

EMERGENCY PROCEDURES - STUDY GUIDE

This study guide is intended to provide information to supplement the published emergencies procedures for Total Flight Solutions FTC aircraft as an aid to understanding those procedures. This is a general study reference only and not a substitute for published emergencies procedures.

Systems and equipment malfunctions on the ground

ENGINE FIRE DURING START

Principle: Most likely source of fire is in or around the carburetor, try to draw the fire into the carburetor while shutting off sources of fuel to the engine compartment.

Action: Continue engaging the starter (cranking.) If the engine starts, run it for a few minutes, then shut-down and report the fire. If engine does not start, keep the throttle open, and shut-down (mixture idle/cutoff, fuel selector off, ignition off, switches off). Evacuate, call the fire department, and consider use of fire extinguisher.

Reference: FTC Checklist - Engine Fire During Start

EMERGENCY GROUND EGRESS

Principle: A thorough crew and passenger pre-flight briefing is mandatory to ensure that everyone aboard can exit the aircraft quickly and safely in an emergency.

Action: Brief emergency exits, seatbelt use and how to open doors. If emergency egress is required, confirm propeller has stopped, rear seat passengers exit first, then front seat occupants can push back seats and exit. After exiting aircraft move to wingtips (to avoid flaps), then proceed 150 yards/meters behind the aircraft. Confirm that all occupants have left the aircraft.

Reference: FTC Checklist - Briefings

BRAKE MALFUNCTIONS DURING TAXI

Principle: Worn brake pads or loss of brake fluid can cause lack of braking ability on one or both main gear. This can lead to inadvertent loss of directional control during taxi.

Action: Reduce power and direct the aircraft to a gentle stop in the safest direction with minimum braking, then shut down the aircraft and call for assistance. Do not attempt to taxi back to the hangar.

Reference: FTC Checklist - Walk-around (main gear checks)

ENGINE FAILURE DURING TAKEOFF RUN

Principle: The stresses of full power during takeoff can lead to engine failure.

Action: Always check engine power prior to rotation. If engine has failed (even partially) do not attempt takeoff. Immediately reduce power and use brakes to bring the aircraft to a stop, leaving the prepared surface if necessary. Shut down the aircraft and call for assistance.

Reference: FTC Checklist - Engine Failure Takeoff Roll

EMERGENCY FUEL SHUT-OFF

Principle: A stuck or broken fuel trigger can prevent the pilot from stopping fuel flow during re-fueling. This can lead to fuel spills which are extremely hazardous.

Action: Aim excess fuel away from people and equipment - point into the grass if able. Press the fuel pump lever OFF and move the emergency shutoff valve to the cutoff position. Move away from the area and wash/flush any skin/eye contact. Report the spill quickly but do not use cellphones anywhere near the spill area.

USE OF FIRE EXTINGUISHERS

Principle: Red extinguishers are appropriate for most small fires. Green extinguishers are suitable for large fires of any type. Fumes are hazardous and must not be inhaled.

Action: Red extinguishers: Break inspection seal, pull safety pin, point nozzle at base of fire and squeeze handle. Green extinguishers: Extend hose, break inspection seal, pull safety pin, turn on valve at tank, grip hose firmly **do not hold nozzle with bare hands** (frostbite risk) aim at the base of fire, brace feet firmly and open valve on nozzle.

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Systems and equipment malfunctions in flight

ENGINE FAILURE AFTER TAKEOFF

Principle: Engine failure after takeoff requires immediate action to land the aircraft as safely as possible. In most cases, trying to return to the departure runway will not be a safe course of action. Always brief the takeoff emergency scenario prior to departure.

Action: Pitch for safe airspeed, land back on the runway or head for the safest landing spot, shut down the aircraft (mixture, fuel selector, MAG switches all off), deploy flaps as required then turn off the master switch.

Reference: FTC Checklist - Engine Failure After Takeoff

ENGINE FAILURE DURING FLIGHT

Principle: Total engine failure during flight is rare, so pilots should attempt a restart if the situation allows.

Action: Establish glide speed, and head for a safe landing area. Conduct a flow check of the fuel and engine controls (fuel selector, mixture, throttle, MAG switches, primer/ fuel pump). Try switching fuel tanks and different throttle/ mixture settings. Try the starter if the propellor has stopped. Repeat as time allows but focus on flying the airplane to a safe landing throughout. If re-start is not possible, execute landing without engine power procedures.

Reference: FTC Checklist - Engine Failure During Flight

OIL PRESSURE MALFUNCTIONS

Principle: Oil pressure is critical to the proper function of the engine. Oil pressure malfunctions can quickly lead to loss of engine power and catastrophic engine damage.

