U.S. Department of Transportation

Federal Aviation Administration

Advisory Circular

Subject: ROLE OF PREFLIGHT PREPARATION

Date: 3/18/85
Initiated by: AFO-840

AC No: 61-84B
Change:

1. PURPOSE. This advisory circular (AC) modifies and updates the flight information available to pilots as a result of changes in the basic Airmen Information Manual format.

2. CANCELLATION. AC 61-84A dated December 1, 1980, is canceled.

3. BACKGROUND.

a. One of the most often neglected acts of a pilot contemplating flight in an aircraft is that of proper preflight planning. While the reasons remain obscure, the facts are well supported by aircraft accident statistics. Although the number of general aviation accidents has shown a downward trend in recent years, the accident and fatality/serious injury statistics indicate an increase in the percentage of accidents during takeoff.

b. Statistics taken from the National Transportation Safety Board files show that from 1979 through 1983, 728 persons died and 665 were seriously injured in 4,291 takeoff accidents. These accidents are significant to general aviation pilots--annually, they represent about 20 percent of all general aviation accidents and about 16 percent of all fatalities and serious injuries. Traditionally, pilots have emphasized the planning of the en route and approach/landing phases of flight; e.g., the route to be taken, en route and destination weather, en route and terminal facilities, applicable altitudes and fuel requirements. Accident data, however, indicate that too little preparation is made for the actual takeoff of the aircraft. In order for pilots to fulfill their responsibilities to ensure the safety of the entire flight, it is necessary that they have adequate knowledge of elements involved in preflight planning. It is also necessary that they take time to analyze the conditions and study the various factors which would affect the takeoff, en route, and landing phases of flight.

4. KEY ELEMENTS OF PREFLIGHT PLANNING.

a. Charts.

(1) A basic element of preflight preparation requires the use of current navigational charts on which pilots can mentally review their intended route of flight. They may or may not wish to draw a line on the chart representing the true

course. They should, however, review the projected path across the face of the chart for the location of good checkpoints, restricted areas, obstructions, other flight hazards, and suitable airports. For visual flight rule (VFR) pilot planning by either pilotage or dead reckoning, the Sectional Aeronautical Chart is an excellent choice. It is scaled at 1/500,000, or 8 miles to the inch. The physical characteristics of most landmarks, both cultural and geographic, are shown in great detail. The pilot should have little difficulty identifying the selected landmarks along the route of flight. Another popular chart is the World Aeronautical Chart (WAC). The scale of the WAC is 1/1,000,000, or 16 miles to the inch. Many states print aeronautical charts which are excellent for VFR navigation within their state boundaries. The pilot should realize, however, that all of these charts are designed primarily for VFR navigation and contain only limited information concerning radio aids and frequencies. The use of instrument flight rules (IFR) navigational charts for planning pilotage or dead reckoning VFR flights is not desirable for the following reasons:

(i) Many airports used by the VFR pilot are not depicted or listed on the IFR charts.

(ii) Very few geographic or cultural landmarks are provided.

(iii) The pilot should refer to the Airman's Information Manual - Basic Flight Information and Air Traffic Control Procedures (AIM) - for more precise coverage of this information.

(2) Most pilots are reluctant to admit to being disoriented or lost. Being lost can be an embarrassing and sometimes frightening experience. Pilots should carry appropriate and current aeronautical charts on all cross-country flights. The use of outdated charts may result in flights into airport traffic areas, control zones, or other restricted airspace without proper authorization. Having available the information contained in current charts will enhance the pilot's ability to complete the flight with greater confidence, ease, and safety.

b. Route. Since the shortest distance between two points is a straight line, a majority of pilots desire direct routes for most flights. Quite often there are factors that should be considered that may make a direct flight undesirable. Restricted and prohibited areas present obstacles to direct flights. In single-engine aircraft, pilots should give consideration to circumnavigating large, desolate areas. Pilots should also consider the single-engine service ceiling of multiengine aircraft when operating over high altitude terrain since the terrain elevation may be higher than the single-engine service ceiling of the multiengine aircraft being flown. An example of this is a multiengine aircraft with a single-engine service ceiling of 6,000 feet being flown over terrain of 9,000 feet elevation. Pilots should be aware that the only advantage they may have over a pilot flying a single-engine aircraft may be a wider latitude in selecting a suitable forced landing area.

