MUSTANG II Operating Manual

Operating Manual must be carried in the aircraft at all times.

The complete Mustang II Operating Manual contains the following:

Mustang II aircraft flight characteristics are similar to the flight characteristics of other standard catagory aircraft.

Aeronautical skill and knowledge required to obtain a F.A.A issued Private Pilot class license is sufficient, and required, for the operation of Mustang II aircraft. Of particular importance is the effects of temperature, atmospheric pressure, and density altitude on the aircrafts performance. The pilot must be aware of increased stall speed as related to angle of bank, "G" forces, and increases of operating weights. Also the increase of turning radius as related to increased air speed.

Engine operating procedures, conditions, and instrument markings to be in accordance with the engine manufacturer's operating manual.

Operation of installed equipment, such as alternator, battery, lights, electronic equipment, etc. are to be in accordance with the equipment manufacturer's manuals and instructions.

CANOPY NOT TO BE OPENED IN FLIGHT

Maximum allowable power:
160 Maximum continuous horse power.
NOTE: 80% power, or approximately 24 1/2 in. manifold pressure when 360 CID engine is installed.

GROSS WEIGHT AND LOAD FACTORS:
1500 lb. gross - normal catagory 4.5 G Pos. & Neg.
1350 lb. gross - utility catagory 6.0 G Pos. & Neg.
Crew weight - refer to Moment Determination chart.
Maximum Baggage - 80 lb. Consult Loading Chart for weight limitations.
Fuel capacity - fuselage tank - 25 useable gallons.
Minimum fuel for take off - 5 gallons.

OPERATING SPEEDS - KIAS.

Never Exceed Speed	230 mph
Maneuvering Speed	140 mph
Flap Extension Speed	100 mph
Stall Speed (No Flap)	62 mph
Stall Speed (Full Flap)	58 mph

Stall Speed Relative to Angle of Bank:

Degree of Bank	Stall Speed
0	62 mph
30	66 mph
45	74 mph
60	88 mph

NOTE: Listed Stall Speeds may vary, depending upon individual workmanship and modifications.

Best Angle of Climb Speed	75 mph
Best Rate of Climb Speed	95 mph
Normal Glide Speed	90 mph
Max. demonstarted Cross Wind Velocity	20 mph

PERFORMANCE INFORMATION:

Range at 60% power at 7500 ft. altitude is 600 Miles (No reserve)
Rate of Climb - 1500 FPM.
Service Ceiling - 19,000 ft. (Breathing Oxygen is required at altitudes above 12,500 ft)
Take-Off Distance Ground Run - 600 ft.
Take-Off Distance to clear 50 ft. obstacle - 1,000 ft.
Landing Distance Ground Run - 1,000 ft.

Above performance figures based upon fixed pitch metal propeller.
Individual flight procedures may alter above figures

SERVICE REQUIREMENTS

Brake Fluid - MIL-H-5606 (red)
Engine Oil - Refer to engine manufacturers instructions.
Engine Fuel - Refer to engine manufacturers instructions.
Aircraft Lubrication - Refer to Servicing Guide page.

ENGINE OPERATION

Refer to engine manufacturers Operating Manual for approved procedures and limits

PRE-TAKE OFF CHECK LIST

Fuel Quantity	Checked
Fuel Valve	On
Carburator Heat	Off
Mixture	Rich
Flaps	Up
Trim Tab	Neutral
Engine Operation Check	Performed

PRE-LANDING CHECK LIST

Mixture	Rich
Carburator Heat	As Required
Flap Position	As Required

TAKE OFF PROCEDURE

Accelerate in tail LOW attitude. Tail wheel 2 in. off ground. Aircraft will leave ground at 65 mph.
Accelerate to desired climb speed.

LANDING PROCEDURE

Decelerate to 100 mph or less.
Lower flaps as desired.

