

# DA20-C1 EMERGENCY PROCEDURES TRAINING GUIDE



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# INTRODUCTION

## **PURPOSE AND SCOPE**

Students who are enrolled in Initial Flight Screening (IFS) must demonstrate the ability to memorize, understand, and apply a significant amount of aircraft-specific information, limitations, and normal/emergency procedures. The standards and expectations set during IFS for general knowledge and emergency procedures lay the foundation for future Air Force undergraduate flying training.

Pilots must be prepared to deal with a variety of emergency situations that might arise while operating the DA20-C1. The aircraft manufacturer's guidance in the Airplane Flight Manual (AFM) addresses the most common emergencies, and this guide adds a few additional procedures. Although no set of procedures can anticipate every scenario, this guide will help prepare pilots to analyze emergency situations and take the proper action.

## **THREE BASIC RULES**

Emergency procedures training will emphasize three basic rules or priorities. Before talking through any EP, students will recite the following phrase to establish these priorities: "I will maintain aircraft control, analyze the situation, take proper action, and land as soon as conditions permit."

1. **Maintain aircraft control.** Flying the aircraft must be your primary consideration during any emergency situation. Do not attempt to analyze the problem until you have the aircraft under control. State what you are physically doing in the aircraft and which control inputs you will make in order to keep the aircraft in the desired attitude and in a safe position to analyze the situation. During ground emergencies, you will begin a controlled deceleration toward a stop prior to analyzing the situation. During airborne emergencies, you will generally establish straight-and-level flight prior to analyzing the situation. Maintaining aircraft control may also involve the initial turn and/or climb toward the recovery airfield or emergency landing site.
2. **Analyze the situation and take proper action.** After explaining how you are going to maintain aircraft control, you can begin to analyze the situation. Analyze the situation beginning with the indications you have already noticed (or as provided by the instructor). Search for additional indications (i.e., by asking about specific gauges, etc.) that will lead you to a correct analysis of the situation. While asking the IP about additional indications during tabletop and standup EPs, time stands still because you will not be able to take a snapshot view of those indications as you would in the airplane. However, you should be expeditious about your analysis, and the IP will not allow any unnecessary delays for the proper action to be taken. If your analysis leads you to determine that boldface items (critical actions) apply, state the applicable boldface by memory, in order, and without error. During standup EPs, stand at attention while stating the boldface. After reciting all applicable boldface items, go back and explain the specific actions taken to accomplish the boldface. Next, refer to the checklist to accomplish any cleanup items (i.e., checklist items that follow the boldface). However, your use of checklists must also be realistic, and you should not refer to a checklist or publication during an EP scenario whenever this would not be practical or safe during flight (e.g., engine failure shortly after takeoff). Use all available in-flight resources (checklists, IFG, AFM, GPS, Local Area Map, ATC, SOF, etc.) as required or permitted by the situation.
3. **Land as soon as conditions permit.** Once all action items have been accomplished, the student should determine the most appropriate means of recovering and landing the aircraft. This process should include using ATC and the SOF as resources to help bring the situation to a logical conclusion. Select a suitable landing site (i.e., KPUB, an approved auxiliary field, an emergency divert airfield, or a suitable off-airfield landing site), as required by the situation. Overflying a suitable airfield following an in-flight emergency is not generally recommended, but the requirements of the situation must also be considered (e.g., nature of the emergency, availability of emergency services, width/length of the runways, etc.). When any in-flight emergency occurs, the training mission is automatically terminated, and the aircraft must be recovered to a full-stop landing as soon as conditions permit.

## EP TRAINING METHODS

**Standup EPs.** Students are tested on emergency procedures during formal flight briefings. All students assigned to the flight attend these briefings. The flight Unit Standardization and Evaluation Monitor (USEM) presents EP scenarios in a sterile and professional setting, and there is no tolerance for poor preparation among students. At the conclusion of the standup EP scenario, the USEM and other IPs in the room have an opportunity to provide a thorough debrief of the student's performance.

**Tabletop EPs.** Aside from the formal briefings, student EP comprehension is also evaluated during sortie briefing or debriefing for all dual sorties. EP questions should match the student's progress through the IFS syllabus, in accordance with guidance found in the Playbook. These one-on-one tabletop scenarios between IP and student should be executed in the same manner as standup EP scenarios in the formal brief, with the exception that the student remains seated. The student is given a set of circumstances and is asked to talk through the situation from inception to a safe conclusion. Instructors emphasize proper application of procedures and realistic use of available publications. Procedural deficiencies in students result in additional instruction and study assignments based on individual student needs.

**Airborne Simulated EPs.** All airborne simulated emergencies must be thoroughly briefed prior to flight. During flight, the instructor verbally initiates the simulated emergency. Students are expected to verbalize their analysis of the situation based on the specific indications listed by the instructor. Students must perform (simulate) any applicable critical actions (boldface items) by pointing to the appropriate switch or lever in the cockpit. Boldface items must be performed (simulated) by memory, without error, and in the correct sequence. Students should also state the boldface as they simulate each critical action, but the emphasis is on the *action* rather than the exact verbiage during airborne simulated emergencies. Checklists and other publications should be referred to just as they would during an actual emergency. After stating any applicable boldface items, the student must refer to the checklist to accomplish any remaining steps in the procedure, unless time and/or conditions do not permit reference to the checklist.

## CHECKLIST TERMINOLOGY

**Warning.** A WARNING in the abbreviated checklist means that the non-observation of the corresponding procedure leads to an immediate or important degradation of flight safety.

**Caution.** A CAUTION in the abbreviated checklist means that the non-observation of the corresponding procedure leads to a minor or long-term degradation of flight safety.

**Note.** A NOTE in the abbreviated checklist draws attention to any special item not directly related to safety but which is important or unusual.

**Challenge and Response Item.** Challenge and response items are marked with an asterisk in the abbreviated checklist. The pilot flying will call out the required item, and the pilot not flying will verbally confirm it.

**Additional Procedure.** In the abbreviated checklist, the → symbol indicates that a separate procedure applies at this point in the checklist. Most emergency situations will require the pilot to apply multiple emergency procedures as they bring the situation to a safe conclusion.

**Critical Action.** Some emergency procedures include critical actions that must be accomplished immediately to ensure a safe outcome. Critical actions are indicated in **boldface** type in order to set them apart from the rest of the procedure.

**Memory Item.** Many emergency situations will occur under circumstances that make reference to a checklist impractical or unsafe. In these situations, the pilot may not have the time or ability to divert attention to the checklist. Procedures that are more likely to apply in these types of situations are referred to as "memory items."

# EMERGENCY GROUND EGRESS

(Memory Item)

## INDICATIONS

- Any situation that requires immediate evacuation of the aircraft *after the engine has been shut down and the aircraft has been brought to a full stop on the ground.*

## ACTIONS

- Call out “EGRESS, EGRESS, EGRESS!” and accomplish the EMERGENCY GROUND EGRESS procedure:
  1. PARKING BRAKE...SET. *Set the parking brake to prevent the airplane from rolling during or after egress. To set the brake, move the parking brake lever down to the ON position, and then repeatedly press on the toe-brake pedals to build pressure.*
  2. HEADSET & SAFETY BELTS...REMOVE. *Unfasten your safety belts by pulling the belt lock cover. Remove the belts from your shoulders. Remove your headset and drop it behind the seat.*
  3. CANOPY...UNLOCK, OPEN. *Pull both (right and left) red canopy locking handles fully aft, and then use these handles to push the canopy upward and backward until it is fully open.*
  4. EVACUATE AIRPLANE IMMEDIATELY. *Deplane normally, using the handhold and footstep. Proceed a safe distance from the aircraft to reduce exposure to possible fire or explosion. Meet up with the other crewmember (if dual) as previously briefed.*

## CONSIDERATIONS

- WARNING: Do not attempt egress until after the engine has been shut down and the aircraft has come to a complete stop.
- For common emergencies that require egress, the applicable emergency procedure will include three steps to appropriately shut down the engine. If a situation arises that is not covered by a published emergency procedure, use these same three steps to quickly shut down the engine prior to egress:
  1. MIXTURE...IDLE CUTOFF.
  3. IGNITION SWITCH...OFF.
  4. GEN/BAT MASTER SWITCH...OFF.
- Do not attempt to extinguish a fire that is burning the aircraft after you accomplish an emergency ground egress. Pilots should use fire extinguishers to ensure their personal safety only.
- Do not delay emergency ground egress in any situation where remaining in the aircraft may threaten your personal safety. There are situations where continuing to operate the engine will not present any danger to the pilot, and it may be appropriate to taxi clear of the runway or even to the non-movement area prior to shutting down the engine. However, in cases where you are uncertain about the risk involved in continuing to run the engine and remain in the airplane, do not delay emergency ground egress.
- After egress, watch for other ground traffic and responding emergency vehicles. Their attention will most likely be focused on the burning aircraft, and they may not see you standing away from the aircraft.
- Always remain clear of the propeller during emergency ground egress, even though the engine has been shut down.
- Consider the presence of hazards to either side of the aircraft prior to egress. If safety hazards are isolated to one side of the aircraft (e.g., fire, smoke, etc.), egress on the side that presents the least risk to personal safety. When fire and smoke are present, consider moving away from the aircraft upwind of the flames and smoke.
- Setting the parking brake may not be practical if there is no danger of the aircraft rolling after it comes to a complete stop (e.g., soft-field landing, tree landing, ditching, broken landing gear, etc.), or if the situation is time-critical (e.g., imminent danger from fire).
- If the safety belt lock is jammed, cut the waist belt (on either side of the belt lock) with the razor blade located in the handle of the rescue hammer.
- If the canopy locking mechanism is jammed, or if you are unable to fully open the canopy (e.g. the aircraft comes to a stop inverted, or the aircraft is lodged beneath an obstacle), use the rescue hammer to break through the canopy. Strike the canopy with the pointed end of the hammer until the canopy is cracked, and then hit/kick the canopy near this crack to create a hole large enough for egress. Striking the canopy near the window may facilitate creating this hole.

# STARTER RELAY FAILURE

## INDICATIONS

- The START Warning light remains illuminated after you release the key during engine start.
- Audible indication that the starter motor is still engaged after you release the key during engine start.
- The propeller does not spin up to normal idle RPM when you release the key after engine start.

## ACTIONS

- Accomplish the STARTER RELAY FAILURE procedure:
  1. THROTTLE...IDLE. *Bring the throttle fully aft to the IDLE stop. Any preceding steps in the normal ENGINE SHUTDOWN checklist are skipped in order to expedite the engine shutdown process and reduce the risk of damage to aircraft systems during the stuck starter condition.*
  2. MIXTURE...IDLE CUTOFF. *Squeeze the safety lock against the red mixture control knob, and then move the mixture control lever fully aft to the IDLE CUTOFF stop. This action will cause the engine to immediately shut down.*
  3. IGNITION SWITCH...OFF. *Rotate the key fully counterclockwise to turn the ignition switch OFF.*
  4. GEN/BAT MASTER SWITCH...OFF. *Press the GEN/BAT Master Switch (red split-rocker switch) down to the OFF position.*
- Complete the remaining steps of the normal ENGINE SHUTDOWN checklist and egress normally.

## CONSIDERATIONS

- Do not re-attempt engine start after a starter malfunction. Maintenance action is required.

## ELECTRICAL MALFUNCTION (LOW VOLTAGE ON THE GROUND)

### INDICATIONS

- Voltmeter indicates significantly less than 14 volts during normal ground operations with the engine running.
- Ammeter indicates negative (discharging battery) during ground operations with the engine running.
- GEN Warning light is illuminated during ground operations with the engine running.
- *COM transmitter power has been reduced* message on the GNS 430 display.

### ACTIONS

- Accomplish the ELECTRICAL MALFUNCTION (LOW VOLTAGE ON THE GROUND) procedure:
  1. NON-ESSENTIAL ELECTRICAL CONSUMERS...OFF. *Minimize drain on the battery by turning off electrical consumers that are not essential in the specific situation. Turn off each electrical component using its power switch/knob/control or by pulling its circuit breaker. In general, one radio (for required communications) and the electric fuel pump (to prevent engine stoppage at low throttle settings) should remain on.*
  2. RETURN TO PARKING. *Terminate the mission and taxi back to the parking area (Doss Ramp if operating at KPUB).*

### CONSIDERATIONS

- NOTE: If the battery is fully charged, expect approximately 30 minutes of battery power with a discharge load of 20 amperes.
- Expect no more than 30 minutes of battery power at a discharge load of 20 amperes. This figure assumes that the battery is in perfect condition. It also assumes that the battery is fully charged, which means that you noticed the abnormal condition immediately and reduced the electrical load to 20 amperes without any delay.
- A circuit breaker may be reset once, but do not reset a circuit breaker if it trips a second time.
- Leave the fuel pump ON during taxi to prevent engine stoppage.
- Where the AFM procedure leaves open the possibility of continuing the mission after an abnormal condition on the voltmeter is noticed, the Doss procedure is more restrictive. Any abnormal voltage indication in a Doss aircraft shall result in automatic termination of the mission (i.e., even if the voltmeter indication returns to the green arc after switching off electrical consumers, as permitted by the AFM).
- Accomplish the normal AFTER LANDING checklist if the condition is observed during takeoff roll or landing roll. However, you may decide to forgo flap retraction after exiting the runway in order to preserve battery power for fuel pump operation and required radio transmissions. For example, you may not have noticed the low voltage condition until after landing when the problem occurred several minutes earlier during flight.
- Advise ATC of the condition and that you may lose electrical power and radio communications.
- Keep radio transmissions brief to conserve battery power.
- Consider taxiing clear of the runway, shutting down, and having the aircraft towed to the Doss Ramp to avoid a total electrical power failure and communications failure during taxi.
- Total electrical power failure is possible at any time. When stopping (e.g., holding short of runway 35), stop in a position that will allow you to see light gun signals from the control tower in the event of total electrical power failure.

