Mountain Fury
Mountain Search Flying
Course Syllabus

Third Sortie : High Altitude Takeoff / Landing, Mountain Navigation, Up / Downdrafts

Objectives

1. Develop trainee's proficiency in maximum performance takeoffs and landings at high altitude airports.
2. Develop trainee's ability in mountain pilotage, dead reckoning and use of navigation equipment.
3. Develop trainee's awareness of locations and ability to deal with up and downdrafts while conducting search operations.

Timeline

The trainee should expect to spend at least 45 minutes in preflight planning for this sortie prior to meeting with the instructor. The trainee and instructor should plan on an additional hour of discussions and briefing prior to the commencement of the flight. Sortie three will require one and one half to two hours of flight time. Finally, a debrief and completion of paperwork will require one additional hour.

Detailed Description of Third Sortie

Preflight Preparation

A considerable amount of preparation is required of the trainee pilot prior to this sortie. This is intended to allow the prediction of aircraft performance and comparison of predictions with actual performance. These items should be completed prior to meeting with the instructor pilot so that the sortie can be accomplished as expeditiously as possible.

Obtain the following information from the instructor pilot and enter it on the outline/data form:

- The instructor's weight and the weight of his/her personal equipment
- The location or locations in which the sortie will be flown.

Weight and Balance

Obtain data on the aircraft needed to complete a weight and balance computation. Perform a weight and balance calculation including planned fuel load, weights of the trainee and instructor and their personal equipment. Enter the gross weight, CG, maximum allowable gross weight and percent difference of the operating weight from maximum gross weight on the outline/data form. Note that a **forward CG position produces a higher stall speed**. This should be considered in calculating stall speeds below.

Airspeed and performance calculations

Calculate critical airspeeds from the airport elevation through the highest altitude expected to be flown on this sortie and fill these in on the outline/data form. These include Vx, Vy, Va, stall speeds for flaps up and normal search configuration (typically 10° to 25° of flap), best glide speed, and stall speeds in a 45° and 60° bank turn. Determine from the POH the density altitude at which the aircraft will climb at 300 feet per minute. Record this information on the outline / recording form.

Note: When calculating canyon turn diameter and entry speed, CALIBRATED stall speed must be used. The resulting entry speed in calibrated airspeed must be converted into INDICATED airspeed for use in flight. For most aircraft used by CAP, the difference between calibrated airspeed and indicated airspeed at stall speed is fairly large, but at the canyon turn entry airspeed it is very small. If INDICATED stall speed is used for the calculations, the calculated canyon turn entry speed will be about 15 knots too slow.

Weather Briefing

Obtain a standard briefing for the area in which the sortie will be flown. A DUAT briefing is preferred as it assures that all available weather information is obtained. Print out the briefing or record information from the briefing form on the outline/data form so that the briefing and conditions may be discussed with the instructor pilot. Prepare and file a flight plan (or mission flight plan) for the sortie.

Airport Information:

Since this sortie will be flown from a high altitude airport or search base, it is likely that the trainee will not be familiar with the airports to be used. The AFD or other reference should be used to gather information on runway lengths, elevation (at each end), slope, obstructions, and approach and departure patterns. Actual or forecast temperatures should be obtained or estimated and density altitudes should be calculated. Record this information on the outline/data recording form.

Preflight Briefing

Safety. Safety is of paramount concern to everyone. If weather at the time of the sortie is of any concern, postpone the sortie for another day. Complete the CAP personal safety matrix prior to the flight. Once again, if the score is high and unacceptable, postpone the flight for another day.

Unlike the first two sorties, this sortie will be flown at relatively low AGL altitudes over high terrain. An altitude of at least 2,000 feet AGL is suggested for navigation exercises. Use a minimum of 1,000 feet AGL for up and downdraft exercises.

Verify that appropriate survival equipment is on board, and that both crewmembers have clothing suitable to spend the night in the open if an off-airport landing occurs. Note wind chill factors and expected night time temperatures. Carriage of sleeping bags and some form of shelter (tarp or tent) is highly recommended for flight operations in mountainous areas.

