

Emergency Procedures

Introduction

Changing weather conditions, air traffic control (ATC), aircraft, and pilots are variables that make instrument flying an unpredictable and challenging operation. Safety of the flight depends on the pilot's ability to manage these variables while maintaining positive aircraft control and adequate situational awareness (SA). This appendix discusses recognition and suggested remedies for emergency events related to un-forecasted, adverse weather, aircraft system malfunctions, communication/navigation system malfunctions, loss of SA, and inadvertent instrument meteorological conditions (IIMCs).

Emergencies

An emergency can be either a distress or urgency condition as defined in the pilot/controller glossary. Distress is defined as a condition of being threatened by serious and/or imminent danger and requiring immediate assistance. Urgency is defined as a condition of being concerned about safety and requiring timely but not immediate assistance; a potential distress condition.

Pilots do not hesitate to declare an emergency when faced with distress conditions, such as fire, mechanical failure, or structural damage. However, some are reluctant to report an urgency condition when encountering situations that may not be immediately perilous but are potentially catastrophic. An aircraft is in an urgency condition the moment that the pilot becomes doubtful about position, fuel endurance, weather, or any other condition that could adversely affect flight safety. The time for a pilot to request assistance is when an urgent situation may, or has just occurred, not after it has developed into a distress situation.

The pilot in command (PIC) is responsible for crew, passengers, and operation of the aircraft at all times. Title 14 of the Code of Federal Regulations (14 CFR) part 91, § 91.3 allows deviations from regulations during emergencies that allow the PIC to make the best decision to ensure safety of all personnel during these contingencies. Also, by declaring an emergency during flight, that aircraft becomes a priority to land safely. Pilots who become apprehensive for their safety for any reason should request assistance immediately. Assistance is available in the form of radio, radar, direction finding (DF) stations, and other aircraft.

Inadvertent Thunderstorm Encounter

A pilot should always avoid intentionally flying through a thunderstorm of any intensity; however, certain conditions may be present that could lead to an inadvertent thunderstorm encounter. For example, flying in areas where thunderstorms are embedded in large cloud masses may make thunderstorm avoidance difficult, even when the aircraft is equipped with thunderstorm detection equipment. Pilots must be prepared to deal with inadvertent thunderstorm penetration. At the very least, a thunderstorm encounter subjects the aircraft to turbulence that could be severe. The pilot, as well as the crew and any passengers, should tighten seat belts and shoulder harnesses and secure any loose items in the cabin or flight deck.

As with any emergency, the first order of business is to fly the aircraft. The pilot workload is high; therefore, increased concentration is necessary to maintain an instrument scan. Once in a thunderstorm, it is better to maintain a course straight through the thunderstorm rather than turning around. A straight course most likely gets the pilot out of the hazard in the least amount of time, and turning maneuvers only increase structural stress on the aircraft.

Reduce power to a setting that maintains a recommended turbulence penetration speed as described in the appropriate aircraft operator's manual, and try to minimize additional power adjustments. Concentrate on keeping the aircraft in

a level attitude while allowing airspeed and altitude to fluctuate. Similarly, if using autopilot, disengage altitude and speed hold modes because they only increase the aircraft's maneuvering, which increases structural stress.

During a thunderstorm encounter, the potential for icing also exists. As soon as possible, if the aircraft is so equipped, turn on anti-icing/deicing equipment. Icing can be rapid at any altitude, and may lead to power failure and/or loss of airspeed indication. Lightning is also present in a thunderstorm and can temporarily blind the pilot. To reduce risk, turn up flight deck lights to the highest intensity, concentrate on flight instruments, and resist the urge to look outside.

Inadvertent Icing Encounter

Because icing is unpredictable, pilots may find themselves in icing conditions although they have done everything to avoid the condition. To stay alert to this possibility while operating in visible moisture, pilots should monitor the outside air temperature (OAT).

Anti-icing/de-icing equipment is critical to safety of the flight. If anti-icing/de-icing equipment is not used before sufficient ice has accumulated, it may not be able to remove all ice accumulation. Use of anti-icing/de-icing reduces power availability; therefore, pilots should be familiar with the aircraft operator's manual for use of anti-icing/de-icing equipment.

