Winnipeg Headingley Aero Modellers

Now…
How Do I Do This?

[Advanced Flying Training]

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Advanced Flying Training

Objective

The objective of the **Advanced Flying Training** syllabus is to provide the Instructor Pilot a suggested structure for the presentation of advanced flying techniques to qualified pilots. It is intended that, upon successful completion of the training exercises, the graduate pilot will be able to safely and competently fly the maneuvers comprising the 1998 IMAC Basic Sequence.

Liability

The Instructor Pilot is to ensure that, before any flights are undertaken, the student pilot clearly understands that WHAM and its staff of Instructor Pilots will assume no liability for any damage to airplanes or objects with which the training airplane may come into contact during any training session.

Exercise 1 - Safety of Operations Review

Objective

To review with the student features of the WHAM airfield environment and the safety related requirements during flying operations.

Essential Background

1. Review:
   a. the WHAM airfield environment, pointing out the landmark features which will be used during the training exercises, and,

   b. the safety requirements for flying operations, including those related to activities within the pit area.

Advice to Instructors

1. In reviewing the airfield environment, emphasize that most of the training exercises will take place parallel to the active runway and approximately 100 yards out from the pilot's position, at altitudes between 20' and 500'. The line projected out from the pilot's position at 90 degrees to the runway is called the pilot centerline.

2. In reviewing the safety requirements, emphasize that the nature of the training exercises can easily lead to the loss of situational and positional awareness, that special effort will be needed to avoid the "**no fly**" areas of the airfield.

3. Inform the student that, in the event of any incursion of unusual attitudes and maneuvers into any of the "**no fly**" areas, including between the active runway and the pilot's position, he will be commanded to **"Knock It Off"** and return to a safe area.

4. Ensure the student is clear on the liability position assumed by WHAM and its Instructor Staff in the event of an accident during the training exercises.

Exercise 2 - Airplane Preparation

Objective

To determine the flight readiness and suitability of the airplane selected by the student to be used during these advanced training exercises.

Essential Background

As the student is a qualified and relatively experienced pilot and likely quite familiar with the airplane selected for the training, responsibility for the basic flight readiness of the airplane should rest with the student.

Advice to Instructors

1. Discuss the desirable features of a basic aerobatic airplane and compare to those of the training airplane, highlighting any expected limitations of the training airplane:

    a. symmetrical airfoil,

    b. tapered wing planform, for improved roll response,

    c. long tail moment, for improved pitch and yaw response,

    d. correctly positioned center of gravity,

    e. laterally balanced,

    f. wing loading of 20 – 24 ounces per square foot for good stall characteristics and vertical performance,

    g. sealed or close tolerance elevator and aileron hinge lines,

    h. full and free movement of the control surfaces, and,

    i. good contrast between the colors of the top and bottom of the airplane.

Exercise 3 - Airplane Trimming

Objective

To investigate the flying characteristics of the training airplane and to determine what, if any, corrections or adjustments are required so that the airplane can be easily used as an aerobatic training platform.

Essential Background

1. Explain that to accurately trim an airplane for competition requires patience, keen observation and a number of flights; however, for the purpose of learning basic aerobatic maneuvers, it is only required that the airplane:

    a. flies predictably and reliably,

    b. flies straight and level with the trim switches neutral and hands off the control sticks, and,

    c. does not depart controlled flight when placed in extreme attitudes at various power settings and airspeeds.

Advice to Instructors

1. Fly the airplane through several maneuvers involving unusual attitudes (stall turns, rolls, spins) and using a variety of power settings and airspeeds.

2. Observe and have the student note any undesirable characteristics and the conditions in which they occur, including the trim switch positions required to fly straight and level with hands off the control sticks.

3. After having landed and returned to the pit area, discuss in detail each of the undesirable characteristics observed, the probable causes and the required adjustments or corrections. Have the student make the necessary changes to the airplane.

4. Fly the airplane again through a similar range of maneuvers to determine if further adjustments are required.

5. Upon landing, have the student make further changes or declare the airplane useable as an aerobatic training platform.

Exercise 4 - The Inside Loop

Objective

To teach flying the Inside Loop as a centered display maneuver.

Advice to Instructors

1. Explain that:

   a. flying a truly round loop takes significant concentration and is not as easy as it may look,

   b. power management is crucial to the presentation of an elegant and graceful display, and,

   c. roll and yaw corrections in a loop are achieved by the use of rudder. Ailerons may be used to correct a roll if it occurs during the segments where the elevator position is neutral.