# ELECTRICAL MALFUNCTION (LOW VOLTAGE DURING FLIGHT/GEN FAILURE)

## INDICATIONS

- A low voltage indication (significantly less than 14 volts) on the voltmeter during flight.
- A negative (discharging battery) indication on the ammeter during flight.
- An illuminated GEN Warning light during flight.
- *COM transmitter power has been reduced* message on the GNS 430 display.

## ACTIONS

- Accomplish the ELECTRICAL MALFUNCTION (LOW VOLTAGE DURING FLIGHT/GEN FAILURE) procedure:
  1. NON-ESSENTIAL ELECTRICAL CONSUMERS...OFF. *Minimize drain on the battery by turning off electrical consumers that are not essential in the specific situation. Turn off each electrical component using its power switch/knob/control or by pulling its circuit breaker. In general, one radio (for required communications) and the electric fuel pump (when operating at low throttle settings to prevent engine stoppage) should remain on.*
  2. LAND AS SOON AS CONDITIONS PERMIT  
-----IF GEN WARNING LIGHT ILLUMINATED-----
  3. GEN/BAT MASTER SWITCH...CYCLE GEN SIDE (OFF, ON)
  4. GEN CIRCUIT BREAKER...RESET IF TRIPPED
  5. GEN CNTRL CIRCUIT BREAKER...RESET IF TRIPPED  
-----IF GENERATOR IS STILL OFFLINE-----
  6. AMMETER & VOLTMETER...MONITOR.

## CONSIDERATIONS

- NOTE: If the battery is fully charged, expect approximately 30 minutes of battery power with a discharge load of 20 amperes.
- Expect no more than 30 minutes of battery power at a discharge load of 20 amperes. This figure assumes that the battery is in perfect condition. It also assumes that the battery is fully charged, which means that you noticed the abnormal condition immediately and reduced the electrical load to 20 amperes without any delay.
- A circuit breaker may be reset once, but do not reset a circuit breaker if it trips a second time.
- Turn the fuel pump ON for landing to prevent engine stoppage. The electrical fuel pump is considered essential for landing or any other low-throttle operations. However, it should be turned OFF during cruise flight along with other non-essential electrical consumers in order to conserve battery power.
- Plan to land on the longest runway permitted by the current wind condition.
- Low-throttle or IDLE operations without an operating electric fuel pump may result in engine stoppage. A PRECAUTIONARY EMERGENCY LANDING may be appropriate in many situations, but consideration should also be given to shooting a power-on straight-in approach.
- Be prepared for a no-flap landing and abnormal control pressures during landing if battery power is exhausted prior to configuring for landing and trimming the aircraft for final approach airspeed. When en route battery power is critically low, consider configuring for landing early (i.e., flaps set to LDG and the airplane trimmed for 60 KIAS) to ensure that flap and trim motor activation does not result in sudden loss of electrical power in a critical phase of flight.
- Consider setting the flaps to T/O for landing because electrical power may not be available to raise the flaps during a go-around. In high density altitude conditions, the aircraft may not have sufficient engine power for climb with flaps LDG.
- While the AFM procedure for low voltage during flight leaves open the possibility of continuing the mission after an abnormal voltage indication is Noted, the Doss procedure is more restrictive. Any abnormal voltage indication in a Doss aircraft shall result in automatic termination of the mission (i.e., even if the voltmeter indication returns to the green arc after switching off electrical consumers, as permitted by the AFM). The AFM also includes a WARNING that if the voltmeter “indicates in the red arc, you should land at the nearest suitable airfield and service the aircraft accordingly before continuing the flight.” Again, the Doss policy is more restrictive: *any* abnormal indication on the voltmeter during flight—not merely an indication in the red arc—shall result in termination of the mission.
- Consider diversion to an alternate airfield if your current position is a significant distance from KPUB and battery power is critically low. The safer choice may be to land with electrical power available at an approved auxiliary airfield rather than risk total loss of electrical power prior to landing at KPUB.
- Accomplish the normal AFTER LANDING checklist if the condition is observed shortly before landing. However, you may decide to forgo flap retraction after exiting the runway in order to preserve battery power for fuel pump operation and required radio transmissions. For example, you may not have noticed the low voltage condition until several minutes after the condition began.
- Advise ATC of the condition and that you may lose electrical power and radio communications.
- Keep radio transmissions brief to conserve battery power.
- Consider taxiing clear of the runway, shutting down, and having the aircraft towed to the Doss Ramp to avoid a total electrical power failure and communications failure during taxi.
- Total electrical power failure is possible at any time. When stopping (e.g., holding short of runway 35), stop in a position that will allow you to see light gun signals from the control tower in the event of total electrical power failure.

## ELECTRICAL MALFUNCTION (TOTAL ELECTRICAL POWER FAILURE)

### INDICATIONS

- All electrically powered equipment becomes inoperative during flight.

### ACTIONS

- Accomplish the ELECTRICAL MALFUNCTION (TOTAL ELECTRICAL POWER FAILURE) procedure:
  1. BATTERY CIRCUIT BREAKER...RESET IF TRIPPED
  2. GEN/BAT MASTER SWITCH...CHECK ON. *Press the GEN/BAT Master Switch (red split-rocker switch) up to the ON position (if it is not already ON) to enable the generator and battery as sources of power to the electrical system.*
  - IF ELECTRICAL POWER IS NOT RESTORED-----
  3. GEN/BAT MASTER SWITCH...OFF. *Press the GEN/BAT Master Switch (red split-rocker switch) down to the OFF position to remove the generator and battery as sources of power to the electrical system.*
  4. LAND AS SOON AS CONDITIONS PERMIT
- If problem cannot be resolved, accomplish the RADIO FAILURE procedure in the In Flight Guide.

### CONSIDERATIONS

- A circuit breaker may be reset once, but do not reset a circuit breaker if it trips a second time.
- Plan to land on the longest runway permitted by the current wind condition.
- Low-throttle or IDLE operations without an operating electric fuel pump may result in engine stoppage. A PRECAUTIONARY EMERGENCY LANDING may be appropriate in many situations, but consideration should also be given to shooting a power-on straight-in approach.

# FLAP MALFUNCTION

## INDICATIONS

- Flap position indicator lights do not show the position currently selected with the flap switch.
- When checked visually, the flap position does not appear to match the position selected with the flap switch.
- The expected change in aircraft performance does not occur when selecting a new flap setting.
- Sudden rolling moment when changing flap setting.

## ACTIONS

- Accomplish the FLAP MALFUNCTION procedure:

1. FLAP SWITCH...CHECK POSITION. *Check the selected position to ensure that the switch is actually in the position you intended to select.*
  2. FLAP POSITION INDICATOR LIGHTS...CHECK. *Check the flap position indicator lights next to the flap switch. A single light next to the selected position should be illuminated.*
  3. FLAPS...VISUALLY CHECK POSITION. *Turn your head right and left to visually check the position of each wing flap.*
  4. INSTRUMENT PANEL LIGHT RHEOSTAT...OFF. *The instrument panel light rheostat controls the brightness of the instrument panel lights during night operations. During daylight operations, the dimming control knob must be turned OFF (fully counterclockwise). If the instrument panel lights are inadvertently turned on during daylight, the flap indicator lights will automatically dim for night operations and will not be visible. Turn the knob fully counterclockwise to ensure that the flap indicator lights are fully illuminated.*
- WHEN AIRSPEED AND ALTITUDE PERMIT----- *Before taking an action that could cause a sudden change in flap setting, ensure that you are in a safe position for this change. Maintain a safe speed below 78 KIAS to avoid overspeeding the flaps as you check each flap position with the following steps.*
5. FLAPS CIRCUIT BREAKER...RESET IF TRIPPED.
  6. FLAP SWITCH...CHECK ALL POSITIONS. *Cycle the flaps to each position individually.*
  7. LAND AS SOON AS CONDITIONS PERMIT.

## CONSIDERATIONS

- NOTE: Final approach speed with flaps CRUISE is 65 KIAS.
- Use the following final approach airspeeds for non-standard flap settings (other than LDG):
  1. 65 KIAS with flaps CRUISE
  2. 60 KIAS with flaps T/O
  3. When flaps are stuck between two settings, use the higher of the two approach speeds. For example, use 65 KIAS with flaps stuck at 10°, or 60 KIAS with flaps stuck at 30°.
- A circuit breaker may be reset once, but do not reset a circuit breaker if it trips a second time.
- When selecting flap position, always grab the flap switch between the thumb and index finger. Carefully move the flap switch into the detent for the desired setting. A contributing factor in one DA20-C1 accident was the pilot's flap retraction technique during a low-altitude go-around. The pilot used only the index finger to "flick" the flap switch upward, and the flaps were inadvertently retracted from LDG to CRUISE, which led to a stall at approximately 50 feet AGL. The aircraft was destroyed (fuselage sheared in half, landing gear sheared off, etc.) when the aircraft impacted the runway in a stall.
- Ensure that the aircraft is in a safe position with adequate airspeed and altitude before resetting a circuit breaker or cycling the flaps. Use special Caution at low altitudes because flap retraction may cause a sudden increase in sink rate.
- When operating in high density altitude conditions, the aircraft may not have sufficient engine power for climb with flaps LDG. In one documented case of flap failure in the DA20-C1, the flaps failed to retract from LDG to T/O during a touch-and-go, and the pilot was only able to maintain a positive rate of climb after the flap circuit breaker was reset and the flaps retracted to the T/O position.
- When the right and left wing flaps are not extended equally (asymmetric flap condition), the airplane will have a strong tendency to roll away from the wing with the more fully extended flap. The airplane will also yaw in the direction of the wing with the more fully extended flap. The pilot must counter these rolling and yawing tendencies with sustained aileron and rudder deflection. The result will be a cross-control condition. Nearly full aileron may be required to maintain a wings-level attitude, especially at the reduced airspeed during approach and landing. Therefore, do not attempt to land with a crosswind from the side of the more fully extended flap, because the additional roll control required to counteract the crosswind may not be available. Also be aware that the wing with the least-extended flap will have a higher stall speed. A stall in this condition will result in an uncontrollable roll in the direction of the stalled wing, followed by a spin (if altitude permits) prior to impacting terrain. An approach with a split flap condition must be flown no slower than the recommended approach airspeed for the least-extended flap.
- If a sudden rolling moment is encountered upon changing flap setting, immediately move the flap switch to the previous setting in an attempt to correct a suspected split-flap condition.

# ENGINE FIRE ON THE GROUND

## INDICATIONS

- Visible flames or smoke emanating from the engine compartment during ground operations.
- Notification from third party (ground personnel, other aircrew, or ATC) of fire or smoke emanating from your aircraft.
- Scent of burning gasoline, oil, or other components in the engine compartment.
- Discoloration, bubbling, and/or melting of the engine cowling skin.
- Fluctuating engine gauges with erratic or rough engine operation.
- Abnormally high indications on temperature-related engine gauges.
- Structural damage to the engine compartment (e.g., after a ground collision) that may lead to fuel leakage and fire.

