

**SECTION 10**

**SAFETY TIPS AND NOTICES**

**CONTENTS**

	<b>Page</b>
General . . . . .	10-1
Safety Tips . . . . .	10-1
Pilot Knowledge and Proficiency . . . . .	10-4
Safety Notices . . . . .	10-6

INTENTIONALLY BLANK

## **SECTION 10**

### **SAFETY TIPS**

#### **GENERAL**

This section provides suggestions for the pilot to operate the helicopter more safely.

#### **SAFETY TIPS**

1. Never push the cyclic forward to descend or to terminate a pull-up (as you would in an airplane). This may produce a low-G (near weightless) condition which can result in a main rotor blade striking the cabin. Always use the collective to initiate a descent.
2. Never intentionally allow the fuel quantity to become so low in flight that the low fuel warning light comes on.
3. Never leave the helicopter unprotected where curious onlookers may inadvertently damage critical parts, such as the tail rotor blades.
4. Turn the strobe light on before starting the engine and leave it on until the rotors stop turning. The strobe light is located near the tail rotor and provides a warning to ground personnel. In-flight operation of all external lights even during daylight is recommended to promote collision avoidance.
5. Never carry any external load except when using an approved hook, and never attach anything to the outside of the helicopter. Also, be sure no loose articles are in the cabin, particularly when flying with any doors removed. Even a small, lightweight object can damage the tail rotor in flight.
6. Avoid abrupt control inputs or accelerated maneuvers, particularly at high speed. These produce high fatigue loads and, over time, could lead to failure of a critical component.

**SAFETY TIPS (cont'd)**

7. A change in the sound or vibration of the helicopter may indicate an impending failure of a critical component. If unusual sound or vibration begins in flight, make a safe landing and have aircraft thoroughly inspected before flight is resumed. Hover helicopter close to the ground to verify problem is resolved, and then have aircraft reinspected before resuming free flight.
8. Take steps to ensure ground personnel or onlookers remain well clear of tail rotor and exhaust. Main rotor blades can also be dangerous, especially if personnel are upslope from helicopter.
9. Never allow rotor RPM to become dangerously low. Most hard landings will be survivable as long as the rotor is not allowed to stall.
10. Never make takeoffs or landings downwind, especially at high altitude. The resulting loss of translational lift can cause the aircraft to settle into the ground or obstacles.
11. A vertical descent or steep approach, particularly downwind, can cause the rotor to fly into its own downwash, a condition known as vortex ring state. In this condition, even maximum engine power may not be enough to stop the descent, resulting in a hard ground impact. Vortex ring state can be avoided by always reducing rate of descent before reducing airspeed. (See Safety Notice SN-22.)
12. The helicopter is stable on its landing gear as long as ground contact is made vertically or with the aircraft moving forward. Should ground contact be made with the helicopter moving rearward or sideward, damage and possibly a rollover could occur. Low-time pilots and students should practice landings and hovering with the aircraft slowly moving forward.

**SAFETY TIPS (cont'd)**

13. When operating at higher altitudes (above 3000 or 4000 feet), the throttle is frequently wide open and RPM must be controlled with the collective. Throttle/collective correlation is not effective under these conditions and governor response rate is fairly slow. It may be necessary to roll throttle off as collective is lowered to prevent an overspeed.
14. Do not use collective pitch to slow the rotor during shut-down. Collective pitch produces lift on the blades which can disengage the droop stop friction and allow the blades to strike the tailcone. Also, do not slow or stop the rotors by grabbing the tail rotor. Stopping the tail rotor by hand can damage the tail rotor drive.
15. Do not land in tall dry grass. The exhaust is low to the ground and very hot; a grass fire may be ignited.
16. Always check an area for wires or other obstructions before practicing autorotations.
17. With hydraulic controls, use special caution to avoid abrupt control inputs or accelerated maneuvers. Since no feedback is felt in the flight controls, the pilot may be unaware of the high fatigue loads generated during such maneuvers. Frequent or prolonged high-load maneuvers could cause premature, catastrophic failure of a critical component.
18. Never attempt a magneto check while in flight. If one magneto is malfunctioning and the pilot grounds the other one, the engine may stop completely. If a magneto malfunction is suspected, leave the key in the BOTH position and land as soon as practical.
19. Use caution when loading helicopter near the forward CG limit and remember that CG shifts forward as fuel is burned. Near the forward CG limit, a fore-aft oscillation may develop during steep turns or autorotations. To stop this oscillation, return to straight and level powered flight. Oscillation may take several seconds to dissipate.

## **PILOT KNOWLEDGE AND PROFICIENCY**

Pilot knowledge and proficiency is essential to safe helicopter operation. In addition to being appropriately licensed and complying with regulatory recurrency requirements such as 14 CFR §61.56 and §61.57, all pilots should seek to keep their knowledge base current and proficiency at a high level.

Periodic study and recurrent training is needed to maintain proficiency. Emphasis on the areas below is recommended. These areas should also be covered during transition training for each specific make and model that a pilot flies.

All Robinson dealers are staffed with approved instructors, and the factory can provide up-to-date information on instructors in your area.

### **RECOMMENDED REVIEW AND PROFICIENCY TOPICS:**

#### ***NOTE***

The FAA Helicopter Practical Test Standards, FAA Helicopter Flying Handbook, and commercially available helicopter training syllabi can provide detailed lessons and standards in many of the areas listed.

- All Safety Tips and Safety Notices (SNs) in the Pilot's Operating Handbook
- Limitations and Emergency Procedures
- Precision hovering, hovering turns, hover taxi (*Ref SNs 9 and 42*)
  - Safe liftoff and set down with no tendency to drift
  - Crosswind and tailwind position and directional (yaw) control
- Vortex Ring State (*Ref SNs 22 and 34*)
  - Conditions conducive
  - Recovery procedures (Vuichard and traditional)
- Loss of outside visual reference (*Ref SNs 18, 19, and 26*)
  - Seriousness of this condition
  - Traps (night flight with clouds, gradually worsening conditions, etc.)
  - Featureless terrain or glassy water

## PILOT KNOWLEDGE AND PROFICIENCY (cont'd)

- Flight planning (*Ref SNs 15, 26, and 43*)
  - Thorough preflight inspection
  - Fuel
  - Weather
  - Performance (hot/high/loading)
- Distractions (*Ref SNs 16, 34, 36, and 41*)
  - Failure to keep eyes outside scanning for wires, other obstacles, and traffic
  - High workload missions such as photo flights
  - Passengers
  - Avionics
  - Cell phones
- Low-G and mast bumping (*Ref SNs 11, 29, and 32*)
  - Avoidance
    - Reduce airspeed in turbulence
    - Monitor airspeed when lightly loaded
    - Ensure passenger controls are removed
  - Recognition and recovery

### **CAUTION**

Never practice/demonstrate low-G in flight. Low-G training should be knowledge based only.