Air Instruction

1. Demonstrate the Inside Loop by:

   a. establishing straight and level flight from either end of the aerobatic zone, parallel to the runway, approximately 100 yards out, at a low-to-medium altitude and at about 2/3 throttle,

   b. as the pilot centerline is approached advance to full throttle and smoothly apply up-elevator, establishing the desired radius of the loop (75' – 100' in diameter),

   c. hold the initial up-elevator input until the vertical position is reached, then progressively increase the up-elevator input as the airplane slows and control effectiveness decreases,

   d. adjust the elevator input smoothly and carefully to maintain the radius of the loop,

   e. as the airplane approaches the top of the loop begin to reduce the up-elevator input and reduce the throttle to above idle; the amount of elevator input and throttle over the top depends greatly upon the wind strength,

   f. as the airplane passes top center, gradually input up-elevator again and reduce the throttle to idle,

g. as the airplane enters the final quarter of the loop, begin to advance the throttle to maintain constant airspeed and reduce the up-elevator input while the airplane exits the loop, straight and level, at the entry altitude and heading, flying toward the end of the aerobatic zone and a turn-around maneuver.

Exercise 5 - The Stall Turn

Objective

To teach flying the Stall Turn both as a turn-around and centered display maneuver.

Advice to Instructors

1. Explain that:

    a. this maneuver is used to reverse the airplane's direction of flight, with no resultant change in altitude, after having completed a centered display, and,

    b. the grace and elegance of this maneuver is best achieved by not rushing the airplane through it.

Air Instruction

1. Demonstrate the Stall Turn as a turn-around maneuver by:

    a. establishing straight and level flight toward either end of the aerobatice zone, parallel to the runway, approximately 100 yards out, at a low-to-medium altitude and at full throttle,

    b. when the airplane reaches a position approximately 100 feet beyond the pilot centerline, commence the maneuver by inputting up-elevator to bring the airplane smoothly into a vertical climb,

    c. once established on the vertical up-line, neutralize the elevator input and reduce the throttle to idle, allowing the airplane to decelerate,
    d. at a point where sufficient control effectiveness remains, smoothly input either left or right rudder to yaw the airplane into a vertical down attitude,

    e. reduce the rudder input as the airplane achieves a vertical down-line, allowing the airplane to accelerate, and,

    f. as the airplane approaches the entry altitude, begin to smoothly input up-elevator and advance the throttle to maintain airspeed while achieving straight and level flight approaching the pilot centerline for entry into the next centered display maneuver.

2. Demonstrate the Stall Turn as a centered display maneuver by:

a. establishing straight and level flight toward either end of the aerobatic zone, parallel to the runway, approximately 100 yards out, at a low-to-medium altitude and at full throttle,

b. as the pilot centerline is approached, smoothly pull up into a vertical climb, and deciding how high the maneuver is to be,

c. perform a ¼ roll at the half-way point, in the direction which will show the top of the airplane, maintaining the vertical up-line,

d. as the airplane approaches the planned top of the maneuver, begin the stall turn by reducing throttle to idle,

e. at a point where sufficient control effectiveness remains, smoothly input full rudder to yaw the airplane into a vertical down attitude,

f. reduce the rudder input as the airplane achieves a vertical down-line, allowing the airplane to accelerate,

g. at the half-way point, perform a ¼ roll in the opposite direction as on the up-line,

h. as the airplane approaches the entry altitude, smoothly input up-elevator and advance the throttle to maintain airspeed while achieving straight and level flight toward the end of the aerobatic zone for the next turn-around maneuver.

Exercise 6 - The Continuous Roll

Objective

To teach flying the Continuous Roll as a centered display maneuver.

Advice to Instructors

1. Explain that:

   a. a simple aileron roll will be practiced first,

   b. it will be entered from a nose up attitude to minimize altitude loss, and,

   c. it should take about 3 seconds for the airplane to complete a simple roll.

2. Have the student perform the initial rolls in only one direction, e.g., rolling right starting from the right end of the aerobatic zone. When the student is comfortable, progress to rolls in the opposite direction and entering from the other end of the aerobatic zone.

3. Once the student is competently performing simple aileron rolls, progress to the more refined roll by introducing elevator inputs to maintain altitude.

4. As the student develops confidence, progress to linking 2 or more rolls together, striving to maintain entry altitude and heading.

