PHANTOM I, X-1 & X-1E OPERATIONS MANUAL

Phantom Aeronautics LLC
2010 Hov Aire Dr
Three Rivers, MI 49093
PH: 616-610-6597
WEBSITE: www.phantomaero.com

Version 2.20.23

Table of Contents

INTRODUCTION

The Phantom is a three-axis controlled, cable-braced, Dacron-Covered, Aircraft with a tricycle landing gear and steerable nose gear. The side mounted control stick controls both the full span aileron and the elevator while the rudder pedals control the rudder and the nose gear for airplane like-controls.

The Phantom was designed with the novice as well as the experienced pilot in mind. The aircraft combines nimble handling with high performance; it has a wide speed range and superior structural integrity.

Even though, with the ultralight version of the aircraft, there is no airman certification required, flight training in the amount that would permit an individual to solo a fixed wing certified aircraft is required prior to operations of the Phantom X-1 and X-1E. Flight training should be obtained from a USUA or ASC approved flight instructor.

Phantoms can be flown as Ultralights, Light Sport Aircraft, or Experimental Amateur built aircraft. Each type of license should be researched thoroughly before determining which route is the best for you. A Light Sport Aircraft License or Private Pilot License is required for the latter two versions of the Phantom.

If you desire to perform aerobatics with this aircraft proper training should be obtained from a Certified Flight Instructor. Aerobatics are dangerous without the proper training. Aerobatics should be performed only with a backup parachute recovery system properly installed on the aircraft. Special attention should be paid to the g limits and center of gravity location before doing aerobatics. An improperly balanced aircraft will not recover from spins and an overweight aircraft will not be able to handle the g loadings seen during aerobatics. Maneuvers should be limited to low g load maneuvers. Phantoms “ARE NOT CERTIFIED AIRCRAFT” and aerobatics are conducted “AT YOUR OWN RISK” and Phantom Aeronautics LLC accepts no responsibility for problems encountered during aerobatic maneuvering.

PERFORMANCE – SPECIFICATIONS

AIRSPEED:

Vne – Never Exceed Speed	**100 mph**
Vx – Best Angle of Climb	**50 mph**
Vy – Best Rate of Climb	**55 mph**
Vs – Stall Speed at 600 lb. gross weight	**35 mph**
Vapproach – Approach to landing	**55 mph**
Vglide – Best Glide Speed	**45 mph**
Vfe – Max Flap Extension Speed	**65 mph**

CRUISE SPEED AT SEA LEVEL:

Phantom X-1 with Rotax 447 or MZ 201	**60 mph**
Phantom X-1, Phantom I with Rotax 503	**65 mph**
Phantom X-1, Phantom I with Rotax 582	**70 mph**
Phantom X-1E with Rotax 447 or MZ 201	**65 mph**
Phantom X-1E with Rotax 503	**70 mph**
Phantom X-1E with Rotax 582	**75 mph**

RATE OF CLIMB AT SEA LEVEL:

(Numbers are for a gross weight of 600 lbs. Heavier aircraft will climb slower and lighter aircraft will climb faster)

Phantom X-1 & X-1E with Rotax 447 or MZ 201	**450 fpm**
Phantom X-1, I & X-1E with Rotax 503	**700 fpm**
Phantom X-1 & X-1E with Rotax 582	**1000 fpm**

TAKE OFF PERFORMANCE:

(Numbers are for a gross weight of 600 lbs. Heavier aircraft will takeoff in longer distances and lighter aircraft will takeoff in shorter distances)

Phantom X-1, I & X-1E (all engines) Ground Roll **200 ft**

Total take off distance over a 50 ft obstacle with a climb out speed of 55 mph, this includes the ground roll.

Phantom X-1 & X-1E with Rotax 447 or MZ 201	**740 ft**
Phantom X-1, I & X-1E with Rotax 503	**520 ft**
Phantom X-1, I & X-1E with Rotax 582	**440 ft**

LANDING PERFORMANCE:
(Numbers are for a gross weight of 600 lbs. Heavier aircraft will land in longer distances and lighter aircraft will land in shorter distances)

Phantom X-1, I & X-1E (all engines) Ground Roll 200 ft

Landing distance over a 50 ft obstacle with a standard descent rate of 500 fpm and approach speed of 55 mph, this includes the ground roll.

Phantom X-1, I & X-1E (all engines) 680 ft

STALL SPEED:

The following graph shows the stall speed versus the gross weight of the aircraft. The heavier the aircraft the higher the stall speed. *NOTE: Subtract 8 mph for aircraft equipped with flaps.*

Stall Speed at 600 lb gross weight 35 mph

MAXIMUM WEIGHT:

The Maximum recommended weight for the Phantom X-1 and X-1e is 600 pounds. We have seen owner built aircraft fly with weights up to 725 pounds. Maximum weight for the Phantom I is 760 lbs. At higher weights, care should be taken to keep your airspeeds higher during landing. The stall speed increases significantly with increased weight and thus your takeoff, approach and landing speeds should also be increased.

