variety of materials, including Nomex. There were no significant differences in the generation of static electricity among the materials tested.

One of the most important safety procedures in preventing an accident caused by static electricity during refueling is proper grounding of the aircraft. Another equally important safety procedure is plugging in the bonding wire from the fuel nozzle to the aircraft before the fuel cap is removed. Replace the fuel cap before unplugging the bonding wire.

If your Nomex becomes saturated with fuel, the saturated area should be thoroughly soaked in water before removal of the clothing to prevent static electricity from igniting the fuels. One crewmember received first and second-degree burns when his fuel-soaked clothing was ignited by static electricity as he tried to remove them without first washing the saturated area with water.

CLEANING

Garments of Nomex can be cleaned by home or commercial laundry or by drycleaning procedures without loss of their outstanding protective features. Nomex can be drycleaned safely without altering its fire retardant qualities. Any drycleaning solvent remaining in the garment is soon dissipated into the air, thus eliminating any fire hazard.

Nomex can also be laundered as many times as necessary and still be fire resistant. Since it is an easily cleaned synthetic fiber, you probably won't need a full wash cycle. Simply set the washing machine on a short cycle e.g., "delicate" or "wash and wear". Wash garments with a heavy-duty detergent such as "Tide, Cheer, All or Whisk". Pre-treat greasy stains and collar/cuff lines with a product such as "Spray 'n Wash or Shout". Do not overload home laundry equipment.

Launder garments of Nomex only with other garments of Nomex to help avoid surface entrapment of flammable lint and to minimize static in the tumble dryer. Close the zippers to prevent damage and fasten the velcro to avoid picking up lint. Home hot water heaters and dryers do not get hot enough to harm the material. Remember, Nomex is high-temperature-resistant and has even been boiled without damage. However, to conserve energy, we suggest a warm wash and cold rinse.

If Nomex is tumble dried separately from other material, an antistatic strip probably will not be required to get rid of static electricity. Tumble dry garments at a medium or high-temperature setting. Use the cool-down cycle if available; remove and hang garments as soon as tumbler stops. The rubbing together of dissimilar materials causes the buildup of static electricity. If you live in a cold, dry climate and static electricity is a nuisance, you can use a good brand of fabric softener in the wash or a strip in the dryer.

Washer and dryer added softener/antistats, although they may help reduce nuisance static and garment cling, they often reduce wickability (a comfort factor). Detergents, fabric softeners, and antistatic strips leave a residue which accumulates on Nomex. This affects the fabric's "wickability," i.e., the ability to transport water (sweat) to aid in evaporation and cooling. You can test your Nomex's "wickability" by placing a drop of water on a clean flight suit. If the water soaks in within 10 to 12 seconds, fine. If it takes 30 seconds or longer for the water to soak in, or it simply beads on the material, your Nomex needs to be drycleaned to remove the residue. If you have ever wondered why it is so difficult to dry yourself with a towel from a hotel or motel, it's because they use strong detergents and softeners which greatly decrease the ability to absorb water.

For maximum fire protection, greases and oils should be thoroughly removed from garments of Nomex after each wearing. If home procedures do not accomplish this, commercial laundering or drycleaning is recommended. When using laundry aids, read and carefully follow the manufacturer's instructions.

POTPOURRI

The flight-suit should be fastened over the boot. Sleeves are to be worn down, zipper zipped to the top, and collar turned up. Of course, Nomex or leather gloves are to be worn. Wear the gloves under the sleeve cuff to prevent accidental snagging of the helicopter center console switches.

POTPOURRI

The unprotected throat area comprises less than 1 percent of the total skin area. In contrast, the skin of the face makes up about 5 percent of the total skin area and is not protected by Nomex. The unprotected face has not received the consideration and publicity the neck has and yet covers five times the skin area of the unprotected neck area. The helmet visor offers the upper portion of the face only limited protection in a flash fire or a full-fledged, raging inferno. Some enterprising individuals have fabricated scarves from Nomex for neck protection at very little cost.

Nomex is Nomex regardless of the weave, color, or article of clothing. Take care of it and it will take care of you when you need it most. This garment could save your life. It is made of Nomex Aramid, a fiber that is high temperature resistant and permanently flame resistant. This article, with minor exclusions, was taken from the U.S. Army, Flightfax.

The next generation of material is polybenzimidazole (PBI) or kevlar, which have enhanced fire resistance and improved comfort. To obtain maximum protection it is important to wear cotton, wool, cotton-wool blend, or Nomex undergarments. Maximum protection is based upon the thickness and the amount of skin contact to the material.

Synthetic or petroleum-based materials (nylon, polyester, or polypropelyne) impose a hazard of high flammability and melting to the skin and should not worn under fire resistant clothing. During the flight safety briefing, passengers and crew members should be made aware of the inherent danger associated with wearing synthetic materials.

The requirements and recommendations provided in this section are for all aviation users. Past experience and unfortunate circumstances have shown that an ounce of prevention far outweighs the inconvenience and occasional discomfort of using personal protective equipment. The Departmental aviation goal is for everyone to have a safe and enjoyable flight.

