

U.S. Department
of Transportation

Federal Aviation
Administration

Air Traffic Bulletin

Issue # 2012-1
February 2012

*A Communication from the
Vice President, Mission Support Services*

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Radio Communications

*TRFE FAAO 7110.65 provides standard air traffic control (ATC) phraseology for providing ATC services. Phraseology is standardized in part to reduce the opportunities for confusion and misunderstanding between air traffic controllers and pilots. To minimize the chances for misunderstanding instructions, we encourage air traffic controllers to use standard ATC phraseology, and to speak at reasonable rates when communicating with all flight crews, especially those whose primary language is not English.

Minimum Fuel Declaration by Pilot ‘Awareness’ Training for both Pilots and Controllers

***TRE Purpose:** This article is meant to educate pilots and controllers on the appropriate use, connotation, and regulatory definition of the terms “minimum fuel,” “emergency fuel,” and “reserve fuel.”

A recent long-distance flight from Anchorage, AK to Louisville, MI raised the question about fuel levels.

Because the flight had to circle an extended period of time before they were able to land, the plane nearly ran out of fuel. The aircrew was later told that had they declared “minimum fuel,” they might have received priority from ATC.

This event raises an important concern: pilots are being conservative with fuel and are using this declaration to get priority handling. What is the difference between declaring “minimum fuel”, “emergency fuel”, and “reserve fuel”?

a. Minimum Fuel. The Aeronautical Information Manual (AIM) and the Pilot/Controller Glossary both define “minimum fuel” as the following:

“Indicates that an aircraft’s fuel supply has reached a state where, upon reaching the destination, it can accept little or no delay. This is not an emergency situation but merely indicates an emergency situation is possible should any undue delay occur.”

“Minimum fuel” declarations are **essentially advisory in nature to ATC**.

FAA Order 7110.65U, *Air Traffic Control*, states in paragraph:

2-1-8. Minimum Fuel

“If an aircraft declares a state of ‘minimum fuel,’ inform any facility to whom control jurisdiction is transferred of the minimum fuel problem and be alert for any occurrence which might delay the aircraft en route.”

NOTE –

Use of the term “minimum fuel” indicates recognition by a pilot that the fuel supply has reached a state where, upon reaching destination, the pilot cannot accept any undue delay. This is not an emergency situation but merely an advisory that indicates an emergency situation is possible should any undue delay occur. A minimum fuel advisory does not imply a need for traffic priority. Common sense and good judgment will determine the extent of assistance to be given in minimum fuel situations. If, at any time, the remaining usable fuel supply suggests the need for traffic priority to ensure a safe landing, the pilot should declare an emergency and should re-port remaining fuel level (in minutes).

b. Emergency Fuel. Although not defined in the AIM or FAA regulations, the industry-wide connotation typically associated with the term “Fuel Emergency” is:

“The point at which, in the judgment of the pilot-in-command, it is necessary to proceed directly to the airport of intended landing due to low fuel. Declaration of a fuel emergency is an explicit statement that priority handling by ATC is both required and expected.”

c. Reserve Fuel. The regulatory basis for reserve fuel may be found in Title 14 of the Code of Federal Regulations parts 91, 121, and 135 §§ 91.167, 121.639, and 135.223. Minimum required domestic reserve fuel for instrument flight rule (IFR) operations all specify essentially the same requirements. For example, § 91.167 Fuel requirements for flight in IFR conditions state that:

“No person may operate a civil aircraft in IFR conditions unless it carries enough fuel (considering weather reports and forecasts and weather conditions) to”:

- (1) Complete the flight to the first airport of intended landing;
- (2) Fly from that airport to the alternate airport [if one is required]; and
- (3) Fly after that for 45 minutes at normal cruising speed or, for helicopters, fly after that for 30 minutes at normal cruising speed.