STANDARD EMPTY WEIGHT:

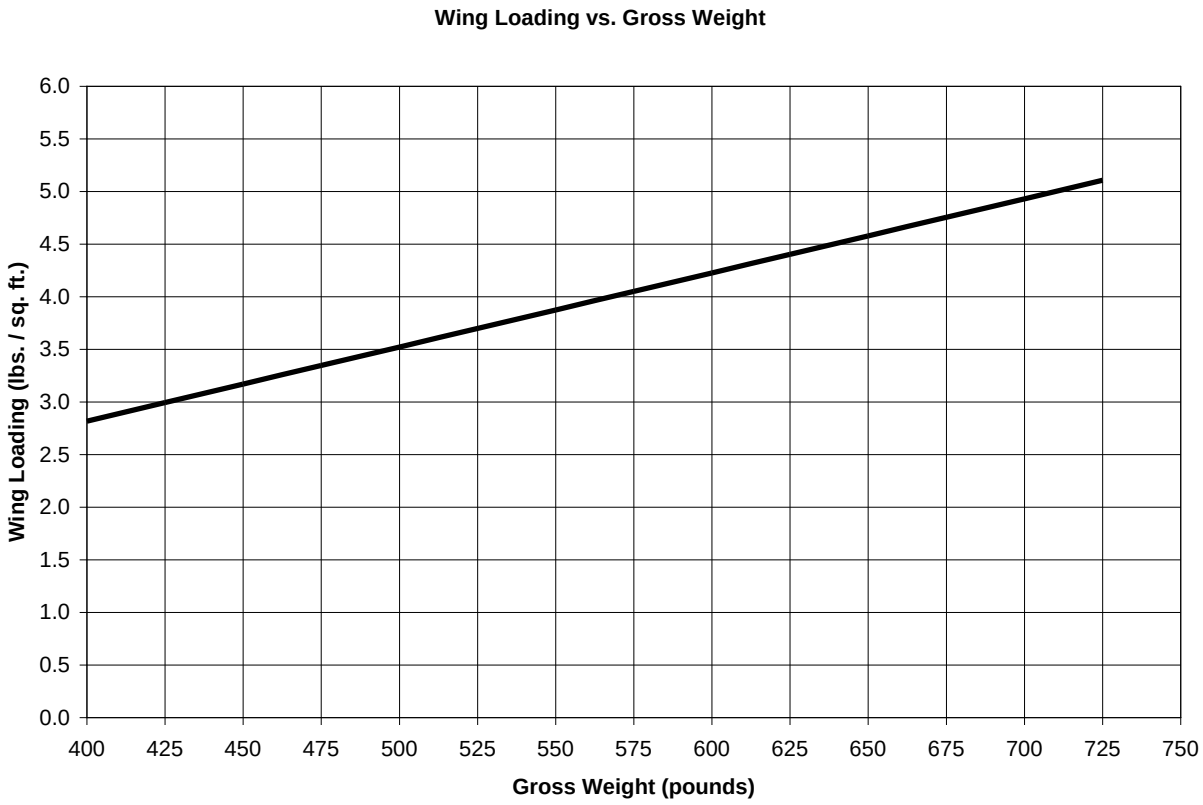
These weights are an average of some existing Phantoms. Weights will vary significantly depending on options such as electric start, electric fuel pumps, 10 gallon tanks etc.

Phantom X-1 with Rotax 447 or or MZ 201 (basic ultralight)	**254 lbs.**
Phantom X-1 with Rotax 447	**270 lbs.**
Phantom X-1 with Rotax 503	**330 lbs.**
Phantom X-1 with Rotax 582	**380 lbs.**
Phantom I with Rotax 503	**435 lbs**
Phantom I with Rotax 582	**450 lbs**
Phantom X-1E with Rotax 447 or MZ 201	**285 lbs.**
Phantom X-1E with Rotax 503	**400 lbs.**
Phantom X-1E with Rotax 582	**450 lbs.**

WING LOADING:

The following graph shows the wing loading versus the gross weight of the aircraft. The heavier the aircraft the higher the wing loading.

Wing loading at 600 lb gross weight **4.2 lbs / sq. ft.**



RANGE:
(Assumes a throttled back cruise setting of 75% - 80% power setting)

5 GALLON FUEL TANK

Phantom X-1	**85 miles**
Phantom X-1E	**92 miles**

10 GALLON FUEL TANK

Phantom X-1, I	**170 miles**
Phantom X-1E	**184 miles**

PROPELLOR:
(specs are given for a 2.58:1 gearbox ratio with a ground adjustable Powerfin Propeller)

Rotax 447 or MZ 201
2-Blade – 62”
3-Blade – 58”

Rotax 503 Single Carb
2-Blade – 65”
3-Blade – 60”

Rotax 503 Dual Carb
2-Blade – 65”
3-Blade – 61”

Rotax 582
3-Blade – 65”
(2 Bladed version will strike the pod)

FLIGHT OPERATIONS

Preflight

Always be very thorough in preflight your Phantom. Be especially particular after the airplane has been reassembled, i.e. check for parts that may have been damaged during transportation. Start the preflight at the cockpit and walk around the airplane and complete the entire check list below:

Preflight check list

1. Cockpit:	Check instruments and wiring for security. Check control stick for proper direction and freedom of movement. Turn off all switches.
2. Kingpost:	Check for stress cracks and tightness of nuts and bolts.
3. Wing Wires	Check ground wires (upper) and lift wires (lower) for tension and proper connection. Use a cloth to run along each cable to check for broken cable strands. Replace before flight if stands are broken.
4. Left wing:	Check general conditions. Fix any holes in sails. Note: Transportation with folded wings may case holes to be rubbed in the sails along the rear spar.
5. Compression Struts (left):	Open Zipper underneath the wings and check if struts and bracing wire are properly attached. Close zipper.
6. Wingtip (left):	Check for proper security.
7. Ailerons (left):	Check for freedom of movement and proper direction of travel.
8. Idler Cable:	Check for tension and check if turnbuckle is safety wired.
9. Fuel Tank:	Check fuel quantity, fuel filter for cleanliness, cap for security. Check fuel lines. All lines should be safety wired to the tank and engine.

