NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

December 10, 2013

Attachment 17 – Ratheon Safety Communique

OPERATIONAL FACTORS

ERA13MA139

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A. RATHEON SAFETY COMMUNIQUE[1]

[1] A note contained within the Communiques stated the following: "Raytheon Aircraft Company, which has been renamed Hawker Beechcraft Corporation, is now owned by Hawker Beechcraft, Inc. Neither Hawker Beechcraft, Inc., nor Hawker Beechcraft Corporation are affiliated any longer with Raytheon Company. Any Raytheon marks contained in this document are owned by Raytheon Company and are employed pursuant to a limited license granted by Raytheon Company."

Raytheon Aircraft

Safety Communique

June 2004

TO: **ALL OWNERS AND OPERATORS, RAYTHEON AVIATION CENTERS, CHIEF PILOTS, DIRECTORS OF OPERATIONS, DIRECTORS OF MAINTENANCE, ALL RAYTHEON AIRCRAFT AUTHORIZED SERVICE CENTERS, AND INTERNATIONAL DISTRIBUTORS AND DEALERS**

MODELS: **RAYTHEON AIRCRAFT MODEL 390 PREMIER I, ALL SERIALS**

SUBJECT: **LANDING PERFORMANCE AWARENESS**

Raytheon Aircraft Company (RAC) is issuing this Safety Communiqué to remind owners and operators of the importance of strictly following Airplane Flight Manual (AFM) Procedures during approach and landing.

Procedures identified in the FAA Approved AFM must be adhered to in order to obtain the scheduled performance. Along with the procedures presented in the normal procedures section, the operator should review the Flight Test Performance Conditions presented in Section V of the AFM to better understand the conditions under which the AFM performance was obtained.

Beginning in April of 2004, RAC initiated a pilot enhancement program for Model 390 operators. This program included specific information on landing capabilities and characteristics of the Model 390. So that operators might more fully understand landing performance, RAC is providing the following detailed information to amplify the information presented in the FAA approved AFM.

Landing Distance Determination

Prior to initiating the approach, the pilot is to determine the required landing distance for the aircraft considering the aircraft configuration, weight and field conditions. The Landing Distance graphs contained in the AFM relate required landing distance for combinations of airfield elevation, temperature, wind, runway gradient, and airplane weight. The pilot needs to account for all these variables in the assessment of the required landing distance. Be advised, the airplanes that have not been modified by RAC kit 390-3607 are still operating under FAA Airworthiness Directives 2003-07-09 or 2003-10-05 and are required to utilize the temporary (yellow page) AFM Landing Distance Without Lift Dump graph for this determination, regardless of whether lift dump is available or used. If the airplane is landing in an abnormal configuration due to a system failure, the normal landing distance should be determined from the appropriate landing distance graph accounting for all the given variables, then increased by the factor identified in the abnormal or emergency procedure. Lastly, the Landing Distance graphs present performance on paved dry runways. Runway conditions other than this will result in longer distances. Wet and contaminated runway performance is currently being prepared for distribution.

Landing Approach

A successful landing begins with the approach. The FAA has emphasized the stabilized approach concept for many years, although many of us find it difficult to incorporate this into our daily flying with schedule constraints as well as ATC requests and clearances. This notwithstanding, it is incumbent on the pilot in command to establish a safe, stabilized approach prior to initiating a landing. There are as many definitions of a stabilized approach as there are pilots flying, each one with good points. At a

SAFETY COMMUNIQUE

minimum, it is recommended that the pilot evaluate the approach at approximately ½ nautical mile from the runway. At the appropriate published Vref speed, the airplane will be approximately 15 seconds from the start of the landing procedure. At ½ nautical mile from the threshold, a standard three-degree glide path would place the airplane at 160 ft above the landing field elevation. At this point, the airplane should be in the final landing configuration, trimmed at Vref with a normal power setting for the approach. Deviations from this glide path, airspeed, thrust setting or configuration will probably carry into the landing maneuver and could adversely impact the results. If you are still working on establishing the stabilized approach at this point, a go-around should be considered to allow you the opportunity to better set up the landing approach.