Discussion: Parts 121 and 135 essentially mirror the same requirements. There are additional and different requirements for international and extended over water operations.

a. The act of using a portion of the reserve fuel assigned to a flight is not, in itself a cause to declare a minimum fuel state with the controlling agency. Regulations require reserve fuel to enable aircraft to maneuver, due to unforeseen circumstances. Many aircraft safely arrive at their destination having used a portion of the fuel designated as reserve. There is no regulatory definition as to when, specifically, a pilot *must* declare “minimum fuel” or a fuel emergency. Air carriers typically develop such guidance for their pilots and include it in their General Operations Manuals; such guidance generally falls along the following lines:

- Declare “minimum fuel” when, in your best judgment, any additional delay will cause you to burn into your reserve fuel.
- Declare a fuel emergency at the point at which, in your judgment, it is necessary for you to proceed directly to the airport at which you intend to land. Declaration of a fuel emergency is an explicit statement that priority handling by ATC is necessary and expected.

b. Aeronautical Information Manual (AIM). AIM paragraph 5-5-15, Minimum Fuel Advisory, provides the following example of how a minimum fuel and/or emergency fuel situation is typically handled:

5-5-15. Minimum Fuel Advisory.

a. Pilot.

- 1.** Advise ATC of your minimum fuel status when your fuel supply has reached a state where, upon reaching destination, you cannot accept any undue delay.
- 2.** Be aware this is not an emergency situation, but merely an advisory that indicates an emergency situation is possible should any undue delay occur.
- 3.** On initial contact the term "minimum fuel" should be used after stating call sign.

**EXAMPLE- Salt Lake Approach,
United 621, "minimum fuel."**

- 4.** Be aware a minimum fuel advisory does not imply a need for traffic priority.
- 5.** If the remaining usable fuel supply suggests the need for traffic priority to ensure a safe landing, you should declare an emergency due to low fuel and report fuel remaining in minutes.

REFERENCE –

Pilot/Controller Glossary Item- Fuel Remaining

b. Controller.

- 1.** When an aircraft declares a state of minimum fuel, relay this information to the facility to whom control jurisdiction is transferred.
- 2.** Be alert for any occurrence which might delay the aircraft.

Recommended action: Appropriate air operator management personnel should ensure that this information is made available to pilots and, where appropriate, incorporated into company flight operations manuals.

7110.65 para 3-1-8 and PCG Update on Pilots Actions during Wind Shear Conditions and "Wind Shear Es- cape" Phraseology

*TR/E Low level wind shear can affect aircraft airspeed during takeoff and landing and is classified as the most dangerous air turbulence for aircraft. Airplane pilots generally regard significant wind shear to be a change in airspeed of 15 knots (28 m/s) at each increment of 1000 feet.

Between 1964 and 1985, wind shear directly caused or contributed to 26 major civil transport aircraft accidents in the U.S. that led to 620 deaths and 200 injuries. Since 1995, the number of major civil aircraft accidents caused by wind shear has dropped to approximately one every ten years, due to the Doppler weather radar units on the ground and the mandated on-board detection predictive wind shear (PWS) alert system. PWS is a self-contained system used onboard some aircraft to alert the flight crew to the presence of a potential wind shear. PWS systems typically monitor 3 miles ahead and 25 degrees left and right of the aircraft's heading at or below 1200' AGL. Departing flights may receive a wind shear alert after they start the takeoff roll and may elect to abort the takeoff. If aircraft receive an alert while on approach to land they may elect to go around or perform a wind shear escape maneuver.

As aviation professionals, it is important to know the conditions that produce wind shear:

- **Weather fronts** - Significant shear is observed when the temperature difference across the front is 5 °C (9 °F) or more, and the front moves at 30 knots or faster.
- **Upper-level jet streams** - Associated with upper level jet streams is a phenomenon known as clear air turbulence (CAT), caused by vertical and horizontal wind shear connected to the wind gradient at the edge of the jet streams.