Final Approach Speed	85 mph
Over the Fence Speed	75 mph
Three Point Touch Down Speed	65 mph

MUSTANG II

Aircraft Design Specifications

Suggested Gross Weight (Aerobatic Category)	1,350 pounds
Suggested Gross Weight (Utility Category)	1,600 pounds
Baggage Capacity	80 pounds
Power Recommendations	150 to 200 hp
Maximum Continuous Power	180 hp
Maximum Takeoff/Climb Power	210 hp
Wing Loading @ 1600 pounds	16.47 lb/ft^2
Wing Aspect Ratio	6.1
Power Loading (200 to 150hp)	8.0 to 10.7 lb/hp

Wing Span	24' 4"	Height	5' 9"
Fuselage Length	19' 6"	Max. Fuselage Width	40”
Max. Prop Diameter	74”	Wheel Tread	6' 9"

Wing Area	97.1 ft^2	Fin Area	4.25 ft^2
Flap Area	8.0 ft^2	Elevator Area	6.85 ft^2
Aileron Area	4.8 ft^2	Rudder Area	3.72 ft^2
Stabilizer Area	10 ft^2	Trim Tab Area (elevator)	0.30 ft^2

Flap Travel	40 deg maximum Down
Aileron Travel	20 deg Up, 15 deg Down
Elevator Travel	20 deg Up, 20 deg Down
Elevator Trim Tab Travel	20 deg Up, 40 deg Down
Rudder Travel	20 deg Right, 20 deg Left
Wing Angle of Incidence	+1.0 deg
Stabilizer Angle of Incidence	-1.5 deg
Wing Wash Out (geometric twist)	+2.5 deg
Wing Dihedral (outer panels)	+5.0 deg
Airfoil (modified)	64A212 (root), 64A210 (tip)
Thrust Line Above Fuselage Center Line	1.25 in

Center of Gravity Limits	16% to 28% MAC

Never Exceed Speed (V_{ne}, smooth air)	230 mph
Max. Structural Cruise Speed (V_{no})	195 mph
Max. Maneuvering Speed (V_A)	150 mph
Maximum Flap Extension Speed (V_{fe})	100 mph
Stall Speed Clean at 1,600 lbs (V_s)	62 mph
Stall Speed Full Flap at 1,600 lbs (V_{so})	57 mph

Maximum Structural Loading - Aerobatic Cat. +/- 6 g's yield / 9 g's ultimate

Rev. 10/2/97 CKT

MUSTANG-II SERVICING GUIDE

1 - Wheel bearings.
250 hr. interval.
High temp. grease.

2 - Tail wheel bearings.
100 hr. interval.
High temp. grease.

3 - Control surface hinges.
100 hr. or annualy.
General purpose oil.

4 - Aileron tube ball guide.
100 hr. or annualy.
Graphite or low temp.
grease.

5 - Control stick & rudder
pedal pivots.
100 hr. or annualy.
General purpose oil.

6 - Aileron and elevator
bellcranks.
100 hr. or annualy.
General purpose oil.

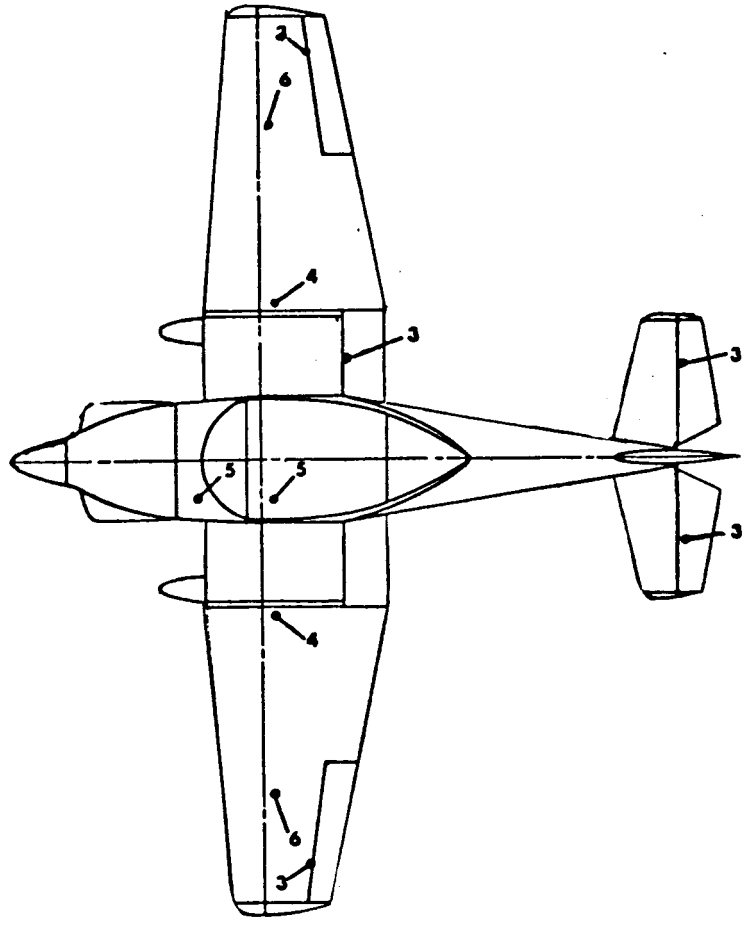
7 - Starter Bendix drive.
100 hr. or annualy.
Graphite and keroseen
mixture.

