Mountain Fury
Mountain Search Flying
Course Syllabus

Second Sortie : Advanced Aircraft Performance

Objectives

1. Develop trainee's proficiency in normal and emergency turn techniques for high altitude search operations.
2. Develop trainee's knowledge of effect of altitude on turn and climb performance.
3. Develop trainee's ability to estimate wind speed and turn distances.
4. Introduce and develop techniques for controlled impact with terrain, ridge search procedures, and downdraft escape.

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 two 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 Second 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 turn performance calculations

Calculate critical airspeeds at sea level (or the airport elevation) through 12,000 feet density altitude 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. Also calculate and record the expected distances required to complete 30°, 45° and 60° turns at low and high altitude. 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 for the sortie.

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. While flying the sortie the air work should be conducted at an altitude far away from any obstacles and well above terrain. An altitude of 3,000 feet AGL is suggested. Sufficient altitude to recover from an inadvertent stall/spin is needed.

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.

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. Select an altitude at which to perform high altitude maneuvers. This should be between 8,000 and 12,000 feet depending on expected aircraft performance and availability of oxygen for the crew. Compare this to the density altitudes calculated from the winds aloft forecast during preflight preparation and note the indicated altitude that will be needed to achieve the desired density altitude.

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

Discuss procedures for:

- power off course reversal
- ridge search technique
- distance estimation technique.

Complete a CAP safety inspection form for the aircraft.

A note on record keeping

This sortie requires that a substantial amount of data be collected and recorded in flight. The goal is that the trainee obtain a quantitative measure of the aircraft performance that he or she can obtain so that the benefits of using these procedures and techniques be fully understood. The items that need to be recorded consist of either times in seconds, distances or altitudes in feet, and occasionally a heading or groundspeed off of a navigation radio. In all but one case only one number need be recorded per maneuver, so this work should not constitute a major distraction for the instructor. If however the instructor feels that this would compromise his or her ability to instruct or maintain the safety of the flight, it would be reasonable to add another crewmember to the flight whose sole duty would be to record data. If an additional crewmember is needed, it would be best to select the lightest possible person so that aircraft weight can be minimized and thus have the least possible effect on aircraft performance.

Turning and Climb Performance Demonstrations

The goal of the turning maneuvers is to demonstrate the relative turn performance obtained at various bank angles, airspeeds and altitudes. The first set of maneuvers is intended to provide a performance baseline for comparison to flying these maneuvers at mountain search altitudes. The second set will show how that performance changes at high altitude.

Depart the airport and proceed to the practice area. Climb to a safe altitude to perform these maneuvers. 3000' AGL is recommended as sufficient for recovery from incorrectly flown maneuvers yet low enough to show differences in performance versus when these maneuvers are repeated at high altitude.

Establish search airspeed (approximately 85 KIAS, as appropriate to the aircraft) with flaps at search setting (10-25°). A series of 180° turns will be flown to demonstrate the effect of bank angle on the time needed to complete the turn. These times will be converted to turn diameter during the postflight debriefing for comparison with the performance calculations made before the flight.

It is important to keep in mind that:

- 30° is the maximum bank angle that should be used while searching
- 45° is the maximum bank angle that should be used for establishing position, and
- 60° bank angle should be reserved for emergency escape and is the maximum that should be used.

Perform and time 180° turns at 30°, 45°, and 60° of bank. Record the time to complete each turn.

Perform and time a canyon turn (using the technique described in Sortie Number One) at minimum safe speed above stall for 180° of heading change at 60° of bank. Record the time to complete the turn. This turn should take less time and distance than the three turns above.

The next series of maneuvers are power-off course reversals. The goal is to learn the technique that will allow a course reversal with a minimum loss of altitude following an engine failure. You would probably want to use such a maneuver when the engine loses power or fails while headed toward higher terrain. These maneuvers show that the conventional technique of flying at best glide speed in a shallow bank is not optimal.

Reduce power to idle, establish best glide speed, and perform a 180 degree turn at 30° of bank. Record the altitude lost in turn, then climb back to 3000' AGL. Repeat this maneuver at 45° of bank again at best glide speed. Record the altitude lost in turn, then climb back to 3000' AGL.