- Low RPM considerations (*Ref SNs 10, 24, and 29*)
  - Recognition and recovery
- Power failures (*Ref SNs 10, 24, and 29*)
  - Instinctive autorotation entry
  - Continuously consider emergency landing sites throughout every flight
- Practice autorotations (*Ref SN 38*)
  - Proven, safe methods

### **CAUTION**

In-flight practice of Low RPM, power failures, and autorotations should only be conducted under the supervision of an instructor.

## **SAFETY NOTICES**

The following Safety Notices have been issued by Robinson Helicopter Company as a result of various accidents and incidents. Studying the mistakes made by other pilots will help you avoid making the same errors. Safety Notices are available on the RHC website: [www.robinsonheli.com](http://www.robinsonheli.com).

### **SAFETY NOTICE**

### **TITLE**

- SN-1 Inadvertent Actuation of Mixture Control in Flight
- SN-9 Many Accidents Involve Dynamic Rollover
- SN-10 Fatal Accidents Caused by Low RPM Rotor Stall
- SN-11 Low-G Pushovers - Extremely Dangerous
- SN-13 Do Not Attach Items to the Skids
- SN-15 Fuel Exhaustion Can Be Fatal
- SN-16 Power Lines Are Deadly
- SN-17 Never Exit Helicopter with Engine Running  
Hold Controls When Boarding Passengers  
Never Land in Tall Dry Grass
- SN-18 Loss of Visibility Can Be Fatal  
Overconfidence Prevails in Accidents
- SN-19 Flying Low Over Water is Very Hazardous
- SN-20 Beware of Demonstration or Initial Training Flights
- SN-22 Vortex Ring State Catches Many Pilots By Surprise
- SN-23 Walking into Tail Rotor Can Be Fatal
- SN-24 Low RPM Rotor Stall Can Be Fatal
- SN-25 Carburetor Ice
- SN-26 Night Flight Plus Bad Weather Can Be Deadly
- SN-27 Surprise Throttle Chops Can Be Deadly
- SN-28 Listen for Impending Bearing Failure  
Clutch Light Warning
- SN-29 Airplane Pilots High Risk When Flying Helicopters
- SN-30 Loose Objects Can Be Fatal
- SN-31 Governor Can Mask Carb Ice
- SN-32 High Winds or Turbulence
- SN-33 Drive Belt Slack
- SN-34 Aerial Survey and Photo Flights - Very High Risk
- SN-35 Flying Near Broadcast Towers
- SN-36 Overspeeds During Liftoff
- SN-37 Exceeding Approved Limitations Can Be Fatal
- SN-38 Practice Autorotations Cause Many Training Accidents
- SN-39 Unusual Vibration Can Indicate a Main Rotor Blade Crack
- SN-40 Post-Crash Fires
- SN-41 Pilot Distractions
- SN-42 Unanticipated Yaw
- SN-43 Use Extra Caution During Post-Maintenance Flights



## **Safety Notice SN-1**

Issued: Jan 81 Rev: Feb 89; Jun 94

### **INADVERTENT ACTUATION OF MIXTURE CONTROL IN FLIGHT**

Cases have been reported where a pilot inadvertently pulled the mixture control instead of the carb heat or other control, resulting in sudden and complete engine stoppage. The knobs are shaped differently and the mixture control has a guard which must be removed and a push-button lock which must be depressed before actuating. These differences should be stressed when checking out new pilots. Also, in the R22, it is a good practice to always reach around the left side of the cyclic control when actuating the lateral trim. This will lessen the chance of pulling the mixture control by mistake. Always use the small plastic guard which is placed on the mixture control prior to starting the engine and is not removed until the end of the flight when the idle cut-off is pulled. Replace the guard on the mixture control so it will be in place for the next flight.

If the mixture control is inadvertently pulled, lower the collective and enter autorotation. If there is sufficient altitude, push the mixture control in and restart the engine using the left hand. **DO NOT** disengage the clutch.

---

Safety Notices SN-2 thru SN-8 have been superseded or deleted.

## **Safety Notice SN-9**

Issued: Jul 82 Rev: Jun 94

### **MANY ACCIDENTS INVOLVE DYNAMIC ROLLOVER**

A dynamic rollover can occur whenever the landing gear contacts a fixed object, forcing the aircraft to pivot about the object instead of about its own center of gravity. The fixed object can be any obstacle or surface which prevents the skid from moving sideways. Once started, dynamic rollover cannot be stopped by application of opposite cyclic alone. For example, assume the right skid contacts an object and becomes the pivot point while the helicopter starts rolling to the right. Even with full left cyclic applied, the main rotor thrust vector will still pass on the left side of the pivot point and produce a rolling moment to the right instead of to the left. The thrust vector and its moment will follow the aircraft as it continues rolling to the right. Quickly applying down collective is the most effective way to stop a dynamic rollover.

To avoid a dynamic rollover:

- 1) Always practice hovering autorotations into the wind and never when the wind is gusty or over 10 knots.
- 2) Never hover close to fences, sprinklers, bushes, runway lights or other obstacles a skid could catch on.
- 3) Always use a two-step liftoff. Pull in just enough collective to be light on the skids and feel for equilibrium, then gently lift the helicopter into the air.
- 4) Do not practice hovering maneuvers close to the ground. Keep the skids at least five feet above the ground when practicing sideward or rearward flight.

## **Safety Notice SN-10**

Issued: Oct 82 Rev: Feb 89; Jun 94

### FATAL ACCIDENTS CAUSED BY LOW RPM ROTOR STALL

A primary cause of fatal accidents in light helicopters is failure to maintain rotor RPM. To avoid this, every pilot must have his reflexes conditioned so he will instantly add throttle and lower collective to maintain RPM in any emergency.

The R22 and R44 have demonstrated excellent crashworthiness as long as the pilot flies the aircraft all the way to the ground and executes a flare at the bottom to reduce his airspeed and rate of descent. Even when going down into rough terrain, trees, wires or water, he must force himself to lower the collective to maintain RPM until just before impact. The ship may roll over and be severely damaged, but the occupants have an excellent chance of walking away from it without injury.