Air Instruction

1. Demonstrate the Continuous Roll by:

   a. establishing straight and level flight from either end of the aerobatic zone, parallel to the runway, approximately 100 yards out, at a medium altitude and at full throttle,

   b. as the airplane approaches the pilot centerline pull the nose up to about 15 degrees, neutralize the elevator and smoothly input full left or right aileron deflection,

   c. wait for the airplane to roll all the way around,

   d. as the airplane approaches the upright position, smoothly reduce aileron input to neutral, and,

e. correct the airplane back to straight and level flight at the entry altitude and heading.

2. Once the student is proficient in the simple aileron roll, demonstrate the use of elevator to achieve a more axial roll, eliminating the need to begin the roll by pitching the nose up:

   a. establishing straight and level flight from either end of the aerobatic zone, parallel to the runway, approximately 100 yards out, at a medium altitude and at full throttle,

   b. as the airplane approaches the pilot centerline, initiate the roll with smooth aileron input, maintaining a nose level attitude,

   c. as the airplane rolls toward the inverted position, smoothly input approximately 25% of down elevator,

   d. as the airplane continues to roll toward the upright position, smoothly neutralize the elevator input, then smoothly reduce the aileron input to neutral, and,

   e. strive to exit the roll at the entry altitude and to maintain runway heading, flying toward the next turn-around maneuver.

3. Demonstrate linking two axial rolls together by:

   a. establishing straight and level flight from either end of the aerobatic zone, parallel to the runway, approximately 100 yards out, at a medium altitude and at full throttle,

   b. perform the first roll so that it is complete as the airplane reaches the pilot centerline,

   c. without hesitation, perform the second roll as the airplanes departs the pilot centerline, exiting at the entry altitude and heading, flying toward the next turn-around maneuver.

Exercise 7 - The Immelmann Turn and Split–S Turn

Objective

To teach flying the Immelmann Turn as a turn-around maneuver.

While not part of the aerobatic sequence to be taught in Exercise 11, it is appropriate to teach, as part of this exercise, the Split-S Turn as a turn-around maneuver.

Advice to Instructors

1. Explain that:

    a. the Immelmann Turn is described as a half loop followed immediately by a half roll. The half roll must take place at the apex of the half loop, achieving straight and level flight in the reversed direction and with an upward adjustment in entry altitude for the next display maneuver, and,

    b. the Split-S Turn is described as a half roll followed immediately by a half loop, achieving straight and level flight in the reversed direction and with a downward adjustment in entry altitude for the next display maneuver.

Air Instruction

1. Demonstrate the Immelmann Turn by:

    a. establishing straight and level flight toward either end of the aerobatic zone, parallel to the runway, approximately 100 yards out, and at a low-to-medium altitude,

    b. as the airplane passes the pilot centerline apply full throttle and begin to pull the airplane up into a loop with a constant radius,

    c. as the airplane passes through the vertical position, smoothly reduce up-elevator input, using rudder to correct for drift and roll,

    d. as the airplane approaches the top of the half loop it will be near the stall so the roll into the upright position should be initiated using coordinated rudder and aileron inputs,

    e. finish the roll to the upright position with a small up-elevator input to maintain altitude while the airplane accelerates toward the entry point for the next display maneuver. The resulting increase in altitude should be approximately 75’ – 100’.

2. Demonstrate the Split-S Turn by:

    a. establishing straight and level flight toward either end of the aerobatic zone, parallel to the runway, approximately 100 yards out, at an altitude of approximately 300’ and about 2/3 throttle,

    b. as the airplane passes the pilot centerline, chop the throttle to idle and roll the airplane to the inverted position, causing the nose to drop,

    c. as the airplane descends toward the bottom of the half loop, smoothly input up-elevator,

    d. as the airplane exits the half loop, smoothly apply power and reduce the up-elevator input, allowing the airplane to accelerate toward the entry point for the next display maneuver. The resulting decrease in altitude should be approximately 75’ – 100’.

Exercise 8 - The Upright Spin

Objective

To teach flying the Upright Spin as a centered display maneuver.

Advice to Instructors

1. Explain that:

   a. the spin occurs when the airplane is stalled and caused to auto-rotate about its C of G, descending at a constant rate. If the speed builds, the airplane has not stalled and has entered a spiral dive, and,

   b. control inputs to recover from the spin should commence ¼ to ½ of a rotation before the desired stop point.

2. Emphasize that to successfully recover from a spin, the airplane must be allowed to descend with neutral elevator input to ensure the wings are "unstalled" and as the airplane accelerates, control effectiveness is regained. Aggressive and early input of up-elevator to regain upright flight could cause the wings to stall again with the airplane likely re-entering the spin.