This next maneuver demonstrates the optimal technique. It should produce an altitude loss of less than half of the 30° bank turn at best glide speed. Reduce power to idle. Perform a 180 degree turn at 45° of bank at the slowest airspeed which you can safely maintain without stalling. Record altitude lost in the turn.

The above set of turning maneuvers will be repeated at a higher altitude to demonstrate the effect of altitude on turn radius and altitude lost in a power off course reversal. The climb performance will be checked at the beginning and end of the climb to demonstrate the effect of airspeed on rate of climb and to establish the actual rate of climb achieved.

Enter a climb using the airspeed for Vy at sea level, maximum gross weight with flaps up. After the VSI stabilizes, record the rate of climb. An alternative and more accurate method to obtain the rate of climb is to climb for 1 minute and record the actual change in altitude.

Return to the previous altitude. Enter a climb using the airspeed for Vy for the current density altitude and weight as you calculated during your preflight preparations. Record the rate of climb achieved.

Continue the climb to the altitude selected before the flight for the desired density altitude to simulate high altitude search. Cruise-climb airspeed may be used if desired to keep the engine from becoming too hot. When you reach the pre-selected altitude, change to the airspeed listed in the POH for Vy at sea level, maximum gross weight. After the VSI stabilizes, record the rate of climb.

Return to pre-selected altitude. Enter a climb using the airspeed for Vy for the current density altitude and weight, and record the rate of climb. Return to the pre-selected altitude.

Repeat each of the turn maneuvers described above and record the results. The data will be reviewed after the flight so that the trainee can more fully appreciate the change in aircraft performance. Again, fly at search airspeed (~85 KIAS) with flaps at search setting (10-25°). For reference, these maneuver are:

180° turns at 30°. 45°, and 60° of bank,
a canyon turn flown at 60° of bank and the minimum safe airspeed above stall,
power-off course reversals at 30° and 45° of bank at best glide speed,
power-off course reversal at 45° of bank at the minimum safe airspeed above stall.

Simulated Controlled Impact

On rare occasion during mountain search operations a collision with terrain may become unavoidable. This might be due to weather closing in rapidly, an errant turn toward terrain, or a mechanical problem. Under such circumstances it can save your life to know how to impact the terrain with minimum energy to allow the smallest chance of injury, or at least minimize injuries. This maneuver is an emergency procedure for that situation. It simulates rolling out of a turn just prior to impact and then pulling up to reduce airspeed to the minimum possible without stalling.

Climb back to the pre-selected search altitude and resume flight at search airspeed (~85 KIAS) with flaps at search setting (10-25°). Enter a turn with 30° of bank.

Roll-out to wings level, then simultaneously apply full power and smoothly raise the nose to achieve level flight with the stall warning horn sounding. Hold this airspeed for at least 10 seconds. Recover to level flight.

Repeat this maneuver starting with throttle at idle and best glide airspeed.

Simulated Downdraft Escape

Up and downdrafts are common in mountainous areas. It is inevitable that downdrafts will be encountered that exceed the climb performance of the aircraft. The following maneuver is intended to simulate the effect of a downdraft and have the trainee respond by using an appropriate technique to minimize altitude loss. Glider technique is used, which dictates that airspeed be increased to quickly fly out of the area of the downdraft.

Resume flight at search airspeed (~85 KIAS) with flaps at search setting (10-25°)
Simulate a downdraft by either reducing power and increasing drag (extend gear) and/or point to the VSI and state that the aircraft is descending at 1000 fpm (or twice the aircraft's expected rate of climb, whichever is higher).

Increase power slightly and change speed to Vy. This simulates the effect of trying to climb against a strong downdraft. Note the rate of climb (should still be a descent).

Simulate a downdraft escape by lowering the nose and increasing speed to Va, and then to normal cruise speed (raising flaps and gear if necessary). The aircraft will be descending at a faster rate at the higher airspeeds, but the increased speed will result in leaving the downdraft area more quickly and produce a smaller total altitude loss.