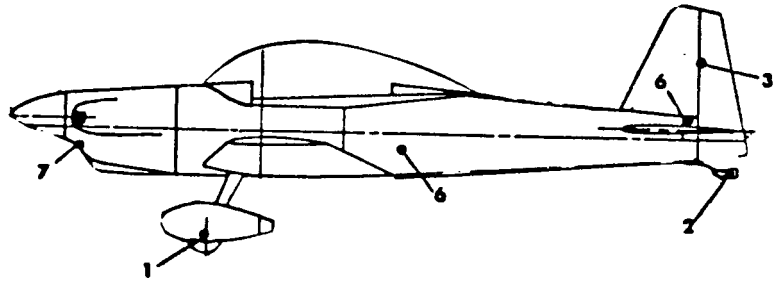
All control system rod
end ball fittings.
Annualy.
Spray with silicone
lubricant.

Check brake fluid
periodicaly.

Check battery fluid
periodicaly.

Engine lubrication,
refer to manufacture's
instructions.





5/12/82

Mustang II Airframe Inspection

(important points above and beyond a normal airframe inspection)

1. Engine Mount and attach points
2. Canopy latch and frame
3. Brake fluid
4. Battery and battery box
5. ELT battery
6. Control stick & rudder pedal pivots lubricate
7. Aileron pushrod support ball guide at end of center wing section, lubricate with graphite (n/a folding wing)
8. Elevator linkage and hinges (from control stick to elevator)
9. Flap linkage and hinges (from flap handle to flap)
10. Aileron linkage and hinges (from control stick to aileron)
11. Rudder cable linkage and hinges (from rudder pedal assembly to rudder)
12. Wheel bearings main and tailwheel grease
13. Brake pads and calipers
14. Tires
15. Gear torque tubes (especially between main spar and gear leg)
16. Transverse tailcone bulkhead (small horiz. bulkhead visible when tail inspection cover removed at fin) check for cracks and inspect lower fin attachment
17. Leading edge fin and horiz. stabilizer attach points
18. Tailwheel spring & mount
19. Folding wing bracket (if applicable)
20. Aileron counterweights
21. Outboard hinge brackets for fin and horiz stab inspect for cracking of spars around brackets.

WEIGHT AND BALANCE COMPUTATION

The aircraft must be weighed to determine its weight and Center of Gravity location. The aircraft is weighed in level flight attitude by the use of a scale under each wheel. This should be done in a closed hanger, as a slight wind over the aircraft will effect the scale readings.

After placing a scale under each wheel the aircraft is blocked up on the scales into level flight attitude. The weight of the blocking, or "tare", is subtracted from the Gross scale reading to obtain the Net aircraft weight. Levels are placed on the top fuselage side stringer aft of Sta. 73.75 for longitudinal leveling, and on the center section main spar for lateral leveling.

After leveling the fuselage it is necessary to determine the location of the wheel axle centers, or weighing points, in terms of fuselage stations. The aircraft must be completely assembled for weighing, so, the most convenient point from which to measure is the forward face of the Firewall, which is Sta. 47.75. To determine the station location of the main wheel weighing points, drop a plumb bob from the Firewall to the floor. From the plumb bob point on the floor measure back to a line connecting the centers of the two main wheel axles. Add this measurement to 47.75 to determine station location of main wheel weighing points. In a similar manner determine the weighing point location of tail wheel, or nose wheel. If nose wheel is used its measurement will be subtracted from 47.75. This method of measurement will put all distances and moment arms relative to Sta. ZERO.