EQUIPMENT SOURCE LIST

AVIATOR'S PROTECTIVE HELMET (SPH-5)

National Interagency Fire Center
ATTN: Great Basin Cache Supply Office
3833 South Development Avenue
Boise, ID 83705
(208) 387-5547
Direct orders from all NWCG-affiliated agencies, inside and outside the geographic area, will be honored at NIFC for the following items: 1. Sole source item.
2. Item unavailable to all customers through specific vendors.
For catalog, order NFES #0362

Flight Suits Ltd.
1675 Pioneer Way
El Cajon, CA 92020
(619) 440-6976 or (800) 748-6693

Gentex Corporation (min. order of 20)
P.O. Box 315
Carbondale, PA 18407
(717) 282-3550 or (800) 233-4773

FIRE RESISTANT CLOTHING

Aureus International
2860 S. Circle Drive
Suite GL-22
Colorado Springs, CO 80906
(719) 540-9077 or (800) 448-9034

Barrier Wear
2400 Industrial Lane
Box 280D
Broomfield, CO 80020
(303) 469-5994 or (800) 469-5994

Bulwark Protective Apparel Inc.
Suite 110
100 E. NASA Road One
Webster, TX 77598
(713) 332-4441 or (800) 223-3372

Charkate/Worksafe
130 West 10th Street
Huntington Station, NY 11746
(800) 929-9000

Chicago Protective Apparel
8140 N. Ridgeway Avenue
Skokie, IL 60076
(847) 674-7900

FIRE RESISTANT CLOTHING

Flight Suits Ltd.
1675 Pioneer Way
El Cajon, CA 92020
(619) 440-6976 or (800) 748-6693

Fyrepel Products, Inc.
P.O. Box 1584
Decatur, AL 35601
(800) 345-7845

Guard-Line, Inc.
215-217 S. Louise Street
Atlanta, TX 75551
(903) 796-4111 or (800) 527-8822

Lion Apparel, Inc.
6450 Poe Avenue
P.O. Box 14576
Dayton, OH 45413-0576
(513) 898-1949 or (800) 421-2926 Ext.548

PGI
550 Commercial Avenue
P.O. Box 307
Green Lake, WI 54941
(800) 558-8290

Red Kap Industries
545 Marriott Drive
Nashville, TN 37224-0841
(615) 391-1200 or (800) 733-5271

Ronco Textile Products
1405 Eastlake Avenue
Peoria, IL 61614
(309) 685-7266 or (800) 323-1152

Rubin Brothers
2241 S. Halstead Street
Chicago, IL 60608
(312) 942-1111 or (800) 632-2308

Safeguard America
800 16th Avenue North
P.O. Box 1649
Clanton, AL 35045
(205) 755-7710

Stanco Mfg. Co.
2004 West Main Street
P.O. Box 1148
Atlanta, TX 75551
(903) 796-7936 or (800) 348-1148

Steel Grip Safety Apparel Co.
700 Garfield Street
P.O. Box 747
Danville, IL 61832
(217) 442-6240 or (800) 397-8390

Tops Mfg. Co.
501 Main Street
P.O. Box 750
Rochester, IN 46975
(219) 223-4311 or (800) 348-1148

Workrite Uniform
P.O. Box 1192
Oxnard, CA 93032
(805) 483-0175 or (800) 521-1888

THOUGHTS TO CONSIDER IN AVIATION OPERATIONS

- You are now in charge of a sacred trust, the safety of human lives.

- You must not let undue pressure (expressed or implied) influence your judgement during the performance of this sacred trust.

- You must be able to develop "a team" in which members must participate and contribute to the safety of the operation.

- You must delete false pride, calculated risk, real world, and "good enough for Government work" from your professional vocabulary.

- You must not let your actions instill the attitude of competition between pilots or "team members". This attitude may alter their performance and compromrise the safety of the operation.

- You will not be criticized or stigmitized for any decision you make which will insure added safety to an operation.

AIRPLANE SAFETY

Operations will comply with the applicable general safety rules for operations and practices prescribed in Agency manuals and Federal, State, and OSHA standards.

GENERAL SAFETY PRECAUTIONS

- Upon arrival and prior to flight, check pilot and aircraft data cards.

- The pilot is responsible for the safety of the aircraft and passengers at all times.

- Request a safety briefmg from the pilot concerning safety features of the aircraft.

  - **Approach and depart airplane when the engine and propeller(s) have come to a complete stop.**
  - **Operation of doors and emergency exits.**
  - **Use and operation of seat belts.**
  - **Seats in an upright position during takeoff or landing.**
  - **No smoking.**
  - **Location of first-aid and survival equipment.**
  - **Operation and location of fire extinguisher.**
  - **Location of emergency electrical and fuel shut-off.**
  - **Ditching procedures and location of floatation equipment for extended overwater flights.**
  - **Normal and emergency use of oxygen.**
  - **Emergency procedures.**

- Brief the pilot prior to mission, on intent, known hazards and other pertinent data.