Distance and Crosswind Estimation

It is often useful during search flying to be able to estimate distances on the ground. This skill can be used to determine whether there is sufficient room to fly into a particular area or to direct ground crews to a particular point. It is also important to be able to judge winds in the search area as they can present a hazard to search operations. These maneuvers are intended to develop skills in judging distances and winds.

Distance estimation by flying in a straight line:
Descend to 1000 to 2000 feet AGL (consistent with safety for the weather conditions). Select two prominent points on the ground that are approximately 1000 feet apart based on your visual approximation of that distance. It would be ideal if you can determine the exact distance

between two such points through other means, such as from a topographic chart or ground survey or GPS data.

Fly at an airspeed that yields 100 knots groundspeed (but no slower than normal search indicated airspeed) and take up a position and heading to fly a course to cross the two points. Record the time it takes to fly between the two points. Each 6 seconds corresponds to 1000 feet.

Distance estimation with turn radius:
Fly to a position that is perpendicular to the previous course abeam one of the points. Fly over the point and enter a 45° turn toward the second point. Note the position over the ground upon completing 180 degrees of turn. At 100 knots true airspeed and a 45° bank the turn radius is about 1000 feet (actually 890 feet). Each 10 knots of wind will move the end point of the turn by about 280 feet.

Crosswind Estimation:
Select a road or ridge which is perpendicular to the wind direction.
Fly at an airspeed that yields 100 knots groundspeed (but no slower than normal search indicated airspeed) and fly along (while safely above) the road or ridge. Record the ridge alignment and crab angle.

Each 10 knots of crosswind component will produce 6° of crab. Divide the crab angle by 6 and multiply by 10 to find the crosswind component.

If GPS, LORAN, or DME is available use that equipment to find the wind velocity. Turn into the wind and record the groundspeed, then turn 180 degrees and record groundspeed again. The difference in groundspeeds is the wind velocity. During postflight debrief, use a crosswind chart or calculator to determine the crosswind component.

"Ridge Soaring" Search Technique

Searching a ridge has some inherent hazards as you are in close proximity to high terrain that often rises more steeply than the aircraft can climb. Thus it is important that ridges be searched in a manner that minimizes the chances of flying into that terrain. The glider community has developed a technique for safely exploiting the lift that can be found on the windward sides of ridges. This is called ridge soaring. The aircraft is flown parallel to the ridge until the end is reached, then a turn is made away from the ridge through about 225°. This puts the aircraft pointing back toward the ridge at a 45 degree angle. The aircraft is then turned in the opposite direction for 45° so that it is once again flying parallel to the ridge but now in the opposite direction from the first pass. In strong winds are blowing toward the ridge the initial turn should be less than 225° as the wind will increase the angle of the ground track toward the ridge. The most important features of this technique are that the aircraft never heads directly toward the terrain and is never more than 45° of turn from flying away from the ridge. This maneuver is practiced here for familiarity. Its use is recommended whenever a point or area on a ridge needs to be viewed repeatedly.

Select a ridge (or road as a simulated ridge). Fly along the windward side of the ridge and practice making a series of teardrop turns (approximately 225° of heading change) with the start of the turn away from the ridge, followed by a turn away from the ridge to end up paralleling the ridge in the opposite direction. The instructor should emphasize importance of always turning away from the ridge and scanning for traffic.

Postflight Debrief

Review the data recorded during the flight for comparison to POH data and calculated turn performance. This provides the trainee with an objective look at how much of the book performance he or she can obtain. Compare estimated to actual values for rates of climb and time and distance to complete 180 degree turns. Compare the altitude lost using 30° and 45° bank angles at best glide speed to that lost when turning at 45° of bank and minimum safe airspeed. This review should aid in the trainee in more fully understanding the actual performance capability of the airplane. Also review the pilot's results in estimating distance using time for distance and by using turn diameter.

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.

Satisfactory performance is a judgment call on behalf of the check pilot. If the pilot understands the requirements and can execute those requirements in accordance with the FAA test standards for his rating in the judgment of the check pilot, the pilot's records should be endorsed to move on to the next phase of the program.

The check pilot should endorse the Mountain Fury completion certificate when this first training section (sorties one and two) has been completed successfully.