Power available from the engine is directly proportional to RPM. If the RPM drops 10%, there is 10% less power. With less power, the helicopter will start to settle, and if the collective is raised to stop it from settling, the RPM will be pulled down even lower, causing the ship to settle even faster. If the pilot not only fails to lower collective, but instead pulls up on the collective to keep the ship from going down, the rotor will stall almost immediately. When it stalls, the blades will either "blow back" and cut off the tailcone or it will just stop flying, allowing the helicopter to fall at an extreme rate. In either case, the resulting crash is likely to be fatal.

No matter what causes the low rotor RPM, the pilot must first roll on throttle and lower the collective simultaneously to recover RPM before investigating the problem. It must be a conditioned reflex. In forward flight, applying aft cyclic to bleed off airspeed will also help recover lost RPM.

## **Safety Notice SN-11**

Issued: Oct 82 Rev: Nov 00

### LOW-G PUSHOVERS - EXTREMELY DANGEROUS

Pushing the cyclic forward following a pull-up or rapid climb, or even from level flight, produces a low-G (weightless) flight condition. If the helicopter is still pitching forward when the pilot applies aft cyclic to reload the rotor, the rotor disc may tilt aft relative to the fuselage before it is reloaded. The main rotor torque reaction will then combine with tail rotor thrust to produce a powerful right rolling moment on the fuselage. With no lift from the rotor, there is no lateral control to stop the rapid right roll and mast bumping can occur. Severe in-flight mast bumping usually results in main rotor shaft separation and/or rotor blade contact with the fuselage.

The rotor must be reloaded before lateral cyclic can stop the right roll. To reload the rotor, apply an immediate gentle aft cyclic, but avoid any large aft cyclic inputs. (The low-G which occurs during a rapid autorotation entry is not a problem because lowering collective reduces both rotor lift and rotor torque at the same time.)

Never attempt to demonstrate or experiment with low-G maneuvers, regardless of your skill or experience level. Even highly experienced test pilots have been killed investigating the low-G flight condition. Always use great care to avoid any maneuver which could result in a low-G condition. Low-G mast bumping accidents are almost always fatal.

**NEVER PERFORM A LOW-G PUSHOVER!!**

-----  
Safety Notice SN-12 has been superseded by SN-24  
-----

## **Safety Notice SN-13**

Issued: Jan 83 Rev: Jun 94

### DO NOT ATTACH ITEMS TO THE SKIDS

The landing gear strut elbows have cracked on several helicopters when the pilot attempted to carry an external load strapped to the landing gear skids. The landing gear is optimized to take high "up" loads. Consequently, it has very low strength in the opposite or "down" direction. Also, even a small weight attached to the landing gear may change the natural frequency enough to cause high loads due to inflight vibration. Do not attempt to carry any external load or object attached to the landing gear.

-----  
Safety Notice SN-14 has been superseded by SN-17, SN-27 and SN-28

## **Safety Notice SN-15**

Issued: Aug 83 Rev: Jun 94

### **FUEL EXHAUSTION CAN BE FATAL**

Many pilots underestimate the seriousness of fuel exhaustion. Running out of fuel is the same as a sudden total engine or drive system failure. When that occurs, the pilot must immediately enter autorotation and prepare for a forced landing. Refer to Section 3 of the Pilot's Operating Handbook under Power Failure. If autorotation is not entered immediately, the RPM will rapidly decay, the rotor will stall, and the results will likely be fatal. Serious or fatal accidents have occurred as a result of fuel exhaustion.

To insure this does not happen to you, observe the following precautions:

- 1) Never rely solely on the fuel gage or the low fuel warning light. These electromechanical devices have questionable reliability in any airplane or helicopter. Always record the hourmeter reading each time the fuel tanks are filled.
- 2) During your preflight:
  - a) Check the fuel level in the tanks visually.
  - b) Be sure the fuel caps are tight.
  - c) Drain a small quantity of fuel from each tank and the gascolator to check for water or other contamination.
- 3) Before takeoff:
  - a) Insure that the fuel valve is full on.
  - b) Be sure guard is placed on mixture control.
  - c) Plan your next fuel stop so you will have at least 20 minutes of fuel remaining.
- 4) In flight:
  - a) Continually check both hourmeter and fuel gages. If either indicates low fuel, LAND.
  - b) Always land to refuel before the main tank fuel gage reads less than 1/4 full.
  - c) NEVER allow the fuel quantity to become so low in flight that the low fuel warning light comes on.

## **Safety Notice SN-16**

Issued: Apr 84 Rev: Jun 94

### **POWER LINES ARE DEADLY**

Flying into wires, cables, and other objects is by far the number one cause of fatal accidents in helicopters. Pilots must constantly be on the alert for this very real hazard.

- \* Watch for the towers; you will not see the wires in time.
- \* Fly directly over the towers when crossing power lines.
- \* Allow for the smaller, usually invisible, grounding wire(s) which are well above the larger more visible wires.
- \* Constantly scan the higher terrain on either side of your flight path for towers.
- \* Always maintain at least 500 feet AGL except during take-off and landing. By always flying above 500 feet AGL, you can virtually eliminate the primary cause of fatal accidents.

---

## **Safety Notice SN-17**

Issued: Nov 84 Rev: Feb 89; Jun 94

### **NEVER EXIT HELICOPTER WITH ENGINE RUNNING**

Several accidents have occurred when pilots momentarily left their helicopters unattended with the engine running and rotors turning. The collective can creep up, increasing both pitch and throttle, allowing the helicopter to lift off or roll out of control.

### **HOLD CONTROLS WHEN BOARDING PASSENGERS**

It is important to firmly grip both cyclic and throttle while loading or unloading passengers with the engine running in case they inadvertently bump the controls or slide across the throttle, rolling it open.

### **NEVER LAND IN TALL DRY GRASS**

The engine exhaust is very hot and can easily ignite tall grass or brush. One R22 was completely destroyed by fire after a normal landing in tall grass.