## ACTIONS

- Accomplish the ENGINE FIRE ON THE GROUND procedure:

1. **FUEL SHUTOFF VALVE...OFF.** *Lift the fuel shutoff handle release lock with your thumb, and pull the handle fully aft to the stop. This action closes the fuel shutoff valve, which is located on the aft face of the firewall. Stopping the flow of fuel and vapor through the fuel supply and fuel return lines will ensure that the fire in the engine compartment will not continue to be fed through the fuel lines, which will significantly increase your chances of survival.*
  2. **CABIN HEAT...OFF.** *Move the cabin heat lever fully upward to the OFF position. This action closes the cabin heat control valve, which is located on the front face of the firewall. By preventing the potential flow of toxic fumes, smoke, and fire through the cabin heat system into the cockpit, you will significantly decrease your chances of injury or death by smoke inhalation, asphyxiation (from carbon monoxide and other chemical asphyxiants), heat damage to the upper respiratory tract, or fire that spreads into the cockpit through the valve.*
  3. **MIXTURE...IDLE CUTOFF.** *Squeeze the safety lock against the red mixture control knob, and then move the mixture control lever fully aft to the IDLE CUTOFF stop.*
  4. **IGNITION SWITCH...OFF.** *Rotate the key fully counterclockwise to turn the ignition switch OFF.*
  5. **GEN/BAT MASTER SWITCH...OFF.** *Press the GEN/BAT Master Switch (red split-rocker switch) down to the OFF position to remove the generator and battery as sources of power to the electrical system.*
- 6. **EMERGENCY GROUND EGRESS.**

## CONSIDERATIONS

- Stopping all fuel flow through the firewall (FUEL SHUTOFF VALVE...OFF) and isolating the cockpit from the fire/smoke/fumes (CABIN HEAT...OFF) are *critical actions* that must be accomplished immediately to ensure your personal safety.
- If the aircraft is in motion (e.g., taxi, takeoff roll, or landing roll), maintain aircraft control and *begin* decelerating to a stop prior to accomplishing the ENGINE FIRE ON THE GROUND procedure. Once you have begun a controlled deceleration toward a stop, immediately apply the Engine Fire on the Ground boldface. After applying the boldface, complete the remaining items in the procedure to secure the fuel, ignition, and electrical systems.
- Do not delay accomplishing the ENGINE FIRE ON THE GROUND procedure in order to make a radio call.
- The ENGINE FIRE ON THE GROUND procedure is also appropriate in situations where imminent collision with obstacles on the ground could cause catastrophic damage to the engine compartment. Leaking fuel and oil in these cases may cause an engine fire when these fluids come into contact with hot engine components or other sources of ignition.

# ELECTRICAL FIRE ON THE GROUND

## INDICATIONS

- Strange odors (e.g., burning electrical insulation) in the cockpit during ground operations.
- Flames, sparks, or smoke emanating from the instrument panel or other location with electrically-powered equipment.
- Abnormally high indication on the ammeter during ground operations.
- One or multiple circuit breakers tripping during ground operations.
- Failure or uncommanded operation of an electrically-powered system during ground operations.

## ACTIONS

- Accomplish the ELECTRICAL FIRE ON THE GROUND procedure:

1. **GEN/BAT MASTER SWITCH...OFF.** *Press the GEN/BAT Master Switch (red split-rocker switch) down to the OFF position to remove the generator and battery as sources of power to the electrical system. By immediately deactivating the source of the fire, you will significantly decrease your chances of injury or death by smoke inhalation, asphyxiation (from carbon monoxide and other chemical asphyxiants), heat damage to the upper respiratory tract, or fire.*
  2. **THROTTLE...IDLE.** *Bring the throttle fully aft to the IDLE stop.*
  3. **MIXTURE...IDLE CUTOFF.** *Squeeze the safety lock against the red mixture control knob, and then move the mixture control lever fully aft to the IDLE CUTOFF stop. This action will cause the engine to immediately shut down.*
  4. **IGNITION SWITCH...OFF.** *Rotate the key fully counterclockwise to turn the ignition switch OFF.*
  5. **CANOPY...UNLOCK, OPEN.** *Pull both (right and left) red canopy locking handles fully aft, and then use these handles to push the canopy upward and backward until it is fully open.*
  6. **FIRE EXTINGUISHER...DISCHARGE AS REQUIRED.** *Discharge the fire extinguisher if required to maintain your personal safety or that of the other crew member. However, do not jeopardize your personal safety in an attempt to save the aircraft itself. Unclamp the latch that holds the fire extinguisher in place, and hold the extinguisher in one hand. Twist the metal safety pin to break the plastic tie that holds the pin in place. Remove the safety pin. Hold the extinguisher upright and squeeze the handle to discharge. Spray at the base of the fire in a sweeping motion.*
- 7. **EMERGENCY GROUND EGRESS.**

## CONSIDERATIONS

- Deactivating the source of the electrical fire (GEN/BAT MASTER SWITCH...OFF) is a *critical action* that must be accomplished immediately to ensure your personal safety.
- If the aircraft is in motion (e.g., taxi, takeoff roll, or landing roll), maintain aircraft control and *begin* decelerating to a stop prior to accomplishing the ELECTRICAL FIRE ON THE GROUND procedure. Once you have begun a controlled deceleration toward a stop, immediately apply the Electrical Fire on the Ground boldface. After applying the boldface, complete the remaining items in the procedure to secure the fuel and ignition systems.
- Do not delay accomplishing the ELECTRICAL FIRE ON THE GROUND procedure in order to make a radio call.
- It is normal for the ammeter to indicate a significant positive charge for short periods of time in some cases. For example, if you use the battery extensively prior to engine start (e.g., using the radio, running the lights, activating the fuel pump, activating the starter motor, etc.), the ammeter will indicate a large positive deflection after engine start. This indication shows that the battery is being charged by the generator. **RULE OF THUMB:** If the needle does not return to within two needle widths of zero within 30 minutes, suspect problems with the battery or generator. For example, a voltage regulator problem may lead to overcharging the battery, which can boil off battery fluid (electrolyte), causing damage to the battery and possibly causing a battery fire.
- The battery in the DA20-C1 is located on the forward left side of the firewall in the engine compartment.

# ENGINE FIRE DURING FLIGHT

## INDICATIONS

- Visible flames or smoke emanating from the engine compartment during flight.
- Discoloration, bubbling, and/or melting of the engine cowling skin.
- Fluctuating indications on engine gauges, and abnormally high indications on temperature-related engine gauges.
- Erratic or rough engine operation accompanied by other indications of engine fire during flight.
- Scent of burning gasoline, oil, or other components in the engine compartment during flight.
- Notification from third party (e.g., other aircrew or ATC) of fire or smoke emanating from your aircraft.

## ACTIONS

- Accomplish the ENGINE FIRE DURING FLIGHT procedure:
  1. **FUEL SHUTOFF VALVE...OFF.** *Lift the fuel shutoff handle release lock with your thumb, and pull the handle fully aft to the stop. This action closes the fuel shutoff valve, which is located on the aft face of the firewall. Stopping the flow of fuel and vapor through the fuel supply and fuel return lines will ensure that the fire in the engine compartment will not continue to be fed through the fuel lines, which will significantly increase your chances of survival.*
  2. **CABIN HEAT...OFF.** *Move the cabin heat lever fully upward to the OFF position. This action closes the cabin heat control valve, which is located on the front face of the firewall. By preventing the potential flow of toxic fumes, smoke, and fire through the cabin heat system into the cockpit, you will significantly decrease your chances of injury or death by smoke inhalation, asphyxiation (from carbon monoxide and other chemical asphyxiants), heat damage to the upper respiratory tract, or fire that spreads into the cockpit through the valve.*
  3. **FUEL PUMP...OFF.** *Press the Fuel Pump rocker switch down to the OFF position.*
  4. **AIRSPEED...73 KIAS.** *Adjust pitch attitude and trim to establish a glide at 73 KIAS with flaps CRUISE.*
  - 5. **FORCED LANDING.**

## CONSIDERATIONS

- NOTE: If a suitable landing area is available and can be safely reached, airspeed may be increased to help extinguish the fire. Do not exceed airspeeds for structural limitations.
- If the fire does not extinguish after accomplishing this procedure, the airspeed should be increased in an attempt to “blow out” the fire. However, Caution must be exercised during “emergency descent” maneuvers to avoid exceeding airspeeds established for structural limitations. Consideration must also be given to energy management during the descent to ensure that a safe emergency landing can be performed in a suitable landing zone following the descent. The recommended technique for emergency descent in the DA20-C1 is a descent with flaps CRUISE at or above 118 KIAS. This technique will simultaneously achieve the greatest rate of descent and the highest forward speed.
- Stopping all fuel flow through the firewall (FUEL SHUTOFF VALVE...OFF) and isolating the cockpit from the fire/smoke/fumes (CABIN HEAT...OFF) are *critical actions* that must be accomplished immediately to ensure your personal safety. An engine compartment fire is often well-developed by the time a pilot becomes aware of it. It is therefore even more critical for the pilot to immediately close the fuel shutoff valve.
- Do not attempt to restart an engine that has been shut down following an engine fire.
- Thick, black smoke is an indication of an oil-fed fire, while bright orange flames are an indication of a fuel-fed fire.
- If the engine compartment fire is oil-fed, the pilot should consider stopping the windmilling propeller by temporarily slowing below 60 KIAS. Stopping the rotation of the crankshaft will stop the engine-driven oil pump from continually pumping flammable fluid to feed the fire.
- In some cases, the fire could continue to burn or smolder under the engine cowlings. A smoldering fire (one with a slow combustion rate and without visible flame) that is left unattended may re-ignite with changes in airflow pattern and airspeed.
- An in-flight engine compartment fire is usually caused by a failure that allows a flammable substance (e.g., fuel or oil) to come in contact with a hot surface. This may be caused by structural damage, a mechanical failure in the engine or engine-driven accessory, a defective induction or exhaust system, improperly fastened lines/fittings, or broken lines.
- In the agricultural areas surrounding the Arkansas River, controlled burning is often used to prepare land for planting by burning off crop residue and weeds. Do not mistake the scent of smoke from these or other ground fires with the scent of burning gasoline or oil in the engine compartment.
- Note that the fuel, electrical, and ignition systems will be completely secured with the FORCED LANDING procedure prior to landing. The ENGINE FIRE DURING FLIGHT procedure leaves the mixture in the full rich position and the magnetos on BOTH to allow fuel remaining forward of the firewall to burn off normally in the cylinders. It also leaves the GEN/BAT Master Switch ON to enable transmission of distress signals with the transponder and radio.

# ELECTRICAL FIRE DURING FLIGHT

## INDICATIONS

- Flames, sparks, or smoke emanating from the instrument panel or other location with electrically-powered equipment.
- Strange odors (e.g., burning electrical insulation) in the cockpit during flight.
- Abnormally high indication on the ammeter during flight.
- One or multiple circuit breakers tripping during flight.
- Failure or uncommanded operation of an electrically-powered system during flight.

## ACTIONS

- Accomplish the ELECTRICAL FIRE DURING FLIGHT procedure:

1. **GEN/BAT MASTER SWITCH...OFF.** *Press the GEN/BAT Master Switch (red split-rocker switch) down to the OFF position to remove the generator and battery as sources of power to the electrical system. By immediately deactivating the source of the fire, you will significantly decrease your chances of injury or death by smoke inhalation, asphyxiation (from carbon monoxide and other chemical asphyxiants), heat damage to the upper respiratory tract, or fire.*
2. **AIR VENTS AND WINDOWS...OPEN.** *Twist both air-vent nozzles to the fully open position to allow fresh air to flow into the cockpit through the NACA ducts on each side of the fuselage. Open the sliding windows on each side of the canopy by pulling the knob inward and sliding the window aft to the stop. This action ventilates the cockpit with fresh air, while letting smoke and toxic fumes escape out the sliding windows. Allow a few seconds for smoke to clear before taking further action. Immediate ventilation of the cockpit is critical to your personal safety when smoke is present, and it will also be important should you need to discharge the fire extinguisher.*
3. **FIRE EXTINGUISHER...DISCHARGE IF SMOKE CONTINUES.** *Turning off the GEN/BAT Master Switch will generally stop the fire/smoke immediately. However, it is possible that materials exposed to the fire may continue to burn. If the smoke continues, use the fire extinguisher to put out the fire.*
4. **LAND AS SOON AS CONDITIONS PERMIT**  
----LINES 5-17 ONLY IF ELECTRICAL PWR ESSENTIAL & FIRE IS OUT---- *Situations that justify restoring electrical power after an in-flight electrical fire are unlikely in day VFR conditions. However, if you determine that operating electrically powered equipment is essential to the safe operation of the aircraft, use the following actions to restore power to the required systems. Reset any required circuit breakers systematically, allowing time between each one to monitor the voltmeter and ammeter for abnormal indications and to notice additional odors, smoke, sparks, or flames. If resetting a specific circuit breaker indicates a faulty circuit or produces any further indication of fire, pull that breaker immediately and confirm that any resulting smoke has stopped. Repeat line 3 if required (FIRE EXTINGUISHER...DISCHARGE IF SMOKE CONTINUES).*
5. **AVIONICS MASTER SWITCH...OFF**
6. **ELECTRICALLY POWERED EQUIPMENT...OFF**
7. **ALL CIRCUIT BREAKERS...PULL**
8. **BATTERY CIRCUIT BREAKER...RESET**
9. **GEN/BAT MASTER SWITCH (BAT SIDE ONLY)...ON**
10. **GEN CIRCUIT BREAKER...RESET**
11. **GEN CNTRL CIRCUIT BREAKER...RESET**
12. **GEN/BAT MASTER SWITCH...ON**
13. **AVIONICS MASTER CIRCUIT BREAKER...RESET**
14. **AVIONICS MASTER CNTRL CIRCUIT BREAKER...RESET**
15. **AVIONICS MASTER SWITCH...ON**
16. **ANY CIRCUIT BREAKERS...RESET IF REQUIRED**
17. **ELECTRICALLY POWERED EQUIPMENT...AS REQUIRED**

## CONSIDERATIONS

- **CAUTION:** If the fire extinguisher is used, the cabin must be ventilated.
- **CAUTION:** Restore electrical power systematically, allowing time to monitor the system voltmeter and ammeter between the reconnection of loads. Watch carefully for smoke.
- Before accomplishing this procedure, check all indications to confirm the type of fire. Misinterpreting an electrical fire as an engine fire may lead you to shut down a perfectly good engine, and the ENGINE FIRE DURING FLIGHT procedure will not help extinguish the electrical fire.
- Do not delay accomplishing the ELECTRICAL FIRE DURING FLIGHT procedure in order to make a radio call.
- Use the following final approach airspeeds for non-standard flap settings (other than LDG):
  1. 65 KIAS with flaps CRUISE
  2. 60 KIAS with flaps T/O
  3. When flaps are stuck between two settings, use the higher of the two approach speeds. For example, use 65 KIAS with flaps stuck at 10°, or 60 KIAS with flaps stuck at 30°.
- Plan to land on the longest runway permitted by the current wind condition.
- Low-throttle or IDLE operations without an operating electric fuel pump may result in engine stoppage. A PRECAUTIONARY EMERGENCY LANDING may be appropriate in many situations, but consideration should also be given to shooting a power-on straight-in approach.