Set up a schedule for more training if needed.

Detailed Description of Emergency Power-off Course Reversal Maneuver:

If your engine fails or loses power for any reason while flying over inhospitable terrain at a low altitude, your first priority will likely be to turn the aircraft toward lower terrain with the minimum possible loss of altitude. This will give you the greatest chance of dealing with the problem or simply more time to find a better place to land. Most pilots will try to do this by flying at best glide speed with a shallow to moderate bank angle. This is not the optimum technique however.

The turn technique to produce a minimum altitude loss while reversing course with power off is to use a 45° bank at the slowest airspeed you can fly while staying safely above stall speed. In simplified terms, you can think of the 45° bank as the best balance between using the lift of the wing for turning and keeping the airplane up. Best glide speed is not desirable as it produces the longest glide distance, but that's not what you want in this case. You're looking for the least altitude lost in the turn, not the greatest distance you can fly while turning. For a given bank angle, the slower you fly, the faster the rate of turn. The minimum rate of altitude loss is usually at a speed that is fairly close to stall speed. Thus while in a 45° bank at slow airspeed the airplane turns rapidly while descending relatively slowly, with the result being the smallest altitude loss possible to reverse course.

If this maneuver is performed correctly in a C-172, course can be reversed in less than 250 feet at 10,000 feet density altitude. In a C-182, in less than 350 feet. At best glide in a 30° bank, the altitude loss would be over 750 feet for the C-172, and over 1000 for a C-182. This is a big difference when conducting search operations at or below 1000 feet AGL.

If the engine fails, as soon as you realize you need to turn you should begin that turn and roll to a 45° bank. Hold the nose up to bleed off airspeed as you turn until you hear the stall warning horn or reach the slowest speed at which you're comfortable flying under the conditions. At this point you should adjust back pressure on the yoke to maintain the desired airspeed. Relax back pressure and transition to best glide speed once you're heading in the desired direction.

Some pilots try to pull up after the engine failure to try to trade airspeed for altitude before they begin the turn. If you're heading toward higher terrain this is not a good idea as you'll be going in the wrong direction that much longer. In any case, the altitude gain from a pull up is usually fairly small, especially when you're starting from search airspeed. In addition, a pull-up makes the maneuver more complicated and will require more of your attention at a time when you have other things to think about, like finding a good place to land or getting the engine restarted. Keeping things simple will raise the chances of successfully dealing with this emergency.

MOUNTAIN FURY
SORTIE NUMBER TWO
OUTLINE / DATA RECORDING FORM

PILOT ____

CHECK PILOT ____

Check Pilot Number _________

Date of Sortie _______________ **Aircraft Type** __________

Location ____________________

Preflight Preparation

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	___________

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	________	________	________	________	________

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)	________	________	________	________

Desired density altitude for high altitude maneuvers (8-12,000 feet) ________
Indicated altitude (approximate) for above density altitude ________
(NOTE: this is the indicated altitude you will use for this sortie)

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: ________

EXAMPLE: C-182Q, @2612 lb, 2950 lb max gross weight

Airspeeds for max gross weight: --------------- density altitude -------------------

	sea level	6,000'	8000'	10,000'	12,000'
Vx	54	59	60	62	64
Vy	78	74	73	72	71
Vy ROC from POH	1010	680	570	460	350

stall speed flaps up, KCAS 59
stall speed, search configuration (flaps), KCAS 57 (10° flaps)
stall speed, search config, 45° bank ↳ x 1.2 = 68
stall speed, search config, 60° bank ↳ x 1.4 = 80
canyon turn entry airspeed KCAS ↳ + 10 = 90
canyon turn entry airspeed KIAS (use table in POH/AFM) 91

Va 111
best glide 70

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	51	56	56	58	60
Vy	73	70	69	68	67

stall speed flaps up, KCAS 56
stall speed, search configuration (weight, flaps), KCAS 54
stall speed, search config, 45° bank ↳ x 1.2 = 65
stall speed, search config, 60° bank ↳ x 1.4 = 76
canyon turn entry airspeed KCAS ↳ + 10 = 86
canyon turn entry airspeed KIAS (use table in POH/AFM) 87