Weather. The trainee should provide the instructor with his/her personal assessment of the weather conditions based on the contents of a standard weather briefing . Specific items needed include forecast clouds and weather, winds and temperatures aloft, and the presence of turbulence. The instructor should obtain an independent briefing so that the trainee's assessment can be evaluated.

Flight Plan. The trainee should review the flight plan (filed earlier) with the instructor, and review route and airport departure procedures.

Aircraft Preflight. If possible, the preflight inspection should be performed in the presence of the instructor. Any non-standard equipment (radios, oxygen, survival gear) should be should be discussed to ensure familiarity of both pilots with that equipment. Any inoperative equipment should be identified and assessed as to whether it is required for the flight. Review the weight and balance calculations performed by the trainee and verify that the aircraft is loaded within limits.

Aircraft Performance. Discuss power settings, maximum rates of climb (and associated airspeeds) estimated takeoff distance and takeoff abort point. The instructor should review the pre-flight data entered by the trainee on the outline / data form. Verify that the density altitude expected in the practice search area will be at or below the search ceiling for the aircraft. If flight above 10,000 feet is planned, oxygen should be available and used by the crew..

Discuss turn effects of bank angle, airspeed and altitude on turn performance. Review the trainee's calculations for turn diameters.

Complete a CAP safety inspection form for the aircraft.

Takeoffs and Landings

The takeoffs and landings practiced in the first sortie of the program will be repeated to demonstrate the effect of high density altitude on aircraft performance. **An airport with a density altitude of at least 6,000 feet is preferred** for effective training.

Note points along the runway that correspond to the distance required for ground roll, 50 foot obstacle clearance height, and takeoff abort point before beginning each takeoff run. **At least 75 percent of indicated takeoff speed must be obtained by half way down the runway or the aircraft will not lift off on the runway remaining.** Estimate the distance (or time) differences from the predicted takeoff point / obstacle clearance height to the actual distances. Record this information on the outline/data form. Make the same estimates for landing distances, note actual distances and record this data on the form. Short field and soft field takeoffs and landings should be performed, as well as at least one power-off approach and landing.

Terrain Navigation

Accurate navigation in mountain areas is very important but it has unique challenges. Enroute altitudes will usually be at a lower AGL altitude than in low terrain areas, thus the appearance of ground features is different and it is more difficult to obtain a big-picture view of the terrain. Conventional electronic navigation aids such as VOR and DME may not be usable due to the signals being blocked by terrain. GPS and LORAN are less effected by terrain, but this equipment can fail or be subject to signal outage. For these reasons it is important that the search pilot be skilled in visual navigation (pilotage). The goal of the following exercise is to develop skills in pilotage and use of electronic navigation aids.

Climb to an altitude that is at least 2000 AGL for the route to the practice search area. While enroute and on reaching the grid, attempt to continuously determine position with pilotage and dead reckoning. Try to use each piece of navigation equipment and assess whether it provides a usable indication in the search area.

While enroute, the instructor should simulate several equipment failures or emergencies. The simplest and safest method of simulating such failures is to announce an anomalous reading of an instrument or a condition, such as: The alternator is showing a discharge; oil pressure has dropped to zero; engine temperatures are nearing redline. It is also reasonable to change the heading indicator or radio frequency when the trainee is not watching. The goals are to increase the trainee's monitoring skills and demonstrate the effects of mild hypoxia and high workload on troubleshooting skills.

Also while enroute, the instructor should give hypothetical weather problems (e.g., if there were clouds here at XXXX MSL, or visibility was at 4 miles and decreasing, what would you do?). Discuss options to maintain safe VFR operations and whether IFR escape is possible.

Updraft / downdraft locations and magnitudes

In the following maneuvers the aircraft will be deliberately flown in areas expected to contain up and downdrafts. The goals are to give the trainee experience in locating such conditions and to allow recognition of aircraft performance characteristics which can indicate the presence of lift and sink. When the aircraft is flown in areas of downdrafts particular attention should be devoted to identifying escape routes to lower terrain. If downdrafts are consistently of intensity that produce a descent against full power climbs, either move further away from terrain or abort the flight and return to base. Training flights are not a time to take unnecessary risks.