Landing Distance

The landing distance in the AFM comprises two segments: landing air distance and landing ground roll. The landing distance presented in the AFM reflects the maximum performance landing capability of the Model 390. The presented distances are based on the following procedure: As stated in Section V of the AFM, the landing distance begins at a point 50 feet above the landing runway threshold. The airplane is assumed to be stabilized on a three-degree glide path to that point. At 50 feet above the runway threshold, throttles are moved to idle with a minimum flare touchdown. No attempt is made to execute a smooth landing. Full brake application is assumed to be applied within one second after touchdown, followed by lift dump deployment within one second later. Full brake application is maintained until the airplane reaches a full stop. As used here, "full brake application" means applying maximum brake pressure such that anti-skid is active and controlling the brakes throughout the landing roll. It is not expected that every landing will follow this technique, nor is this technique necessary for every landing. However, every operator needs to know how their individual technique may influence actual landing distance of the airplane. To assist in that effort, a full review of the landing process is presented below with information to assist you in determining how your individual technique will influence the landing distance of the airplane.

Air Distance

The first major segment of the landing distance lies between the point 50 feet above the landing runway threshold and the point the airplane touches down. At a typical landing condition of 10,500 pounds, Vref would be 115 knots. At this speed the stabilized descent rate on the three degree glide path would be 628 ft/min. If no flare were accomplished, the airplane would touch down 954 feet from the threshold at a sink rate of 628 ft/min (10 ft/sec). Although the airplane is designed for the loads resulting from this sink rate, it is not the style of landing most passengers would appreciate. To provide for a more reasonable touchdown, the landing distance in the AFM accounts for a flare of approximately three seconds to reduce the sink rate to approximately 1-2 ft/sec. This flare increases the landing air distance from the 954 geometric distance to approximately 1,500 feet. The distance in your AFM accounts for this technique. The 1-2 ft/sec touchdown sink rate will be a firm landing and may be more than you, or your passengers, desire. If your technique involves a flare that exceeds three seconds, approximately 230 feet of runway is utilized for every additional second (beyond 3) of flare until touchdown. The airplane deceleration rate will be negligible in this extended flare, requiring the same braking distance, so this additional distance would be above and beyond that presented in the AFM.

In addition to a delayed touchdown, a threshold crossing height above 50 feet will increase your landing air distance. For every 10 feet above the standard 50-foot threshold height, your landing air distance will increase 200 feet.

Ground Roll Distance

The other major segment of the landing distance is the ground roll distance. Beginning at the touchdown point, the brakes are to be immediately applied. The brakes are the only deceleration device provided on the Model 390 and the sooner they are applied, the sooner you will stop. The lift dump system greatly increases the effectiveness of the brakes but does not provide deceleration itself. The AFM assumes full brake application is achieved one second after touchdown. Assuming a typical landing touchdown speed, every second delay beyond one second will add approximately 220 additional feet to your landing distance. Following brake application, the lift dump is assumed to be deployed one second later. The lift dump deployed maximum braking condition is assumed to be maintained until the airplane reaches a full stop.

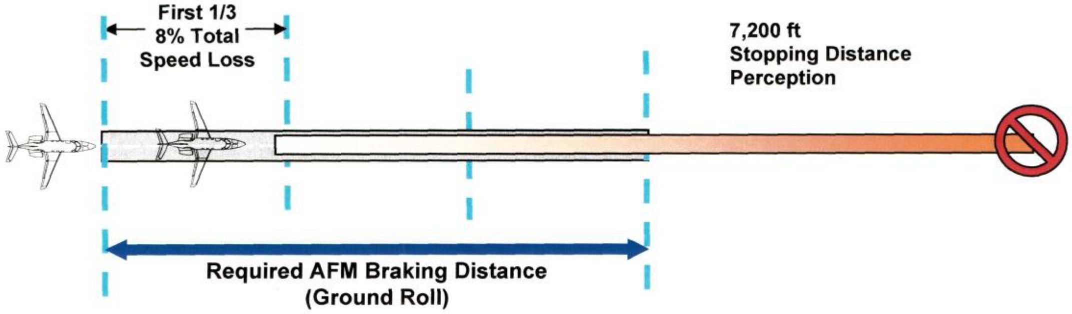
Another important factor that affects your landing distance is your approach speed. For every knot above Vref the landing distance will increase 120 feet. The Model 390 operates at a relatively high wing loading. This results in the airplane being less influenced by turbulence than other aircraft of similar size. This feature allows Premier I pilots to operate the airplane at scheduled landing approach speeds without adding additional speed for normal turbulence or wind gusts. The scheduled Vref speed should be utilized as the target and response of the airplane monitored on the approach. Speed variations around Vref (above and below) would be normal in gusty or turbulent conditions, but no speed increase would be necessary unless (1) the average of the airspeed excursions starts to drift below Vref or (2) the low speed transients extend down to a speed halfway between Vref and the low speed awareness cue (red line). If either of these cases is noted, the approach speed should be increased just enough to alleviate the condition. If the turbulence diminishes, the speed should be returned back to Vref. If for any reason additional speed is carried into the landing maneuver, the impact of this speed must be accounted for in your landing distance determination.