- A flight plan is required for all flights.

- Front seat occupants must wear shoulder restraints.

- Passengers in the front seat and in tandem seat aircraft must avoid interfering with flight controls and switches.

- Permit only necessary flights, with authorized passengers and cargo.

- Report aircraft mishaps as soon as possible.

SAFETY AROUND AIRPLANES

- **Approach and depart in view of the pilot,** only when engine and propeller(s) have come to a complete stop.

  With multiple engine airplanes, it is required that all engines on the passenger door side be turned off during boarding and exiting. If cargo must be unloaded from the opposite side, a guard will be posted to protect personnel from moving propellers.

- **Cabin door in front of wing,** walk to the front, avoiding the propeller area, never under the wing.
- **Cabin door below, or behind wing,** walk behind wing, then toward wing-tip and door. Avoid walking under wing.
- **When entering and exiting,** use designated steps, or wing-walkways. Do not step where "no step" is indicated.
- **Use door latches** as instructed.
- **Secure loose items** in the aircraft.
- **Provide the pilot with accurate weights** and types of baggage or cargo.
- **During refueling,** passengers must be out of aircraft and at least *50* feet away. No smoking within *50* feet.

IN-FLIGHT EMERGENCY

- Pilot declares emergency.
- Seat belt snug.
- Protective clothing in use (if applicable).
- Keep away from flight controls.
- Secure loose gear.
- Note emergency exits.
- Wait until all motion stops, (except in the event of a post-crash fire).
- Exit aircraft.

AERIAL HAZARDS

- Use a hazard map for known hazards.
- Look for hazards and alert the pilot.
- Stay above 500 feet whenever possible.
- Do not fly during poor visibility (half-mile minimum).
- Do a high-level reconnaissance before descending below 500 feet AGL.

AIRPLANE CAPABILITIES AND LIMITATIONS

INTRODUCTION

Airplanes provide us the capability of accomplishing a variety of tasks. We use them in our job for resource management, various utility purposes and in traveling from point to point. By having a fundamental understanding of aircraft performance and limitations we can develop a better relationship for information sharing with the pilot. This allows us to improve our comfort level and increase our knowledge of how an airplane flies.

BASIC AERODYNAMICS

The only way air can exert a force on a solid body, such as an airplane wing, is through pressure. A wing or "airfoil" is generally designed to increase the velocity of the air flowing over the top, reducing the pressure. The top of the wing is curved, while the bottom is flat. Because of the curve, air traveling over the top must travel farther and at greater speed, than on the bottom. This creates a low pressure area above the wing, and a high pressure area below. The higher pressure pushes the wing towards the lower pressure area, resulting in lift. At the same time, the air flowing along the underside of the wing is deflected downward. The downward deflection also reacts by lifting the wing upward. The faster the wing travels through the air, at a given angle of attack, the greater the lift generated. The "angle of attack" is the angle at which the wing meets the relative wind. *(Fig. 1)*

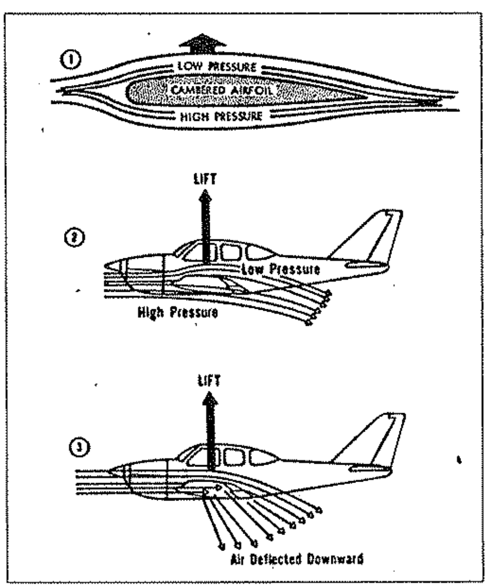


Fig. 1

An airplane must move through the air with enough speed to create sufficient lift to support the aircraft. To accomplish this, the airplane must be either pulled or pushed through the air by an engine-driven propeller or jet engine. To develop a better understanding of the capabilities of an airplane, other forces must be considered.

Like all objects, aircraft are affected by gravitational force. Thrust (or power) is provided by the aircraft's engine(s) to propel the aircraft through the air and create lift which counteracts the weight of the aircraft. Another force that constantly acts on the airplane is called drag. This resistant force is produced as the airplane moves through the air. To provide the aircraft with forward motion, thrust must overcome drag. In steady flight (no change in speed or direction) the opposing forces are equal, lift equals weight, and thrust equals drag. *(Fig. 2)*