Action: Keep power to a minimum and make as few power changes as practical. If oil temperature is normal, land as soon as practicable. If oil temperature is high, execute a precautionary landing.

Reference: FTC Checklist - Low Oil Pressure (with normal/high oil temperature)

OIL TEMPERATURE MALFUNCTIONS

Principle: A key function of oil is to cool the engine. High oil temperature may be a sign of an overheating engine OR it could be a sign of an oil malfunction. These two situations require different actions.

Action: if oil temperature is high with a normal pressure indication, cool the engine by stopping any climbs (either leveling out or descending), using lower power settings, and/or enriching the mixture. If oil pressure is indicating low, execute a precautionary landing.

Reference: FTC Checklist - Low Oil Pressure (with high oil temperature)

ENGINE ROUGHNESS

Principle: Engine roughness is typically caused by carburetor ice, fouled spark plugs or magneto problems. Gradual onset is likely carb ice; slight roughness is likely spark plug fouling; sudden onset is likely MAG failure.

Action: For carb ice, apply carb heat and leave it on until the engine is smooth. For spark plug fouling, try leaning the mixture normally and/or richer settings. For MAG failure, verify which side has failed then land as soon as practicable using either just the good MAG or both, whichever setting has the best results.

Reference: FTC POH Aircraft Manual

FUEL SYSTEM MALFUNCTIONS

Principle: Fuel exhaustion is the most common fuel-related emergency, but fuel system malfunctions can also arise due to blockages caused by the fuel itself. The fuel selector should always be set to left or right above 5000 ft MSL as fuel can get blocked in fuel lines at high altitudes.

Action: If fuel flow stops or drops suddenly, switch the fuel selector to the best functioning fuel tank. Try switching tanks after a short period but do not use the BOTH setting. Use the minimum power setting required. Try different mixture settings. Land as soon as practicable.

Reference: FTC POH Aircraft Manual

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ENGINE FIRE IN FLIGHT

Principle: A fuel leak is the most likely cause of an engine fire in flight. An engine fire requires immediate action to stop fuel flow to the engine. This will subsequently require a landing without engine power.

Action: Stop fuel flowing to the engine (mixture idle/cut off, fuel selector off, fuel shutoff valve ignition off). Turn off cabin air and heat to prevent smoke and fumes entering the aircraft. Pitch for 110 mph / 100 kias to try to extinguish the fire, then execute an emergency landing.

Reference: FTC Checklist - Engine Fire In Flight

ELECTRICAL SYSTEM MALFUNCTIONS

Principle: Excessive electrical charge poses a serious risk of fire or explosion. Insufficient charge will eventually lead to loss of avionics and other electrical equipment. Some avionics have emergency backup batteries, but useful time is limited.

Action: If a circuit breaker pops in flight, it may be reset once if determined to be safe. If the battery gauge indicates excessive voltage, try turning off non-required electrical/electronic equipment and re-setting the master switch. If the ammeter shows excessive charge, pull the alternator circuit breaker. If the ammeter shows a discharge, try resetting the avionics switch, the alternator switch and circuit breaker, and the master switch. If the discharge indication persists, use only essential equipment, confirm status of backup batteries and land as soon as practicable.

Reference: FTC Checklist - Ammeter (Excessive Rate of Charge, or Discharge)

ELECTRICAL FIRE

Principle: Smoke, sparks, flames or a burning smell coming from the instrument panel should be treated as evidence of an electrical fire and action taken immediately. If a popped circuit breaker is accompanied by smoke or a burning smell, do not reset the breaker regardless of the system(s) affected.

Action: Turn the master switch off. Close the air vents to prevent fanning the fire. Extinguish the fire and then clear the cabin of smoke by opening windows and vents. Turn off all electrical equipment and do not reset any circuit breakers. Turn the master switch back on and turn on only required equipment while monitoring.

Reference: FTC Checklist - Cabin Or Electrical Fire In Flight

SMOKE AND FUME ELIMINATION

Principle: Smoke and carbon monoxide (CO) can incapacitate a pilot quickly. Immediate action is required to remove smoke or fumes from the cabin after a fire has been extinguished or if the CO detector is activated.

Action: Shut off cabin heat. Open windows, air vents and cabin air. The windows can be opened at any speed. Sideslipping may improve cross-ventilation.

PROPELLER MALFUNCTION

Principle: Malfunction of the propeller from striking an object or from previous damage can lead to vibration severe enough to tear the engine off its mounts. Loss of the spinner will significantly reduce airflow over the engine and can result in severe overheating.