10. Landing Gear:	Check tire pressure (25-35 psi), condition of the landing gear and the condition of the bungee chords. Make sure axle nut is properly attached. Check brakes.
11. Tail Section:	Check elevator and rudder freedom of movement, check bracing cables of tail sections for fraying and proper security. Replace before flight if fraying has occurred.
12. Aileron Belcrank:	Check for proper connection of aileron cables to belcrank. The cable shackles should be free to pivot.
13. Right Wing:	Repeat steps 3-7 for right wing.
14. Pod:	Check for cracks, check nose gear and pitot tube for obstruction and check alignment of pitot tube, align with the direction of flight.
15. Engine:	Check condition and security of propeller. Check air filter for cleanliness. Check ignition wires and instrument wires (RPM, EGT and CHT if applicable). Check fuel line connections, all connections should be safety wired. Check rudder carb boots for cracks. Check security of spark plugs and spark plug wires.

Starting Engine

Before starting the engine check to see if the propeller area is clear and will remain clear. If the engine is cold, the following procedure should be followed. Pump the squeeze bulb primer until you can see the fuel fill up the line from the fuel pump to the carburetor. Pump the carburetor push pull primer 3 – 4 times. Open throttle a half inch. With the ignition switch in the on position, pull the starter cable once or crank the electric starter.

If the engine is warm, the priming procedure can be deleted. Using the push pull primer prime the carburetor 1 – 2 pumps. With the ignition switch in the on position, pull the starter cable once or crank the electric starter.

Taxi and warm-up

The engine should be warmed up prior to take-off. Engine temperatures should rise to the manufacture recommended values. These are different for every engine. Consult with the engine manufacturer for proper temperatures. Temperatures for newer Rotax engines are listed below. Run the engine until there is little to no smoke emitting from the exhaust pipe. If possible conduct a full power run up before taking off. With a dual ignition engine check the proper operation of each magneto by shutting them off one at a time and checking for the proper 150 RPM drop.

CYLINDER HEAD TEMPERATURES (CHT)

	447 UL SCDI		**503 UL DCDI**		**582 UL DCDI**	
	deg C	deg F	deg C	deg F	deg C	deg F
max.	260	500	250	480	150	300
normal	190 - 230	377 - 446	180 - 220	350 - 430	110 - 130	230 - 270
difference between cyl. 1 & 2	max 20	max 36	max 20	max 34	max 10	max 16

EXHASUT GAS TEMPERATURES (CHT)

	447 UL SCDI		**503 UL DCDI**		**582 UL DCDI**	
	deg C	deg F	deg C	deg F	deg C	deg F
max.	650	1200	650	1200	650	1200
normal	460 - 580	860 -1000	460 - 580	860 -1000	500 - 620	930 - 1150
difference between cyl. 1 & 2	max 25	max 43	max 25	max 43	max 25	max 43

Take-off and Climb

1. Prior to take-off; insure that your seat belt is fastened.
2. Never attempt a take-off if the engine does not accelerate smoothly when the throttle is advanced. This indicates that the engine is not warmed up sufficiently.
3. Before starting the take-off roll, check the stick position for neutral ailerons which is slightly to the left of vertical position. The method used for take-off is the soft field technique. After the airplane has been lined up with the runway and a final wind check has been preformed, smoothly apply full power. During the take-off roll keep the controls stick all the way back. This will reduce the load on the nose gear which is especially important on rough fields. Very soon after full power has been applied the nose gear will come off the ground. At this point slightly reduce the back pressure on the control stick so that the nose gear will stay clear off the ground. Make small pitch adjustments as necessary to keep the speed during climb out at 50 - 55 mph. The airplane will fly itself off the runway in this attitude. Take off distances are given in the performance section. The total take-off distance includes climbing to 50 ft. These distances were calculated using a full throttle take-off. If a rolling take-off is preformed added approximately 50ft to each distance.

Note: During climb out, especially on a hot day, do not fly for a long period of time at a slow airspeed. It is better to climb at a slower rate with a high airspeed as this will provide better engine cooling.