Va 104
best glide 66

From Winds Aloft Forecast (FD)	3000'	6000'	9000'	12000'
wind / temperature	0314 ~17	0618+19	0721+12	0624+04
density altitude (calculate)	3,926	7,820	10,700	13,471

Desired density altitude for high altitude maneuvers (8-12,000 feet) 10,000
Indicated altitude (approximate) for above density altitude 8,300
(NOTE: this is the indicated altitude you will use for this sortie)

Altimeter setting	29.85
Field elevation	1,531
Temperature	25 C
Density Altitude	3,035

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 = 1,283 (@ 85 KIAS)
30° bank at sea level: 45° bank distance x 1.75: ↳ x 1.75 = 2,246
60° bank at sea level: 45° bank distance x 0.6: ↳ x 0.6 = 770

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 = 1,848 (@85KIAS/10K')
30° bank at search altitude: 45° bank distance x 1.75: ↳ x 1.75 = 3.234
60° bank at search altitude: 45° bank distance x 0.6: ↳ x 0.6 = 1,109

Total time flown on this sortie: _______

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

Takeoff and Climbout

- ❑ Proceed to practice area.
- ❑ Level off at least 3000 AGL

Turning and Climb Performance Demonstrations

Low altitude turn performance

- ❑ Fly at search airspeed (~85 KIAS) with flaps at search setting (10-25°)
- ❑ Perform and time a 180° turn at 30° of bank. Record the time to complete the turn: _______
- ❑ Perform and time a 180° turn at 45° of bank. Record the time to complete the turn: _______
- ❑ Perform and time a 180° turn at 60° of bank. Record the time to complete the turn: _______
- ❑ Perform and time a canyon turn at minimum safe speed above stall for 180° of heading change at 60° of bank. Record the time to complete the turn: _______

- ❑ Reduce power to idle, establish best glide speed.
- ❑ Perform a 180 degree turn at 30° of bank. Record altitude lost in turn: _______
- ❑ Climb back to 3000' AGL.
- ❑ Reduce power to idle, establish best glide speed.
- ❑ Perform a 180 degree turn at 45° of bank. Record altitude lost in turn: _______
- ❑ Climb back to 3000' AGL.
- ❑ Reduce power to idle.
- ❑ Perform a 180 degree turn at 45° of bank at the slowest airspeed which you can safely maintain without stalling. Record altitude lost in turn: _______

Climb Performance

- ❑ Enter a climb using the airspeed for Vy at sea level, maximum gross weight with flaps up. After the VSI stabilizes, record the rate of climb (or climb for 1 minute and record actual climb): _______
- ❑ Return to previous altitude. Enter a climb using the airspeed for Vy for the current density altitude and weight. Record the rate of climb: _______
- ❑ Climb to the altitude selected before the flight for the desired density altitude.
- ❑ Enter a climb using the airspeed for Vy at sea level, maximum gross weight. After the VSI stabilizes, record the rate of climb (or climb for 1 minute and record actual climb): _______
- ❑ Return to previous altitude. Enter a climb using the airspeed for Vy for the current density altitude and weight. Record the rate of climb: _______

High altitude turn performance

- ❑ Return to previous altitude and level off at search airspeed (~85 KIAS) with flaps at search setting (10-25°)
- ❑ Perform and time a 180° turn at 30° of bank. Record the time to complete the turn: _______
- ❑ Perform and time a 180° turn at 45° of bank. Record the time to complete the turn: _______
- ❑ Perform and time a 180° turn at 60° of bank. Record the time to complete the turn: _______
- ❑ Perform and time a canyon turn at minimum safe speed above stall for 180° of heading change at 60° of bank. Record the time to complete the turn: _______
- ❑ Reduce power to idle, establish best glide speed.
- ❑ Perform a 180 degree turn at 30° of bank. Record altitude lost in turn: _______

- ❑ Climb back to the pre-selected search altitude.
- ❑ Reduce power to idle, establish best glide speed.
- ❑ Perform a 180 degree turn at 45° of bank. Record altitude lost in turn: _______
- ❑ Climb back to the pre-selected search altitude.
- ❑ Reduce power to idle.
- ❑ Perform a 180 degree turn at 45° of bank at the slowest airspeed which you can safely maintain without stalling. Record altitude lost in turn: _______