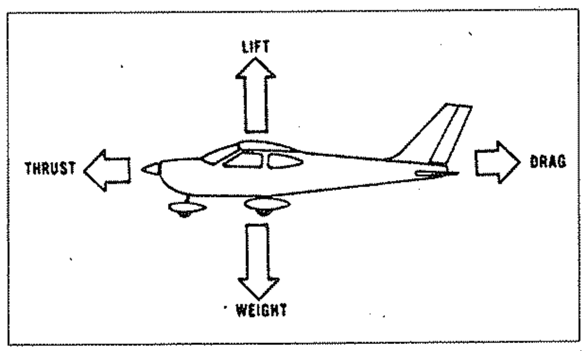


Fig. 2

FLIGHT CONTROL

To manuever an airplane, the pilot must control its movement or rotation around its longitudinal, lateral and vertical axes. Rotation about the airplane's longitudinal axis (nose to tail) is roll, (or "bank"). Rotation about its lateral axis (wing tip to wing tip) is pitch, and rotation about its vertical axis (up and down through the center of gravity) is yaw. This is accomplished by the use of the exterior flight controls, ailerons, elevators, and rudder. Each can be deflected from their neutral position into the flow of air as the airplane moves forward through the air.

FLIGHT CONTROL

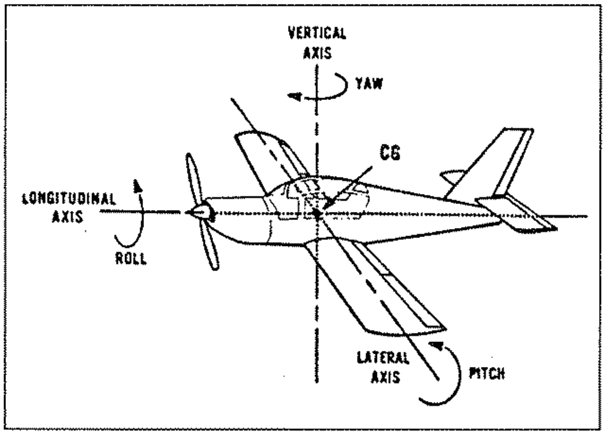


Fig. 3

The ailerons control the airplane about its longitudinal axis. There are two ailerons, one at the trailing edge of each wing, near the wingtips. They are movable surfaces hinged to the wing's rear spar and are linked together by cables or rods. When one aileron is deflected down, the opposite aileron moves up. When the pilot applies pressure to the left on the control stick, or turns the yoke to the left, the right aileron deflects downward, and the left aileron deflects upward. This produces decreased lift on the left wing and increased lift on the right causing the aircraft to roll and bank to the left. **Contrary to popular belief, the differential lift on the wings is the force that turns the airplane in flight, not the rudder.** The rudder is primarily a "trimming" device in flight and is used, to counteract the unequal drag of the ailerons.

The elevators control the movement of the aircraft about its lateral axis. They form the rear part of the horizontal stabilizer, are free to be moved up and down by the pilot, and are connected to the control stick or yoke in the cockpit. Applying forward pressure on the control causes the elevator surfaces to move downward, pushing the tail upward and the nose downward. **In effect, the elevators are the angle-of-attack control.** When back pressure is applied on the control, the elevators move upward, the tail lowers and the nose rises; thus increasing the wing's angle of attack and lift is generated.

The rudder controls movement ("yaw") of the aircraft about its vertical axis. Like the other primary control surfaces, the rudder is a movable surface hinged to a fixed surface, in this case to the vertical stablizer, or fin. Movement of the rudder is controlled by two rudder pedals (left and right). Its action is very much like that of the the elevators, except that it moves in a different plane (vertical). The rudder deflects from side to side instead of up and down. When the rudder is deflected to one side, it protrudes into the airflow, causing a horizontal force to be exerted in the opposite direction. This pushes the tail of the airplane in that direction and yaws the nose in the desired direction. **The primary purpose of the rudder in flight is to counteract the adverse yaw of the ailerons and to help provide directional control. In flight the rudder does not turn the aircraft.** Instead the force of the horizontal component of wing lift turns the airplane when the wings are banked. Rudder alone cannot produce a coordinated turn. **(If rudder alone is used to try to turn the airplane, the airplane "skids".)** The combined blending of aileron, rudder, and elevator pressure accomplishes this manuever. *(Figs. 3 & 4)*

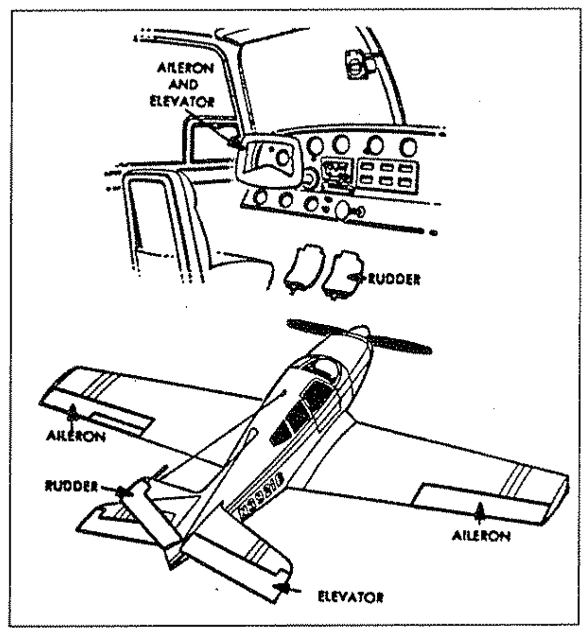


Fig. 4

The wing flaps are movable panels on the inboard trailing edges of the wings. They are hinged so that they may be extended downward into the flow of air beneath the wings to create additional lift and drag. **Their primary purpose is to permit a slower airspeed and a steeper angle of descent during a landing approach. In some cases partial flaps are used to shorten the takeoff distance.** Extending or retracting the flaps has a very noticeable effect on aircraft performance.