Before entering visible moisture with temperatures at five degrees above freezing or cooler, activate appropriate anti-icing/de-icing equipment in anticipation of ice accumulation; early ice detection is critical. Detecting ice may be particularly difficult during night flight. The pilot may need to use a flashlight to check for ice accumulation on the wings, fuselage, landing gear, and horizontal stabilizer. At the first indication of ice accumulation, the pilot must act to circumvent icing conditions. Options for action once ice has begun to accumulate on the aircraft are the following:

- Move to an altitude with significantly colder temperatures.
- Move to an altitude with temperatures above freezing.
- Fly to an area clear of visible moisture.
- Change the heading, and fly to an area of known non-icing conditions.

If these options are not available, consider an immediate landing at the nearest suitable airport. Anti-icing/de-icing equipment does not allow aircraft to operate in icing conditions indefinitely; it only provides more time to evade icing conditions. If icing is encountered, an aircraft controllability check should be considered in the landing configuration. Give careful consideration to configuration changes that might produce unanticipated aircraft flight dynamics.

Precipitation Static

Precipitation static occurs when accumulated static electricity discharges from extremities of the aircraft. This discharge has the potential to create problems with the aircraft's instruments. These problems range from serious, such as complete loss of VHF communications and erroneous magnetic compass readings, to the annoyance of high-pitched audio squealing.

Precipitation static is caused when an aircraft encounters airborne particles during flight (rain or snow) and develops a negative charge. It can also result from atmospheric electric fields in thunderstorm clouds. When a significant negative voltage level is reached, the aircraft discharges it, creating electrical disturbances. To reduce problems associated with precipitation static, the pilot ensures that the aircraft's static wicks are maintained and accounted for. All broken or missing static wicks should be replaced before an instrument flight.

Aircraft System Malfunction

Preventing aircraft system malfunctions that might lead to an in-flight emergency begins with a thorough preflight inspection. In addition to items normally checked before visual flight rules (VFR) flight, pilots intending to fly instrument flight rules (IFR) should pay particular attention to antennas, static wicks, anti-icing/de-icing equipment, pitot tube, and static ports. During taxi, verify operation and accuracy of all flight instruments. The pilots must ensure that all systems are operational before departing into IFR conditions.

Generator Failure

Depending on aircraft being flown, a generator failure is indicated in different ways. Some aircraft use an ammeter that indicates the state of charge or discharge of the battery. A positive indication on the ammeter indicates a charge condition; a negative indication reveals a discharge condition. Other aircraft use a load meter to indicate the load being carried by the generator. If the generator fails, a zero load indication is shown on the load meter. Review the appropriate aircraft operator's manual for information on the type of systems installed in the aircraft.

Once a generator failure is detected, the pilot must reduce electrical load on the battery and land as soon as practical. Depending on electrical load and condition of the battery, sufficient power may be available for an hour or more of flight or for only a matter of minutes. The pilot must be familiar with systems requiring electricity to run and which continue to operate without power. In aircraft with multiple generators, care should be taken to reduce electrical load to avoid overloading the operating generator(s). The pilot can attempt to troubleshoot generator failure by following established procedures published in the appropriate aircraft operator's manual. If the generator cannot be reset, inform ATC of an impending electrical failure.

Instrument Failure

System or instrument failure is usually identified by a warning indicator or an inconsistency between indications on the attitude indicator, supporting performance instruments, and instruments at the other pilot station, if so equipped. Aircraft control must be maintained while the pilot identifies the failed components and expedite cross-check including all flight instruments. The problem may be individual instrument failure or a system failure affecting several instruments.

One method of identification involves an immediate comparison of the attitude indicator with rate-of-turn indicator and vertical speed indicator (VSI). Along with providing pitch-and-bank information, this technique compares the static system with the pressure system and electrical system. Identify the failed components and use remaining functional instruments to maintain aircraft control. Attempt to restore inoperative components by checking the appropriate power source, changing to a backup or alternate system, and resetting the instrument if possible. Covering failed instruments may enhance the ability to maintain aircraft control and navigate the aircraft. ATC should be notified of the problem and, if necessary, declare an emergency before the situation deteriorates beyond the ability to recover.

Pitot/Static System Failure

A pitot or static system failure can also cause erratic and unreliable instrument indications. When a static system problem occurs, it affects the airspeed indicator, altimeter, and VSI. In the absence of an alternate static source in an unpressurized aircraft, the pilot could break the glass on the VSI because it is not required for instrument flight. Breaking the glass provides both the altimeter and airspeed indicator a source of static pressure, but pilots should be cautious because breaking the glass can cause additional instrument errors. Before considering, pilots should be familiar with their aircraft's specific procedures for static problems.