# CABIN FIRE IN FLIGHT

## INDICATIONS

- Burning odor, smoke, or flames coming through the cabin heat system (window defrosting vents, or floor vents).
- Flames and/or smoke in the cockpit that cannot immediately be identified as an electrical fire.
- Dizziness, headache, nausea, fatigue, or positive indication on the carbon monoxide detector.

## ACTIONS

- Accomplish the CABIN FIRE IN FLIGHT procedure:
  1. **GEN/BAT MASTER SWITCH...OFF.** *Press the GEN/BAT Master Switch (red split-rocker switch) down to the OFF position to remove the generator and battery as sources of power to the electrical system. By immediately deactivating the source of the fire, you will significantly decrease your chances of injury or death by smoke inhalation, asphyxiation (from carbon monoxide and other chemical asphyxiants), heat damage to the upper respiratory tract, or fire.*
  2. **AIR VENTS AND WINDOWS...OPEN.** *Twist both air-vent nozzles to the fully open position to allow fresh air to flow into the cockpit through the NACA ducts on each side of the fuselage. Open the sliding windows on each side of the canopy by pulling the knob inward and sliding the window aft to the stop. This action ventilates the cockpit with fresh air, while letting smoke and toxic fumes escape out the sliding windows. Allow a few seconds for smoke to clear before taking further action. Immediate ventilation of the cockpit is critical to your personal safety when smoke is present, and it will also be important should you need to discharge the fire extinguisher.*
  3. **CABIN HEAT...OFF.** *Move the cabin heat lever fully upward to the OFF position. This action closes the cabin heat control valve, which is located on the front face of the firewall. By preventing the potential flow of toxic fumes, smoke, and fire through the cabin heat system into the cockpit, you will significantly decrease your chances of injury or death by smoke inhalation, asphyxiation (from carbon monoxide and other chemical asphyxiants), heat damage to the upper respiratory tract, or fire that spreads into the cockpit through the valve.*
  4. **FIRE EXTINGUISHER...DISCHARGE AS REQUIRED.** *If a cabin fire continues after turning off the GEN/BAT master switch or closing the cabin heat valve, use the fire extinguisher as required.*
  5. **LAND AS SOON AS CONDITIONS PERMIT**

## CONSIDERATIONS

- **CAUTION:** If the fire extinguisher is used, the cabin must be ventilated.
- If indications confirm that source of fire is the cabin heating system (e.g., combustible FOD in the cabin heating system), be prepared to accomplish the ENGINE FIRE DURING FLIGHT procedure if the fire spreads to other areas of the engine compartment. If the source of fire is not the electrical system, it is also acceptable to restore electrical power for emergency transmissions by turning the GEN/BAT Master Switch back on.
- If indications confirm that the source of fire is the electrical system, there is no need to subsequently accomplish the ELECTRICAL FIRE DURING FLIGHT procedure because the primary steps are identical to this procedure. However, if restoring power to specific systems is required for safety of flight (unlikely in day VFR conditions), the ELECTRICAL FIRE DURING FLIGHT procedure provides instructions for restoring power to required systems. It is also acceptable to re-open the cabin heat valve in cases where the source of fire is confirmed to be the electrical system.
- Extreme Caution must be taken to correctly identify the source of fire and the type of fire. If you have an engine fire and incorrectly identify the fire as a cabin fire, you will unnecessarily delay the execution of the ENGINE FIRE DURING FLIGHT boldface. Always look for indications of engine fire before conducting a CABIN FIRE IN FLIGHT procedure. If you incorrectly identify an engine fire as a cabin fire and close the cabin heat valve, you may temporarily reduce or eliminate the indications of fire (i.e., the flow of toxic fumes and smoke into the cabin), but a fuel-fed fire will continue to burn until the fuel shutoff valve is closed.
- Plan to land on the longest runway permitted by the current wind condition.
- Low-throttle or IDLE operations without an operating electric fuel pump may result in engine stoppage. A PRECAUTIONARY EMERGENCY LANDING may be appropriate in many situations, but consideration should also be given to shooting a power-on straight-in approach.

## DEPARTING A PREPARED SURFACE

(Memory Item)

### INDICATIONS

- The aircraft is going to depart the prepared surface (runway, taxiway, or ramp) due to a loss of directional control (e.g., blown main gear tire, brake failure, etc.) or due to inability to stop the aircraft on the paved surface (e.g., overrunning the runway after an aborted takeoff or a forced landing).

### ACTIONS

- Accomplish the DEPARTING A PREPARED SURFACE procedure:

1. CONTROL STICK...FULL AFT. *Hold the control stick aft to reduce the weight on the nose gear. The tendency of the nose gear to dig into the soft surface may make it difficult to maintain directional control. Holding full back stick pressure will also help reduce the chance of a propeller strike against the ground or obstacles while you are shutting down the engine with the mixture control.*
2. MIXTURE...IDLE CUTOFF. *Squeeze the safety lock against the red mixture control knob, and then move the mixture control lever fully aft to the IDLE CUTOFF stop. This action will cause the engine to immediately shut down. Departing the prepared surface can happen suddenly, and getting the propeller stopped immediately is a major concern to prevent severe engine damage from a propeller strike.*
3. IGNITION SWITCH...OFF. *Rotate the key fully counterclockwise to turn the ignition switch OFF.*
4. GEN/BAT MASTER SWITCH...OFF. *Press the GEN/BAT Master Switch (red split-rocker switch) down to the OFF position to remove the generator and battery as sources of power to the electrical system.*

-----AFTER THE AIRCRAFT IS STOPPED-----

- 5. EMERGENCY GROUND EGRESS

### CONSIDERATIONS

- Watch for obstacles, rough terrain, and other hazards that could lead to structural damage when departing a prepared surface. For example, when overrunning the departure end of the runway, be attentive to obstacles near the runway threshold (e.g., approach light systems, localizer antennas, etc.)
- Consider delaying lines 3 and 4 until the aircraft is stopped when conditions require your full attention in order to maintain aircraft control, avoid obstacles, and bring the aircraft safely to a stop.

# ABORT

## INDICATIONS

- Engine-related malfunction during the takeoff roll prior to liftoff.
- Any system malfunction or abnormal cockpit indication during takeoff roll prior to liftoff.
- Any situation where a rejected takeoff is required for safety reasons.

## ACTIONS

- Call out “ABORT, ABORT, ABORT!” and accomplish the ABORT procedure:
  1. **THROTTLE...IDLE.** *Bring the throttle fully aft to the IDLE stop. This action immediately stops the aircraft’s acceleration.*
  2. **BRAKES...AS REQUIRED.** *Apply smooth, simultaneous, and gradually-increasing pressure to the toe-brake pedals to decelerate while tracking down the runway centerline. The aggressiveness of the braking action will depend on the situation.*
  3. **FLAPS...CRUISE.** *Raise flaps to CRUISE in order to hasten transfer of aircraft weight from the wings to the landing gear and increase braking effectiveness.*
  - LINES 4-7 AS REQUIRED---- *The engine should be shut down and an emergency ground egress performed as a precautionary measure if the takeoff was aborted due to any situation where continued operation of the engine might jeopardize your personal safety or cause damage to the aircraft.*
  4. **MIXTURE...IDLE CUTOFF.** *Squeeze the safety lock against the red mixture control knob, and then move the mixture control lever fully aft to the IDLE CUTOFF stop. This action will cause the engine to immediately shut down.*
  5. **IGNITION SWITCH...OFF.** *Rotate the key fully counterclockwise to turn the ignition switch OFF.*
  6. **GEN/BAT MASTER SWITCH...OFF.** *Press the GEN/BAT Master Switch (red split-rocker switch) down to the OFF position to remove the generator and battery as sources of power to the electrical system.*
  - 7. **EMERGENCY GROUND EGRESS.**
- Ensure that you are bringing the aircraft to a stop in a controlled manner using the ABORT procedure before accomplishing any additional emergency procedures required by the situation.
- If the aircraft departs the paved runway/taxiway/ramp surface, accomplish the DEPARTING A PREPARED SURFACE procedure.

## CONSIDERATIONS

- Excessive braking can lead to locked wheels and blown tires. Always apply brake pressure smoothly and evenly. Release brake pressure immediately if a skid develops. The DA20-C1 brakes are not equipped with an anti-skid mechanism.
- In situations where the aircraft has already lifted off and the decision is made to land and stop the aircraft straight ahead, do not apply the ABORT procedure until after the aircraft has touched down. Landing with pressure applied to the brakes will most likely result in one or more blown main gear tires, and retracting the flaps at low altitude may result in rapid sink rate, low-altitude stall, and/or uncontrolled collision with the ground.
- Do not delay accomplishing the ABORT procedure in order to make a radio call. If time and conditions permit, notify the Tower (and other aircraft on the frequency) of the aborted takeoff.
- Use whatever amount of braking is required by the situation. Some situations will require maximum braking, while others may require no braking at all. In those situations where engine shutdown is not required, the conditions may permit you to slow the aircraft to taxi speed for normal runway exit on the first available taxiway.
- For all sorties, the pilot in command must determine prior to flight that the runway length is adequate under the current conditions to accelerate to lift-off speed, abort the takeoff, and stop on the remaining runway. Consideration must be given to takeoff weight, density altitude, wind, runway slope, and any other factor that affects takeoff and stopping distance.
- Aborting during the landing/takeoff roll of a touch-and-go is often more hazardous than rejecting a takeoff that begins from a dead stop. Ground speed is often higher during the touch-and-go (especially during a no-flap touch-and-go), and there is often less runway remaining during a touch-and-go than during a normal takeoff.

# ENGINE MALFUNCTION IN FLIGHT (SUFFICIENT RUNWAY REMAINING TO LAND)

(Memory Item)

## INDICATIONS

- Any emergency landing when the aircraft is in a position to land on the runway straight ahead.
- Abnormal engine performance or engine roughness after liftoff with sufficient runway remaining to land straight ahead.
- Partial or total loss of engine power after liftoff with sufficient runway remaining to land straight ahead.
- Rapid reduction in airspeed shortly after takeoff while attempting to maintain normal climb attitude.
- Any engine-related emergency where it is more hazardous to continue the takeoff climb than to attempt landing on the remaining runway.