Air Instruction

1. Demonstrate the Upright Spin by:

   a. establishing straight and level flight from either end of the aerobatic zone, parallel to the runway, approximately 100 yards out, at an altitude of at least 300' and about 2/3 throttle,

   b. as the airplane approaches the pilot centerline, reduce the power to idle, maintaining altitude with increasing up-elevator input as the airplane decelerates toward the stall, and directional control using smooth and small rudder inputs,

   c. as the airplane stalls and the nose drops through the level attitude, smoothly and firmly apply full rudder and aileron in the same direction and maintain full up-elevator, causing the airplane to auto-rotate about its C of G,

d. to initiate recovery, neutralize all control inputs to stop the auto-rotation and allow the airplane to achieve a steep nose-down attitude, enabling it to accelerate and regain flying speed,
e. after the airplane has regained flying speed, smoothly input up-elevator to complete the recovery to upright flight, adding power to maintain airspeed,

f. correct as necessary back to the entry heading, flying toward the next turn-around maneuver.

Exercise 9 - The Half and Reverse Half Cuban Eight

Objective

To teach flying the Half and Reverse Half Cuban Eight as turn-around maneuvers.

Advice to Instructors

1. Explain that:

    a. these maneuvers are used to reverse the airplane's direction of flight, with no resultant change in altitude, after having completed a centered display maneuver, and,

    b. the maneuvers are simply one-half of the full Cuban Eight and Reverse Cuban Eight which are centered display maneuvers.

2. Similar to the stall turn, elegance and grace in these maneuvers is achieved by not rushing the airplane through them, that power management is required to achieve smooth flowing maneuvers.

Air Instruction

1. Demonstrate the Half Cuban Eight by:

    a. establishing straight and level flight toward the end of the aerobatic zone, parallel to the runway, approximately 100 yards out and at a low-to-medium altitude,

    b. as the airplane passes the pilot centerline, apply full power, allowing the airplane to accelerate,

    c. as the airplane approaches the end of the aerobatic zone, smoothly pull up into an inside loop of approximately 100' in diameter,

    d. as the airplane completes 5/8's of the loop, begin inputting down-elevator to establish an inverted 45 degree down-line,

    e. estimating how far it is to the entry altitude, roll the airplane upright when halfway there,

    f. as the entry altitude is reached, apply up-elevator to exit using the same radius as during the loop segment, achieving straight and

level flight in the reversed direction, flying toward the entry point for the next display maneuver.

2. Demonstrate the Reverse Half Cuban Eight by:

   a. establishing straight and level flight toward the end of the aerobatic zone, parallel to the runway, approximately 100 yards out and at a low-to-medium altitude,

   b. as the airplane passes the pilot centerline, apply full power, pull up to a 45 degree up-line, and decide how high the maneuver is to be,

   c. hold the 45 degree up-line until the halfway point is reached, then roll the airplane inverted while maintaining the up-line,

   d. when the airplane reaches the top, reduce power and begin 5/8's of an inside loop, using a radius which ensures the airplane exits at the entry altitude,

   e. as the airplane exits, neutralize elevator input and add power to achieve straight and level flight in the reversed direction, flying toward the entry point for the next display maneuver.

Exercise 10 - The Humpty Bump

Objective

To teach flying the Humpty Bump as a turn-around maneuver.

Advice to Instructors

1. Explain that:

   a. this maneuver is used to reverse the airplane's direction of flight, after having completed a centered display maneuver,

   b. it can be used to adjust altitude from the exit altitude of one maneuver to the entry altitude of another,

   c. it also can be used to correct for cross-wind "blow-in" by adjusting the length of the cross-over at the top,

   d. the rolls must be centered in the straight, vertical segments, and the entry, cross-over and exit loop segments must be all of the same radius.

Air Instruction

1. Demonstrate the basic Humpty Bump with a Half Roll Up by:

   a. establishing straight and level flight toward the end of the aerobatic zone, parallel to the runway, approximately 100 yards out and at a low-to-medium altitude,

   b. as the airplane passes the pilot centerline, apply full power, allowing the airplane to accelerate,

   c. before the end of the aerobatic zone is reached, pull up into a ¼ inside loop to establish a vertical up-line, and decide how high the maneuver is to be,

   d. as the airplane reaches the half-way point, perform a ½ roll, and then pull into a ½ inside loop, reducing power to idle and flying the airplane over the top into a vertical down-line,

   e. exit using a ¼ inside loop, increasing power and regaining straight and level flight in the reversed direction, flying toward the entry point of the next display maneuver.