Loss of Situational Awareness (SA)

SA is an overall assessment of environmental elements and how they affect flight. SA permits the pilot to make decisions ahead of time and allows evaluation of several different options. Conversely, a pilot who is missing important information about the flight is apt to make reactive decisions. Poor SA means that the pilot lacks vision regarding future events that can force him or her to make decisions quickly often with limited options. During an IFR flight, pilots operate at varying levels of SA. For example, a pilot may be en route to a destination with a high level of SA when ATC issues an unexpected standard terminal arrival route (STAR). Because the STAR is unexpected and the pilot is unfamiliar with the procedure, SA is reduced. However, after becoming familiar with the STAR and resuming normal navigation, the pilot returns to a higher level of SA.

Factors reducing SA include distractions, unusual or unexpected events, complacency, high workload, unfamiliar situations, and inoperative equipment. In some situations, a loss of SA may be beyond a pilot's control. With an electrical system failure and associated loss of an attitude indication, a pilot may find the aircraft in an unusual attitude. In this

situation, established procedures are used to regain SA and aircraft control. Pilots must be alert to loss of SA especially when hampered by a reactive mindset. To regain SA, reassess the situation and work toward understanding what the problem is. The pilot may need to seek additional information from other sources, such as navigation instruments, other crewmembers, or ATC.

Inadvertent Instrument Meteorological Condition (IIMC)

Some pilots have the misconception that inadvertent instrument meteorological condition (IIMC) does not apply to an IFR flight. The following examples could cause a pilot to inadvertently encounter IMC.

1. The aircraft has entered visual meteorological conditions (VMC) during an instrument approach procedure (IAP) and while circling to land encounters IMC.
2. During a non-precision IAP, the aircraft, in VMC, levels at the MDA just below the overcast. Suddenly, the aircraft re-enters the overcast because either the pilot was unable to correctly hold his or her altitude and climbed back into the overcast, or the overcast sloped downward ahead of the aircraft and, while maintaining the correct MDA, the aircraft re-entered the clouds.
3. After inadvertently re-entering the clouds, the pilot maintains aircraft control, and then maneuvers to the published holding fix, while contacting ATC. If navigational guidance or pilot SA were lost, the pilot would then climb to the published MSA (see AIM paragraph 5-4-7c).

In order to survive an encounter with IIMC, a pilot must recognize and accept the seriousness of the situation. The pilot will need to immediately commit to the instruments and perform the proper recovery procedures.

Maintaining Aircraft Control

Once the crewmembers recognize the situation, they commit to controlling the aircraft by using and trusting flight instruments. Attempting to search outside the flight deck for visual confirmation can result in spatial disorientation and complete loss of control. The crew must rely on instruments and depend on crew coordination to facilitate that transition. The pilot or flight crew must abandon their efforts to establish visual references and fly the aircraft by their flight instruments.

The most important concern, along with maintaining aircraft control, is to initiate a climb immediately. An immediate climb provides a greater separation from natural and manmade obstacles, as well as improve radar reception of the aircraft by ATC. An immediate climb should be appropriate for the current conditions, environment, and known or perceived obstacles. Listed below are procedures that can assist in maintaining aircraft control after encountering IIMC with the most critical action being to immediately announce IIMC and begin a substantial climb while procedures are being performed. These procedures are performed nearly simultaneously:

- Attitude—level wings on the attitude indicator.
- Heading—maintain heading; turn only to avoid known obstacles.
- Power—adjust power as necessary for desired climb rate.
- Airspeed—adjust airspeed as necessary. Complete the IIMC recovery according to local and published regulations and policies.

In situations where the pilot encounters IIMC while conducting an instrument maneuver, the best remedy is immediate execution of the published missed approach.

The pilot must trust the flight instruments concerning the aircraft's attitude regardless of intuition or visual interpretation. The vestibular sense (motion sensing by the inner ear) can confuse the pilot. Because of inertia, sensory areas of the inner ear cannot detect slight changes in aircraft attitude nor can they accurately sense attitude changes that occur at a uniform rate over time. Conversely, false sensations often push the pilot to believe that the attitude of the aircraft has changed when in fact it has not, resulting in spatial disorientation.

ATC Requirements During an In-Flight Emergency

ATC personnel can help pilots during in-flight emergency situations. Pilots should understand the services provided by ATC and the resources and options available. These services enable pilots to focus on aircraft control and help them make better decisions in a time of stress.