The first task is to establish a baseline of performance for still-air conditions. Establish level flight in stable air (away from areas of up and downdrafts) at search airspeed (~85 KIAS or Vy + 10, whichever is higher) with flaps at search setting (10-25°). Record the power setting on the outline/data form.

Next the aircraft will be flown in areas of downdraft to show their effects. Locate a valley or canyon with an axis perpendicular to the prevailing wind. The usual pattern of conditions is for the windward slopes to have areas of updrafts and the leeward slopes have downdrafts. If winds are light, solar heating can alter this pattern, with bright areas generating lift and dark ones having sink. Have the pilot point out expected areas where up and downdrafts would be expected

Fly parallel to the leeward side of a ridge into a downdraft area. Maintain airspeed and power setting and allow the aircraft to change altitude. This shows the magnitude of the sink. Record the rate of descent.

Fly out of the downdraft area, climb back to the starting altitude and return to the leeward side of the ridge. Maintain the previous power setting and change pitch and airspeed as needed to maintain altitude. Note the change in airspeed and pitch resulting from the climb against the downdraft. Record the airspeed.

Apply full power and transition to Vy for the aircraft weight and density altitude. Record the rate of climb. This shows the effect of downdrafts on aircraft climb performance.

The above series of maneuvers will next be repeated in an area of updrafts. Fly away from the ridge and out of the downdraft. Climb back to the original altitude and fly to the windward side of a ridge.

Slow to search speed as above, and set the power to what it was in the first step of this section. Maintain airspeed and the power setting, allowing aircraft to change altitude. This shows the magnitude of the lift. Record the rate of climb.

Fly out of updraft area, descend to starting altitude and return to the windward side of the ridge. Maintain altitude and the power setting. Note the change in airspeed and pitch resulting from a dive against the updraft. Record the airspeed.

Apply full power, transition to Vy for the aircraft weight / density altitude. Record the rate of climb. This shows the value of flying along windward sides of ridges to gain climb performance.

High - Altitude / Unfamiliar Field Approach and Landing

Proceed to the another high altitude airport. Fly over the field at least 1000 feet higher than the highest obstacle in the area using a rectangular pattern if possible. Note the wind conditions (through changes in crab angle and turn radius), approach and departure obstacles, condition of runway, and best approach path. Trainee and instructor should discuss the best way to approach the airport given the conditions.

Proceed to the downwind leg for landing. Adjust the mixture control so that maximum power is available should a go-around become necessary. Test climb performance with a full-power climb. If the **sustained rate of climb** obtained is **less than 300 feet per minute**, do not land -- there is insufficient climb performance for a safe go-around on departure. Sustained rate of climb means climb performance in a constant airspeed climb which is not the result of trading airspeed for altitude.

The instructor should direct the pilot's attention to the need for a wider landing pattern / higher rate of descent due to the higher true airspeed produced by flight at high density altitude. Reminder: the **indicated approach speed to be used at high altitude airports is the same speed as used at low altitude airports**. Turbulence or wind shear would favor adding some speed to the normal approach speed.

Perform a normal landing. After clearing the runway, note and record the altimeter reading. Compare this to the known field elevation (from the sectional chart). Record the difference from the known field elevation. Reset the altimeter to field elevation.

High - Altitude / Unfamiliar Field Takeoff

If the runway has a visible slope, taxi to each end of runway and record the altimeter readings. Calculate the percentage of runway slope as follows.

Slope = (difference in height of runway ends / runway length) x 100
Example: (80' difference / 2000' runway) x 100 = 4% slope.

Determine the takeoff distance taking into account the slope, wind, and obstructions.
Prior to takeoff, lean the mixture and perform a full power run-up (in accordance with any procedures or limitations contained in the aircraft handbook). If conditions are significantly different than those expected when the preflight calculations were made, recalculate the takeoff distance for the current conditions.