The flap operating control may be an electric or hydraulic control on the instrument panel, or it may be a lever located on the floor to the right of the pilot's seat. In addition to the flap operating control, there is usually an indicator which shows the actual position of the flaps. On most general aviation airplanes the maximum extent of movement of the flaps is approximately 30 to 40 degrees. *(Fig. 5)*

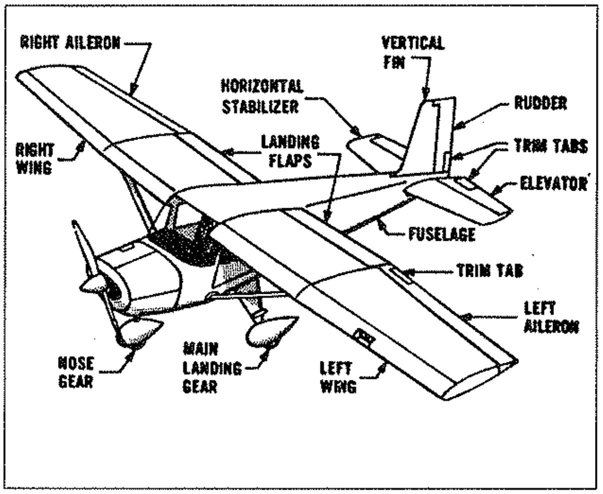


Fig. 5

The throttle controls engine power output. In side-by-side seating aircraft it is centrally located on the lower portion of the instrument panel. In tandem seating aircraft the power quadrant is on the left wall panel. On some airplanes all the engine controls (throttle, mixture, and propeller) are installed on a separate unit called "engine control quadrant". By means of linkage the throttle is connected to the carburetor to regulate the amount of fuel-air mixture supplied to the engine, controlling the power developed. The power output is increased by pushing the throttle forward and decreased by pulling back. *(Fig.6)*

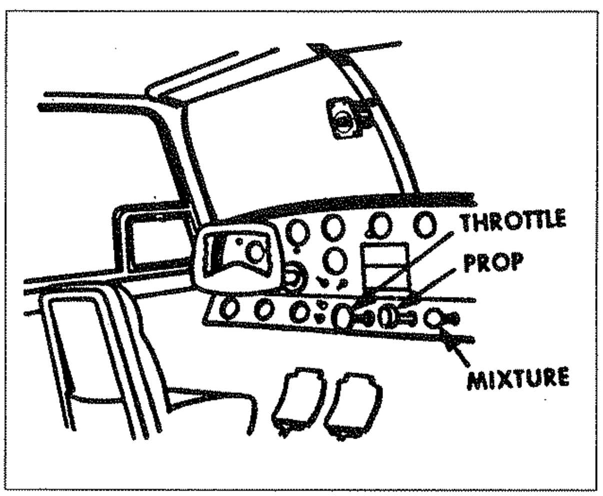


Fig. 6

EFFECTS OF WEIGHT AND BALANCE ON FLIGHT PERFORMANCE

The takeoff and landing performance of an airplane may be determined on the basis of its maximum allowable takeoff and landing weights. **Increased gross weight can be considered to produce a threefold effect on takeoff performance: It requires a higher lift-off speed, the greater mass is slower to accelerate, and it contributes to an increased retarding force (drag and ground friction). A heavier gross weight will result in a longer takeoff run and shallower climb, faster touchdown speed and longer landing roll.** Even a minor overload could make it marginal or impossible for the airplane to clear an obstacle which normally would have not been seriously considered during takeoffs under more favorable conditions. **This is especially true on a hot day and/or high elevation.**

The detrimental effects of overloading on performance are not limited to the immediate hazards of takeoffs and landings. **Overloading has an adverse effect on all climb and cruise performance.** In most airplanes it is not possible to fill all seats, baggage compartments, and fuel tanks, and still remain within approved weight and balance limits. As an example, in typical four-place airplanes, the fuel tanks may not be filled to capacity when four people and their baggage are carried.

The effects of the distribution of the airplane's useful load can have a significant influence on its flight characteristics. The center of gravity (CG) position influences the amount of elevator force required to fly level or "pitch" the airplane. A forward CG (within limits) is more stable, but it can also create a higher drag situation due to additional up-elevator reqiured to maintain flight. **Generally speaking, an aircraft becomes less stable and controllable, especially at slow flight speeds, as the center of gravity is moved further aft. The airplane becomes less and less stable as the CG is moved rearward. The recovery from a stall in any airplane becomes progressively more difficult as its center of gravity moves aft.**

Weight and balance control is a matter of serious concern to all pilots. **Before loading the aircraft, indicate individual weights on packages and cargo so the pilot can distribute the weight within weight and balance limits. As aviation managers and users we must understand the importance of providing the pilot with accurate weights of passengers and cargo.** It is a primary responsibility of the pilot to make sure the airplane is loaded within proper center of gravity limits.