c. Airman's Information Manual - Basic Flight Information and Air Traffic Control Procedures (AIM). Part 91 of the Federal Aviation Regulations (FAR) states, in part, that each pilot in command shall, before beginning a flight, become familiar with all available information concerning that flight. The AIM contains information concerning cross-country flight and basic fundamentals required for safe flight in the U.S. National Airspace System.

d. Airport/Facility Directory. The Airport/Facility Directory, published by the National Ocean Service, lists airports, seaplane bases, and heliports open to the public, communications data, navigational facilities, and certain special notices such as parachute jumping, Flight Service Station (FSS)/National Weather Service (NWS) telephone numbers, preferred routes, and aeronautical chart bulletins.

e. Notices to Airmen (Class II).

(1) Notices to Airmen (Class II) is issued biweekly and is divided into two sections. The first section contains those notices which are expected to remain in effect for at least 7 days after the effective date of the publication. National Flight Data Center (FDC) Notices to Airmen (NOTAMS) primarily reflect changes to standard instrument approach procedures. FDC NOTAMS also establish flight restrictions and correct data on aeronautical charts.

(2) The second section contains special notices that, either because they are too long or because they concern a wide or unspecified geographical area, are not suitable for inclusion in the first section. The content of these notices vary widely and there are no specific criteria for inclusion, other than their enhancement of flight safety.

f. Notices to Airmen (NOTAM). In addition to NOTAM information contained in the Notices to Airmen (Class II) publication, pilots should check with the nearest FSS for an update on the latest NOTAMS.

g. International Flight Information Manual. The International Flight Information Manual is published quarterly for use of private flyers, businessmen, and nonscheduled operators as a preflight and planning guide for flights outside the United States.

h. International Notices to Airmen.

(1) The International Notices to Airmen is a biweekly publication containing significant international NOTAM information and special notices which may affect a pilot's decision to enter or use certain areas of foreign or international airspace.

(2) Pilots should avail themselves of all appropriate charts and publications, including the AIM and NOTAMS.

i. Weather. A weather briefing is an important part of preflight planning. An overview of the synoptic situation and general weather conditions can be obtained from public media (radio, TV, etc.) or by telephone from recorded sources. This will help the pilot to better understand the overall weather picture when obtaining a complete briefing from the FSS, NWS, or other organization that provides this service. Information on public media and recorded weather sources is contained in the Meteorology chapter of the AIM. This chapter also provides information on how to obtain a complete weather briefing, what to look for, and what to ask of the briefer to ensure that the pilot has all the weather necessary for the flight. The weather information should be weighed very carefully in considering the go/no-go decision. This decision is the sole responsibility of the pilot and compulsion should never take the place of good judgment.

j. Navigation Log. Precise flight planning of log items, such as pre-computed courses, time and distance, navigational aids, and frequencies to be used will make en route errors in these items less likely. Special attention should be given to fuel requirements, keeping in mind the need for an ample reserve as well as location of refueling points available as the flight progresses.

k. Flight Plan (VFR). This is not required by FAR, but is dictated by good operating practice. A flight plan not only assures prompt search and rescue in the event the aircraft becomes overdue or missing, but it also permits the destination station to render better service by having prior knowledge of your flight. It costs only a few minutes of time to file a flight plan and may be the best investment the pilot ever makes.

l. Aircraft Manual. Aircraft manuals contain operating limitations, performance, normal and emergency procedures, and a variety of other operational information for the respective aircraft. Traditionally, aircraft manufacturers have done considerable testing to gather and substantiate the information in the aircraft manual. Pilots should become familiar with the manual and be able to refer to it for information relative to a proposed flight.

5. KEY ELEMENTS DURING TAKEOFF PHASE. The importance of thorough preflight preparation which considers possible hazards to takeoff cannot be over-emphasized. The following elements, which should be carefully considered, continue to emerge as factors in takeoff accidents:

a. Gross Weight.

(1) Maximum allowable gross weight is established for an aircraft as an operating limitation for both safety and performance considerations. The gross weight is important because it is a basis for determining the takeoff distance. If gross weight increases, the takeoff speed must be greater to produce the greater lift required for takeoff. The takeoff distance varies with the square of the gross weight. As an example, for an aircraft with a relatively high thrust-to-weight ratio, a 10 percent increase in takeoff gross weight would cause:

(i) a 5 percent increase in speed necessary for takeoff velocity;

(ii) at least a 9 percent decrease in acceleration; and,

(iii) at least a 21 percent increase in takeoff distance.