## Safety Notice SN-18

Issued: Jan 85 Rev: Feb 89; Jun 94

### LOSS OF VISIBILITY CAN BE FATAL

Flying a helicopter in obscured visibility due to fog, snow, low ceiling, or even a dark night can be fatal. Helicopters have less inherent stability and much faster roll and pitch rates than airplanes. Loss of the pilot's outside visual references, even for a moment, can result in disorientation, wrong control inputs, and an uncontrolled crash. This type of situation is likely to occur when a pilot attempts to fly through a partially obscured area and realizes too late that he is losing visibility. He loses control of the helicopter when he attempts a turn to regain visibility but is unable to complete the turn without visual references.

You must take corrective action before visibility is lost! Remember, unlike the airplane, the unique capability of the helicopter allows you to land and use alternate transportation during bad weather, provided you have the good judgement and necessary willpower to make the correct decision.

### OVERCONFIDENCE PREVAILS IN ACCIDENTS

A personal trait most often found in pilots having serious accidents is overconfidence. High-time fixed-wing pilots transitioning into helicopters and private owners are particularly susceptible. Airplane pilots feel confident and relaxed in the air, but have not yet developed the control feel, coordination, and sensitivity demanded by a helicopter. Private owners are their own boss and can fly without discipline, enforced rules, or periodic flight checks and critique by a chief pilot. A private owner must depend on self-discipline, which is sometimes forgotten.

When flown properly and conservatively, helicopters are potentially the safest aircraft built. But helicopters are also probably the least forgiving. They must always be flown defensively. The pilot should allow himself a greater safety margin than he thinks will be necessary, just in case.

## Safety Notice SN-19

Issued: Jul 85 Rev: Jun 94

### FLYING LOW OVER WATER IS VERY HAZARDOUS

Many helicopter accidents have occurred while maneuvering low over water. Many pilots do not realize their loss of depth perception when flying over water. Flying over calm glassy water is particularly dangerous, but even choppy water, with its constantly varying surface, interferes with normal depth perception and may cause a pilot to misjudge his height above the water.

MAINTAIN 500 FEET AGL WHENEVER POSSIBLE AND AVOID MANEUVERS OVER WATER BELOW 200 FEET AGL.

---

## Safety Notice SN-20

Issued: Sep 85 Rev: Jun 94

### BEWARE OF DEMONSTRATION OR INITIAL TRAINING FLIGHTS

A disproportionate number of fatal and non-fatal accidents occur during demonstration or initial training flights. The accidents occur because individuals other than the pilot are allowed to manipulate the controls without being properly prepared or indoctrinated.

If a student begins to lose control of the aircraft, an experienced flight instructor can easily regain control provided the student does not make any large or abrupt control movements. If, however, the student becomes momentarily confused and makes a sudden large control input in the wrong direction, even the most experienced instructor may not be able to recover control. Instructors are usually prepared to handle the situation where the student loses control and does nothing, but they are seldom prepared for the student who loses control and does the wrong thing.

Before allowing someone to touch the controls of the aircraft, they must be thoroughly indoctrinated concerning the extreme sensitivity of the controls in a light helicopter. They must be firmly instructed to never make a large or sudden movement with the controls. And, the pilot-in-command must be prepared to instantly grip the controls should the student start to make a wrong move.

---

Safety Notice SN-21 has been deleted.



## **Safety Notice SN-22**

Issued: July 1986 Revised: June 1994; October 2016

### VORTEX RING STATE CATCHES MANY PILOTS BY SURPRISE

A vertical or steep approach, particularly downwind, can cause the rotor to fly into its own downwash. This condition is known as vortex ring state due to the vortices that develop as the downwash is recirculated through the rotor disk. Once vortex ring state exists, adding power (raising collective) can unexpectedly increase descent rate due to the increase in downwash recirculating through the rotor. Maximum engine power may not be enough to stop the descent before a hard landing occurs.

To avoid vortex ring state, reduce rate of descent before reducing airspeed. A good rule to follow is never allow your airspeed to be less than 30 knots until your rate-of-descent is less than 300 feet per minute.

Signs that vortex ring state is developing include increased vibration levels, decreased control authority ("mushy controls"), and a rapid increase in sink rate.

If vortex ring state is inadvertently encountered, two recovery techniques are available. One technique involves reducing collective pitch (to reduce downwash), lowering the nose to fly forward out of the downwash, and then applying recovery power. This can result in significant altitude loss which may not be acceptable on an approach.

A second technique known as the Vuichard recovery involves applying recovery power while moving the helicopter sideways, assisted by tail rotor thrust, out of the downwash. When flown properly, the Vuichard recovery produces minimal altitude loss.

Pilots should always be aware of wind conditions and plan descents to avoid vortex ring state. Training should emphasize recognition and avoidance of vortex ring state and include instruction in both recovery techniques.

## **Safety Notice SN-23**

Issued: Jul 86    Rev: Jun 94

### WALKING INTO TAIL ROTOR CAN BE FATAL

Non-pilot passengers have been killed by inadvertently walking into a rotating tail rotor. Every possible precaution must be taken by the pilot to prevent this tragic type of accident. The following rules should always be observed:

- 1) Never allow anyone to approach the helicopter unless they are escorted or have been properly instructed. If necessary, shut down and stop rotors before boarding passengers.
- 2) Always have strobe light flashing when rotors are turning.
- 3) Instruct passengers to establish and maintain eye contact with pilot when approaching helicopter. (This will force them to approach only from the nose or side, never the tail).
- 4) Instruct passengers to leave the helicopter in full view of the pilot and walk only around the nose, never the tail.
- 5) Be especially careful when landing off airports as unseen children or adults might approach the helicopter from the rear.

## Safety Notice SN-24

Issued: Sep 86 Rev: Jun 94

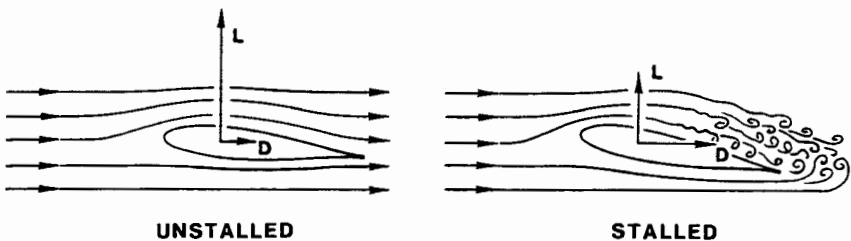
### LOW RPM ROTOR STALL CAN BE FATAL

Rotor stall due to low RPM causes a very high percentage of helicopter accidents, both fatal and non-fatal. Frequently misunderstood, rotor stall is not to be confused with retreating tip stall which occurs only at high forward speeds when stall occurs over a small portion of the retreating blade tip. Retreating tip stall causes vibration and control problems, but the rotor is still very capable of providing sufficient lift to support the weight of the helicopter.