Simulated Controlled Impact

- ❑ Resume flight at search airspeed (~85 KIAS) with flaps at search setting (10-25°)
- ❑ Enter a turn with 30° of bank.
- ❑ Roll-out to wings level, then simultaneously apply full power and smoothly raise the nose to achieve level flight with the stall warning horn sounding. Hold this airspeed for at least 10 seconds.
- ❑ Recover to level flight.
- ❑ Resume flight at search airspeed (~85 KIAS) with flaps at search setting (10-25°)
- ❑ Reduce power to idle and change to best-glide airspeed.
- ❑ Enter a turn with 30° of bank.
- ❑ Roll-out to wings level, then smoothly raise the nose to achieve level flight with the stall warning horn sounding. Hold this airspeed for at least 10 seconds.
- ❑ Recover to level flight.

Simulated Downdraft Escape

- ❑ Resume flight at search airspeed (~85 KIAS) with flaps at search setting (10-25°)
- ❑ Simulate a downdraft by either reducing power and increasing drag (extend gear) and/or point to the VSI and state that the aircraft is descending at 1000 fpm (or twice the aircraft's expected rate of climb, whichever is higher).
- ❑ Increase power slightly and change speed to Vy. Note rate of climb.
- ❑ Simulate downdraft escape by lowering the nose and increasing speed to Va, and then to normal cruise speed (raising flaps and gear if necessary). Note rate of descent at each speed.

Distance and Crosswind Estimation

Distance Estimation:

- ❑ Descend to 1000 to 2000 feet AGL (consistent with safety for wx conditions).
  Select two prominent points on the ground that are approximately 1000 feet apart.
- ❑ Fly at an airspeed that yields 100 knots groundspeed (but no slower than normal search indicated airspeed) and take up a position and heading to fly a course to cross the two points. Record the time it takes to fly between the two points: _______
- ❑ Fly to a position that is perpendicular to the previous course abeam one of the points.
- ❑ Fly over the point and enter a 45 degree turn toward the second point. Note the position over the ground upon completing 180 degrees of turn.

Crosswind Estimation:

- ❑ Select a road or ridge which is perpendicular to the wind direction.
- ❑ Fly at an airspeed that yields 100 knots groundspeed (but no slower than normal search indicated airspeed) and fly along (while safely above) the road or ridge. Record the magnetic direction of the ridge: _______ Record the crab angle: ______
- ❑ Estimate crosswind component (10 knots per 6° of crab): _______
- ❑ If GPS, LORAN or DME is available, turn into the wind, record groundspeed: _______ turn 180 degrees, record groundspeed: _______ Difference in groundspeeds: _______

"Ridge Soaring" Search Technique

- ❑ Select a ridge (or road as a simulated ridge)
- ❑ Fly along the windward side of the ridge and practice making a series of teardrop turns (approximately 225° of heading change) with the start of the turn away from the ridge, followed by a turn away from the ridge (of approximately 45°) to parallel the ridge in the opposite direction.
- ❑ Emphasize importance of always turning away from the ridge and scanning for traffic.

Postflight Debrief

Compare estimated performance to actual performance for:

- ❑ Time to make a 180° turn using various bank angles and canyon turn technique at low and high altitudes
- ❑ Calculate and compare approximate turn diameter for each turn.
  Diameter in feet = true airspeed (in knots) X seconds for 180° turn X 1.1
  Note effect of bank angle, speed and altitude on turn radius
- ❑ Rate of climb difference from using Vy for max gross versus Vy adjusted for weight at low and high altitude
- ❑ Compare altitude lost in power-off 180° using turns at best glide speed vs minimum speed turn.
- ❑ Review results in estimating wind direction and speed.
- ❑ Review performance of ridge search technique.
- ❑ Complete applicable portions of Flying Gradesheet
- ❑ Instructor Pilot: endorse trainee's records and completion certificate

END OF SORTIE NUMBER TWO