NOTE: For aircraft with relatively low thrust-to-weight ratios, the figures are slightly higher.

(2) Operations within the proper gross weight limits are outlined in each operator's manual. Gross weight and center of gravity (CG) limits should be considered during preflight preparation. Weight in excess of the maximum certificated gross weight may be a contributing factor to an accident, especially when coupled with other factors which adversely affect the ability of an aircraft to take off and climb safely. These factors may range from field elevation of the airport to the condition of the runway. The responsibility for considering these factors before each flight rests with the pilot.

b. Balance.

(1) A pilot must not only determine the takeoff weight of the aircraft, but also must assure that the load is arranged to fall within the allowable CG limits for the aircraft. Each aircraft manual provides instructions on the proper method for determining if the aircraft loading meets the balance requirements. The pilot should routinely determine the balance of the aircraft since it is possible to be within the gross weight limits and still exceed the CG limits.

(2) An airplane which exceeds the forward CG limits places heavy loads on the nosewheel and, in conventional landing gear airplanes, may, during braking, cause an uncontrollable condition. Furthermore, performance may be significantly decreased and the stall speed may be much higher.

(3) An airplane loaded in a manner that the CG exceeds the aft limit will have decreased static and dynamic longitudinal stability. This condition can produce sudden and violent stall characteristics and can seriously affect recovery.

(4) Pilots exceeding CG limits in helicopters may experience insufficient cyclic controls to safely control the helicopter. This can be extremely critical while hovering downwind with the helicopter load exceeding the forward CG limit.

c. Ice and Frost.

(1) Ice or frost can affect the takeoff performance of an aircraft significantly. Pilots should never attempt takeoffs with any accumulation of ice or frost on their aircraft. Most pilots are aware of the hazards of ice on the wings of an aircraft. The effects of a hard frost are much more subtle. This is due to an increased roughness of the surface texture of the upper wing and may cause up to a 10 percent increase in the airplane stall speed. It may also require additional speed to produce the lift necessary to become airborne.

(2) Once airborne, the airplane could have an insufficient margin of airspeed above stall such that gusts or turning of the aircraft could result in a stall. Accumulation of ice or frost on helicopter rotor blades results in potential rotor blade stalls at slower forward air speeds. It could also result in an unbalanced rotor blade condition which could cause an uncontrollable vibration.

d. Density Altitude.

(1) Aircraft instruments are calibrated to be correct under one set of conditions. Standard conditions represent theoretical sea level conditions, 59 degrees Farenheit and 29.92 in Hg. As higher elevations are reached, both temperature and pressure normally decrease. Thus, density altitude is determined by compensating for pressure and temperature variances from the standard conditions. A pilot must remember that as density altitude increases, there is a corresponding decrease in the power delivered by the engine and the propellers or rotor blades. For airplanes, this may cause the required takeoff roll to increase by up to 25 percent for every 1,000 feet of elevation above sea level. The most critical conditions of takeoff performance are the result of a combination of heavy loads, unfavorable runway conditions, winds, high temperatures, high airport elevations, and high humidity.

(2) The proper accounting for the pressure altitude (field elevation is a poor substitute) and temperature is mandatory for accurate prediction of takeoff data. The required information will be listed in the aircraft manual and should be consulted before each takeoff, especially if operating at a high density altitude or with a heavily loaded aircraft.

e. Effect of Wind.

(1) Every aircraft manual gives representative wind data and corresponding ground roll distances. A headwind which is 10 percent of the takeoff airspeed will reduce the no-wind takeoff distance by 19 percent. A tailwind which is 10 percent of the takeoff airspeed, however, will increase the no-wind takeoff distance by about 21 percent.

(2) Although this consideration is basic to a successful takeoff, the number of accidents involving the selection of the wrong runway for the existing wind and taking off into unfavorable wind conditions indicates a need for many pilots to reevaluate their preflight planning to ensure that the effect of wind is considered fully.

f. Runway Condition.

(1) There are more than 14,700 airports in the United States, each with runways having various surface compositions, slopes, and degrees of roughness. Takeoff acceleration is affected directly by the runway surface condition and, as a result, it must be a primary consideration during preflight planning.