Rotor stall, on the other hand, can occur at any airspeed and when it does, the rotor stops producing the lift required to support the helicopter and the aircraft literally falls out of the sky. Fortunately, rotor stall accidents most often occur close to the ground during takeoff or landing and the helicopter falls only four or five feet. The helicopter is wrecked but the occupants survive. However, rotor stall also occurs at higher altitudes and when it happens at heights above 40 or 50 feet AGL it is most likely to be fatal.

Rotor stall is very similar to the stall of an airplane wing at low airspeeds. As the airspeed of an airplane gets lower, the nose-up angle, or angle-of-attack, of the wing must be higher for the wing to produce the lift required to support the weight of the airplane. At a critical angle (about 15 degrees), the airflow over the wing will separate and stall, causing a sudden loss of lift and a very large increase in drag. The airplane pilot recovers by lowering the nose of the airplane to reduce the wing angle-of-attack below stall and adds power to recover the lost airspeed.

The same thing happens during rotor stall with a helicopter except it occurs due to low rotor RPM instead of low airspeed. As the RPM of the rotor gets lower, the angle-of-attack of the rotor blades must be higher to generate the lift required to support the weight of the helicopter. Even if the collective is not raised by the pilot to provide the higher blade angle, the helicopter will start to descend until the



Wing or rotor blade unstalled and stalled.

Safety Notice SN-24 (continued)

upward movement of air to the rotor provides the necessary increase in blade angle-of-attack. As with the airplane wing, the blade airfoil will stall at a critical angle, resulting in a sudden loss of lift and a large increase in drag. The increased drag on the blades acts like a huge rotor brake causing the rotor RPM to rapidly decrease, further increasing the rotor stall. As the helicopter begins to fall, the upward rushing air continues to increase the angle-of-attack on the slowly rotating blades, making recovery virtually impossible, even with full down collective.

When the rotor stalls, it does not do so symmetrically because any forward airspeed of the helicopter will produce a higher airflow on the advancing blade than on the retreating blade. This causes the retreating blade to stall first, allowing it to dive as it goes aft while the advancing blade is still climbing as it goes forward. The resulting low aft blade and high forward blade become a rapid aft tilting of the rotor disc sometimes referred to as "rotor blow-back". Also, as the helicopter begins to fall, the upward flow of air under the tail surfaces tends to pitch the aircraft nose-down. These two effects, combined with aft cyclic by the pilot attempting to keep the nose from dropping, will frequently allow the rotor blades to blow back and chop off the tailboom as the stalled helicopter falls. Due to the magnitude of the forces involved and the flexibility of rotor blades, rotor teeter stops will not prevent the boom chop. The resulting boom chop, however, is academic, as the aircraft and its occupants are already doomed by the stalled rotor before the chop occurs.

## Safety Notice SN-25

Issued: Dec 1986 Rev: Jul 2012

### CARBURETOR ICE

Avoidable accidents have been attributed to engine stoppage due to carburetor ice. When used properly, the carburetor heat and carb heat assist systems on the R22 and R44 will prevent carburetor ice.

Pressure drops and fuel evaporation inside the carburetor cause significant cooling. Therefore, carburetor ice can occur at OATs as high as 30°C (86°F). Even in generally dry air, local conditions such as a nearby body of water can be conducive to carburetor ice. **When in doubt, assume conditions are conducive to carburetor ice and apply carb heat as required.**

For the R22 and R44, carburetor heat may be necessary during takeoff. Unlike airplanes which take off at full throttle, helicopters take off using power as required, making them vulnerable to carburetor ice. Also use full carb heat during run-up to preheat the induction system.

On aircraft equipped with the carb heat assist system, the control knob should be left unlatched unless it is obvious that conditions are not conducive to carburetor ice.

Carburetor heat reduces engine power output for a given manifold pressure. Approximately 1.5 in. Hg additional MAP is required to generate maximum continuous power (MCP) or takeoff power (TOP) with full heat applied. The additional MAP with carb heat does not overstress the engine or helicopter because power limits are still being observed. Since the engine is derated, it will produce TOP at lower altitudes even with full heat. However, avoid using more heat than required at high altitudes as the engine may reach full throttle at less than MCP or TOP.

---

## Safety Notice SN-26

Issued: Jan 87 Rev: Jun 94

### NIGHT FLIGHT PLUS BAD WEATHER CAN BE DEADLY

Many fatal accidents have occurred at night when the pilot attempted to fly in marginal weather after dark. The fatal accident rate during night flight is many times higher than during daylight hours.

When it is dark, the pilot cannot see wires or the bottom of clouds, nor low hanging scud or fog. Even when he does see it, he is unable to judge its altitude because there is no horizon for reference. He doesn't realize it is there until he has actually flown into it and suddenly loses his outside visual references and his ability to control the attitude of the helicopter. As helicopters are not inherently stable and have very high roll rates, the aircraft will quickly go out of control, resulting in a high velocity crash which is usually fatal.

Be sure you NEVER fly at night unless you have clear weather with unlimited or very high ceilings and plenty of celestial or ground lights for reference.

## Safety Notice SN-27

Issued: Dec 87 Rev: Jun 94

### SURPRISE THROTTLE CHOPS CAN BE DEADLY

Many flight instructors do not know how to give a student a simulated power failure safely. They may have learned how to respond to a throttle chop themselves, but they haven't learned how to prepare a student for a simulated power failure or how to handle a situation where the student's reactions are unexpected. The student may freeze on the controls, push the wrong pedal, raise instead of lower the collective, or just do nothing. The instructor must be prepared to handle any unexpected student reaction.

Before giving a simulated power failure, carefully prepare your student and be sure you have flown together enough to establish that critical understanding and communication between instructor and student. Go through the exercise together a number of times until the student's reactions are both correct and predictable. Never truly surprise the student. Tell him you are going to give him a simulated power failure a few minutes before, and when you roll off the throttle, loudly announce "power failure". The manifold pressure should be less than 21 inches and the throttle should be rolled off smoothly, never "chopped". Follow through on all controls and tighten the muscles in your right leg to prevent the student from pushing the wrong pedal if he becomes confused. And always assume that you will be required to complete the autorotation entry yourself. Never wait to see what the student does. Plan to initiate the recovery within one second, regardless of the student's reaction.

