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ADVISORY CIRCULAR

10A TECHNICAL UNIT

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DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

Washington, D.C.

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Subject: PREVENTION OF RETRACTABLE LANDING GEAR FAILURES

1. PURPOSE. This advisory circular updates statistical information related to landing accidents involving aircraft with retractable landing gear and suggests procedures to minimize those accidents.

2. CANCELLATION. Advisory Circular 20-34C, Prevention of Retractable Landing Gear Failures, dated May 17, 1979, is canceled.

3. DISCUSSION. A review of the Federal Aviation Administration's General Aviation Accident Factual Reports for the year 1979 disclosed that 1,002 airplanes equipped with retractable landing gear were involved in accidents. Of those 1,002 airplanes, 106 or 10.5 percent were involved in "landing gear" accidents. Further study showed that 63 percent of the 106 accidents were the result of a human factor and 37 percent involved mechanical/technical reasons. Accidents involving retractable landing gear can be reduced with deliberate, careful, and continued use of the checklist by pilots, and the performance of maintenance, as recommended by the aircraft manufacturer, by qualified personnel.

4. OPERATIONAL FACTORS AND PERCENTAGES INVOLVED IN RETRACTABLE GEAR AIRCRAFT ACCIDENTS.

- a. Neglected to extend landing gear -- 35.8 percent.
- b. Inadvertent retraction of landing gear -- 10.3 percent.
- c. Activated gear, but failed to check gear position -- 11.3 percent
- d. Misused emergency gear system -- 0.9 percent.
- e. Retracted gear prematurely on takeoff -- 2.8 percent.
- f. Extend gear too late -- 1.8 percent.

Initiated by: AWS-340

5. PREVENTION OF GEAR UP OR COLLAPSED GEAR LANDINGS.

a. We recommend the following tried and proven landing procedures to deter inadvertent wheels up or inadvertent gear retraction during touchdown and rollout:

(1) On the downwind leg, or at the final approach fix inbound, make it a habit to complete the recommended landing gear checklist for your aircraft. This accomplishes two purposes. It ensures that action has been taken to lower the gear, and it increases your awareness so you can recheck the gear-down indicators prior to landing.

(2) Complete the landing roll and clear the runway before operating any levers or switches unless good operating practices dictate otherwise. This will accomplish the following: The landing gear strut safety switches will be actuated, deactivating the landing gear retract system. After rollout and clearing the runway, you will be able to focus attention on the after landing checklist and to identify the proper controls.

b. We suggest the following for consideration by the owner/operator:

(1) Provide a condensed checklist, mounted in view of the pilot, as a reminder for its use and easy reference.

(2) Periodically review the landing gear emergency extension procedures for your aircraft.

(3) Be familiar with the landing gear warning horn and warning light systems of your aircraft. Use the horn system to cross-check the warning light system when an unsafe condition is noted.

(4) Review the procedure for replacing light bulbs in the landing gear warning light displays for your aircraft, so that you can properly replace a bulb to determine if the bulb(s) in the display is good. Check to see if spare bulbs are available in the aircraft spare bulb supply before flight.

(5) Have known landing gear deficiencies corrected before flight.

REMEMBER, AS A PILOT YOU ARE RESPONSIBLE FOR THE SAFE OPERATION OF YOUR AIRCRAFT.

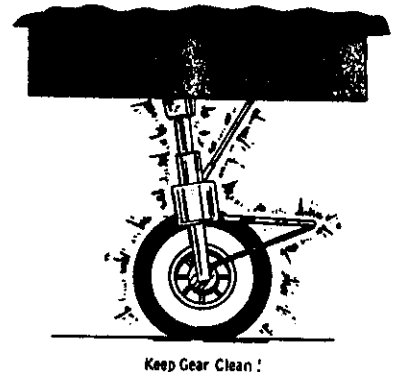
6. MECHANICAL FAILURE. Mechanically-induced failures of retractable landing gear have involved:

- a. Metal fatigue/failure.
- b. Improper installation of parts.
- c. Improperly secured parts.

- d. Use of non-standard parts.
- e. Rupture of hydraulic lines.
- f. Failure of electrical wire connections, relays, contactors, and/or actuators.
- g. Malfunctions of warning systems.
- h. Inoperative limit and safety switches.
- i. Uplocks failed to release.
- j. Downlocks failed to engage.
- k. Wheels jammed or hung up in wheelwells.
- l. Chains have disengaged from sprockets.
- m. Cables fouled in pulleys.
- n. Slide tubes became bound due to contamination and corrosion.
- o. Torque tubes and drag struts were bent due to excessive loads being applied.

Many of those difficulties were found to be the result of improper rigging and adjustment, lack of lubrication and/or an insufficient program for the prevention and control of corrosion.

7. PREVENTIVE MAINTENANCE. It is a good practice to use the information furnished by aircraft manufacturers in servicing your aircraft. Particular attention should be directed toward keeping the landing gear, wheelwell, and adjacent areas clean and free of mud and debris. Dirty switches and valves may cause false safe light indications or interrupt the extension cycle before the landing gear is completely down and locked. Repair or replace protective boots that are damaged or missing. Oversize or recapped tires may cause landing gear to stick in the wheelwell and prevent extension. Assure that shock struts are properly inflated and the pistons are kept clean. Lubricate landing gear in accordance with the manufacturer's instructions. Wipe off excess grease when lubricating landing gear system. Establish a program for corrosion prevention and control for your aircraft to preclude its effect upon proper operation/failure of landing gear structure and parts.



8. REQUIRED MAINTENANCE. During the annual, 100-hour or progressive landing gear inspection cycle, the aircraft is placed on jacks and the gear completely inspected for condition, rigging, and proper operation, including the warning system. Intermediate inspection and servicing will further ensure against landing gear system malfunction.

9. INSPECTION FREQUENCY.

a. How often shall a landing gear system be inspected and serviced? As often as it is necessary to assure proper function of the landing gear system. At least as often as Federal Aviation Regulations, including applicable Airworthiness Directives, require. It is recommended that the aircraft manufacturer's instructions for inspection frequency and procedure be followed.

b. An ideal time for an interim inspection of the landing gear system would be during the pilot's preflight inspection.

c. When aircraft are operated from rough surfaces or are used for student instruction, more frequent inspections may be in order. When a hard landing is experienced or the gear strikes an object while taxiing, it is wise to inspect for damage. Damage may occur and rigging may be affected by sharp turns at high taxi speeds, by faulty technique during a crosswind landing, or by taxiing off a hard surface into deep mud or snow.

d. Awareness of our human limitations, those of the aircraft we operate, and the proper application of good maintenance practices can effect a substantial reduction in accidents involving retractable landing gear, and a substantial improvement in aviation safety.



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