As discussed in "helicopter capabilities and limitations", the density of air in which we fly has a significant effect on aircraft capability. **As we increase the elevation and/ or the outside air temperature increases, performance**

decreases. As air becomes less dense it reduces power because the engine takes in less air. Thrust is also decreased due to loss of propeller efficiency, and lift is reduced because "thin" air exerts less force on the wings.

When operating from high elevation airports, landing strips, or on hot days, aircraft performance will be dr matically effected. **The airplane at higher elevations will takeoff at the same indicated airspeed as at sea level, but due to the reduced air density, the true airspeed will be greater. This will result in a longer takeoff run and shallower climb.** Accounting for pre sure altitude and temperature is necessary for accurate calculation of takeoff distance and,climb performance. (Remember, aircraft takeoff and climb performance varies inversely to the altitude and temperature.)

Because of high density altitude, the airplane may have to be "downloaded" by reducing gross weight to stay within weight and balance limits. This can be accomplished by reducing the number of passengers, or weight of cargo. Another option is for the pilot to adjust the fuel load of the aircraft to compensate for the number of passengers or cargo. This is always a "tradeoff", by reducing the fuel load, one or more fuel stops may have to be used enroute., In either circumstance, it is necessary for the pilot to have accurate weights. This is the responsibility of the desig nated aviation manager in coordination with the pilot for that flight.

A key safety factor is to always operate within the weight and balance limits of any aircraft. Remember that no two aircraft, even of the same make and model, will have the same useful load.

Departmental aviation accident statistics have indicated that aviation users can affect the continuing success of the program. By understanding aircraft capabilities and limitations we can make the pilot's job easier.

All Department of Interior employees have a responsibility,to use aircraft safely, efficiently, and effectively. To do so we need to have a foundation on what aircraft can and cannot do.

"LANDINGS"

If done correctly, helicopters stop and then land. Airplanes, land then stop.

"LOWLEVEL FLIGHT"

The best you can do is tie the record.

"A superior aviatior is one who exercises superior judgement before having to exercise superior skill."

EMERGENCY LOCATOR TRANSMITTER (ELT)

COPAS-SARSAT SATELLITE SYSTEM

The National Environmental Satellite, Data and Information Service (NESDIS), of the National Atmospheric Administration (NOAA) of the Department of Commerce manages all United States civil operational earth-observing satellite systems. NESDIS operates geostationary and polar-orbiting satellites that monitor daily weather and surface conditions over the entire globe. In addition to weather and environmental sensors, Search and Rescue Satellite-Aided Tracking (SARSAT) payloads, which are provided by Canada and France, are carried on the polar orbiting spacecraft. Russia also operates polar-orbiting satellites as part of their spacecraft navigation system and some carry similar SARSAT payloads. The Russian SARSAT payload is called COSPAS.

COSPAS and SARSAT are both being used in an international cooperative search and rescue satellite effort. The COSPAS/SARSAT Project objective is to help save the lives of aviators and mariners who are in distress and transmit emergency signals to the satellites that pass above them. Aircraft carry fixed Emergency Locator Transmitters (ELT) that are normally triggered by the impact of the crash. Ships and boats carry floating Emergency Position-Indicating Radio Beacons (EPIRB) that are activated by immersion in water. Both the ELT and EPIRB can also be activated manually.

The common operational COSPAS/SARSAT ELT and EPIRB radio frequency is 121.5 Megahertz (MHz). This frequency provides the location of an aviator or mariner in distress with an accuracy of 5-10 miles. The new ELT EPIRB 406 MHz radio frequency will provide the location of an aviator or mariner in distress with an accuracy of 1-3 miles. Both the U.S. and the Russian satellites receive the 406 MHz signals and retransmit them to ground stations similar to the 121.5 MHz signal. The differences in the two signals are: (1) the 406 MHz signals are also stored aboard the spacecraft for later relay to the next available ground station giving it a global capability, and (2) the 406 MHz transmits a digital signal containing information unique to that particular beacon such as identification, type of vehicle (aircraft or surface vessel), and country code.

HOW SATELLITES HELP SAVE LIVES IN THE UNITED STATES

- Aviators and mariners in distress use an ELT or EPIRB to transmit an emergency signal to the SARSAT and/or COSPAS satellites.

- The ELT or EPIRB emergency signal is received by the SARSAT and/or COSPAS satellites. The satellite retransmits the ELT or EPIRB emergency signal to a ground receiving station called a Local User Terminal.