The aircraft EMPTY WEIGHT is the sum of the three scale NET readings. Determine EMPTY WEIGHT CENTER of GRAVITY as follows:

1. Multiply the total net weight of the two main wheels times the main wheel weight point station location.

2. Multiply the net weight of the tail (nose) wheel time its weight point station location.

3. Add together the products of steps 1. and 2., and divide this sum by the aircraft empty weight. The resulting figure is the station location of the EMPTY WEIGHT CENTER of GRAVITY.

After determining the aircraft Empty Weight Center of Gravity, the Most Forward and the Most Rearward flight Center of Gravity locations must be determined. The accompanying Weight and Balance form should be used for this purpose. This form should be made a part of the aircraft records.

THE AIRCRAFT MUST BE OPERATED AT ALL TIMES WITHIN THE PRESCRIBED LIMITS.

The basis of Center of Gravity computations are weights, distances, or moment arms, and moments. The following values and terms will be used in the center of gravity computations.

Fuel - 25 gal @ 6.0 lb/gal. Located at Sta. 55.25

Oil - 2 gal @ 7.5 lb/gal. Located at Sta. 31.50

Pilot & Passenger - Use actual occupant weights.
Average Location is Sta. 92.50
Forward occupant C.G. is Sta. 91.00
Aft occupant C.G. is Sta. 94.00

Baggage - 75 lb Maximum Located at Sta. 107.00

Minimum Fuel - 60 lb to be used for Most Rearward center of gravity computation.

DATUM is an imaginary vertical line from which all measurements are taken. Datum used for Mustang II is Sta. ZERO.

MOMENT ARM is horizontal distance from Datum to center of gravity of the item.

MOMENT is the product of the weight of the item times its moment arm.

EMPTY WEIGHT CENTER OF GRAVITY is the center of gravity of the empty aircraft as determined by weighing.

CENTER OF GRAVITY LIMITS are the most forward and rearward permissable center of gravity locations.

CENTER OF GRAVITY RANGE is the distance between the C.G. Limits in which the operating C.G. must fall.

TARE is the weight of the blocking material on the scales used to level the aircraft. Tare weight is subtracted from the gross scale weights.

Although other methods and formula can be used for Center of Gravity computation, I find the above method most desirable as the C.G. is obtained directly in relation to the fuselage stations, and it is applicable to both nose and tail wheel type aircraft. Complete information relative to weight and balance is printed in CAM 18, and FAA publication AC 43.13.1.

WEIGH AIRCRAFT in LEVEL ATTITUDE, in a CLOSED hanger, and with the brakes released.

MUSTANG II Center of Gravity Adjustments

Ther have been several reports from the completed Mustang II builders stating a Center of Gravity location other than specified.

EMPTY WEIGHT CENTER OF GRAVITY is approximately Sta. 64.5

There are several items that would lead to an Aft CG and only a few items that would lead to a Forward CG location.

The following are some of the more common items that lead to an AFT CG location and their approximate effect on CG.

Scott pneumatic tailwheel	+735 inch pound moment
Polyurethane Paint	+530 " " "
Heavier type seats	+200 " " "
Wooden Propeller	+800 " " "
Added Instruments	neg.

Total: +2265

The following are some of the items that lead to a Forward CG.

180 HP Engine	-1400 inch pound moment
Controllable Pitch Prop	-1300 " " "

Total: -2700

Metal Propeller of 30 lb is considered standard

It is obvious that incorporation of all of the above items will not effect the CG appreciably, but, would result in a HEAVY aircraft.

The majority of Mustang II builders are incorporating many of the items creating an Aft CG location, but, retaining the Lycoming 0-320 engine with either a fixed pitch metal or wooden propeller. An Aft CG location may be compensated for by moving the battery to the engine compartment, or by installation of a controllable pitch propeller.

To assist builders wishing to use the heavier engine/propeller installation which may lead to a Forward CG location, a shorter engine mount (up to 2") is available.