There have been instances when the engine has quit during simulated engine failures. As a precaution, always perform the simulated engine failure within glide distance of a smooth open area where you are certain you could complete a safe touch-down autorotation should it become necessary. Also, never practice simulated power failures until the engine is thoroughly warmed up. Wait until you have been flying for at least 15 to 20 minutes.

## **Safety Notice SN-28**

Issued: Jul 1988      Rev: Jul 2012

### LISTEN FOR IMPENDING BEARING FAILURE

An impending ball or roller bearing failure is usually preceded by a noticeable increase in noise. The noise will typically start several hours before the bearing actually fails or before there is any increase in bearing temperature. To detect pending failure of a drive system bearing, the pilot should uncover one ear and listen to the sound of the drive system during start-up and shutdown. After the pilot becomes familiar with the normal sound of the drive system, he should be able to detect the noise made by a failing bearing. The failing bearing will produce a loud whine, rumble, growl, or siren sound. Upon hearing an unusual noise, the pilot must immediately ground the aircraft and have the bearings thoroughly inspected by a qualified mechanic. Failure of a bearing in flight could result in a serious accident.

Do not rely on Telatemps to indicate impending bearing failure. A failing bearing may not run hot enough to black out the Telatemps until it actually starts to disintegrate. This may occur only seconds before complete failure.

### CLUTCH LIGHT WARNING

It is normal for the clutch light to come on occasionally in flight for a short time (approximately 3 to 6 seconds) to re-tension the drive belts. If the clutch light flickers or does not go out within 10 seconds, it can indicate a belt or bearing failure. If abnormal clutch light indication occurs, pull clutch circuit breaker and reduce power. Select a safe landing site and make a precautionary landing to check drive system. If additional symptoms of drive system failure (smell of hot rubber, noise, or vibration) are present, land immediately. If tachometer needle split occurs, enter autorotation.

After landing, shut down and check the drive belts to insure that the belts are in their grooves and not damaged. Check the upper and lower actuator bearings for seal damage. Also check the Telatemp indicator readings. If drive system problems are found, have the aircraft inspected by a mechanic before further flight.

## Safety Notice SN-29

Issued: Mar 93 Rev: Jun 94

### AIRPLANE PILOTS HIGH RISK WHEN FLYING HELICOPTERS

There have been a number of fatal accidents involving experienced pilots who have many hours in airplanes but with only limited experience flying helicopters.

The ingrained reactions of an experienced airplane pilot can be deadly when flying a helicopter. The airplane pilot may fly the helicopter well when doing normal maneuvers under ordinary conditions when there is time to think about the proper control response. But when required to react suddenly under unexpected circumstances, he may revert to his airplane reactions and commit a fatal error. Under those conditions, his hands and feet move purely by reaction without conscious thought. Those reactions may well be based on his greater experience, ie., the reactions developed flying airplanes.

For example, in an airplane his reaction to a warning horn (stall) would be to immediately go forward with the stick and add power. In a helicopter, application of forward stick when the pilot hears a horn (low RPM) would drive the RPM even lower and could result in rotor stall, especially if he also "adds power" (up collective). In less than one second the pilot could stall his rotor, causing the helicopter to fall out of the sky.

Another example is the reaction necessary to make the aircraft go down. If the helicopter pilot must suddenly descend to avoid a bird or another aircraft, he rapidly lowers the collective with very little movement of the cyclic stick. In the same situation, the airplane pilot would push the stick forward to dive. A rapid forward movement of the helicopter cyclic stick under these conditions would result in a low "G" condition which could cause mast bumping, resulting in separation of the rotor shaft or one blade striking the fuselage. A similar situation exists when terminating a climb after a pull-up. The airplane pilot does it with forward stick. The helicopter pilot must use his collective or a very gradual, gentle application of forward cyclic.

To stay alive in the helicopter, the experienced airplane pilot must devote considerable time and effort to developing safe helicopter reactions. The helicopter reactions must be stronger and take precedence over the pilot's airplane reactions because everything happens faster in a helicopter. The pilot does not have time to realize he made the wrong move, think about it, and then correct it. It's too late; the rotor has already stalled or a blade has already struck the airframe and there is no chance of recovery. To develop safe helicopter reactions, the airplane pilot must practice each procedure over and over again with a competent instructor until his hands and feet will always make the right move without requiring conscious thought. **AND, ABOVE ALL, HE MUST NEVER ABRUPTLY PUSH THE CYCLIC STICK FORWARD.**

Also see Safety Notices SN-11 and SN-24.



## **Safety Notice SN-30**

Issued: Jun 94 Rev: Apr 2009

### LOOSE OBJECTS CAN BE FATAL

Fatal accidents have occurred due to loose objects flying out of the cabin and striking the tail rotor. Any object striking the tail rotor can cause failure of a tail rotor blade. Loss of or damage to a tail rotor blade may cause a severe out-of-balance condition which can separate the tail rotor gearbox or entire tail assembly from the tailcone, resulting in a catastrophic accident. Accidents have also been caused by fuel caps, birds, and other objects striking the tail rotor. Before each flight perform the following:

- 1) Walk completely around the aircraft checking fuel cap security and tail rotor condition. Ensure no loose objects or debris in helicopter vicinity. Verify cotter rings or pins are installed in all door hinge pins.
- 2) Stow or secure all loose objects in the cabin. Even with doors on, items such as charts can be sucked out of a vent door.
- 3) Instruct passengers regarding the dangers of objects striking the tail rotor. Warn them never to throw anything from the helicopter or place items near vent doors where they could get sucked out.
- 4) Firmly latch all doors.
- 5) Never fly with a left door removed. (Remove only the right door for ventilation.)

---

## **Safety Notice SN-31**

Issued: Dec 96

### GOVERNOR CAN MASK CARB ICE

With throttle governor on, carb ice will not become apparent as a loss of either RPM or manifold pressure. The governor will automatically adjust throttle to maintain constant RPM which will also result in constant manifold pressure. When in doubt, apply carb heat as required to keep CAT out of yellow arc during hover, climb, or cruise, and apply full carb heat when manifold pressure is below 18 inches.

Also remember, if carb heat assist is used it will reduce carb heat when you lift off to a hover and the control may require readjustment in flight.

## **Safety Notice SN-32**

Issued: Mar 1998

Revised: May 2013; Feb 2016

### HIGH WINDS OR TURBULENCE

Flying in high winds or turbulence should be avoided.