Action: If the propeller malfunctions, exercise extreme caution in changing throttle settings and try to find a throttle setting that minimizes any vibration. In a severe case, it may be necessary to turn off the engine. Land as soon as possible. If the spinner is lost, manage mixture, throttle and flight profile to minimize heating of the engine and land as soon as possible.

THROTTLE LINKAGE FAILURE

Principle: A broken or damaged throttle cable will keep the engine at a single power setting. On/off control will still be available through the mixture control (using the ignition switches may result in a flooded engine).

Action: Loosen the friction control and check throttle movement. If unable to maintain altitude, make an emergency landing. If throttle setting is excessive, use carb heat to reduce power, and use mixture control to interrupt engine power for landing. When shutting off the engine with a high throttle setting, move the mixture control briskly to idle/cutoff to avoid the risk of detonation.

STRUCTURAL FAILURE / CONTROLLABILITY CHECK

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Principle: Damage to the aircraft in flight will affect its flight characteristics. You will need to confirm that you can maintain control of the aircraft as you slow for landing. Expect that damage will get worse over time.

Action: Avoid abrupt control movements and try to minimize loading on the aircraft. Maintain sufficient altitude to recover from a stall which could occur at a substantially higher speed. Determine whether you can make shallow turns in each direction. Reduce speed in 5 mph / 5 kias increments to determine whether you can maintain control at normal speeds for approach and landing. If you experience a loss of control, note the speed at which that occurred and try to maintain at least 10 mph / 10 kias above that speed. Do not change the flap setting.

TRIM SYSTEM FAILURE

Principle: The trim tab has two modes of failure. It may stick in one position, or it may move freely. In either situation, it should be possible to manually overpower the effect of the trim tab.

Action: Fly at the speed that minimizes pressure on the yoke and expect heavy control forces during landing.

PITOT/STATIC SYSTEM FAILURE

Principle: Pitot/static failures can affect airspeed, altitude and vertical speed indications, but should not present a significant risk to safety of VFR flight as long as the pilot is aware of the problem. The autopilot uses a separate static system and should be able to provide an altitude hold even if the primary static port is blocked.

Action: If the problem is a blocked pitot tube, turn pitot heat on and observe effects. If the problem is a blocked static port, use the alternate static source. Refer to the GPS for a satellite-based altitude. The GPS will also provide ground speed, which can be used to estimate airspeed. Listen carefully for the stall warning horn. Land the aircraft using usual power settings and pitch attitudes.

FLAP MALFUNCTIONS

Principle: Flaps failures include failure to extend, failure to retract, and asymmetrical extension.

Action: If flaps fail to retract, maintain airspeed below 100mph / 80 kias and land as soon as practicable. If flaps fail to extend, execute a no-flap landing as soon as practicable. If the airplane starts to roll as you move the flaps, try to return the flaps to their previous position, and use very shallow banks only.

INDUCTION AND STRUCTURAL ICING

Principle: *Induction* ice (carb ice) can quickly reduce engine power and lead to engine failure, even on warm clear days. *Structural* ice is always life-threatening and must be dealt with immediately. Even a thin coating of ice will significantly reduce lift, increase drag, and raise the stall speed. Icing can overwhelm an aircraft in minutes.

Action: If carb ice is suspected, engage carb heat and leave it on even if power drops. At the first sign of ANY structural icing, change altitude and/or course to exit the icing conditions *immediately*. If the aircraft is contaminated with structural icing do not change configuration. Do a controllability check to determine any changes to flight characteristics. Land at a higher-than-normal speed at the nearest suitable field.

SPIN RECOVERY

Principle: Spins are a result of stalling in uncoordinated flight. The most dangerous time for this to occur is during the final turns of the traffic pattern, as rapid loss of altitude may preclude a recovery. Always fly coordinated in turns (ball in the center) and fly forward slips and side slips with caution not to approach a stalled condition.

Action: Bring power to idle and neutralize the ailerons, then apply rudder opposite the direction of the spin to stop the rotation while applying forward pressure on the yoke to break the stall. Raise the nose gently to recover to level flight without over-stressing the aircraft.

BIRD STRIKE

Principle: Bird strikes can cause significant structural damage to an airplane, and are sudden, shocking events for pilots. Birds will generally try to dive away from an aircraft, so pilots should try to climb behind a bird in order to avoid it. Birds will easily smash through windscreens.

Action: If a bird strikes the airframe, visually inspect the damage, if possible, and perform a controllability check and land as soon as practicable. If the propeller hits a bird, treat that as a prop strike; use power carefully, land as soon as practicable.