Allow 100 percent margin for required distance. If the runway length is not at least twice as long as the distance required, do not takeoff. Either wait for improved conditions (more headwind, cooler temperatures) or off-load weight to reduce the required takeoff distance.

Identify points along the runway that can be easily recognized (taxiways, windsocks, hangars, etc.) that correspond to the required distance needed for takeoff. Pick specific objects along the runway to identify the expected takeoff point, abort point (if not in the air by that point, abort the takeoff) and position where you expect to be 50 feet AGL.

Review the airspeeds for rotation, Vx, and Vy before takeoff.

Perform a short field / obstacle clearance takeoff. Record the distance (or time) past the markers you selected for your takeoff point and distance to clear a 50' obstacle.

If time permits, practice a soft field takeoff / landing at this airport.

After completing these tasks at this airport, return to the search/training base.

Postflight Debrief

Compare the actual distances obtained for takeoff / landing to predicted distances. If time past a takeoff marker was used instead of distance, you may convert this time to distance by multiplying the rotation speed in knots true airspeed by the number of seconds from the expected takeoff point and multiply by 1.7 to get distance in feet. For time past a 50' obstacle clearance marker, use the average of the liftoff speed and speed at 50' (converted to true airspeed) instead of rotation speed in the above equation.

Discuss trainee performance during pilotage exercises, simulated emergencies, possible effects of hypoxia / fatigue. Discuss the causes of any errors that were made, how they were detected and how they were corrected. If the pilot was had more difficulty than usual in dealing with problems, it might have been due to mild hypoxia and is an indicator that oxygen should be used on future flights at these altitudes.

Review aircraft performance obtained during flight in up and downdrafts. Note that changes in airspeed needed to maintain level flight can be used as indicators of the presence of up and downdrafts. Deviation from expected performance is often the first sign of a problem of some kind.

Discuss use of available lift for increased climb performance. Note how much less time is needed for a climb to search or enroute altitude if available lift is used, or if sink is avoided.

Review the operations conducted at the unfamiliar airport. Note altimeter errors recorded. This is a reminder that flying by indicated MSL may not provide the desired AGL altitudes desired if a local altimeter setting is not available. Compare the recorded takeoff and landing distances to pre-flight estimates. This provides a good metric for judging the merit of other POH calculations.

Fill out the Flying Gradesheet for maneuvers performed in this sortie. Mark an "S" for satisfactory performance, "T" or more training required, and "U" for unsatisfactory performance. The grade of "T" should be used when performance is marginally acceptable or the trainee shows signs of improvement but is not yet proficient. "U" should be used when the trainee is experiencing considerable difficulty and maneuvers are deemed unsafe or unacceptable. The check pilot should endorse the trainee's records to show completion of this sortie.

MOUNTAIN FURY
SORTIE NUMBER THREE
OUTLINE / DATA RECORDING FORM

PILOT ____

CHECK PILOT ____

Check Pilot Number _________

Date of Sortie _______________ **Aircraft Type** __________

Location ____________________ **Second Airport** ____________________

<u>Preflight Preparation</u>

Verify the following have been performed, and data entered on recording form.
Discuss and review as necessary:

- ☐ Weight and balance
- ☐ Airspeed calculations
- ☐ Weather briefing
- ☐ Preflight briefing
  - ☐ safety, including personal matrix, survival equipment and clothing
  - ☐ weather, including clouds, winds, temperatures and turbulence
  - ☐ flight plan, discussed and filed
  - ☐ aircraft preflight -- discuss non-standard equipment, oxygen, inop equipment
  - ☐ aircraft performance -- discuss and fill in recording form with performance predictions
  - ☐ safety inspection form -- verify completed