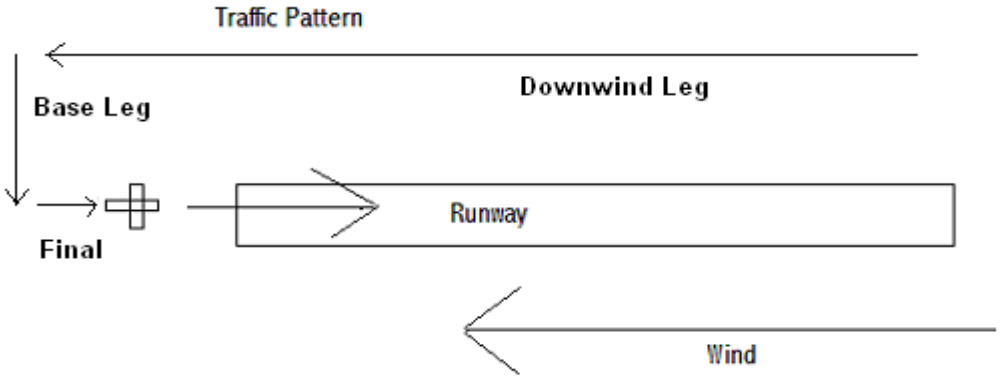
Cruise

After leveling off, reduce power to establish airspeed to desired cruise speed. It is important to monitor the engine temperatures. Always be aware of your surroundings and practice having fields or runways picked out for emergency landings.

Landing

Standard Landing

The easiest way to a good landing is flying a traffic pattern. A normal traffic pattern consists of a down wind leg, a base leg and a final shown in the following picture:



The pattern is not flown at a fixed distance from the runway. It is flown closer to or further away from the runway depending on the wind conditions so that in case of an engine failure you will be able to land on the runway. The downwind leg is flown at a constant altitude, Approximately 300 to 400 ft above the ground. When you are opposite your intended touchdown point, reduce the power and start a descent at 55 mph, remember to monitor the engine temperatures. Continue the downwind leg until your intended touchdown point is 45 degrees behind you and start your base leg. When turning final you should be 150 to 200 ft above the ground. Make small pitch and power adjustments as necessary to maintain an approach speed of 55 mph and a constant approach angle. Before touchdown the descent should be stopped by slowly adding back pressure on the control stick. At the same time reduce the power. A little power should be carried until the airplane is in a slightly nose high attitude and only a few inches off the ground. At this point the power can be reduced to idle and the airplane will settle on the main gear first. Care should be taken to touchdown on the main gear only. Three point landings are not recommended and can seriously damage your nose gear.

As the airplane slows down the elevator will becomes less effective and the nose will start dropping. This entire procedure is known as the flare to landing. Touchdown should occur at or near the stall speed. A landing is not complete until the aircraft has come to a complete stop. A large number of accidents occur after the aircraft has touched down and the pilot is no longer paying as close attention to the aircraft.

Crosswinds

The Phantom has been flown in winds up to 20 mph. The aircraft has been landed in direct crosswinds of 15 mph. During approach to landing add 5 mph to your approach speed to compensate for any wind gusts and to provide more control during a cross wind landing. To control an aircraft during crosswinds a slip is used. Apply enough rudder pedal to line the aircraft up with the runway. Once this is complete apply aileron opposite to the rudder to compensate for any sideways movement that occurs. This is called a slip to landing and allows the aircraft to be perfectly lined up with the runway. Constant adjustments will be needed through the final leg of landing. Right rudder requires left aileron and left rudder requires right aileron.

Your First Landing

During a first attempt at landing, approach speeds should remain higher. Airspeed and altitude are your friend. To make a good first landing use a runway twice as long as recommended. On the final leg dive the aircraft in at 65 mph and reduce the power to idle. As you approach the ground pull back on the stick and rotate so the aircraft is flying level one to two feet off the ground. The aircraft will float a long distance in this configuration and will give you time to setup the proper angle for touch down. Slowly increase back pressure on the stick and hold the aircraft one to two feet off the ground. As you slow down the aircraft will settle to the ground and touch on the main gear. As you get used to the proper attitude for landing slow your approach speeds to 55 mph. This will allow you to utilize smaller runways and shorten your landing distances.

Emergency Procedures

Engine failure during take-off roll

Stop the airplane on remaining runway

Engine failure after take-off roll and during climb out

Lower the nose to maintain a safe airspeed. Your best glide speed is 45 mph. Land Straight ahead avoiding obstructions. If altitude and airspeed permit turn around and land down wind or on the runway from which you just took off. It will take an average pilot with the engine turned off 500 feet to execute a 180 degree turn. If you do not have 500 feet of altitude to complete a 180 degree turn then land straight ahead. Airspeed is your friend. Do not try to stretch a landing

by pulling back on the stick. Maintain the proper airspeed. By trying to stretch a landing you will stall the aircraft and spin into the ground. It is better to land short and in control than to spin into the ground.

Engine failure in flight

Establish best glide speed of 45 mile per hour and select a suitable field for an emergency landing. If attitude permits, try to restart engine. Make sure your seat belt is tight; the engine throttle is back and the ignition is turned off before touching down. Airspeed is your friend. Fly the airplane first and maintain control.

Stalls

Stalls are mild in a Phantom. You feel a small buffet and the aircraft will drop nose down when the stall occurs. If one wing should drop control the aircraft with the rudder. Having a wing drop during a stall means that you were not flying the aircraft with the proper control coordination. If the left wing drops use right rudder to bring it back up. If the right wing drops use left rudder to bring it back up. If you try to use aileron the wing will continue to drop and you will enter a spin. Using aileron adds drag to the wing and hinders its recovery from a stalled spin entry configuration. The rudder on a Phantom is large enough to bring the aircraft back to level.