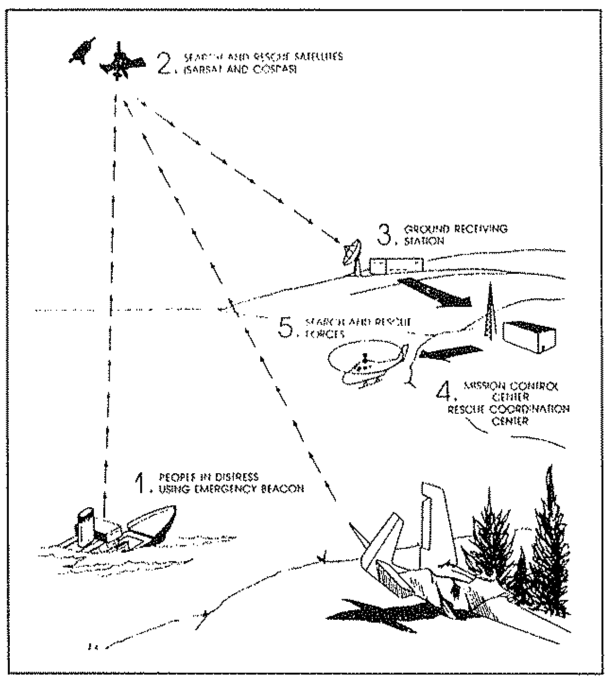
- The ground receiving station receives the ELT or EPIRB emergency signal from the SARSAT and/or COSPAS satellite. The ELT or EPIRB emergency signal is processed and the location of the aviator or mariner in distress is recorded.

- The ground receiving station passes the location of the aviator or mariner in distress to the U.S. Mission Control Center (USMCC) at Scott Air Force Base, Ill. The USMCC sends the location of the aviator or mariner in distress to the proper land or sea Rescue Coordination Center (RCC).

- The location of people in distress is given to U.S. Air Force RCC's. The location of people in distress at sea is given to U.S. Coast Guard RCC's.

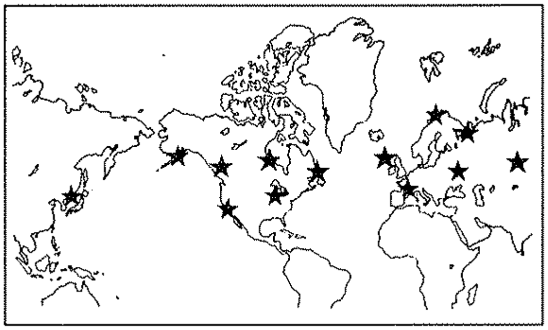
- Search and Rescue (SAR) forces are sent out by either the U.S. Air Force or the U.S. Coast Guard. SAR forces include fixed wing aircraft, helicopters, ships, boats, ground search parties, and may include commercial airlines or commercial ships.

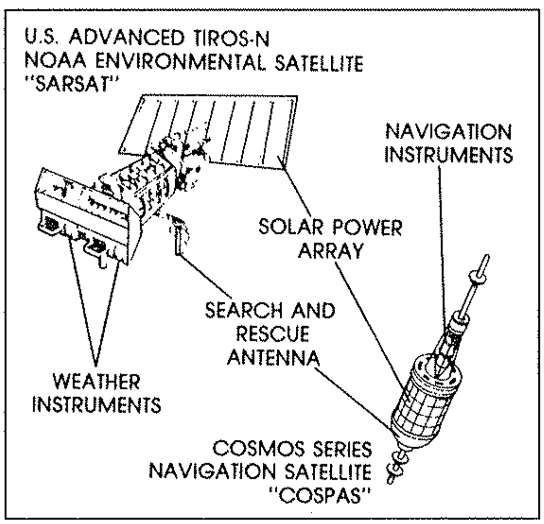
- The SAR forces find the aviators or mariners in distress, bring them to safety, and switch off the ELT or EPIRB.



LOCAL USER TERMINALS

There are 13 Local User Terminals (LUT) operating, as of 1987. The LUT's are located in the United States (3), Canada (3), United Kingdom (1), France (1), Norway (1), and Russia (4). Almost half the world is covered and ready to receive ELT and EPIRB emergency transmissions on a radio frequency of 121.5 MHz, and the entire globe is covered on the 406 MHz frequency.





POLAR-ORBITING SATELLITES

The U.S. NOAA SARSAT polar orbiting satellite circles the Earth every 102 minutes at an altitude of 528 miles. The Russian COSPAS polar orbiting satellite circles the Earth every 105 minutes at an altitude of 621 miles. The circular orbit of both satellites permits uniform data collection by the satellite and efficient command and control of the satellite by ground stations.

FALSE ALARMS

The majority of ELT and EPIRB emergency transmissions at the LUT's are false alarms. False alarms waste valuable search and rescue time that could be used for a real emergency situation. Aviators and mariners can help stop false alarms by doing the following:

- The ELT and EPIRE beacons should be mounted properly.