Systems and equipment malfunctions during landing

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LANDING WITH A FLAT TIRE

Principle: Flat tires cause severe directional control problems when landing. Be prepared to depart the runway.

Action: If the main gear is flat, set down on the good side using ailerons to keep weight off the bad tire as long as possible. Expect the airplane to pull sharply in the direction of the flat tire when it touches down. If you suspect a flat tire or deflated nose gear strut, hold the nose off the runway as long as possible and set it down lightly. As the airplane slows, keep the yoke full back to minimize pressure on the nose wheel.

Reference: FTC Checklist - Landing Gear (Flat Main Tire, Flat Nose Tire)

LANDING WITHOUT ELEVATOR CONTROL

Principle: Elevator control may be lost if the control cable breaks or is jammed. The aircraft cannot be controlled without elevator input. However, the trim system provides a rough secondary method of control.

Action: If the elevator cannot be controlled by yoke inputs, try to control pitch attitude with a combination of elevator trim inputs and power control. Do not change configuration and exercise extreme caution when landing.

LANDING WITHOUT AILERON CONTROL

Principle: Aileron control may be lost if the control cable breaks or is jammed. The aircraft cannot be controlled without aileron input. However, the rudder provides a rough secondary method of control.

Action: If the ailerons cannot be controlled by yoke inputs, try to control roll with by using rudder inputs in the direction you need to roll. Do not change configuration and exercise extreme caution when landing.

BRAKE FAILURE DURING LANDING ROLL

Principle: Worn brake pads or loss of brake fluid can cause lack of braking ability on one or both main gear. This can lead to inadvertent loss of directional control during landing.

Action: During landing, use aerodynamic braking, use the good brake judiciously while offsetting with nose wheel steering. Direct the aircraft to the safest roll-out route.

Reference: FTC Checklist - Walk-around (main gear checks).

DEPARTING A PREPARED SURFACE

Principle: The C172 can be safely directed onto grass or other non-paved surfaces as long as the nose gear is protected. Keep pressure off the nose wheel and direct the aircraft to the safest route on or off the runway.

Action: Yoke full back to protect nose gear, use minimum braking, try to avoid objects on the ground. Move mixture to idle cutoff to reduce the risk of a prop strike. Shut down and secure the aircraft and get help. Do not attempt to taxi back to the prepared surface.

OFF-AIRPORT LANDING

Principle: If a precautionary or forced landing is required, the choice of landing area and wind direction will have a major impact on the success of the landing.

Action: Select a landing site with adequate length and surface. Avoid power lines, people, traffic, trees and rice paddies etc. Beaches, golf courses or river banks are preferred. Overfly the landing site if able. Try to land into the wind and be prepared for loss of directional control and an abrupt stop.

Reference: FTC Checklist - Precautionary Landing With Engine Power; Emergency Landing W/O Engine Power

DITCHING (WATER LANDING)

Principle: If landing into water is required, or cannot be avoided, the pilot will need to decide how to land considering the wind and sea conditions; and will need to evacuate all occupants urgently after landing.

Action: If winds are strong, land into the wind. If winds are light, land parallel to wave swells. Unlatch doors prior to touchdown and touch down at minimum descent rate. Evacuate immediately and deploy life vests after leaving aircraft.

Reference: FTC Checklist - Ditching (Water Landing)

Aeromedical Emergencies

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HYPOXIA

Principle: Hypoxia means not enough oxygen is getting to your brain, due to environmental factors (altitude) and/ or physiological factors. It severely impairs your ability to safely fly the airplane and can lead to loss of consciousness. Symptoms include cognitive impairment, tunnel vision, blue fingertips, euphoria.

Action: Descend to a lower altitude and avoid prolonged flight.

HYPERVENTILATION

Principle: Hyperventilation means breathing too fast, upsetting the carbon dioxide (CO₂) concentration in the blood. Hyperventilation is often the result of anxiety, resulting in dizziness, tingling in the lips, hands or feet, headache, weakness, fainting and seizures.

Action: Try to calm down and breathe slowly. Talking aloud can help restore normal breathing. Note: breathing into a paper bag is no longer recommended to combat hyperventilation.

MIDDLE EAR AND SINUS PROBLEMS

Principle: Blocked sinuses and Eustachian tubes can trap air pressure, resulting in excruciating pain, rendering a pilot incapable of flying the airplane. Pilots should not fly with colds or congestion of any sort. Many cold and sinus medicines are not approved by the FAA for use by flight crews.