(2) Most aircraft manuals list takeoff data for level, dry, hard-surfaced runways. The runway to be used, however, is not always hard-surfaced and level. Consequently, pilots must be aware of the effect of the slope or gradient of the runway, the composition of the runway, and the condition of its surface. Each of these can contribute to a failure to obtain/maintain a safe flying speed.

(3) The effective runway gradient is the maximum difference in the runway centerline elevation divided by the runway length. The FAA recognizes the effect of runway gradient on the takeoff roll of an aircraft and has published limits on the maximum gradients. For general aviation VFR airports the maximum longitudinal runway grade is 2 percent and the longitudinal runway grade change is 2 percent maximum. Furthermore, the takeoff length for a runway must be increased an additional 20 percent for each 1 percent of change in effective gradient to a maximum allowable effective gradient change of 2 percent.

(4) Since the runway gradient has a direct bearing on the component weight of the aircraft, a runway gradient of 1 percent would provide a force component along the path of the aircraft which is 1 percent of gross weight. In the case of an upslope, the additional drag and rolling friction caused by a 1 percent upslope can result in a 2 percent to 4 percent increase in the takeoff distance and subsequent climb.

(5) Frequently, the only runway at an airport has a slope. When determining which direction to use for takeoff, pilots must remember that a

direction uphill, but into a headwind, is generally preferred to a downwind takeoff on a downsloping runway. Factors such as steep slope, light wind, etc., however, make an uphill takeoff impractical.

(6) It is difficult to predict the retarding effect on the takeoff run that water, snow/slush, sand, gravel, mud, or long grass on a runway will have, but these factors can be critical to the success of a takeoff. Since the takeoff data in the aircraft manual is predicated on a dry, hard surface each pilot must develop individual guidelines for operations from other type surfaces.

g. Cold Weather Takeoffs. The following is an excerpt taken from AC 91-13C, Cold Weather Operation of Aircraft:

"Takeoffs in cold weather offer some distinct advantages, but they also offer special problems. A few points to remember are:

"(1) Do not overboost supercharged or turbine engines. Use the applicable power charts for the pressure altitude and ambient temperature to determine the appropriate manifold pressure or engine pressure ratio. Care should be exercised in operating normally aspirated engines. Power output increases at about 1 percent for each ten degrees of temperature below that of standard air. At -40 degrees F, an engine might develop 10 percent more than rated power even though RPM and MP limits are not exceeded.

"(2) On multiengine aircraft it must be remembered that the critical engine-out minimum control speed (Vmc) was determined at sea level with a standard day temperature. Therefore, Vmc will be higher than the published figure during a cold weather takeoff unless the power setting is adjusted to compensate for the lower density altitude.

"(3) With reciprocating engines, use carburetor heat as required. In some cases, it is necessary to use heat to vaporize the fuel. Gasoline does not vaporize readily at very cold temperatures. Do not use carburetor heat in such a manner that it raises the mixture temperature to freezing or just a little below. In such cases, it may be inducing carburetor icing. An accurate mixture temperature gauge is a good investment for cold weather operation. On some occasions in extremely cold weather, it may be advisable to use carburetor heat on takeoff.

"(4) If icing conditions exist, use the anti-ice and deice equipment as outlined in the Airplane Flight Manual. If the aircraft is turbine powered, use the appropriate power charts for the condition, bearing in mind that the use of bleed air will, in most cases, affect the aircraft's performance."

6. SUMMARY. Preflight preparation is the foundation of safe flying. Accident statistics of recent years indicate that adequate preflight preparation is lacking in many cases. As a result, while the number of general aviation accidents and approach and landing accidents has declined, takeoff accidents have increased. Statistics indicate that takeoff accidents occur because elements of the preflight preparation were:

a. not assigned the proper importance,

b. not incorporated into the preflight routine, or

c. pilots did not anticipate potential takeoff emergencies and the required procedures to follow.

7. RECOMMENDATION. To enhance the safety of flying, pilots are encouraged to:

a. form good preflight planning habits and review them continually,

b. be thoroughly knowledgeable of the hazards and conditions which would represent potential dangers, particularly during takeoff, and,

c. be aware of the capabilities and limitations of their aircraft.

William T. Brennan
Acting Director of Flight Operations

8 Par 6