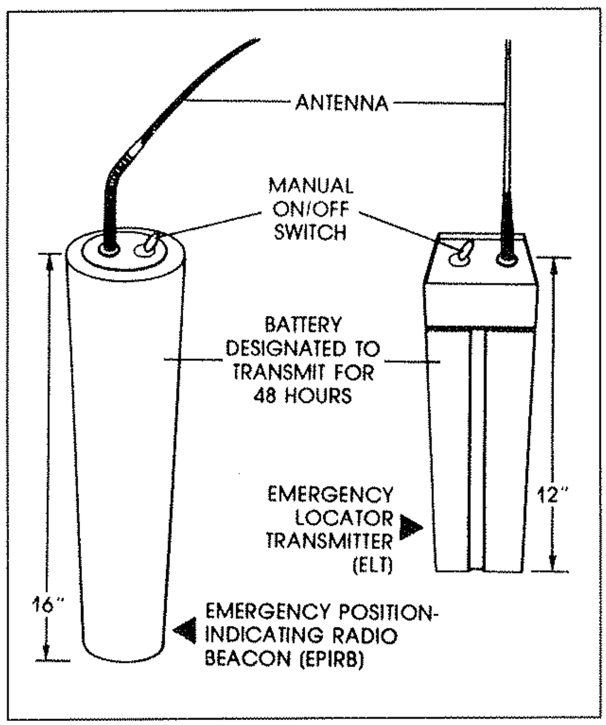
- ELT and EPIRB beacons should be maintained regularly.

- ELT and EPIRB beacon batteries should be disconnected when the unit is not regularly used,or being shipped or disposed of.

- Familiarize yourself with ELT and EPIRB operating instructions before having to use the unit in an emergency situation.

- Only test the ELT and EPIRB during the first five minutes of any hour and limit the test to 3 audio sweeps.

- If equipped, listen to 121.5 MHz to verify that the ELT or EPIRB is not accidentally on.

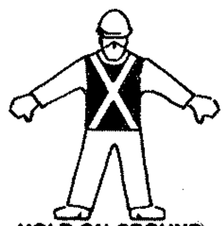


For additional information contact:

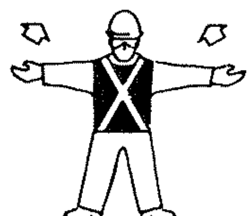
NOAA, National Environmental Satellite, Data, and Information Service,
SARSAT Program Manager,
Suitland Federal Center,
Washington, D.C. 20233

Helicopter Hand Signals

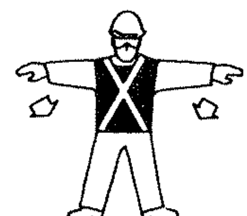
CLEAR TO START ENGINE
make a circular motion above head with right arm.



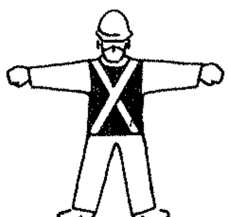
HOLD ON GROUND
extend arms out at 45, thumbs pointing down.



MOVE UPWARD
arms extended sweeping up.

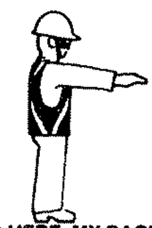


MOVE DOWNWARD
arms extended sweeping down.



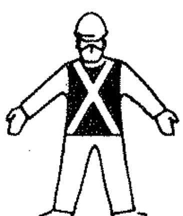
HOLD HOVER
arms extended with clenched fists.

CLEAR TO TAKE-OFF
extend both arms above head in direction of take-off.

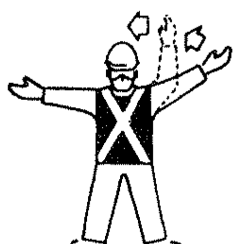


LAND HERE, MY BACK IS INTO THE WIND
extend arms toward landing area with wind at your back.

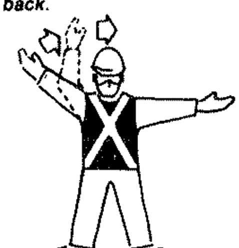
MOVE FORWARD
extend arms forward and wave helicopter toward you.



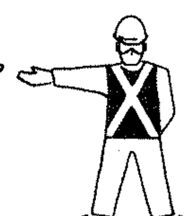
MOVE REARWARD
arms extended downward using shoving motion.



MOVE LEFT
right arm horizontal, left arm sweeps over head.

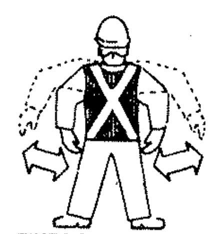


MOVE RIGHT
left arm horizontal, right arm sweeps over head.



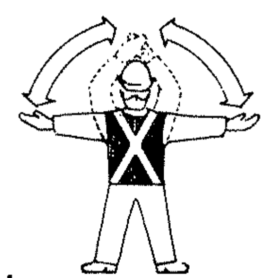
MOVE TAIL ROTOR
rotate body with one arm extended.

SHUT OFF ENGINE
cross neck with right hand, palm down.



FIXED TANK DOORS
open arms outward, close arms inward.

RELEASE SLING LOAD
contact left forearm with right hand.



WAVE OFF DO NOT LAND
wave arms from horizontal to crossed overhead.

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