A pilot's improper application of control inputs in response to turbulence can increase the likelihood of a mast bumping accident. If turbulence is encountered, the following procedures are recommended:

1. Reduce power and use a slower than normal cruise speed. Mast bumping is less likely at lower airspeeds.
2. For significant turbulence, reduce airspeed to 60–70 knots.
3. Tighten seat belt and rest right forearm on right leg to minimize unintentional control inputs. Some pilots may choose to apply a small amount of cyclic friction to further minimize unintentional inputs.
4. Do not overcontrol. Allow aircraft to go with the turbulence, then restore level flight with smooth, gentle control inputs. Momentary airspeed, heading, altitude, and RPM excursions are to be expected.
5. Avoid flying on the downwind side of hills, ridges, or tall buildings where turbulence will likely be most severe.

The helicopter is more susceptible to turbulence at light weight. Reduce speed and use caution when flying solo or lightly loaded.

## **Safety Notice SN-33**

Issued: March 1998      Revised: July 2013

### DRIVE BELT SLACK

R22 and R44 drive belts must have the proper slack prior to engine start. Belts which are too loose may jump out of their sheave grooves during engine start while clutch is engaging.

1. During preflight, with clutch disengaged, press in on belts with fingers just above fan scroll. Verify belts deflect approximately 1 ½ inches (4 cm). If belts are significantly looser than this, have actuator adjusted prior to engine start.
2. After engine start, engage clutch and verify rotor turns within 5 seconds. If rotor does not turn within 5 seconds, shut down and have actuator adjusted prior to flight.

New drive belts may be tight and cause the rotor to turn during engine start. This places unnecessary strain on the starter and drive system. If necessary, stretch new belts as follows:

1. During shutdown, do not disengage clutch.
2. After battery switch is off, put clutch switch in DISENGAGE position. If the clutch switch is left in ENGAGE position, the tachometers still draw power and can drain the battery.
3. Switch battery on and allow clutch to disengage during next preflight.

INTENTIONALLY BLANK

## **Safety Notice SN-34**

Issued: Mar 99 Rev: Apr 2009

### AERIAL SURVEY AND PHOTO FLIGHTS – VERY HIGH RISK

There is a misconception that aerial survey and photo flights can be flown safely by low time pilots. Not true. There have been numerous fatal accidents during aerial survey and photo flights, including several involving Robinson helicopters.

Often, to please the observer or photographer, an inexperienced pilot will slow the helicopter to less than 30 KIAS and then attempt to maneuver for the best viewing angle. While maneuvering, the pilot may lose track of airspeed and wind conditions. The helicopter can rapidly lose translational lift and begin to settle. An inexperienced pilot may raise the collective to stop the descent. This can reduce RPM thereby reducing power available and causing an even greater descent rate and further loss of RPM. Rolling on throttle will increase rotor torque but not power available due to the low RPM. Because tail rotor thrust is proportional to the square of RPM, if the RPM drops below 80% nearly one-half of the tail rotor thrust is lost and the helicopter will rotate nose right. Suddenly the decreasing RPM also causes the main rotor to stall and the helicopter falls rapidly while continuing to rotate. The resulting impact is usually fatal.

Aerial survey and photo flights should only be conducted by well trained, experienced pilots who:

- 1) Have at least 500 hours pilot-in-command in helicopters and over 100 hours in the model flown;
- 2) Have extensive training in both low RPM and settling-with-power recovery techniques;
- 3) Are willing to say no to the observer or photographer and only fly the aircraft at speeds, altitudes, and wind angles that are safe and allow good escape routes.

Also see Safety Notice SN-24.

## **Safety Notice SN-35**

Issued: Apr 1999

Revised: Feb 2016

### FLYING NEAR BROADCAST TOWERS

High-power radio broadcast towers (typically 50 kW or greater) may generate Electromagnetic Interference (EMI) with helicopter electrical systems and electronic equipment. Early indications of a high-power radio field can be considerable radio squelch break or static in the intercom system. More severe effects may include random illumination of warning lights or erratic engine governor and tachometer operation. In the worst cases, the governor may attempt to fully open or close the throttle. If the pilot is not ready to counteract a governor malfunction, a low-RPM condition or overspeed may occur.

Radio field strength decreases rapidly as distance from a transmitting antenna increases. To minimize the probability of encountering EMI, do not fly within ½ mile of high-power broadcast towers.

If EMI is inadvertently encountered:

- Do not become distracted trying to adjust the radio or audio system.
- Keep one hand on the throttle twist grip and feel for normal operation. If operation is abnormal, tighten grip to override governor and control throttle manually. If desired, governor may be switched off until helicopter is clear of the EMI area.
- Monitor tachometer, engine instruments, and warning lights carefully. Use caution not to overreact to a false instrument or warning light indication.
- Following a flight where EMI was encountered, have electrical system and installed electronic equipment assessed by qualified maintenance personnel.

The location and height of radio broadcast towers are marked on aeronautical charts. However, transmitter power and frequency are not. While all broadcast towers should be circumnavigated at a safe distance, those in the HF/Short Wave band have the highest likelihood of causing EMI. A list of such towers for the United States can be found on the Robinson Helicopter Company website at [www.robinsonheli.com/sn35antennas](http://www.robinsonheli.com/sn35antennas). The list was compiled from a Federal Communications Commission (FCC) database of HF/Shortwave stations. Appropriate agencies in other countries may be able to provide similar databases.

## **Safety Notice SN-36**

Issued: Nov 00

### OVERSPEEDS DURING LIFTOFF

Helicopters have been severely damaged by RPM overspeeds during liftoff. The overspeeds caused a tail rotor drive shaft vibration which led to immediate failure of shaft and tailcone. Throughout the normal RPM range, tail rotor shaft vibration is controlled by damper bearing. However, damper is not effective above 120% RPM.

Mechanical correlation can cause overspeed during liftoff if RPM is increased to normal flight settings and collective raised before governor is switched on. Overspeeds can also occur if throttle is gripped too firmly during liftoff causing governor to be overridden. Inexperienced pilots, who are most likely to be nervous or distracted, are particularly susceptible to this type of overspeed.

To avoid overspeeds during liftoff:

1. Always confirm governor on before increasing RPM above 80%.
2. Verify governor stabilizes engine RPM near top of green arc.
3. Maintain relaxed grip on throttle allowing governor to control RPM.

