



U.S. Department
of Transportation
**Federal Aviation
Administration**

Advisory Circular

Subject: HAZARDS OF ROTATING PROPELLER
AND HELICOPTER ROTOR BLADES

Date: 3/3/83
Initiated by: AWS-340

AC No: 91-42D
Change:

1. PURPOSE. This advisory circular updates statistical information on propeller- and rotor-to-person accidents and offers suggestions to reduce the frequency of those accidents.
2. CANCELLATION. AC 91-42C, Hazards of Rotating Propeller and Helicopter Rotor Blades, dated May 22, 1981, is canceled.
3. BACKGROUND. A review of National Transportation Safety Board reports of propeller- and rotor-to-person accidents for the years 1979, 1980, and 1981, showed a total of 54. Of those accidents, two were the result of helicopter rotors which caused two serious injuries. The 52 propeller accidents caused 9 fatalities and 45 serious injuries. In two of the propeller accidents, two persons received serious injuries. Propeller- and rotor-to-person accidents are a small percentage of the total aircraft accidents. With proper education and discipline, those accidents could be reduced to zero. The following chart summarizes the events leading to the various accidents.

<u>EVENTS LEADING TO THE ACCIDENT</u>	<u>FATALITIES</u>	<u>SERIOUS INJURIES</u>
Passengers deplaning aircraft with operating engine(s)	2	16
Passengers enplaning aircraft with operating engine(s)	1	3
Handcranking of propellers by pilot	1	9
Handcranking of propeller by passengers	0	2
Pilot working on aircraft with engine(s) operating	0	2
Passengers assisting pilot taxiing and parking	2	1
Bystanders in vicinity of operating aircraft	2	7
Ground personnel working near aircraft with operating engine(s)	1	2
Propeller blade separation	0	0
Ground personnel working near helicopters with rotor in motion	0	2
Handcranking of propellers by ground crew	0	2
Pilot exiting aircraft with engine operating	0	1

4. GENERAL. It is particularly tragic that propeller- and rotor-to-person accidents, along with airmen, have included bystanders, passengers, and children among the injured persons. Propeller- and rotor-to-person accidents differ from other aircraft accidents in that they usually result in fatal or serious injury. This is due to the fact that a propeller or rotor rotating under power, even at slow idling speed, has sufficient force to inflict serious injury. It should be remembered that a rotating propeller or rotor is extremely dangerous and should be treated with all due caution.

5. CONSPICUITY. The propeller or rotor is difficult to see when in operation, and the nonprofessional public is often not aware of its danger. Even personnel familiar with the danger of a turning propeller or rotor are likely to forget it.

a. Some manufacturers of propeller and rotor blades use paint schemes to increase the conspicuity of the blades. Owners should give strong consideration to maintaining the conspicuity paint scheme of the original manufacturer.

b. In the event that the paint scheme does not lend itself to conspicuity, the owner should consider having the blade repainted. A customized paint scheme should not be used until an evaluation is made by a person qualified to determine that it will not interfere with the pilot's visibility, promote vertigo, or create an unbalanced blade condition.

c. In August of 1978, the FAA issued Report No. FAA-AM-78-29, Conspicuity Assessment of Selected Propeller and Tail Rotor Paint Schemes. The report summarizes the evaluation of three paint schemes for airplane propellers and two for helicopter tail rotor blades. The document is available to the public through the National Technical Information Service, Springfield, Virginia 22161.

6. NONFLIGHT CREW PERSONNEL. Persons directly involved with enplaning or deplaning passengers and aircraft servicing should be instructed as to their specific duties through proper training, with emphasis placed on the dangers of rotating propellers and rotors. Ramp attendants and passenger-handling personnel should be made aware of the proper procedures and methods of directing passengers to and from parked aircraft. The following safety measures should be considered to help prevent accidents on airport ramp areas:

a. When the possibility of passengers wandering on the ramp exists, physical barriers should be provided such as rope stanchions from the aircraft to the terminal doors.

b. Airport management personnel should be on the alert to keep unauthorized persons from milling around on ramps among parked aircraft. When spectators are permitted to view and move among aircraft parked on a ramp, the airport management personnel should caution those persons to stay clear of all propellers and not touch or move them.

c. Helicopter landing and ramp areas should be marked and provided with safety barriers to restrict access by unauthorized persons.

d. Tail rotor danger areas should be clearly marked on ramp areas. Helicopters should be parked with tail rotors within the marked area.