## ACTIONS

- Accomplish the ENGINE MALFUNCTION IN FLIGHT (SUFFICIENT RUNWAY REMAINING TO LAND) procedure:
  1. **AIRSPEED...60 KIAS.** *Adjust pitch attitude to capture 60 KIAS, which is the forced landing final approach airspeed with flaps T/O. This action is critical in order to avoid rapid deceleration and a potential stall at low altitude. By capturing 60 KIAS, you will preserve adequate energy for normal roundout. In situations where partial power is still available, reduce the throttle to IDLE when conditions permit for normal deceleration through the roundout and landing flare.*
  2. **FLAPS...LDG.** *Extend flaps LDG prior to touchdown in order to minimize landing distance and touchdown speed. Reducing touchdown speed will significantly reduce landing roll distance, which may be critical to successfully stopping on the remaining runway.*
  3. LAND ON REMAINING RUNWAY.  
-----LINES 4-7 AS REQUIRED-----
  4. MIXTURE...IDLE CUTOFF
  5. IGNITION SWITCH...OFF
  6. GEN/BAT MASTER SWITCH...OFF
  - 7. EMERGENCY GROUND EGRESS

## CONSIDERATIONS

- Immediately lowering the nose (AIRSPEED...60 KIAS) and extending flaps (FLAPS...LDG) are *critical actions* that must be accomplished immediately to ensure your personal safety. When the aircraft is still very close to the runway, extreme Caution must be used to ensure that adequate energy is preserved to control sink rate during roundout and flare. Your airspeed may have already decreased below 60 KIAS by the time the emergency condition is recognized.
- This emergency procedure shall not be simulated for training purposes in Doss aircraft.
- A more significant change in pitch attitude (lowering the nose) will be required after a complete loss of engine power than for a partial loss of engine power.
- If it becomes clear that *touchdown* on the paved runway surface straight ahead is not possible, accomplish a PRECAUTIONARY EMERGENCY LANDING or FORCED LANDING procedure, as required by the specific circumstances. In most cases, the best choice will be to secure the engine prior to touchdown using the FORCED LANDING procedure. Some situations may require the use of any available engine power throughout the touchdown phase, in which case the PRECAUTIONARY EMERGENCY LANDING procedure should be used.
- To determine whether a landing on the departure runway is possible, it is not enough to merely consider the runway length remaining straight ahead. Factors such as height above the ground, airspeed, groundspeed, and wind condition must also be considered. For example, it will not be possible to land straight ahead on 2,000 feet of runway remaining after a runway 26R departure at KPUB if the aircraft has already climbed to 800' AGL.
- Study the airfield diagram to become aware of possible taxiways, ramp areas, or runway overrun areas straight ahead (or nearly straight ahead) that can be utilized for touchdown or for a landing roll that overruns the runway. For example, at KPUB, taxiways K and B are sufficiently aligned with runways 8R and 26L to be suitable for overrun and touchdown beyond the runway departure threshold (in the absence of conflicting ground traffic).

# ENGINE MALFUNCTION IN FLIGHT (INSUFFICIENT ENGINE POWER AFTER TAKEOFF)

(Memory Item)

## INDICATIONS

- Inability to maintain positive rate of climb after takeoff due to partial loss of engine power.
- Uncommanded reduction in engine power/RPM during takeoff climb.
- Audible reduction in the engine RPM during takeoff climb.
- Decreasing airspeed and stall warning during takeoff climb while maintaining full throttle and normal climb attitude.
- VSI indicates zero or negative during full-throttle takeoff climb at  $V_Y$ .

## ACTIONS

- Accomplish the ENGINE MALFUNCTION IN FLIGHT (INSUFFICIENT ENGINE POWER AFTER TAKEOFF) procedure:
  1. AIRSPEED...60 KIAS. *Adjust pitch attitude to capture the forced landing final approach airspeed with flaps T/O.*
  2. THROTTLE...FULL. *Push the throttle fully forward to the FULL stop.*
  3. MIXTURE...FULL RICH. *Squeeze the safety lock against the red mixture control knob, and push the mixture control lever fully forward to the RICH stop.*
  4. FUEL SHUTOFF VALVE...ON. *Push the fuel shutoff handle fully in to the stop so that it is secured by the release lock.*
  5. IGNITION SWITCH...BOTH. *Ensure that the ignition switch is on BOTH (rotate the key clockwise to BOTH if necessary).*
  6. FUEL PUMP...ON. *Press the Fuel Pump rocker switch up to the ON position.*
  7. ALTERNATE AIR...ON. *Move the alternate air lever fully aft into the ON detent. This action opens a door on the rear side of the air intake, bypassing a potentially clogged intake filter and allowing unfiltered air from the engine compartment to enter the engine intake manifold.*

----- IF SUFFICIENT ENGINE POWER IS RESTORED -----

→8. PRECAUTIONARY EMERGENCY LANDING

----- IF SUFFICIENT ENGINE POWER NOT RESTORED -----

→9. FORCED LANDING

## CONSIDERATIONS

- **WARNING:** If adequate engine performance cannot be restored immediately, prepare for an emergency landing. If possible, land straight ahead, avoiding obstacles.
- In engine malfunction situations after takeoff where there is *not* sufficient runway remaining to land straight ahead, the pilot must decide whether it is safer to return for landing on a runway at the airfield, or whether the situation requires an off-airfield landing. Carefully consider factors that affect the aircraft's energy state (e.g., available engine power, rate of climb/descent, altitude, airspeed, geographical position, wind condition, etc.) when deciding where to land the aircraft. If the situation requires a forced off-airfield landing, you must be prepared to accept this outcome. Many fatal accidents have occurred when pilots vainly attempted to turn back to the airfield without sufficient energy to do so.
- When sufficient engine power is available to climb and/or maintain altitude and return to the airfield for a PEL, the applicable engine malfunction during flight procedure (e.g., ENGINE RUNNING ROUGHLY, OIL PRESSURE LOSS, or FUEL PRESSURE LOSS) should be accomplished while returning to the airfield for a PEL.
- If sufficient engine power is restored, climb and maintain a safe altitude/airspeed and return for a PEL at the airfield. The departure runway is the ideal choice, but other runways and taxiways should also be taken into consideration when choosing the landing site.
- Do not assume that lack of climb performance is always caused by engine malfunction. For example, high density altitudes and wind shear may significantly degrade climb performance. If the aircraft is flying through an area of sinking air (e.g., a dry microburst), it may be impossible to climb or even maintain altitude. Airframe and propeller icing can also significantly degrade climb performance.
- Full-throttle RPM during flight should be *greater than* the static RPM noted during the engine runup before takeoff. If your full-throttle RPM during flight is lower than the static RPM, you have probably experienced a partial loss of engine power during flight.

## ENGINE MALFUNCTION IN FLIGHT (ENGINE RUNNING ROUGHLY)

### INDICATIONS

- Engine roughness, engine vibrations, engine sputtering, surging RPM, abnormal engine sounds, or abnormal cockpit indications for any engine-related system.
- Uncommanded reduction in engine RPM.
- Perceptible loss of available engine power during flight.

### ACTIONS

- Accomplish the ENGINE MALFUNCTION IN FLIGHT (ENGINE RUNNING ROUGHLY) procedure:
  1. MIXTURE...FULL RICH.
  2. ALTERNATE AIR...ON. *Move the alternate air lever fully aft into the ON detent. This action opens a door on the rear side of the air intake, bypassing a potentially clogged intake filter and allowing unfiltered air from the engine compartment to enter the engine intake manifold.*
  3. FUEL SHUTOFF VALVE...ON.
  4. FUEL PUMP...ON.
  5. IGNITION SWITCH...CYCLE (L, BOTH, R, BOTH). *The engine roughness may be caused by an ignition problem (e.g., faulty timing, abnormal combustion, etc.), and grounding one of the magnetos may correct the problem. If selecting either L or R noticeably improves engine operation, leave the ignition switch in that position. If neither L nor R noticeably improves engine operation, return the switch to BOTH.*
  6. THROTTLE...PRESENT POSITION.  
-----IF NO IMPROVEMENT-----
  7. THROTTLE...MINIMUM REQUIRED POWER. *Retarding the throttle tends to decrease stress in the engine, which may reduce damage or the progression of damage toward catastrophic engine failure.*
  - 8. PRECAUTIONARY EMERGENCY LANDING.

### CONSIDERATIONS

- For engine roughness during takeoff climb that is associated with partial power loss and inability to maintain a positive rate of climb, use the ENGINE MALFUNCTION IN FLIGHT (INSUFFICIENT ENGINE POWER AFTER TAKEOFF) procedure.
- Abnormal oil temperature indications are often caused by pilot technique rather than system malfunctions. Utilizing the winterization kit (i.e., installing inlet or outlet baffles) in temperatures that exceed the manufacturer's limitations may cause the engine to overheat (i.e., oil temperature may exceed 240° F). Running the engine too cold (e.g., no baffles in cold ambient temperatures) may result in oil congealing inside the oil/air separator, which may also contribute to high oil temperatures. High oil pressure indications are often caused by cold oil and failure to adequately warm up the engine in cold ambient temperatures. Failing to utilize a cruise climb (i.e., a climb speed higher than  $V_{\gamma}$ ) during departure climb in hot ambient temperatures will also contribute to high oil temperatures as well as high cylinder head temperatures.

# ENGINE MALFUNCTION IN FLIGHT (OIL PRESSURE LOSS, BELOW GREEN ARC)

## INDICATIONS

- Low or fluctuating oil pressure indication during flight.
- Steadily rising oil temperature indication with an abnormally low oil pressure indication.

## ACTIONS

- Accomplish the ENGINE MALFUNCTION IN FLIGHT (OIL PRESSURE LOSS, BELOW GREEN ARC) procedure:

1. OIL TEMPERATURE...CHECK

-----IF OIL TEMPERATURE IS NORMAL----- *If oil temperature does not rise after an indication of oil pressure loss, the malfunction may be due to faulty indication (e.g., oil pressure sensor or oil pressure gauge).*

→2. PRECAUTIONARY EMERGENCY LANDING.

-----IF OIL TEMPERATURE IS RISING----- *If the oil temperature continues to rise, the oil pressure indication is most likely not faulty, and there is probably an actual loss of oil pressure due to oil system malfunction/damage (e.g., broken pressure relief valve, burned out bearings, loose oil lines, low oil supply, etc.). Engine overheating and catastrophic engine failure are most likely imminent.*

3. THROTTLE...MINIMUM REQUIRED POWER. *Reducing throttle to minimum required power may extend the engine's operating life, which in turn may increase your chances of reaching the desired airfield or landing site.*

4. PREPARE FOR ENGINE FAILURE & FORCED LANDING. *Anticipate engine failure and subsequent FORCED LANDING. Be prepared to glide to a suitable off-airfield landing site at all times while en route to your selected airfield.*

## CONSIDERATIONS

- If catastrophic engine failure seems imminent, it may be appropriate in many situations to shut down the engine prior to complete engine failure. Consider the availability of a suitable landing site within gliding distance, and carefully weigh the risks associated with continuing to operate the engine. Consider the extent of internal engine damage, oil leakage, the risk of engine fire, etc.

## ENGINE MALFUNCTION IN FLIGHT (FUEL PRESSURE LOSS)

### INDICATIONS

- Fuel pressure indication drops when you turn off the electrical fuel pump during flight.
- Engine sputtering or audible loss of engine power during low-throttle operations (e.g., power-off stall)
- Fuel pressure indication is abnormally low for the current condition (e.g., near the lower limit red line with high engine speed).
- A low fuel pressure indication accompanied by abnormal engine operation (e.g., engine sputtering, engine roughness, etc.).

### ACTIONS

- Accomplish the ENGINE MALFUNCTION IN FLIGHT (FUEL PRESSURE LOSS) procedure:

1. **FUEL PUMP...ON.** *Press the Fuel Pump rocker switch up to the ON position. The most common causes for fuel pressure loss are failure of the mechanical fuel pump and the pilot neglecting to turn on the electrical fuel pump before low-throttle operations (e.g., power-off stalls, descent, landing, taxi, etc.). In either case, fuel pressure may be restored and imminent engine stoppage prevented by immediately turning on the electrical fuel pump*
- 2. PRECAUTIONARY EMERGENCY LANDING.

### CONSIDERATIONS

- DO NOT activate the FUEL PRIME switch (high pressure setting) during low/IDLE throttle settings. This will cause an over-rich mixture in these situations, which may lead to engine roughness and engine stoppage (see AFM 7.10.6).
- When flying at or near stall speed with low/IDLE throttle settings (e.g., during a power-off stall), it is normal for fuel pressure to indicate at or near the lower limit, even with the electric fuel pump ON. However, if indicated fuel pressure does not increase as you increase engine speed (e.g., during a power-off stall recovery), accomplish the ENGINE MALFUNCTION IN FLIGHT (FUEL PRESSURE LOSS) procedure.
- Fuel exhaustion during flight will also cause loss of fuel pressure and imminent engine stoppage.

# ENGINE MALFUNCTION IN FLIGHT (ENGINE STOPPAGE)

## INDICATIONS

- Complete loss of engine power during flight, generally preceded by one or more indications of impending engine failure.
- Catastrophic engine failure or severe engine damage that either causes the engine to seize/stop or requires the pilot to shut it down.
- Audible cessation of normal engine noise.
- Rapid decay of EGT, CHT, and oil pressure readings.
- The propeller stops turning during flight.

## ACTIONS

- Accomplish the ENGINE MALFUNCTION IN FLIGHT (ENGINE STOPPAGE) procedure:
  1. AIRSPEED...73 KIAS. *Adjust pitch attitude and trim to establish a glide at 73 KIAS with flaps CRUISE.*
  2. LANDING SITE...SELECT, TURN FOR ELP INTERCEPT. *Select a suitable landing site that is safely within gliding distance, and turn as required to intercept an Emergency Landing Pattern appropriate for that landing site. Plan to cross directly above the touchdown zone (or slightly offset) at approximately 1,600' AGL, headed in the direction of landing (into the wind). There may be a significant amount of gliding time between engine stoppage and ELP interception, but it is important to immediately turn toward the planned ELP to ensure that you remain in a position to intercept the ELP.*
- 3. ENGINE RESTART (IF WARRANTED). *If warranted under the circumstances, attempt the appropriate engine restart procedure.*  
-----IF RESTART UNSUCCESSFUL OR UNWARRANTED-----
- 4. FORCED LANDING.