If you have an aft cg location your aircraft will be less controllable and will be more likely to spin. If you a have an extremely far forward cg it may be impossible to stall the aircraft. The tail will not have enough control to sufficiently change the attitude of the aircraft to a high angle of attack to produce the stall. The controls will feel mushy, but the wing will still be flying. The center of gravity should be moved further to the rear. A far forward cg will result in more three point landings and broken nose gear. Make sure the center of gravity for the aircraft falls within the proper ranges.

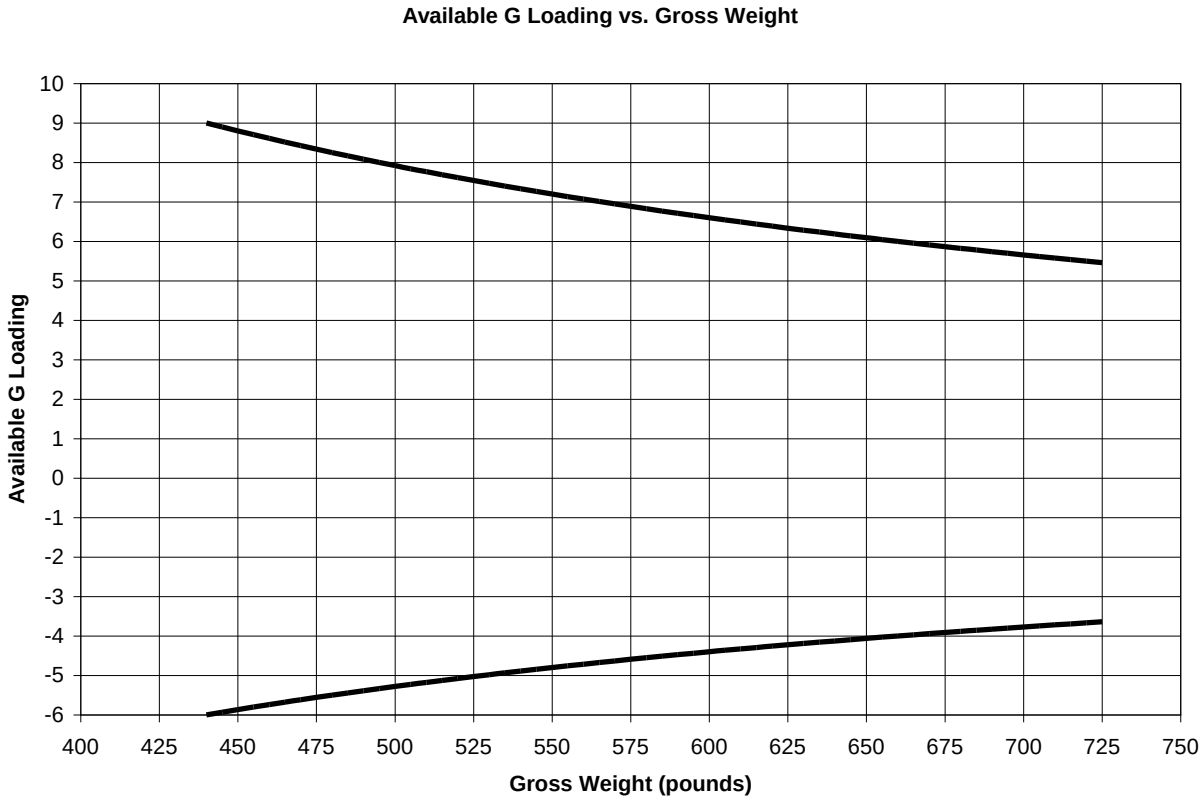
Spins

Use the following procedure to recover from a spin:

1. Throttle idle and ailerons neutral
2. Apply full rudder opposite to the direction of rotation until the rotation stops.
3. Move control stick forward to break the stall.
4. Neutralize rudder and recover from the dive keeping the aircraft below Vne of 100 mph.

Aerobatics

The Phantom is designed for maximum pitch up angles of 40 degrees relative to the horizon, maximum pitch down angles of 30 degrees relative to the horizon and maximum bank angle of 60 degrees to the horizontal. Maximum dive speed 100 mph indicated airspeed and minimum flight speed is 30 mph indicated airspeed. Flight outside this envelope constitutes aerobatic flight. Although the Phantom has done loops, rolls, snap rolls, hammerheads, whip stall, inverted flight and spins during its flight test program; do not attempt to fly these maneuvers without proper aerobatic training in a properly certified airplane with a qualified instructor. It also is recommend to install a ballistic recovery system on the aircraft. Aerobatics are dangerous without the proper training. Special attention should be paid to the g limits and center of gravity location before doing aerobatics. An improperly balanced aircraft will not recover from spins and an overweight aircraft will not be able to handle the g loadings seen during aerobatics. Maneuvers should be limited to low g load maneuvers. Phantoms "ARE NOT CERTIFIED AIRCRAFT" and aerobatics are conducted "AT YOUR OWN RISK" and Phantom Aeronautics LLC accepts no responsibility for problems encountered during aerobatic maneuvering. If you do attempt Aerobatics it is important to remember that the available maximum g loading for the aircraft changes with the gross weight of the aircraft. The Phantom has been tested up to +9 g's and -6 g's at a gross weight of 440 pounds. The maximum available g loading for other gross weights is shown in the graph below. Care should be taken to remain below these g limits. The limits are maximum limits and the aircraft can be overstressed and break at g loadings above the recommended.