Rev. 5/15/78

Weight and Balance Report

Mustang II

Registration No. _____ Serial No. M-II-_____ Date _____

Datum used is Fuselage Station ZERO. Station Zero is located 47.75" forward of the firewall.
Location of Main Wheel weighing point is Sta. _____
Location of Tail Wheel weighing point is Sta. _____

AIRCRAFT WEIGHTS AS FOLLOWS

	Scale Reading	Tare	Net	Station	Moment
Left Wheel					
Right Wheel					
Tail Wheel					
TOTALS	Empty Aircraft Weight				

Total Moment
EMPTY WEIGHT C.G. = ---------- = Sta. _____ {typ. ~sta 64.5}
Total Weight

Most FORWARD C.G. Determination

ITEM	WEIGHT	STATION	MOMENT
Aircraft Empty Wt.			
Oil (max. qts.)			
Fuel Header (max gal)			
Pilot			
TOTALS			

Total Moment
FORWARD C.G. = ---------- = Sta._____
Total Weight

Most REARWARD C.G. Determination

ITEM	WEIGHT	STATION	MOMENT
Aircraft Empty Wt.			
Oil (min. qts.)			
Fuel Header (min.)			
Pilot			
Passenger			
Baggage			
TOTALS			

Total Moment
REARWARD C.G. = ---------- = Sta._____.
Total Weight

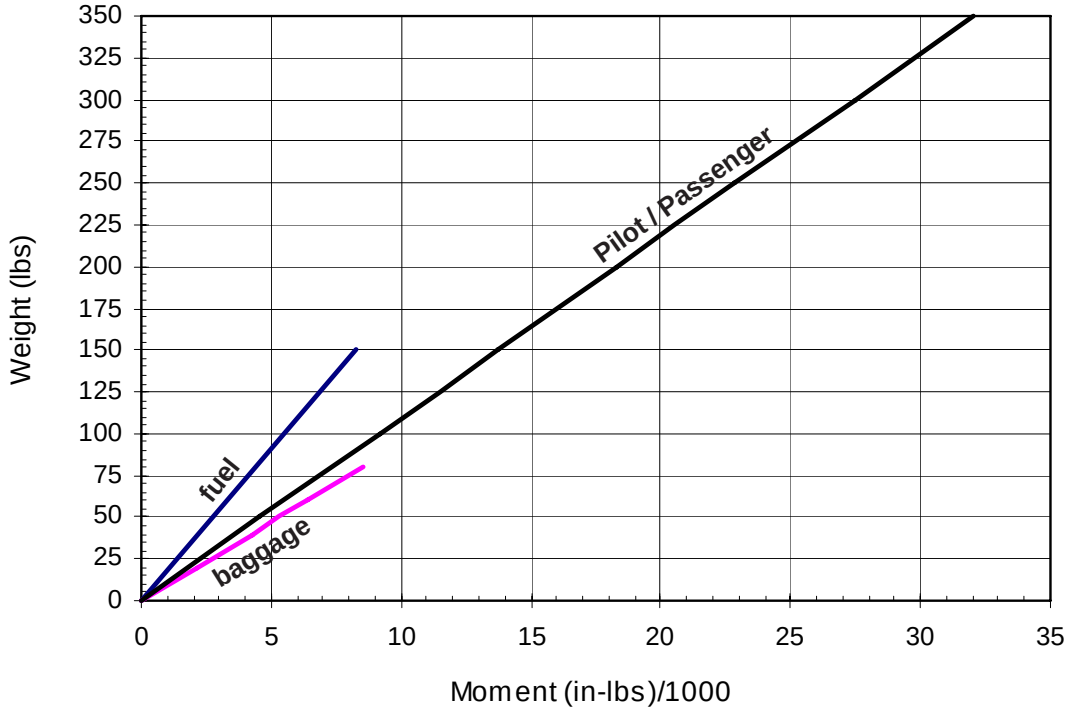
CENTER OF GRAVITY LIMITS are STA. 66.75 to 72.75. (16% to 28% MAC)