Action: If pain is experienced during descent, level-off or climb to relieve the immediate symptoms. Try the Valsalva maneuver (hold nose and blow) and descend with the least vertical speed practical.

MOTION SICKNESS

Principle: Motion sickness can affect pilots, especially in situations such as turbulence, during maneuvers, or and as a result of stress and fatigue. Once symptoms start, they can persist for the remainder of the flight.

Action: Return to straight and level flight, keep eyes outside the aircraft, increase cabin ventilation. Use autopilot if able. If necessary, be sick into a motion sickness bag. Land as soon as practicable

CARBON MONOXIDE POISONING

Principle: Carbon Monoxide (CO) is contained in exhaust fumes. It is odorless and colorless and can incapacitate and kill quickly. In rare situations, CO may enter the cabin when using cabin heat. Each aircraft is equipped with a CO detector to warn pilots of this situation.

Action: Turn cabin heat off immediately. Open window, vents and cabin air fully. Land as soon as practicable. If you suspect CO poisoning, seek immediate medical attention.

STRESS AND FATIGUE

Principle: Stress and fatigue are increased significantly when flying, particularly on long flights or in challenging conditions. Exceeding stress or fatigue limits can significantly degrade the pilot's ability to safely fly the aircraft.

Action: Head back to home base and/or consider diverting to a closer airport if necessary. Use resources such as the autopilot to relieve workload.

HEAT STRESS

Principle: Flying involves extended time outside in the sun and inside a hot cabin, particularly in summer. Any amount of heat exposure will degrade the pilot's capabilities. Severe exposure can lead to heatstroke and loss of consciousness.

Action: During pre-flight, take a break before flying in a cool, shaded area. Put on a hat and appropriate clothing. In the cabin, stay hydrated and avoid prolonged procedures prior to starting the engine. Open windows and vents.

EXPOSURE TO COLD TEMPERATURES

Principle: Flying involves extended time outside in the cold and possible exposure to sub-freezing temperatures at altitude if heating does not function properly. Cold temperatures will degrade the pilot's capabilities. Severe exposure can lead to loss of consciousness.

Action: Dress warmly and avoid prolonged exposure to cold conditions. If cabin air fails (or CO contamination is suspected), descend to altitudes with warmer temperatures and land as soon as practicable.

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Other Emergency Procedures

USE OF SURVIVAL EQUIPMENT

Principle: A forced landing away from an airport could result in injuries, and/or extended periods waiting for rescue. Pilots need to be equipped with appropriate survival gear for their intended flight. Each aircraft is equipped with a basic survival and first aid kit. Life jackets are also available from the FTC.

Action: Develop a personal equipment pack for each type of flight (including routing flights to the training area). The simplest pack might include water, snacks, a phone charger, money and a jacket. For more complex flights consider items such as a personal locator beacon (PLB) and survival items appropriate to a hiking trip. Life jackets **MUST** be taken on any flights beyond gliding distance of the shoreline.

COMMUNICATIONS FAILURE

Principle: Communications failure is relatively common, and more stressful than dangerous. Typical cause is mismanagement of the audio panel. Whatever the cause, the pilot should exercise their judgement in place of ATC instructions and land as soon as practicable.

Action: Set the transponder code to 7600. Transmit intentions even if no response is heard. Try different audio panel settings (volume, COM1/COM2 change, frequency change). Try using the co-pilot headset jack inputs. Enter the traffic pattern and look for light gun signals. Obey the signals. If no signals are offered, fly a standard traffic pattern and land. Be extremely cautious of other traffic.

Best Practices in an Emergency

Fly the aircraft: Don't panic and don't become so distracted or focused that you fail to fly the aircraft safely. Always maintain safe airspeed.

Run your flows: Many "emergencies" are the result of pilot error (e.g. pulling the mixture instead of the carb heat). Developing a good flow pattern to check the main flight controls can help quickly solve these situations.

Run your checklists: It is hard to think calmly during an emergency. Know how to find your checklists and use them to help deal with the situation. Avoid impulsive actions. Learn the memory items from the checklist.

Declare an emergency: Do not hesitate to declare an emergency when you need to. You will get immediate help and priority handling. There is no cost or penalty for declaring an emergency. Use "mayday" in communications to get immediate emergency handling.

Use resources: There are many resources to help during an emergency, including ATC, the autopilot, checklists, Foreflight, even your cellphone.

Prevent emergencies: A thorough pre-flight inspection can identify malfunctioning equipment before it can cause an emergency. Similarly, pilots should monitor their stress, fatigue, health, and hydration, and be confident to cancel flights if conditions are not conducive to safe operations.