Provide Information

During emergency situations, pilots should provide as much information as possible to ATC. ATC uses the information to determine what kind of assistance it can provide with available assets and capabilities. Information requirements vary depending on the existing situation. ATC requires at a minimum, the following information for in-flight emergencies:

- Aircraft identification and type
- Nature of the emergency
- Pilot's desires

If time and the situation permits, the pilot should provide ATC with more information. Listed below is additional information that would help ATC in further assisting the pilot during an emergency situation.

- Aircraft altitude
- Point of departure and destination
- Airspeed
- Fuel remaining in time
- Heading since last known position
- Visible landmarks
- Navigational aids (NAVAID) signals received
- Time and place of last known position
- Aircraft color
- Pilot reported weather
- Emergency equipment on board
- Number of people on board
- Pilot capability for IFR flight
- Navigation equipment capability

When the pilot requests, or when deemed necessary, ATC can enlist services of available radar facilities and DF facilities operated by the FAA. ATC can also coordinate with other agencies, such as the U.S. Coast Guard (USCG) and other local authorities and request their emergency services.

Radar Assistance

Radar is an invaluable asset that can be used by pilots during emergencies. With radar, ATC can provide navigation assistance to aircraft and provide last-known location during catastrophic emergencies. If a VFR aircraft encounters or is about to encounter IMC weather conditions, the pilot can request radar vectors to VFR airports or VFR conditions. If the pilot determines that he or she is qualified and the aircraft is capable of conducting IFR flight, the pilot should file an IFR flight plan and request a clearance from ATC to the destination airport as appropriate. If the aircraft has already encountered IFR conditions, ATC can inform the pilot of appropriate terrain/obstacle clearance minimum altitude. If the aircraft is below appropriate terrain/obstacle clearance minimum altitude and sufficiently accurate position information has been received or radar identification is established, ATC can furnish a heading or radial on which to climb to reach appropriate terrain/ obstacle clearance minimum altitude.

Emergency Airports

ATC personnel consider how much remaining fuel in relation to the distance to the airport and weather conditions when recommending an emergency airport to aircraft requiring assistance. Depending on the nature of the emergency, certain weather phenomena may deserve weighted consideration. A pilot may elect to fly further to land at an airport with VFR conditions instead of closer airfield with IFR conditions. Other considerations are airport conditions, NAVAID status, aircraft type, pilot's qualifications, and vectoring or homing capability to the emergency airport. In addition, ATC and pilots should determine which guidance can be used to fly to the emergency airport. The following options may be available:

- Radar
- DF
- Following another aircraft
- NAVAIDs
- Pilotage by landmarks
- Compass headings

Emergency Obstruction Video Map (EOVM)

The emergency obstruction video map (EOVM) is intended to facilitate advisory service in an emergency situation when appropriate terrain/obstacle clearance minimum altitude cannot be maintained. The EOVM, and the service provided, are used only under the following conditions:

1. The pilot has declared an emergency.
2. The controller has determined an emergency condition exists or is imminent because of the pilots inability to maintain an appropriate terrain/obstacle clearance minimum altitude.

Note: Appropriate terrain/obstacle clearance minimum altitudes may be defined as minimum IFR altitude (MIA), minimum en route altitude (MEA), minimum obstacle clearance altitude (MOCA), or minimum vectoring altitude (MVA).

When providing emergency vectoring service, the controller advises the pilot that any headings issued are emergency advisories intended only to direct the aircraft toward and over an area of lower terrain/obstacle elevation. Altitudes and obstructions depicted on the EOVM are actual altitudes and locations of the obstacle/terrain and contain no lateral or vertical buffers for obstruction clearance.

Responsibility

ATC, in communication with an aircraft in distress, should handle the emergency and coordinate and direct the activities of assisting facilities. ATC will not transfer this responsibility to another facility unless that facility can better handle the situation. When an ATC facility receives information about an aircraft in distress, they forward detailed data to the center in the area of the emergency. Centers serve as central points for collecting information, coordinating with search and rescue (SAR) and distributing information to appropriate agencies.

Although 121.5 megahertz and 243.0 megahertz are emergency frequencies, the pilot should keep the aircraft on the initial contact frequency. The pilot should change frequencies only when a valid reason exists. When necessary, and if weather and circumstances permit, ATC should recommend that aircraft maintain or increase altitude to improve communications, radar, or DF reception.

Escort

An escort aircraft, if available, should consider and evaluate an appropriate formation. Special consideration must be given if maneuvers take the aircraft through clouds. Aircraft should not execute an in-flight join up during emergency conditions unless both crews involved are familiar with and capable of formation flight and can communicate and have visual contact with each other.