- **Low-level jet streams** - When a nocturnal low level jet forms overnight above the earth's surface ahead of a cold front, significant low-level vertical wind shear can develop near the lower portion of the low-level jet.
- **Mountains** - When winds blow over a mountain, vertical shear is observed on the lee side.
- **Inversions** - When on a clear and calm night, a radiation inversion is formed near the ground; the friction does not affect wind above the top of the inversion layer.
- **Downbursts** - When an outflow boundary forms due to a shallow layer of rain-cooled air spreading out near ground level from the parent thunderstorm, both speed and directional wind shear can result at the leading edge of the three-dimensional boundary.

The following situation describes the dangerous effects of wind shear:

A controller asks a pilot to reduce airspeed because his aircraft is overtaking the aircraft ahead of him. The pilot agrees to throttle down. At that moment, the aircraft passes into the region of the downdraft, the localized headwind diminishes, reducing the aircraft's airspeed and increasing its sink rate. When the aircraft passes through the other side of the downdraft, the headwind becomes a tailwind, normally reducing airspeed further, leaving the aircraft in a low-power, low-speed descent. This may result in an accident if the aircraft is too low to recover before ground contact.

Situational Awareness is needed by both the pilot and controller to circumvent the effects of wind shear.

Much like a TCAS alert, the pilots **will take no other control instructions** when they are in a "wind shear alert escape" maneuver other than what they feel necessary to get themselves out of the situation.

Depending on the severity, a wind shear encounter low to the ground can be one of the most alarming, high workload maneuvers a flight crew will be expected to perform. During this high workload time, communication with ATC will take a back seat. Flying the airplane is the first priority.

While the pilot is going to maximum thrust and attempting to fly out of the shear, the aircraft performance is often degraded to such an extent, that many times, the airplane will not climb. This maneuver can last for a few seconds, to over a minute. As with any wind shear encounter, the outcome is uncertain. The aircraft crew is task saturated. At the end of the shear, the airplane's performance improves drastically, enabling a very large climb rate.

Airline crews are trained in wind shear recovery each year. During these scenarios, it is stressed that communicating to ATC is to be done after the airplane has safely exited the wind shear. Pilots understand that the controller has to know as soon as possible if the aircraft is either unable to comply, or taking emergency action in order to save the airplane. Once they are out of the situation, they can then continue to follow control instructions. That being said, if the crew has the ability to communicate quickly during this escape maneuver, they will most certainly use the word "wind shear."

The confusion in the control tower, the need for the following/surrounding aircraft to be alerted and the potential for a traffic conflict to be resolved is the controller's task. Controllers often expect the aircraft to execute either the published missed approach or follow their control instructions. This may not happen.

The 7110.65 Para 3-1-8. Low Level Wind Shear/Microburst Advisories and the Pilot Controller Glossary have been updated to help clarify these situations. The 7110.65 states that a communication disconnect exists between ATC and the aviation communities concerning actions a flight crew will make during a wind shear go around that has been initiated following in cockpit wind shear detection escape guidance. Flight crews are tasked with first escaping the wind shear event and then communicating and complying with ATC instructions. Unfortunately, ATC may not be aware that an aircrew is executing a "wind shear escape" procedure and the current directive does not identify this procedure.

Wind Shear Escape – An unplanned abortive maneuver initiated by the pilot in command (PIC) as a result of onboard cockpit systems. Wind shear escapes are characterized by maximum thrust

climbs in the low altitude terminal environment until wind shear conditions are no longer detected.

The Air Traffic Bulletin (ATB) is a means for headquarters to remind field facilities of proper application of procedures and other instructions. It is published and distributed quarterly, with special issues published as necessary.

Articles must be submitted electronically in Microsoft® Word by the offices of primary responsibility with approval at the group level or above. Quarterly articles must be received by the end of September, December, March, and June of each year.

*In this publication, the option(s) for which a briefing is required is indicated by an asterisk followed by one or more letter designators, i. e., *T – Tower, *E – ARTCC, *R – TRACON, or *F – FSS. Designators following a slash (/) indicates a briefing is recommended, but not required.*

*(Reference FAA Order JO 7210.3, Facility Operation and Administration, paragraph 2-2-9)
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