Fill in the blanks before the flight

Weights:
Aircraft Basic Empty Weight __________
Trainee __________
Trainee's Equipment __________
Instructor __________
Instructor's Equipment __________
Other items in aircraft __________
Fuel load __________
Gross Weight __________
Maximum Gross Weight __________
Empty CG __________
CG as loaded __________
Within CG / Weight limits (Y/N)? __________
CG in forward 30% of range (higher stall speed) ? _______
Percent Difference from Max Gross Weight __________

departure airport: short field technique:	ground run	over 50' obstacle
Expected takeoff distance:	_________	_________
Expected landing distance:	_________	_________

secondary airport: short field technique:	ground run	over 50' obstacle
Expected takeoff distance:	________	_________
Expected landing distance:	_________	_________

Airspeeds for max gross weight:	--------------- density altitude -------------------				
	sea level	6,000'	8000'	10,000'	12,000'
Vx	________	________	________	________	________
Vy	________	________	________	________	________
Vy ROC from POH	________	________	________	________	________

stall speed flaps up, KCAS ________
stall speed, search configuration (flaps), KCAS ________
stall speed, search config, 45° bank ↳ x 1.2 = ________
stall speed, search config, 60° bank ↳ x 1.4 = ________
canyon turn entry airspeed KCAS ↳ + 10 = _______
canyon turn entry airspeed KIAS (use table in POH/AFM) _______
Va ________
best glide ________

For actual takeoff weight, reduce airspeeds above by 1/2 the percent difference from max gross weight):

	--------------- density altitude -------------------				
	sea level	6,000'	8000'	10,000'	12,000'
Vx	________	________	________	________	________
Vy	________	________	________	________	________

search ceiling (altitude for 300 fpm ROC): ________
stall speed flaps up, KCAS ________
stall speed, search configuration (weight, flaps), KCAS ________
stall speed, search config, 45° bank ↳ x 1.2 = ________
stall speed, search config, 60° bank ↳ x 1.4 = ________
canyon turn entry airspeed KCAS ↳ + 10 = _______
canyon turn entry airspeed KIAS (use table in POH/AFM) _______
Va ________
best glide ________

From Winds Aloft Forecast (FD)	3000'	6000'	9000'	12000'
wind / temperature	________	________	________	________
density altitude (calculate)	________	________	________	________

Altimeter setting ________
Field elevation ________
Temperature ________
Density Altitude ________

Calculate turn diameters at search airspeed: (DA = density altitude, results are in feet)
45° bank at sea level: (Airspeed (KIAS) ^{2} / 11.26) x 2 = ________
30° bank at sea level: 45° bank distance x 1.75: ↳ x 1.75 = ________
60° bank at sea level: 45° bank distance x 0.6: ↳ x 0.6 = ________

45° bank at search altitude: (increases by 2% per 1000 feet Density Altitude above sea level)
((Airspeed (KIAS) x (1 + (.02 x DA in K feet)) ^{2} / 11.26) x 2 = ________
30° bank at search altitude: 45° bank distance x 1.75: ↳ x 1.75 =________
60° bank at search altitude: 45° bank distance x 0.6: ↳ x 0.6 =________

Total time flown on this sortie: ________

FLYING THE SORTIE
(Fill in the blanks in-flight)

Takeoffs and Landings

Perform at least 3 takeoffs and landings, including:

- ❑ short field takeoffs / landing. Estimate and record distance over 50 foot obstacle:
  takeoff: _______ landing: _______
- ❑ soft field takeoff / landing. Estimate and record distance over 50 foot obstacle:
  takeoff: _______ landing: _______
- ❑ power off approach / landing. Estimate and record distance over 50 foot obstacle: _______

Terrain Navigation

- ❑ Climb to an altitude that is at least 2000 AGL for the route to the practice search area.
- ❑ While enroute and on reaching the grid, attempt to determine position with pilotage, dead reckoning, and each piece of navigation equipment.
- ❑ Simulate (verbally) several equipment failures or emergencies.
- ❑ Present weather problems and discuss methods of handling them.