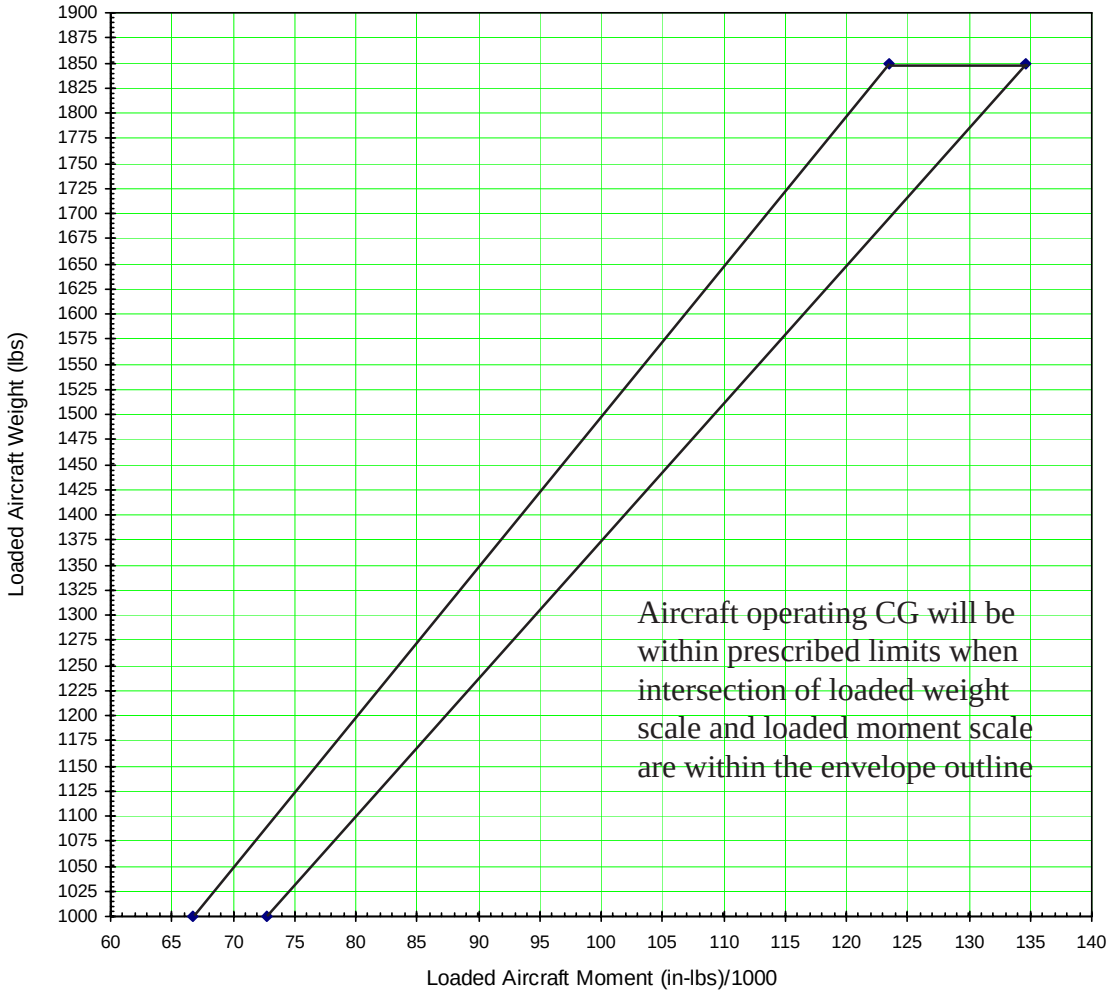
USEFUL LOAD = _____lb. - _____lb. = _____lb.
(Gross Wt.) (Empty Wt.) (Useful Load)

A list of all equipment included in the Empty Weight is to be attached to this form. 7/15/97 CKT

Mustang II

Moment Determination





Center of Gravity Moment Envelope

10/20/08

M U S T A N G A E R O N A U T I C S , I N C .

1990 Heide Dr
Troy, MI 48084

(248) 649-6818
fax (248) 688-9275
www.MustangAero.com

http://mustangaero.com/downloads/Mustang_Revisions

Mustang II Service Letter

Date: April 19, 2021

Subject: Weight and Balance on a newly acquired Mustang

To safely operate a Mustang II, the Center of Gravity needs to be between stations 66.75 and 72.75 at all times during the flight. Flying out of the CG limits will have detrimental effects on the handling characteristics of the airplane. Upon acquiring a Mustang II a new owner should weigh the airplane and redo the weight and balance worksheet before any aerobatic maneuvers are performed and certainly before carrying a passenger. Do not trust the paperwork as it could be out of date or incorrect to begin with.