## CONSIDERATIONS

- CAUTION: Diverting attention to engine restart is not recommended below 800' AGL (Low Key altitude), as primary attention must be on safely executing a forced landing.
- When selecting a landing site, consider your current energy state (position, altitude, and airspeed). Choose a location that is within gliding distance.
- Choose a suitable approach and landing zone that is free of obstacles and other safety hazards. Look for a touchdown zone where the terrain is relatively smooth, even, and dry (i.e., avoid rugged terrain, muddy fields, etc.). Landing *upwind* is desirable in order to minimize groundspeed/energy on touchdown. Landing *uphill* on sloping terrain will also allow more rapid dissipation of energy after landing. Look for a touchdown zone that provides adequate stopping distance (i.e., avoid short fields with ditches or fences immediately after the touchdown zone).
- Trading excess airspeed for altitude may help maximize gliding range and time aloft.
- Adjusted gliding speeds are acceptable, using the rules of thumb listed in this guide under GLIDING.
- See the engine restart procedures for additional considerations for determining whether a restart is warranted.

## ENGINE RESTART (PROPELLER STOPPED)

### INDICATIONS

- The propeller has stopped windmilling after an engine stoppage that is not caused by fire or mechanical failure.

### ACTIONS

- Accomplish the ENGINE RESTART (PROPELLER STOPPED) procedure:
  1. AIRSPEED...73 KIAS. *Adjust pitch attitude and trim to establish a glide at 73 KIAS with flaps CRUISE.*
  2. ELECTRICALLY POWERED EQUIPMENT...OFF. *To increase cranking power, turn off non-essential electrical consumers as conditions permit.*
  3. GEN/BAT MASTER SWITCH...ON
  4. MIXTURE...FULL RICH
  5. FUEL SHUTOFF VALVE...ON
  6. FUEL PUMP...ON
  7. FUEL PRIME...ON
  8. THROTTLE...3/4 INCH FORWARD
  9. ALTERNATE AIR...ON
  10. IGNITION SWITCH...START
  - AFTER SUCCESSFUL RESTART-----
  11. OIL PRESSURE...CHECK
  12. OIL TEMPERATURE...CHECK
  13. FUEL PRIME...OFF
  14. ELECTRICALLY POWERED EQUIPMENT...ON
  - 15. PRECAUTIONARY EMERGENCY LANDING.
- If engine restart is successful, proceed directly to the nearest suitable airfield to perform the PRECAUTIONARY EMERGENCY LANDING procedure.
- If engine restart is unsuccessful, continue with a FORCED LANDING procedure.

### CONSIDERATIONS

- NOTE: If starter is inoperative, the propeller can be forced to windmill by accelerating to 137 KIAS. Expect approximately 1,000 feet of altitude loss.
- CAUTION: Do not engage starter if propeller is windmilling. Engine damage may result.
- If the propeller begins to windmill after cranking but does not start, continue with the ENGINE RESTART (PROPELLER WINDMILLING) procedure.
- If cranking power seems inadequate, accelerating above 73 KIAS during cranking may help turn the propeller/curankshaft.
- Use the “**Five Fs**” to help determine whether an engine restart is warranted:
  1. **Fire**: If you have shut down the engine following an ENGINE FIRE DURING FLIGHT, do not attempt engine restart.
  2. **FOD**: Do not attempt engine restart if the engine has failed (or you shut it down) due to foreign object damage (e.g., bird strikes, midair collisions, etc.).
  3. **Frozen**: If the engine has seized (e.g., loss of oil) or you have shut it down following catastrophic internal damage (e.g., detonation/explosion), do not attempt restart.
  4. **Fumes**: Do not attempt restart if you smell fuel fumes in the cockpit.
  5. **Final**: Once you enter the final turn of a standard ELP (after Low Key) or the final turn of a normal pattern (after the perch), diverting attention to engine restart is no longer recommended. (Engine failures below 800’ AGL always fall in this category.)
- Attempting restart below 800’ AGL (Low Key altitude) is not recommended, as primary attention should be on safely executing a forced landing.

## ENGINE RESTART (PROPELLER WINDMILLING)

### INDICATIONS

- The propeller is windmilling after an engine stoppage that is not caused by fire or mechanical failure.

### ACTIONS

- Accomplish the ENGINE RESTART (PROPELLER WINDMILLING) procedure:
  1. AIRSPEED...73 KIAS. *Adjust pitch attitude and trim to establish a glide at 73 KIAS with flaps CRUISE.*
  2. MIXTURE...FULL RICH
  3. FUEL SHUTOFF VALVE...ON
  4. IGNITION SWITCH...BOTH
  5. FUEL PUMP...ON
  6. FUEL PRIME...ON
  7. THROTTLE...3/4 INCH FORWARD
  8. ALTERNATE AIR...ON
  - AFTER SUCCESSFUL RESTART-----
  9. OIL PRESSURE...CHECK
  10. OIL TEMPERATURE...CHECK
  11. FUEL PRIME...OFF
  - 12. PRECAUTIONARY EMERGENCY LANDING.
- If engine restart is successful, proceed directly to the nearest suitable airfield to perform the PRECAUTIONARY EMERGENCY LANDING procedure.
- If engine restart is unsuccessful, continue with a FORCED LANDING procedure.

### CONSIDERATIONS

- CAUTION: Do not engage starter if propeller is windmilling. Engine damage may result.
- Use the “**Five Fs**” to help determine whether an engine restart is warranted:
  1. **Fire:** If you have shut down the engine following an ENGINE FIRE DURING FLIGHT, do not attempt engine restart.
  2. **FOD:** Do not attempt engine restart if the engine has failed (or you shut it down) due to foreign object damage (e.g., bird strikes, midair collisions, etc.).
  3. **Frozen:** If the engine has seized (e.g., loss of oil) or you have shut it down following catastrophic internal damage (e.g., detonation/explosion), do not attempt restart.
  4. **Fumes:** Do not attempt restart if you smell fuel fumes in the cockpit.
  5. **Final:** Once you enter the final turn of a standard ELP (after Low Key) or the final turn of a normal pattern (after the perch), diverting attention to engine restart is no longer recommended. (Engine failures below 800’ AGL always fall in this category.)
- Attempting restart below 800’ AGL (Low Key altitude) is not recommended, as primary attention should be on safely executing a forced landing.
- If the engine restarts prior to landing, follow through with a PRECAUTIONARY EMERGENCY LANDING, in which case the engine will be secured after landing.

# PRECAUTIONARY EMERGENCY LANDING

## INDICATIONS

- Any emergency landing with engine power available when the aircraft is *not* in a position to land on the runway straight ahead.
- Landing following any situation that presents the *potential* for engine malfunction in flight.

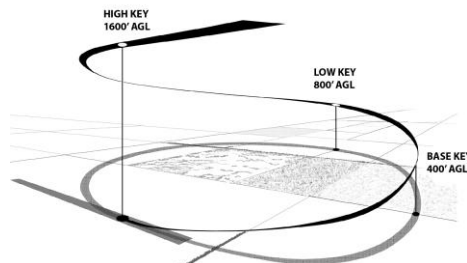
## ACTIONS

- Accomplish the PRECAUTIONARY EMERGENCY LANDING procedure:

1. EMERGENCY LANDING PATTERN...INTERCEPT. *The ELP can be intercepted at any point between High Key and short final. Intercept the ELP at High Key, if able. Intercepting the standard ELP profile, rather than flying a straight-in approach, will help ensure that you are always in a position to glide to the selected landing zone in the event of complete engine failure.*
- \*2. SAFETY BELTS...FASTENED
3. FUEL PUMP...ON
4. FLAPS...AS REQUIRED
5. FINAL APPROACH AIRSPEED (FLAPS LDG)...55 KIAS  
-----AFTER TOUCHDOWN-----
6. BRAKES...AS REQUIRED
7. FUEL SHUTOFF VALVE...OFF. *Lift the fuel shutoff handle release lock with your thumb, and pull the handle fully aft to the stop. This action closes the fuel shutoff valve, which is located on the aft face of the firewall. Stopping the flow of fuel and vapor through the fuel supply and fuel return lines will ensure that any post-crash fire in the engine compartment will not continue to be fed through the fuel lines, which will significantly increase your chances of survival.*
8. MIXTURE...IDLE CUTOFF. *Squeeze the safety lock against the red mixture control knob, and then move the mixture control lever fully aft to the IDLE CUTOFF stop. This action will cause the engine to immediately shut down.*
9. IGNITION SWITCH...OFF. *Rotate the key fully counterclockwise to turn the ignition switch OFF.*
10. GEN/BAT MASTER SWITCH...OFF. *Press the GEN/BAT Master Switch (red split-rocker switch) down to the OFF position to remove the generator and battery as sources of power to the electrical system.*
- 11. EMERGENCY GROUND EGRESS

## CONSIDERATIONS

- Identify potential landing sites along the route of flight, and visualize how you would fly an Emergency Landing Pattern (ELP) to each potential landing site. An engine malfunction (even when the condition seems to have improved) might escalate into complete engine failure at any time prior to landing. Therefore, you must keep the aircraft within gliding distance of a suitable landing site at all times while en route to the airfield.
- If landing on an unprepared surface, use the following soft-field landing techniques. Reduce float during roundout/flare as well as groundspeed/energy on touchdown by using the minimum authorized approach speed (55 KIAS) when conditions permit (e.g., stable air). Minimize touchdown speed by extending LDG flaps prior to touchdown and continuing the flare until minimum touchdown speed is reached. Carry a small amount of power during touchdown and landing roll in order to reduce the airplane's tendency to pitch forward as the landing gear dig into the soft terrain. Pull the control stick fully aft during the landing roll to reduce the weight on the nose wheel and improve directional control.
- The availability of engine power is the primary factor that distinguishes a PEL from an FL. Any available engine power enables the selection of a landing site that is beyond the airplane's engine-out gliding range. Once established in the ELP, engine power can also be used to help correct for errors in maintaining the standard ELP profile (i.e., to correct for low energy state).
- The most suitable airfield is generally a familiar airfield where you have landed during training (i.e., KPUB or one of the auxiliary fields closer to your current position). In those situations where engine failure seems imminent, consideration should also be given to other airfields and landing strips in the local area (e.g., dirt landing strips) that are closer to your current position.
- A Precautionary Emergency Landing should be used for situations involving throttle linkage failure (i.e., the engine does not respond normally to throttle inputs), using available power and flaps as required to safely land the aircraft. If the throttle is stuck at a setting that does not allow descent, you will need to shut down the engine with the action MIXTURE...IDLE CUTOFF when in a position to glide to High Key and intercept the ELP. Power can be restored quickly by returning the mixture control to FULL RICH, as long as the propeller is still windmilling (i.e., maintain at or above 60 KIAS at all times). Otherwise, the approach and landing should follow the standard Precautionary Emergency Landing procedure.
- Standard ELP Profile:



# FORCED LANDING

(Memory Item)

## INDICATIONS

- Engine power is not sufficient to maintain altitude, forcing a descent to the ground.
- Landing with an inoperative engine.