Aircraft Brake Performance Characteristics

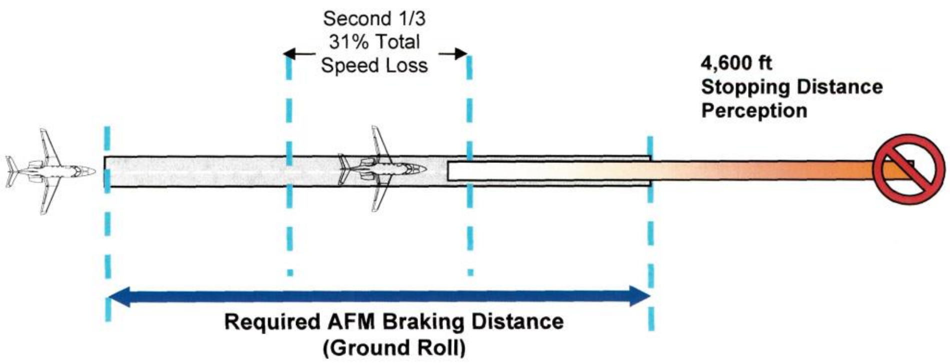
The general brake performance characteristic of the Model 390 is that 80% of your braking distance will be utilized to reduce your speed by 50%. The last 50% of speed will be eliminated in the last 20% of the braking distance. In the initial phase of braking, the pilot may perceive a braking deceleration that appears inadequate to stop on the available runway. As the airplane speed is reduced, the deceleration rate will increase. The initial low deceleration rate associated with anti-skid braking action on wet and/or contaminated runways or with lift dump not deployed may be confused with a brake system failure. The best method to differentiate between a brake system failure and low deceleration due to reduced brake effectiveness is the cycling of the anti-skid system. Following initial maximum brake application and the first tire skid, the anti-skid system will enter an initiation mode and release nearly all brake pressure to avoid a sustained tire skid. This anti-skid system initialization may be perceived as a loss of brakes. The brake pressure, along with increased rate of deceleration, will automatically return within approximately 1.5 seconds. It is imperative that the pilot maintain constant pressure to achieve optimum braking effectiveness. If the pilot brake application is removed and reapplied, the anti-skid initialization will occur again, complete with the same brake release. Pumping, or any other pilot commanded release of the brakes, will result in additional initialization cycles of the anti-skid system, which will cause brake releases and a corresponding increase in aircraft stopping distance.

The following depictions illustrate the relationship between Model 390 braking characteristics and pilot perceptions while landing on a runway where landing distance required equals runway length available.

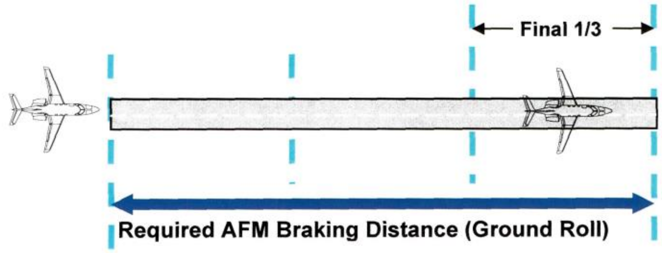
For a maximum performance landing, as stated in the AFM, following touchdown, the brakes are to be applied at maximum pressure. The nose should be lowered to the runway and lift dump deployed. Maximum brakes should be held until the airplane comes to a full stop or the airplane has slowed to an acceptable speed. During the first 1/3 of the braking distance, the airplane speed will be reduced by approximately 8% of the touchdown speed. The pilot may perceive that this deceleration is not adequate, and that the projected stopping distance exceeds the available landing distance. This perception is illustrated below. The shaded bar overlying the runway depiction represents the stopping distance perceived by the pilot at this point in the landing.