WEIGHT AND BALANCE

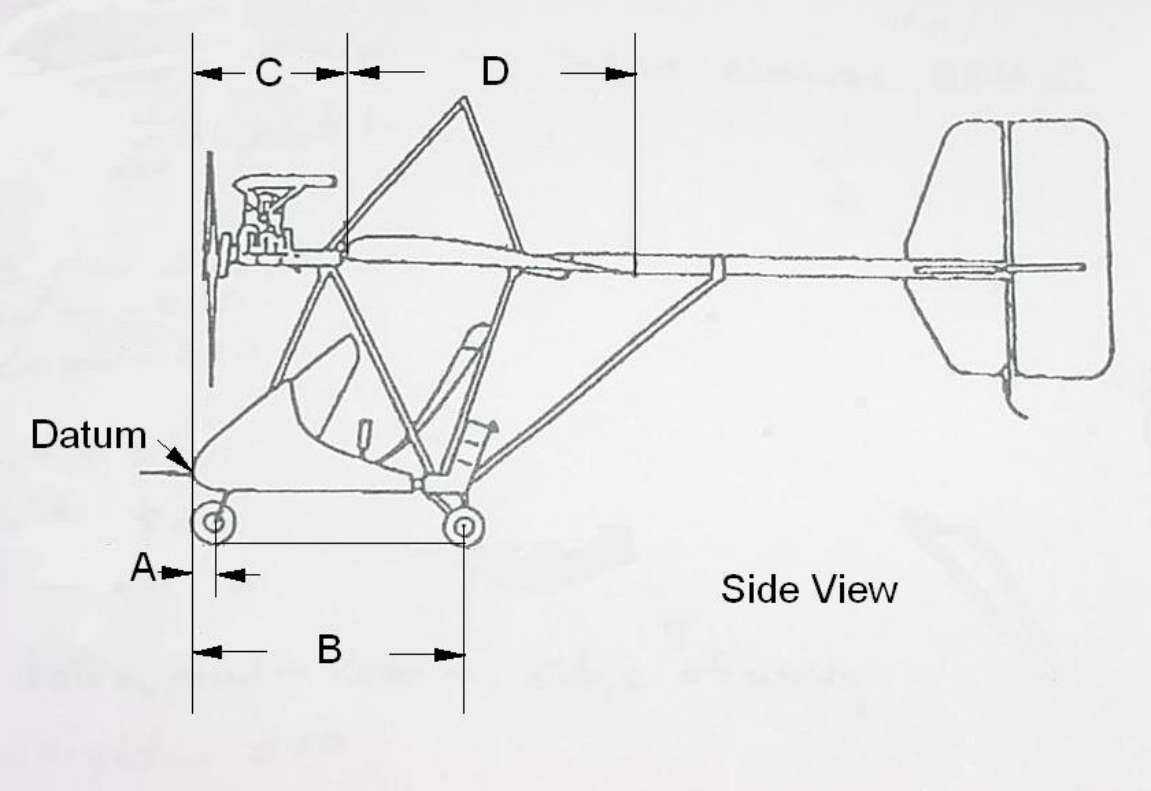


Figure 1: Side View of the Ultralight

WARNING: Do not use the exact numbers calculated here. Each aircraft is different depending on the location of instruments, parachute, and other items that are selected by the builder. A customized weight and balance table should be implemented for each individual aircraft.

STEP 1 – Calculation of the Aircraft Empty Weight and Empty Weight Moment Arm

The first step in calculating the weight and balance for your aircraft is determining the empty weight and empty weight moment arm. You will need a tape measure, a roll of masking tape, a plumb bob and a scale to measure the weight of your aircraft. Three scales are ideal; however this can be completed with one scale and pieces of wood that are exactly the same height as the scale. First measure the distance 'A' shown in Figure 1. This is the distance from the nose of the aircraft (datum) to the axle on the front nose gear. This is the moment arm for the nose gear. Next measure the distance 'B' shown in Figure 1. This is the distance from the datum to the axle on the main gear. Next measure the distance 'C' shown in Figure 1. This is the distance from the datum to the leading edge of the wing. Finally measure the distance 'D' shown in Figure 1. This is the chord length of the wing and is typically 64" for the Phantom X-1 and X-1E. To make

measuring these distances easy the plumb bob is used to transfer the location of the nose leading edge, front axle, main axle and wing leading edge to the floor of your hangar. Mark the location of these on a piece of masking tape attached to the floor and measure the distance between the marks on the floor. All measurements should be made in inches.

Next measure the weight of the aircraft. First place the scales under each wheel and record the weight at each wheel. If you have only one scale you will need to move the scale around to obtain the weight at each wheel. Make sure that you put your pieces of wood under the wheels without the scale to keep the aircraft level. The measurements will be incorrect if the aircraft is not level. These measurements should be taken without the pilot or fuel in the aircraft.

Next calculate the **Empty Weight** of the aircraft:

Empty Weight = Nose Gear Weight + Left Main Weight + Right Main Weight

Next calculate the **Moment Arm (MA):**

$$\textbf{MA} = \frac{(NoseGearWeight \times A) + (LeftMainWeight \times B) + (RightMainWeight \times B)}{EmptyWeight}$$

Typically the moment arm is referenced to the leading edge of the wing. A good center of gravity location is at 25% - 35% of chord of the wing. To determine the **Empty Weight Moment Arm (EWMA)** from the leading edge of the wing use the following formula:

EWMA = MA – Distance C

To determine the % location of the wing chord use the following formula:

$$\text{CG \% Wing Chord} = \frac{EWMA}{D} \times 100$$

A sample Calculation Table is shown below.