Maneuvering Review

- ❑ Climb to an altitude that is at least 3000 AGL, at a position well away from terrain
- ❑ Practice turns at 30° and 45° of bank angle at search airspeed
- ❑ Practice emergency canyon turn and/or modified wingover

Updraft / downdraft locations and magnitudes

- ❑ Establish level flight in stable air (away from areas of up and downdrafts) at search airspeed (~85 KIAS or Vy + 10, whichever is higher) with flaps at search setting (10-25°). Record power setting: _______
- ❑ Locate a valley or canyon with an axis perpendicular to the prevailing wind. Have the pilot point out expected areas of up and downdrafts (windward / leeward slopes, bright / dark slopes).
- ❑ Fly parallel to the leeward side of a ridge into a downdraft area. Maintain airspeed and power setting, allowing aircraft to change altitude. Record rate of descent: _______
- ❑ Fly out of downdraft area, climb back to starting altitude and return to the leeward side of the ridge. Maintain altitude and power setting. Note change in airspeed and pitch resulting from climb against the downdraft. Record airspeed: _______
- ❑ Apply full power, transition to Vy for the aircraft weight / density altitude. Record the rate of climb: _______

- ❑ Fly away from the ridge and out of the downdraft. Climb back to the original altitude and fly to the windward side of a ridge.
- ❑ Slow to search speed as above, and set the power to what it was in the first step of this section. Maintain airspeed and power setting, allowing aircraft to change altitude. Record rate of climb: _______
- ❑ Fly out of updraft area, descend to starting altitude and return to the windward side of the ridge. Maintain altitude and power setting. Note change in airspeed and pitch resulting from dive against the updraft. Record airspeed: _______

- [ ] Apply full power, transition to Vy for the aircraft weight / density altitude. Record the rate of climb: _______

High - Altitude / Unfamiliar Field Approach and Landing

- [ ] Proceed to the another high altitude airport. Over-fly at least 1000 AGL from highest obstacle, in rectangular pattern.
- [ ] Note wind conditions, approach and departure obstacles, condition of runway, best approach path.
- [ ] Proceed to downwind leg for landing. Adjust mixture for best power for a go-around. Test climb performance with a full-power climb. If sustained ROC is < 300 fpm, do not land.
- [ ] Call pilot's attention to need for wider landing pattern / higher rate of descent due to higher true airspeed due to high density altitude.
- [ ] Perform normal landing. After clearing runway, record altimeter reading: _______ Record difference from known field elevation: _______ Reset altimeter to field elevation.

High - Altitude / Unfamiliar Field Takeoff

- [ ] If runway has visible slope, taxi to each end of runway. Record altimeter readings: departure end: _______ approach end: _______ Difference: _______
- [ ] Calculate percent runway slope: (difference / runway length) x 100
  Example: (80' difference / 2000' runway) x 100 = 4% slope: _______
- [ ] Determine takeoff distance taking into account slope, wind, and obstructions.
- [ ] Prior to takeoff, lean mixture and perform full power run-up (as per POH).
- [ ] Recalculate takeoff distance for current conditions: _______
- [ ] Allow 100 percent margin for required distance. Identify abort, takeoff and 50' markers along runway.
- [ ] Review airspeeds for: rotation, Vx, and Vy.
- [ ] Perform short field takeoff. Record distance (or time) past markers for:
  - takeoff roll: _______
  - distance to 50' altitude: _______
- [ ] If time permits, practice soft field takeoff / landing.
- [ ] Return to base.

Postflight Debrief

- [ ] Compare actual distances obtained for takeoff / landing to predicted distances.
- [ ] Discuss performance during pilotage exercises, simulated emergencies, possible effects of hypoxia / fatigue.
- [ ] Review aircraft performance obtained during flight in up and downdrafts. Note changes in airspeed to maintain level flight as indicators of the presence of up/downdrafts.
- [ ] Discuss use of available lift for increased climb performance.
- [ ] Review operations at second airport. Note altimeter errors recorded. Compare actual takeoff / landing distances to pre-flight estimates.
- [ ] Complete applicable portions of Flying Gradesheet
- [ ] Instructor Pilot: endorse trainee's records and completion certificate

END OF SORTIE NUMBER THREE