2. Demonstrate the basic Humpty Bump with a Half Roll Down by:

    a. establishing straight and level flight toward the end of the aerobatic zone, parallel to the runway, approximately 100 yards out and at a low-to-medium altitude,

    b. as the airplane passes the pilot centerline, apply full power, allowing the airplane to accelerate,

    c. as the end of the aerobatic zone is approached, pull up into a ¼ inside loop to establish a vertical up-line, and decide how high the maneuver is to be,

    d. continue to the top and enter a ½ inside loop, reduce power to idle and establish a vertical down-line,

    e. at the half-way point on the down-line, perform a ½ roll and continue on the down-line,

    f. exit at the entry altitude using a ¼ inside loop, increasing power, regaining straight and level flight and flying toward the entry point for the next display maneuver.

3. Demonstrate the Humpty Bump with a ¼ Roll Up and a ¼ Roll Down by:

    a. establishing straight and level flight toward the end of the aerobatic zone, parallel to the runway, approximately 100 yards out and at a low-to-medium altitude,

    b. as the airplane passes the pilot centerline, apply full power, allowing the airplane to accelerate,

    c. as the end of the aerobatic zone is approached, pull up into a ¼ inside loop to establish a vertical up-line and decide how high the maneuver is to be,

    d. as the airplane reaches the halfway point, perform a ¼ roll, and then pull into a ½ loop, reducing power to idle and flying the airplane over the top into a vertical down-line,

    e. at the same point as on the up-line, perform a ¼ roll in the opposite direction, continuing on the down-line,

f. exit at the entry altitude using a ¼ inside loop, increasing power and regaining straight and level flight in the reversed direction toward the entry point for the next maneuver.

Exercise 11 - The 1998 IMAC Basic Sequence

Objective

To teach flying a series of linked aerobatic maneuvers.

Advice to Instructors

1. Explain that this exercise combines those maneuvers learned in Exercises 4 through 10 as an introduction into the IMAC style of flying.

2. The 1998 IMAC Basic Sequence was chosen because of its simplicity and easy flow of one maneuver into the next.

Air Instruction

Demonstrate flying the Basic Sequence by entering the aerobatic zone into wind, straight and level and at a low-to-medium altitude:

1. **Loop:** fly to the pilot centerline and perform an inside loop, symmetrical, centered and at least 100' in diameter. Exit straight and level and fly to the end of the zone for the next maneuver.

2. **Stall Turn:** from level flight, perform a stall turn, exiting straight and level, heading toward the center of the zone for the next maneuver.

3. **Two Continuous Rolls:** before reaching the pilot centerline begin the first axial roll. The goal is to have the airplane cross the pilot centerline as the second roll begins. There should be no hesitation between the rolls. Fly to the end of the zone for the next maneuver.

4. **Immelmann Turn:** from level flight, perform an Immelmann turn, achieving and maintaining the maximum increase in altitude, reducing power as the airplane heads toward the center of the zone for the next maneuver.

5. **Two Turn Spin:** as the pilot centerline is approached, reduce power to idle with the aim of having the airplane stall and enter the spin right at the centerline. The direction of the spin is not important. After establishing the down-line, pull level and exit toward the end of the zone for the next maneuver.

6. **Half Cuban Eight:** as the end of the zone is approached and from level flight, perform a Half Cuban Eight, exiting straight and level, heading toward the other end of the zone for the next maneuver.

7. **Humpty Bump – Half Roll Down:** as the end of the zone is approached, pull vertically up, commencing the Humpty Bump with a half roll down. Complete the maneuver, heading back toward the center of the zone, straight and level.

8. **Stall Turn – ¼ Roll Up, ¼ Roll Down:** as the center of the zone is reached, pull up vertically. Decide how tall the maneuver is to be and, when halfway there, roll the airplane ¼ revolution, preferably in the direction to show the top of the airplane. Perform a stall turn and when flying vertically down, roll the airplane ¼ revolution in the opposite direction at the same altitude as the first roll. Continue down and exit at the entry altitude, flying straight and level toward the end of the zone for the next maneuver.
9. **Humpty Bump – Half Roll Up:** at the end of the zone, pull vertically up, commencing a Humpty Bump with a Half Roll Up. Upon completion, head straight and level toward the other end of the zone for the next maneuver.

10. **Reverse Half Cuban Eight**: before the end of the zone is reached, commence a Reverse Half Cuban Eight, completing the maneuver at the entry altitude, straight and level. Exit the aerobatic zone.

This completes the Advanced Flying Training syllabus. Pilots successfully completing the training will display an increased level of flying skills, an enhanced awareness of flight safety and an increased level of aeronautical knowledge.