## ACTIONS

- Accomplish the FORCED LANDING procedure:

1. EMERGENCY LANDING PATTERN...INTERCEPT. *The ELP can be intercepted at any point between High Key and short final. Intercept the ELP at High Key in a glide, if able. Otherwise, intercept the ELP at the highest point appropriate for your current energy state and the specific conditions.*
- \*2. SAFETY BELTS...FASTENED
3. FLAPS...AS REQUIRED
4. FINAL APPROACH AIRSPEED (FLAPS CRUISE)...64 KIAS. *If executing a forced landing with flaps in the CRUISE position, fly the final approach at 64 KIAS.*
5. FINAL APPROACH AIRSPEED (FLAPS T/O)...60 KIAS. *If executing a forced landing with flaps in the T/O position, fly the final approach at 60 KIAS.*
6. FINAL APPROACH AIRSPEED (FLAPS LDG)...55 KIAS. *If executing a forced landing with flaps in the LDG position, fly the final approach at 55 KIAS.*  
-----BEFORE TOUCHDOWN-----
7. FUEL SHUTOFF VALVE...OFF. *Lift the fuel shutoff handle release lock with your thumb, and pull the handle fully aft to the stop. This action closes the fuel shutoff valve, which is located on the aft face of the firewall. Stopping the flow of fuel and vapor through the fuel supply and fuel return lines will ensure that any post-crash fire in the engine compartment will not continue to be fed through the fuel lines, which will significantly increase your chances of survival.*
8. MIXTURE...IDLE CUTOFF. *Squeeze the safety lock against the red mixture control knob, and then move the mixture control lever fully aft to the IDLE CUTOFF stop. This action will cause the engine to immediately shut down.*
9. IGNITION SWITCH...OFF. *Rotate the key fully counterclockwise to turn the ignition switch OFF.*
10. GEN/BAT MASTER SWITCH...OFF. *Press the GEN/BAT Master Switch (red split-rocker switch) down to the OFF position to remove the generator and battery as sources of power to the electrical system. Deactivation of the electrical system before touchdown reduces the risk of post-crash fire ignited by the electrical system. However, Note that the final flap configuration must be set before turning off the GEN/BAT Master Switch.*  
-----AFTER TOUCHDOWN-----
11. BRAKES...AS REQUIRED
- 12. EMERGENCY GROUND EGRESS

## CONSIDERATIONS

- Opposite direction ELPs from the departure leg (back to the takeoff runway) are not recommended. For all low-altitude engine failures, extreme care must be taken to select a suitable landing site that can be achieved given the aircraft's current energy state. This means that, in many cases, the safest option is to land straight ahead.
- Positive aircraft control during the final approach has priority over all other considerations.
- If landing on an unprepared surface, use the minimum authorized approach speed (55 KIAS) in order to reduce float during roundout/flare as well as groundspeed/energy on touchdown. Minimize touchdown speed by extending LDG flaps prior to touchdown and continuing the flare until minimum touchdown speed is reached. When landing on soft surfaces, pull the control stick fully aft during the landing roll to reduce the weight on the nose wheel and improve directional control.
- Some situations may require the airplane to be forced on the ground before flaring to minimum touchdown speed in order to decelerate more rapidly and avoid impacting obstacles straight ahead in the touchdown zone (deceleration is more rapid on the ground than in the air).
- Ditching (landing on a body of water) is not recommended, but it is generally a more desirable choice than landing on extremely rough terrain or in areas saturated with obstacles. Be attentive to loss of depth perception when landing on a wide expanse of smooth water, which may increase the risk of flaring early or late. Therefore, the airplane should be "dragged in" when conditions permit. Ditch with flaps T/O to help avoid asymmetrical flap failure from increased pressure on the flaps, which may decrease the airplane's chance of stopping straight ahead, right side up.
- Landings in deep snow should use the ditching technique described above, with flaps T/O and attention to loss of depth perception (i.e., "white out"). Depth perception errors will increase over wide open terrain (e.g., the southeast training areas) and in reduced visibility conditions.
- Because flaps improve maneuverability at slow airspeeds and lower the stall speed, they are generally used during final approach and landing. However, the associated increase in drag and decrease in gliding distance call for caution in the timing and the extent of their application. Premature flap extension and the resulting dissipation of energy available may cause the descent angle to steepen and the aim point to shift well short of the desired landing zone.

## TRIM MALFUNCTION (STUCK TRIM)

### INDICATIONS

- Inability to relieve forward or aft control stick pressure with elevator trim.
- Inability to actuate the electric pitch trim motor and change trim position by depressing the trim switch.

### ACTIONS

- Accomplish the TRIM MALFUNCTION (STUCK TRIM) procedure:
  1. TRIM CIRCUIT BREAKER...RESET IF TRIPPED
  2. TRIM SWITCHES...DEPRESS BOTH DIRECTIONS. *Depress the trim switch located on the top of the control stick in both directions (forward and aft) to check functionality of the switch. If your trim switch is still stuck, check the trim switch on the other control stick. There is no advantage to operating both switches simultaneously in the same direction, and the trim motor will not operate correctly if both trim switches are activated simultaneously in opposite directions.*
  3. REPEAT LINE 2 AFTER 5 MINUTES
  4. LAND AS SOON AS CONDITIONS PERMIT.

### CONSIDERATIONS

- NOTE: Expect full range of elevator travel but greater control forces.
- The loss of elevator trim may induce pilot fatigue due to increased control stick pressures. Use a safe airspeed that minimizes workload. If flying dual, take turns flying if muscle fatigue is a factor.
- A circuit breaker may be reset once, but do not reset a circuit breaker if it trips a second time.
- Consider flying a straight-in approach to minimize airspeed changes during the approach.
- Consider accomplishing a CONTROLLABILITY CHECK.
- Consider advising ATC of abnormal arrival airspeed.

## TRIM MALFUNCTION (RUNAWAY TRIM)

### INDICATIONS

- The trim motor continues to change the trim setting after the trim switch is released.

### ACTIONS

- Accomplish the TRIM MALFUNCTION (RUNAWAY TRIM) procedure:
  1. CONTROL STICK...GRIP & MAINTAIN CONTROL
  2. TRIM CIRCUIT BREAKER...PULL. *Pull the trim circuit breaker to deactivate the trim motor.*
  3. TRIM SWITCHES...CHECK IF DEPRESSED. *Check the trim switches located on the top of each control stick in an attempt to un-stick the trim. If a stuck trim switch is the cause of the runaway trim, it is most likely the switch that was depressed when the condition occurred (i.e., on the side of the pilot flying the aircraft).*  
-----IF CONDITION RESOLVED-----
  4. TRIM CIRCUIT BREAKER...RESET. *If the reason for runaway trim condition is obvious and has been resolved, reset the trim circuit breaker.*
  5. LAND AS SOON AS CONDITIONS PERMIT.

### CONSIDERATIONS

- NOTE: Full travel of elevator trim system takes 10 seconds.
- Expect full range of elevator travel but greater control forces. The loss of elevator trim may induce pilot fatigue due to increased control stick pressures. Use a safe airspeed that minimizes workload. If flying dual, take turns flying if muscle fatigue is a factor.
- Consider flying a straight-in approach to minimize airspeed changes during the approach.

# CONTROLLABILITY CHECK

## INDICATIONS

- Something has brought into question the flight characteristics of the aircraft (e.g., structural damage, flight control malfunction, bird strike, midair collision, suspected over-G, structural icing, etc.).

## ACTIONS

- Accomplish the CONTROLLABILITY CHECK procedure:
  1. CLIMB  $\geq 3000'$  AGL AT CONTROLLABLE AIRSPEED. *Climb to at least 3,000' AGL or an altitude that will allow recovery should the aircraft inadvertently depart controlled flight during the controllability check. A significant amount of altitude may be required to recover from some conditions. Do not allow the aircraft to stall. If the aircraft becomes difficult to control or approaches a stall, lower the nose and increase power to recover. Rudder will assist the ailerons to counter roll.*
  2. FUEL PUMP...ON. *Press the Fuel Pump rocker switch up to the ON position. This action will ensure adequate fuel pressure should the aircraft depart controlled flight during the controllability check.*
  - \*3. SAFETY BELTS...FASTENED. *Fasten safety belts in order to ensure that your body is secure in the cockpit should the aircraft depart controlled flight.*
  4. ESTABLISH STRAIGHT-AND-LEVEL FLIGHT.
  5. SLOW TO MCA OR TOUCHDOWN SPEED, WHICHEVER IS HIGHER, IN 5-KNOT INCREMENTS. *Gradually reduce airspeed to determine minimum controllable airspeed. Slow the aircraft in increments of 5 knots, stabilizing the aircraft at each consecutive airspeed for several seconds before continuing. This will allow the MCA to be reached without losing control of the aircraft. Do not decelerate below normal touchdown speed for the current configuration.*
  6. PLAN A POWER-ON, STRAIGHT-IN APPROACH. *Plan to fly a power-on, straight-in approach requiring minimum flare.*
  7. PLAN FOR NORMAL FINAL APPROACH SPEED OR MCA + 10 KNOTS, WHICHEVER IS HIGHER. *Fly the normal approach speed for your flap setting, or MCA + 10 KIAS, whichever is higher.*
  8. PLAN TO TOUCH DOWN AT OR ABOVE MCA. *Plan to touch down at or above MCA. Do not begin to reduce final approach airspeed until the aircraft is very close to the runway.*
  9. DO NOT REDUCE FINAL APPROACH SPEED UNTIL VERY CLOSE TO THE RUNWAY.

## CONSIDERATIONS

- CAUTION: Do not allow the aircraft to stall. If the aircraft becomes difficult to control or approaches a stall, lower the nose and increase power to recover. Rudder will assist ailerons to counter roll.
- CAUTION: Stabilize the aircraft at each consecutive airspeed for several seconds. This will allow MCA to be safely reached without losing control of the aircraft.
- NOTE: Normal touchdown speeds are 45 KIAS (flaps LDG), 50 KIAS (flaps T/O), and 55 KIAS (flaps CRUISE).
- Do not move the flaps if significant damage is located in the wings.
- If you are able to decelerate to normal touchdown speed during a controllability check without any noticeable reduction in controllability, you should be able to do so during the landing flare. In this case, plan on using normal approach and touchdown airspeeds.
- Abnormally high touchdown speed increases risk of the following: bouncing/ballooning after touchdown; touching down on the nosewheel first; porpoising; blowing a tire on landing; and wheelbarrowing.
- Select an unpopulated area with a suitable forced landing site for a controllability check. There is a chance that the aircraft will depart controlled flight into an unrecoverable situation, and you must attempt to minimize the risk of causing harm to persons or property on the ground. Selecting an area with a suitable forced landing site will also increase your chances of survival should the situation deteriorate and require a forced landing.
- Recommended (minimum) normal approach speeds for the various flap settings are as follows: 60 KIAS with flaps LDG; 60 KIAS with flaps T/O; 65 KIAS with flaps CRUISE. For asymmetrical flaps, use the least-extended flap setting to determine approach airspeed.
- RULE OF THUMB: Maintain at least *MCA plus 20 KIAS* during arrival until you are established on a two-mile straight-in final approach. This airspeed should provide an adequate buffer during any required turns on the arrival, as long as you use shallow bank angles. When inside of two miles on final approach, decelerate as required by the conditions (e.g., considering headwind) either to final approach speed or to *MCA plus 10 KIAS*, whichever is higher.
- Due to increased approach speed and the probability that this approach speed will be maintained until very close to the runway, choose the longest runway available when landing an aircraft with controllability problems. The amount of float during the landing flare may significantly increase under these circumstances.
- If the elevator control system is jammed (loss of pitch control), or if damage prevents movement of the elevator, various combinations of power and flap extension allow a limited amount of pitch control, although landing under these conditions will be very problematic.

# SPIN RECOVERY

(Memory Item)

## INDICATIONS

- Following a stall, the aircraft enters a self-sustaining rolling/yawing motion (autorotation) with low indicated airspeed.

## ACTIONS

- Accomplish the SPIN RECOVERY procedure:

1. THROTTLE...IDLE. *Bring the throttle fully aft to the IDLE stop. This action will prevent engine overspeed during later stages of the spin recovery. Closing the throttle also helps minimize altitude loss and reduces the potential for a flat spin to develop. Gyroscopic precession of the rotating engine and propeller tend to hold the nose up, flattening the spin and interfering with recovery.*
2. RUDDER...FULL (OPPOSITE TO SPIN DIRECTION). *After confirming the direction of spin (by visual reference to the ground and by cross-checking the turn coordinator), push and hold the rudder pedal that is opposite to the direction of spin fully forward with your foot. Rudder is the primary control for spin recovery in the DA20-C1. This action (in combination with easing the control stick forward) stops the sideslip and the rotation.*
3. CONTROL STICK...EASE FORWARD. *While holding full opposite rudder deflection, ease the control stick forward to reduce angle of attack and recover from the stalled condition.*
4. RUDDER...NEUTRAL WHEN ROTATION STOPS. *Neutralize the rudder pedals as soon as the rotation stops.*
5. FLAPS...CRUISE. *Move the flap switch fully upward to the CRUISE position. Airspeed will rapidly increase after recovering from the spin, and this action will prevent flap overspeed.*
6. CONTROL STICK...PULL CAUTIOUSLY. *Ease the control stick aft in order to return to level flight. Pull cautiously to ensure that you do not over-G the airplane or enter a secondary stall. On the other hand, excessively delay recovering from the dive may cause the airspeed to exceed structural limitations.*

## CONSIDERATIONS

- CAUTION: Recover to level flight cautiously to avoid inducing a secondary stall, but do not allow the airspeed to exceed 164 KIAS.
- Intentional spins are prohibited in Doss Aviation aircraft, even though the DA20-C1 is FAA-certified for intentional spins with flaps CRUISE. Recovery from (unintentional) spins with flaps extended is more difficult than recovery from a spin with flaps CRUISE.
- The stall pattern on the DA20-C1 wing progresses from the wing root toward the wingtip. This design helps prevent undesirable rolling moments at high lift coefficients, contributes to early stall warning, and preserves aileron effectiveness at high angles of attack.
- To enter a spin, two things are required: stall and yaw. Proper stall recovery technique (i.e., coordinated aileron and rudder inputs) will prevent inadvertent spins.
- Be attentive to increasing left yaw moment when operating at high power settings and high angle of attack (low airspeed). Use appropriate right rudder pressure to counter this yaw and maintain coordinated flight.
- Do not confuse a spin with a spiral dive. A spin involves flight at high angle of attack (low airspeed), whereas a spiral dive involves spiral motion at a relatively low angle of attack (high airspeed).
- Use the miniature airplane on the turn coordinator to verify spin direction. Do not use the ball in the inclinometer to determine spin direction because its indications are not always reliable.
- Perform a CONTROLLABILITY CHECK if you suspect structural damage following an over-G during spin recovery.