As the airplane enters the middle 1/3 of the braking distance, the deceleration rate increases, resulting in a speed reduction to about 59% of the touchdown speed. The perceived stopping distance, although shorter now, may still appear to be in excess of the available runway.



It will not be until the final 1/3 of the braking distance that the deceleration rate will increase to a level where a pilot will clearly perceive that the stopping distance is within the available runway length.



Clearly, in order to achieve AFM landing distance performance, the pilot must depend upon the anti-skid power brake system. Pilot perception of the stopping performance of the airplane must be balanced by proper understanding of the operating characteristics of the airplane.

Runway conditions will also affect your stopping distance. Obviously, wet or contaminated runways will add to your landing distance. Rubber deposits on or around the landing zone and painted runway markings also will reduce braking effectiveness as the aircraft rolls over these areas.

The various numbers presented in this communiqué may appear to be somewhat insignificant when evaluated one at a time. 100 or 200 feet here or there doesn't appear to make a lot of difference. In reality, they generally appear together and can add up quickly. The following is an example.

> You are inbound to Runway 17 at Anytown Executive airport at an estimated landing weight of 10,500 pounds. Anytown is situated at an elevation of 2000 feet, with a 5000 foot runway that has a down hill gradient of 0.6%. The temperature is 86 degrees F (30 deg C) and winds are 270 at 10 gusting to 20 knots. ATC has kept you high and fast before clearing you for an immediate descent and landing. The wind for your selected runway produces, at worse case, a 20 knot crosswind component and a 5 knot tailwind component. You consult the Landing Distance Graph in the Pilot Checklist and determine a landing distance requirement of 3800 feet. This gives you 1200 feet of margin.
>
> Due to the ATC handling you find yourself on short final at Vref + 5 knots and slightly high on the VASI, but close enough, you think. You continue the approach to landing, pass over the threshold at 60' and pull the throttles to idle. As the runway approaches you gently ease the nose up while managing the crosswind condition and smoothly roll the airplane onto the runway at the conclusion of a precision 6 second flare. Using your normal technique, you lower the nose gently, confirm the airplane is tracking straight on the runway and deploy the lift dump. Sensing the comfortable settling caused by the lift dump, you now apply brakes. So how does this landing end?
>
> The 5 knots extra speed added 600 feet. The 10 feet additional height over the threshold added 200 feet. The extended flare added 680 feet. The delayed braking, assuming it was only 2 seconds, added 440 feet. Each of these is relatively minor by themselves, but combined together they total 1,930 additional feet. The 5000 foot runway that previously provided 1,200 feet of margin is now 730 feet too short and you leave the pavement traveling approximately 85 knots.

What could you have done to avoid this? At the 1/2 mile point, where you identified that you were fast and high, you could have elected to go-around and set up for an approach on Vref on glideslope. That would have eliminated 800 feet of additional stopping distance and produced a stop on the available runway even with the other variations in technique. In lieu of the go-around, you could have accepted a firmer touchdown and executed braking immediately upon touchdown. That would have eliminated 1,130 feet of additional stopping distance and produced a stop on the available runway, even being fast and high.

In closing, we cannot emphasize more strongly the importance of adhering to the procedures outlined in the AFM for landing. To achieve the landing distance presented in the AFM the airplane must begin with a stabilized three-degree approach in the full flaps, gear down configuration at Vref. At 50 feet above the threshold, throttles are closed to idle followed by a firm touchdown. Upon touchdown, maximum wheel brakes are applied first. After brake application, the nose should be confirmed to be on the ground and lift dump deployed. Maximum braking should be maintained until a full stop or until less braking is appropriate.

Further we recognize that individual situations may make this procedure undesirable in your operation. Short of adjusting your landing distance for all of the individual variations addressed in this communiqué, you may consider the use of an operational landing distance factor such as those utilized by Air Taxi Operators. Part 135 operators utilize a factored runway field length where the minimum required runway length is equal to the AFM landing distance increased by 67%. Use of this factor would account for many variations in technique and provide increased flexibility to the pilot in aircraft operations.

As previously noted in this communiqué, RAC is conducting a pilot enhancement program. You are highly encouraged to avail yourself of that opportunity. Please contact Joe Grubiak at 316-676-6585.