ITEM	MOMENT ARM (inches)	WEIGHT (pounds)	MOMENT (MA x WEIGHT, in-lbs)
Front Gear	10.5	60	630
Right Main	67.5	95	6412.5
Left Main	67.5	95	6412.5
		250 lbs	**13455 in-lbs**
		EMPTY WEIGHT	**EMPTY WEIGHT MOMENT**
	MA (Empty Weight Moment / Empty Weight)	**53.82"**	
	EWMA (MA - C)	**16.82"**	
	% of wing chord	**26.5%**	

The Empty Weight Moment Arm and the Empty Weight are the important numbers to record and remember from this calculation.

STEP 2 – Calculation of the Pilot Moment Arm

You will need the Empty Weight, Empty Weight Moment Arm, Distances A, B, and C.

First measure the weight of the pilot using the scale.

Next have the pilot sit in the aircraft and measure the weight of the aircraft at the nose gear and each of the main gear just as you had before. Record these new weights and use them in the equation below calculate the pilots moment arm.

Moment Arm =

$$\frac{(NoseGearWeight \times A) + (LeftMainWeight \times B) + (RightMainWeight \times B) - (EmptyWeight \times MA)}{Weight\_of\_the\_Pilot}$$

Pilot Moment Arm = Moment Arm - C

STEP 3 – Calculation of the Fuel Moment Arm

You will need the Empty Weight, Empty Weight Moment Arm, Distances A, B, and C.

First calculate the weight of the fuel. Fuel weighs 6 pound per gallon, thus a 5 gallon tank of fuel weighs 30 pounds. Fill the fuel tanks.

Next measure the weight of the aircraft at the nose gear and each of the main gear just as you had before. Record these new weights and use them in the equation below calculate the fuel moment arm.

Moment Arm =

$$\frac{(NoseGearWeight \times A) + (LeftMainWeight \times B) + (RightMainWeight \times B) - (EmptyWeight \times MA)}{Weight\_of\_the\_Fuel}$$

Fuel Moment Arm = Moment Arm – C

You are now ready to calculate the flying configuration weight and balance.

STEP 4 – Overall Weight and Balance

The aircraft weight and balance should be calculated every flight to ensure that it is in the proper location. If the center of gravity is to far forward the elevator stick forces can be high and it may be impossible to properly flare the aircraft in landing. It may also be impossible to get the aircraft off the ground. If the center of gravity is to far back the stick forces will be very light and the aircraft will be very sensitive to the control inputs. It will be very easy to lose control of the aircraft. The wing may stall and could put the aircraft in an uncontrollable spin.

Aircraft Center of Gravity = Total Moment / Gross Weight

The aircraft CG should fall between 16 inches and 23 inches behind the leading edge of the wing.

SAMPLE WEIGHT AND BALANCE TABLE

ITEM	MOMENT ARM	WEIGHT	MOMENT
Empty Aircraft	16.82 inches	250 lbs	4205 in - lbs
Pilot	21 inches	180 lbs	3780 in - lbs
Fuel	22.9 inches	30 lbs (5 gallons)	687 in – lbs
		450 lbs	**8672 in – lbs**
		GROSS WEIGHT	**TOTAL MOMENT**
AIRCRAFT CG	**18.85 inches**		

WARNING: Do not use the numbers calculated here. Each aircraft is different depending on the location instruments, parachute, and other items that are selected by the builder. A customized weight and balance table should be implemented for each aircraft.

WEIGHT AND BALANCE

Aircraft _____ Date _____
Pilot Name _____ Pilot Weight _____

ITEM	MOMENT ARM	WEIGHT	MOMENT
Empty Aircraft			
Pilot			
Fuel			
		GROSS WEIGHT	**TOTAL MOMENT**
AIRCRAFT CG			

CG Limits: Forward Limit = 16 inches; **Aft Limit** = 26 inches
Maximum Gross Weight = 600 pounds

MAINTENANCE

Storage

The Phantom may be stored in the same manner as a conventional airplane or folded to use less hanger space. If the Phantom is stored outside for long periods, it is advisable to use a cover that will protect the sails from ultraviolet rays. The sails will deteriorate in less than a year if left exposed to the sun all the time. Position the propeller horizontally to prevent moisture from collecting in one blade more than the other.

Preventive Maintenance

A good ultra light pilot leans to fix a problem before it becomes a problem. Preventive maintenance can save a good deal of time, money and hassle as well as add a significant margin of safety to your operations. About every month or after each 25 hours of flight time (which comes first), it makes good sense to give your Phantom an extensive visual inspection to avoid problems. You will notice that the engine and power train need the most care. The maintenance manual for your specific engine should be followed. Moving objects and the vibration they produce are the biggest culprit in system failures, so keep an eye on anything that moves.

Areas to watch are listed below. These are items that are above and beyond a preflight. Parts on the Phantom do not have an hour limit associated with them. The engine will be the only item that has a time between overhaul. All other parts are replace as necessary. Here is a list of common items to thoroughly inspect. It is a good idea to have others examine your aircraft too.