# ICING

## INDICATIONS

- Visible accumulation of structural icing during flight.
- Uncommanded reduction of engine RPM during flight in conditions with visible moisture and low OAT.
- Airspeed indicator drops to zero during flight in conditions with visible moisture and low OAT.

## ACTIONS

- Accomplish the ICING procedure:
  1. LEAVE ICING AREA...CHANGE HDG AND/OR ALTITUDE. *In many cases, executing a 180° turn will allow you to exit the icing condition. Changing altitude to enter warmer ambient temperatures may also stop the accumulation of ice. This generally means descending, although some situations may require a climb (e.g., temperature inversions).*
  2. CONTROL SURFACES...MOVE CONTINUOUSLY. *Move the rudder and ailerons continuously to prevent ice accumulation that could restrict the movement of these control surfaces.*
  3. ALTERNATE AIR...ON. *Move the alternate air lever fully aft into the ON detent. This action opens a door on the rear side of the air intake, bypassing a potentially clogged intake filter and allowing unfiltered air from the engine compartment to enter the engine intake manifold.*
  4. THROTTLE...INCREASE RPM TO REDUCE PROP ICE.
  5. CABIN HEAT...ON, DEFROST. *Move the cabin heat lever fully downward to the ON position. This action opens the cabin heat control valve to allow heated air into the cabin. Move the cabin heat selector to DEFROST to apply hot air to the wind screen, which will reduce or prevent ice accumulation that could potential restrict your forward visibility.*
  6. LAND AS SOON AS CONDITIONS PERMIT.

## CONSIDERATIONS

- CAUTION: Icing on the leading edge of the wings increases stall speed. Expect errors of indicated airspeed, altitude, rate of climb, and stall warning.
- It is illegal and unsafe to enter instrument meteorological conditions in the DA20-C1, especially when OAT is low enough to create icing conditions.
- Stall characteristics with ice accumulation on the wings will be significantly degraded (e.g., increased stall speed). Ice accretion may also be asymmetric between the two wings. Structural icing may also cause the outer part of the wing, which is thinner and thus a better collector of ice, to stall first rather than last.
- Studies have shown that frost, snow, or ice accumulations (on the leading edge or upper surface of the wing) no thicker or rougher than a piece of coarse sandpaper can reduce lift by 30 percent and increase drag up to 40 percent. Larger accretions can reduce lift even more and can increase drag by more than 80 percent.
- The horizontal stabilizer generates a tail-down force (i.e., downward lift), which balances the tendency of the nose to pitch down (i.e., the center of lift lies between the center of gravity and the tail down force). When the tail stalls, this tail-down force is reduced, potentially causing a severe forward pitching moment. Because the tail has a smaller leading edge radius and chord length than the wings, it can collect proportionately two to three times more ice than the wings. Furthermore, ice on the tail is not easily observed.
- If you have accumulated structural ice, consider carrying extra power and airspeed (e.g., an additional 10 to 20 KIAS) during approach and landing. Be cautious when executing turning maneuvers with structural ice. Most icing accidents occur when maneuvering to land or during approach and landing. Use the longest runway available due to the increased speed you will be carrying during the approach.

# AVIONICS MALFUNCTION

## INDICATIONS

- Inability to communicate normally with the aircraft radios.
- Abnormal transmit/receive indications on the radios (e.g., no TX or RX indication).
- *COM has failed, COM is not responding, COM push-to-talk key stuck, or COM needs service* message on the GNS 430 display.

## ACTIONS

- Accomplish the AVIONICS SYSTEM MALFUNCTION procedure:

### -----TRANSMITTER FAILURE-----

1. CHECK RADIO FREQUENCY & VOLUME
2. CHECK MIC & HEADSET JACKS
3. USE ALTERNATE MIC OR HEADSET IF AVAILABLE

### -----RECEIVER FAILURE-----

1. CHECK TRANSCEIVER DISPLAY FOR STUCK MIC
2. DEACTIVATE SQUELCH
3. CHECK HEADSET JACKS IF SQUELCH NOT HEARD
4. ACTIVATE CABIN LOUD SPEAKER

### -----TOTAL AVIONICS FAILURE-----

1. RESET/MONITOR AVIONICS MASTER CIRCUIT BREAKER IF TRIPPED
2. TOGGLE AVIONICS MASTER SWITCH
3. IF AVIONICS REMAINS OFFLINE, PULL AVIONICS MASTER CONTROL CIRCUIT BREAKER

- If problem cannot be resolved, accomplish the RADIO FAILURE procedure in the In Flight Guide.

## CONSIDERATIONS

- A circuit breaker may be reset once, but do not reset a circuit breaker if it trips a second time.
- Use the acronym R.I.C.E. to check common causes of avionics system malfunction:
  - Radio:** Check active frequencies, volumes, and squelch settings on the two radios.
  - Intercom:** Check the audio panel (at the top of the avionics stack) to ensure that settings, volumes, and squelch are correct.
  - Connections:** Check and reset headset connections (jacks located between the two seats).
  - Equipment:** Check your headset for damage and use an alternate headset or transmitter/receiver if available.

## LANDING WITH DEFECTIVE TIRE (MAIN GEAR)

### INDICATIONS

- Known or suspected damage to a tire on the main landing gear when airborne.
- Notification from third party (ground personnel, other aircrew, ATC, etc.) that a tire on the main landing gear appears damaged.
- Audible explosion from the main landing gear area during lift-off.
- Suspected tire or landing gear damage after a touch-and-go following a hard landing, or a go-around after bouncing, porpoising, etc.

### ACTIONS

- Accomplish the LANDING WITH DEFECTIVE TIRE (MAIN GEAR) procedure:
  1. FLY NORMAL FINAL APPROACH WITH FLAPS LDG
  2. LAND ON SIDE OF RWY CORRESPONDING TO GOOD TIRE. *Land on the side of the runway that is opposite the side with the defective tire in order to compensate for the anticipated veering toward the defective tire after touchdown.*
  3. TOUCH DOWN ON GOOD TIRE (WING SLIGHTLY LOW). *Touching down on the good tire will help ensure that directional control is maintained during initial contact with the runway.*
  4. LOWER NOSEWHEEL IMMEDIATELY AFTER TOUCHDOWN. *The nose wheel should be brought to the ground as soon as possible after touchdown on the good main gear tire. This action will improve your ability to maintain directional control during the initial touchdown phase.*
  5. DEFLECT CONTROL STICK FULLY TOWARD GOOD TIRE. *Deflect the control stick fully toward the good tire in order to ease the load on the defective tire.*
  6. USE BRAKING ON GOOD TIRE FOR DIRECTIONAL CONTROL. *The aircraft will encounter a strong yaw moment toward the defective tire. Full opposite rudder deflection will be insufficient to maintain directional control. Therefore, use braking on the wheel with the good tire to counter this veering toward the defective tire. Inadvertent departure from the prepared runway surface is likely in the event of a blown main gear tire.*
  7. MIXTURE...IDLE CUTOFF
  8. IGNITION SWITCH...OFF
  9. GEN/BAT MASTER SWITCH...OFF
  - 10. EMERGENCY GROUND EGRESS. *Hot brakes and potential hydraulic leaks from a damaged brake system present a fire hazard. The possibility of damage to fuel lines under the belly of the aircraft also exists.*
- If the aircraft departs the paved runway/taxiway/ramp surface, accomplish the DEPARTING A PREPARED SURFACE procedure.

### CONSIDERATIONS

- If you experience a blown main gear tire during takeoff roll (including touch-and-goes), it is generally safer to continue the takeoff climb (assuming no engine/propeller damage occurred) rather than to attempt a high-speed abort with a limited amount of remaining runway and with only half the runway width available. The LANDING WITH DEFECTIVE TIRE (MAIN GEAR) procedure reduces the risk of departing the prepared surface by ensuring a carefully planned touchdown at an ideal location on the runway.
- If additional aircraft damage is suspected (e.g., flap damage) accomplish the CONTROLLABILITY CHECK procedure.
- Brief and prepare for the DEPARTING A PREPARED SURFACE procedure before landing.
- Plan to land on the widest runway available, as current wind conditions permit.
- Consider selecting a touchdown zone that will increase your chances of remaining on a prepared surface. For example, touch down on runway 8L just prior to the intersection of runway 17/35.

## LANDING WITH DEFECTIVE TIRE (NOSE GEAR)

### INDICATIONS

- Known or suspected damage to the nose gear tire during lift-off or during flight.
- Notification from third party (ground personnel, other aircrew, ATC, etc.) that the nose gear tire appears damaged.

### ACTIONS

- Accomplish the LANDING WITH DEFECTIVE TIRE (NOSE GEAR) procedure:
  1. FLY NORMAL APPROACH AND LANDING. *Touch down on the main wheels first and gently lower the nose to the ground during the landing roll.*
  2. MIXTURE...IDLE CUTOFF
  3. IGNITION SWITCH...OFF
  4. GEN/BAT MASTER SWITCH...OFF
  - 5. EMERGENCY GROUND EGRESS.
- If the aircraft departs the paved runway/taxiway/ramp surface, accomplish the DEPARTING A PREPARED SURFACE procedure.

### CONSIDERATIONS

- A flat tire on the nose gear may not be noticeable until the airplane decelerates to taxi speed.
- If more substantial damage to the nose gear is suspected during flight (e.g., following a mid-air collision, bird strike, etc.), take extra care to ensure that the nose is lowered to the ground as gently as possible at the slowest possible speed during the landing roll.
- Plan to land on the widest/longest runway available, as current wind conditions permit.
- Brief and prepare for the DEPARTING A PREPARED SURFACE procedure before landing.

# GLIDING

## INDICATIONS

- Desire to maximize horizontal distance traveled during descent with an inoperative engine.

## ACTIONS

- Accomplish the GLIDING procedure:
  1. FLAPS...CRUISE.
  2. AIRSPEED (1764 LBS)...73 KIAS. *Adjust pitch attitude and trim to establish a glide at 73 KIAS with flaps CRUISE.*

## CONSIDERATIONS

- NOTE: With a glide ratio of 11:1, the airplane moves forward approximately 1.8 nm for every 1,000 feet of altitude loss.
- The ELP is ideally intercepted at High Key in a glide at 73 KIAS (calm winds) with flaps CRUISE.
- Minimum sink airspeeds for pre-determined conditions have not been calculated for the DA20-C1. Therefore, the accepted gliding technique in the DA20-C1 is one that maximizes gliding *range* (i.e., minimizes descent angle), rather than one that maximizes time aloft or one that establishes the aircraft somewhere in the middle of the drag envelope. Gliding, as defined here, is flight at the best L/D airspeed (i.e., 73 KIAS) in the best L/D configuration (i.e., flaps CRUISE), which will maximize the horizontal distance traveled in calm wind conditions.
- RULES OF THUMB for maximizing gliding range in headwind and tailwind conditions:
  1. *Add 1/2* of the headwind component to 73 KIAS.
  2. *Subtract 1/4* of the tailwind component from 73 KIAS.

For example, you roll out on final approach in a glide (i.e., 73 KIAS and flaps CRUISE) with a 20-knot headwind and notice that your glidepath intersects the ground short of the desired aim point. In order to reduce descent angle (i.e., increase gliding range), accelerate to 83 KIAS in the glide. On the other hand, using this technique to increase gliding range does not make sense if the aircraft is *not* in a low energy state.
- Never try to “stretch a glide” when your approach is short of the desired aim point. If you are flying the correct glide speed on final approach, consciously resist the tendency to pull back on the stick if you happen to be short of the desired aim point. Slowing down will only make the situation worse. In calm winds, *any* airspeed deviation from the best glide speed (faster or slower) will steepen the glidepath (i.e., angle of descent). Only the best glide speed can achieve the best lift to drag ratio ( $L/D_{max}$ ). Many fatal accidents have followed irrational attempts to “stretch a glide” that resulted in rapid sink rates, stalls, or spins at low altitude.
- It is imperative that you do not terminate the glide by lowering flaps to T/O or LDG until landing is assured. You must be certain that the resulting increase in drag and steeper descent angle will not cause you to come up short of the landing zone. When flying normal IDLE descents in the traffic pattern at 60 KIAS and flaps LDG, notice the angular distance below the horizon where your glidepath intersects the ground. During a glide at 73 KIAS with flaps CRUISE, this angular distance is much smaller because the descent angle is relatively shallow in a glide. Before transitioning from a glide to final approach in the LDG configuration, first visualize and predict the resulting change in descent angle to ensure that you do not lower the flaps too early. If the resulting shift in aim point will move the aim point short of the landing threshold, it is too early to extend flaps LDG.
- Raising LDG flaps to T/O or CRUISE at any time during the ELP is not an accepted technique for student training. The resulting rapid increase in sink rate can lead to unsafe situations at low altitude, especially when the pilot does not accept this increased sink and incorrectly pulls back on the stick. The proper action is simply not to extend flaps to LDG until landing is assured.