7. AIRCRAFT SERVICE PERSONNEL. Persons directly involved with aircraft service are most vulnerable to injuries by propellers or rotors. Working around aircraft places them in the most likely position for possible propeller or rotor accidents. Aircraft service personnel should develop the following safety habits:

a. Treat all propellers as though the ignition switches are "on."

b. Chock airplane wheels before working around aircraft.

c. Use wheel chocks and parking brakes before starting engines or handcranking engines. Handcranking a starter-equipped engine with a low battery or defective starter, although convenient, can expose personnel to a possible accident. For safety reasons, the replacement of the faulty starter and the use of a ground power source should be considered rather than handcranking. Only experienced persons should do the handcranking with a reliable person in the cockpit. Handcranking with the cockpit unoccupied has resulted in accidents.

d. Attach pull ropes to pull chocks from wheels close to rotating propeller or rotor blades.

e. After an engine run and before the engine is shut down, perform an ignition switch test to detect a faulty ignition switch. Follow the manufacturer's recommendations for the switch test and the procedures to be followed when a faulty switch is found. Applicable airworthiness directive requirements related to ignition switches have been issued to help locate and eliminate faulty switches.

f. Before moving a propeller or connecting an external power source to an aircraft, be sure that the aircraft is chocked, ignition switches are in the "off" position, throttle is closed, mixture is in "idle cut-off" position, and all equipment and personnel are clear of the propeller or rotor. Faulty diodes in aircraft electrical systems have caused starters to engage when external power was applied regardless of the switch position.

g. Remember when removing an external power source from an aircraft, keep the equipment and yourself clear of the propeller or rotor.

h. Always stand clear of rotor and propeller blade paths, especially when moving the propeller. Particular caution should be practiced around warm engines.

i. Ground personnel should be given recurrent propeller and rotor safety lectures to keep them alert to dangers when working around helicopters and fixed-wing aircraft.

j. Before removing chocks, signal pilot to hold brakes or apply parking brake.

k. Be sure all equipment and personnel are clear of an aircraft before giving the pilot the signal to depart.

8. FLIGHT PERSONNEL AND FLIGHT INSTRUCTORS. Prior to starting an engine, flight personnel should make certain that all personnel are clear of the propeller or rotor.

a. The engine of a fixed-wing aircraft or of a helicopter should be shut down before boarding or deplaning passengers. This is the simplest method of avoiding accidents.

b. Boarding or deplaning of passengers, with an engine running, should only be allowed under close supervision. The pilot in command should have knowledge that either the company or the airport operator has ground attendants fully trained in their specific duties to board or deplane passengers from an aircraft with an engine(s) running. The pilot should instruct passengers, before they exit an aircraft with an engine(s) running, the path to follow to avoid the propeller or rotor blades.

c. When it is necessary to discharge a passenger from an aircraft on which an engine is running, never stop the aircraft with the propeller in the path of the passenger's route from the aircraft.

d. When flight and ground instructors are instructing their students about propellers or rotors, they should emphasize the dangers of rotating propeller and rotor blades. Students should be taught the techniques and safety procedures for handcranking, and how to determine which engines should not be handcranked. Safety through education is the best and most positive means available for reducing potential accidents from rotating propeller and rotor blades.

e. The prestart portion of the checklist should include an item to make sure the propeller or rotor blades are clear. The proper use of the aircraft checklist should be taught to all student pilots.

f. Flight personnel should perform an ignition switch test prior to engine shutdown to detect faulty switches. (See item 7e.) The checklist should include an item for that test to be made and an item to assure that the switch is off before leaving the cockpit.

9. SUMMARY.

a. In reviewing propeller- and rotor-to-person accidents, the most impressive fact is that every one of them was preventable. The danger of rotating propeller or rotor blades is universally recognized.

b. The pilot can be most effective in ensuring that his or her passengers arrive and depart the vicinity of the airplane safely by stopping the engine completely at the time of loading and unloading, or by providing a definite means of keeping them clear of the propeller if it is left in motion.

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c. Prominent warning signs, placed in the aircraft's interior near or on the inside face of the aircraft doors to alert passengers and crewmembers of propeller or rotor hazards, could be helpful in preventing accidents.



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