Refer to the assembly manual for detailed part numbers for extensive reconstruction and aircraft maintenance.

EVERY 25 HOURS

1) Inspect all brackets for stress cracks; replace brackets if any cracks are found.
2) Inspect cables for fraying replace if any is found.
3) Check security of nuts and bolts.
4) Examine sails for holes and patch or replace before the next flight.
5) Examine tubing for excessive elongation of holes and replace if this is found.
6) Check freedom of movement on all control surfaces and pulleys.
7) Examine landing gear for cracks and bent parts which occur during hard landings.
8) Examine tires for cracks and worn sections and replace as needed.
9) Examine wiring for loose connections and fix as necessary.
10) Examine pitot tube for water in the line. Remove any water if found.
11) Check for cracks in the pod at the mounting pints and fix as necessary

EVERY YEAR

1) Punch test your sails to prove their strength especially if they are stored outside. A punch tester can be found in catalogs from Leading Edge Airfoils or Aircraft Spruce and Speciaility
2) Complete the 25 hour check and any recommended engine maintenance.

FLIGHT TRAINING

The following syllabus is the Phantom flight training course it consists of ten lessons. The first eight lessons to be conducted in a certified training airplane such as the C-150 or C-152; the last two lessons will be conducted in the two-seat ultra light training airplane. The normal flight time for each lesson is approximately one hour. Additional time may be necessary depending on the student proficiency. The course covers all maneuver required by FAR 61.87 ©(1) so that students can count their flight training time towards their student-pilot certificate. Flight training should be given by a certified flight instructor. Students should familiarize themselves with at least the following Federal Aviation Regulations: Part 1, Part 91 and Part 103. Another publication of interest to the ultra light pilot is the airman's information manual. In addition to the flight training the student should have ground training in at least the following areas: Regulations, Basic aerodynamics, emergency procedures, aircraft performance and medical facts of flight.

After completion of this course the student will have the ability to solo the single place Phantom.

Flight Lesson NO. 1

During the First lesson the student will be introduced to the airplane. The controls, instruments and systems will be explained to the student.

1. Familiarization with aircraft.
2. Use of Checklist for:
    a. Preflight
    b. Engine Start and Warm-up
    c. Pretake-off
    d. Run-up
3. Taxing
4. Straight and Level Flight
5. Medium Bank Turns
6. Shutdown and Securing aircraft

Flight Lesson NO. 2

New maneuvers in this flight lesson are:

1. Normal Take offs
2. Traffic pattern with appropriate departure and entry procedures
3. Climbs and Climbing turns
4. Leveloff Procedures
5. Glides
6. Slow Flight and minimum controllable airspeed
7. Tracking a straight line – correcting for wing effects
8. Normal Landing

Review maneuvers from lesson 1 as necessary

Flight Lesson NO. 3

This lesson is a review of the previous two flight lessons to gain proficiency in the described maneuvers and procedures. By completion of this lesson the student should be able to perform the maneuvers while maintaining airspeed with +/- 15 mph and headings with +/- 20 degrees. Altitude control should be with in +/- 200 ft.

Flight Lesson NO. 4

New Maneuvers in this flight lesson are:

1. Use of Climb speeds and attitudes for best rate and best angle climb.
2. Steep Turns
3. Descents and descending turns
4. Airspeed and configuration changes (flap settings)

Review maneuvers from previous lessons as necessary to gain additional proficiency.

Flight Lesson NO. 5

New Maneuvers in this flight lesson are:

1. Approach to landing stalls
2. Take-off and departure stalls
3. Collision avoidance, right of way rules
4. Slips
5. Soft field landing and take-off

Review maneuvers from previous lessons as necessary to gain additional proficiency.

Flight Lesson NO. 6

New Maneuvers in this flight lesson are:

1. Ground Reference Maneuvers
2. Emergency Procedures

Review maneuvers from previous lessons as necessary to gain additional proficiency.

Flight Lesson NO. 7

New Maneuvers in this flight lesson are:

1. Accelerated Stalls
2. Crosswind Take-offs and Landings
3. Go around procedures

Review maneuvers from previous lessons as necessary to gain additional proficiency.

Flight Lesson NO. 8

This lesson is again a review of all the previous maneuvers and procedures to gain proficiency in the weaker areas. Special emphasis should be placed on the take-offs and landings, especially the soft field procedures since this techniques will be used for the Phantom. By completion of this lesson the student should maintain altitude with +/- 125 ft, airspeed with +/- 7 mph and headings within +/- 10 degrees

Flight Lesson NO. 9 & 10 should be preformed in a two seated ultra light

Before flight lesson NO. 9 it should be explained to the student the difference to expect between the previous aircraft used and the ultra light used. Examples are: airspeeds, controls, instrumentation, aircraft attitude and engine operations.

Flight Lesson NO. 9

1. Preflight
2. Engine start and warm up
3. straight and level, climb, descent and turns
4. Climbing and descending turns
5. Slow flight and minimum controllable airspeeds
6. Take-offs and Landings

Flight Lesson NO. 10

1. Steep Turns
2. Stall Series
3. Slips
4. Emergency Procedures
5. Wake turbulence avoidance
6. Review soft field take-off and landings