## **Safety Notice SN-37**

Issued: Dec 01

### **EXCEEDING APPROVED LIMITATIONS CAN BE FATAL**

Many pilots do not understand metal fatigue. Each time a metal component is loaded to a stress level above its fatigue limit, hidden damage occurs within the metal. There is no inspection method which can detect this invisible fatigue damage. The first indication will be a tiny microscopic crack in the metal, often hidden from view. The crack will grow with each repetition of the critical stress until the part suddenly breaks. Crack growth will occur quite rapidly in drive system parts from the high frequency torsional loads. It will also occur rapidly in rotor system components due to the high centrifugal force on the blades and hub. Damaging fatigue cycles occur with every revolution of an overloaded drive shaft or rotor blade.

If a pilot exceeds the power or airspeed limits on a few occasions without failure, he may be misled into believing he can safely operate at those high loads. Not true. Every second the limitations are exceeded, more stress cycles occur and additional fatigue damage can accumulate within the metal. Eventually, a fatigue crack will begin and grow until a sudden failure occurs. If the pilot is lucky, the part will have reached its approved service life and be replaced before failure. If not, there will likely be a serious or fatal accident.

### **WARNING**

- 1) Always operate the aircraft well below its approved Vne (never exceed speed), especially in turbulent wind conditions.
- 2) Do not operate the engine above its placarded manifold pressure limits.
- 3) Do not load the aircraft above its approved gross weight limit.
- 4) The most damaging conditions occur when flying or maneuvering at high airspeeds combined with high power settings.



## **Safety Notice SN-38**

Issued: Jul 2003

Rev: Oct 2004

### PRACTICE AUTOROTATIONS CAUSE MANY TRAINING ACCIDENTS

Each year many helicopters are destroyed practicing for the engine failure that very rarely occurs.

Many practice autorotation accidents occur when the helicopter descends below 100 feet AGL without all the proper conditions having been met. As the aircraft descends through 100 feet AGL, make an immediate power recovery unless all of the following conditions exist:

- 1) Rotor RPM in middle of green arc
- 2) Airspeed stabilized between 60 and 70 KIAS
- 3) A normal rate of descent, usually less than 1500 ft/min
- 4) Turns (if any) completed

Instructors may find it helpful to call out "RPM, airspeed, rate of descent" prior to passing through 100 feet. At density altitudes above 4000 feet, increase the decision point to 200 feet AGL or higher.

A high percentage of training accidents occur after many consecutive autorotations. To maintain instructor focus and minimize student fatigue, limit practice to no more than 3 or 4 consecutive autorotations.

There have been instances when the engine has quit during practice autorotation. To avoid inadvertent engine stoppage, do not roll throttle to full idle. Reduce throttle smoothly for a small visible needle split, then hold throttle firmly to override governor. Recover immediately if engine is rough or engine RPM continues to drop.

-----

## **Safety Notice SN-39**

Issued: Jul 2003

### UNUSUAL VIBRATION CAN INDICATE A MAIN ROTOR BLADE CRACK

A catastrophic rotor blade fatigue failure can be averted if pilots and mechanics are alert to early indications of a fatigue crack. Although a crack may be internal to blade structure and not visible, it will likely cause a significant increase in rotor vibration prior to final failure. If a rotor is smooth after balancing but then goes out of balance again within a few flights, it should be considered suspect. Have the rotor system thoroughly examined by a qualified mechanic before further flight.

If main rotor vibration rapidly increases or becomes severe during flight, make an immediate safe landing. Do not attempt to continue flight to a convenient destination.

## **Safety Notice SN-40**

Issued: July 2006 Rev: May 2013

### POST-CRASH FIRES

There have been a number of cases where helicopter or light plane occupants were severely burned by fire following an accident. Fire-retardant Nomex flight apparel reduces the likelihood of severe burns. Military, law-enforcement, medical, and other organizations often require Nomex apparel for every flight. Pilots should consider the benefits of fire-retardant clothing and brief or equip all occupants accordingly.

---

## **Safety Notice SN-41**

Issued: May 2013

### PILOT DISTRACTIONS

Distractions in the cabin have caused pilots to lose control of the helicopter. Reading charts, programming avionics, or attending to passengers are some common distractions. During flight, it is important to keep eyes focused outside and minimize distractions to avoid an accident. Any avionics programming that takes more than a few seconds should be done while on the ground.

When hovering, keep both hands on the controls. If tuning a radio or other task is required, first land and reduce collective pitch. When dealing with distractions in forward flight, reduce power, slow down, and frequently look outside to verify straight and level flight.

Occasionally, pilots neglect to latch a door before taking off. Never attempt to latch a door while hovering or in flight. It is safer to land before closing a door.

---

## **Safety Notice SN-42**

Issued: May 2013

### UNANTICIPATED YAW

A pilot's failure to apply proper pedal inputs in response to strong or gusty winds during hover or low-speed flight may result in an unanticipated yaw. Some pilots mistakenly attribute this yaw to loss of tail rotor effectiveness (LTE), implying that the tail rotor stalled or was unable to provide adequate thrust. Tail rotors on Robinson helicopters are designed to have more authority than many other helicopters and are unlikely to experience LTE.

To avoid unanticipated yaw, pilots should be aware of conditions (a left crosswind, for example) that may require large or rapid pedal inputs. Practicing slow, steady-rate hovering pedal turns will help maintain proficiency in controlling yaw. Hover training with a qualified instructor in varying wind conditions may also be helpful.

## **Safety Notice SN-43**

Issued: January 2015

### USE EXTRA CAUTION DURING POST-MAINTENANCE FLIGHTS

A number of fatal accidents have occurred during flights immediately following maintenance. In several cases, the cause was incorrect or incomplete reassembly of the helicopter, and the error would have been detectable during a careful preflight inspection.

Even the best maintenance personnel can become distracted and make a mistake. Pilots should conduct an especially thorough preflight inspection after maintenance has been performed. If possible, speak to the technicians who performed the work, find out exactly what was done, and pay special attention to those areas. Professional maintenance personnel will appreciate the pilot's commitment to safety and will welcome an additional check of their work.

Any work done on the flight control system deserves special attention because a flight control disconnect is almost always catastrophic. During track and balance work, always climb up to the rotor head for a close inspection of the pitch link and control tube fasteners after each adjustment. Never rush or skip preflight steps.

INTENTIONALLY BLANK