As part of a pre-buy inspection a quick and easy way to get an estimate of the empty weight CG is to weigh the tailwheel with the airplane in the level flight attitude. A typical *empty* Mustang II should have a tailwheel weight of between 34 and 45 pounds.

For a typical set up the weight on the tailwheel should be the empty weight multiplied by 0.034 (3.4% of the empty weight). A weight much higher than this value indicates an aft empty weight Center of Gravity and a possible aft CG problem.

The main gear station location can play a factor here and change the 0.034 multiplier a fair amount if its located much different than sta 58.7. If the main gear is further forward there will be more weight on the tailwheel. The following page is a print out of a Tail Weight Excel worksheet file that is available on the Mustang Website:

http://mustangaero.com/downloads/Mustang_Revisions/M-II%20Revisions/Mustang-II_Tail_Weight.xlsx

The empty weight CG location for most Mustang II's should be close to station 64.5 but this can vary and the airplane may need to be modified for a new owner. For example a builder that weighs 230 pounds or more will probably have the empty weight CG set a little further forward so the airplane may need to be changed for a new owner that only weighs 140 pounds. Moving the battery or other equipment is the easiest way to do this.

An Excel worksheet for the weight and balance of a Mustang II can be found here:

http://mustangaero.com/downloads/Mustang_Revisions/M-II%20Revisions/Weight_and_Balance_Mustang-II.xlsm

http://mustangaero.com/downloads/Mustang_Revisions/M-II%20Revisions/Mustang-II_Tail_Weight.xlsx

For a Mustang II with:

Sta Location Main Gear =	58.7	[typical value but can change for specific airplane - NOTE a small change will make a noticeable difference] [this is per the plans with the main gear axle 15" fwd of sta 73.75, the center of the C/S main spar]
Sta Location Tailwheel =	228	[typical value but can change for specific airplane]
Sta CG empty =	64.5	[should be close to 64.5 but can change for specific airplane]
Header Fuel Tank =	0	[change to appropriate gallons - NOTE each 8gal only reduces tail weight by 1 pound]

Weight Tail = [Weight Empty * (Sta Loc CG Empty - Sta Loc Main)] / (Sta Loc Tail - Sta Loc Main)

So For a Typical Mustang II: Weight Tail = 0.034 * Weight Empty

Weight Empty =	1000	[enter a value]
Then:		
Weight with Fuel =	1000	
Sta CG with Fuel =	64.5	
Weight Tail =	34.3	pounds

Weight Empty =	1275	[enter a value]
Then:		
Weight with Fuel =	1275	
Sta CG with Fuel =	64.5	
Weight Tail =	43.7	pounds

** Note the tailwheel needs to be weighed in the level flight position. For a standard M-II, the cockpit side rails should be level as shown above.

FLIGHT TESTING THE MUSTANG

Persons intending to fly the tail wheel equipped MUSTANG should have prior tail wheel flying experience. The two characteristics of the MUSTANG that would tend to cause difficulty are common to all small aircraft - this is directional sensativity on the ground, and also sensitivity of the elevator control. This sensitivity is completely forgotten by MUSTANG flyers after a few hours flying, but it does require attention on initial flights.

A smooth sod runway is prefered over a hard surface for two reasons. First, the directionl sensitivity is practically eleminated. Secondly, the landing roll distance is reduced to about half that required on a hard surface runway.

A few taxi runs at high speed are recomended. During these taxi runs the tail should be raised two or three inches. Slow initial acceleration is desirable. On a hard surface urnway 1400 to 1600 RPM will be sufficient as air speed should not exceed 50 MPH. Slightly more power will be required on sod. One caution - Due to slow acceleration the right rudder used to' counteract torque effect is fed in gradualy, and in most cases is un-noticed by the flyer. The effect of this is that if the throttle is cut abruptly the flyer finds he is holding right rudder which is not needed., and imediately overcontrols with left rudder - thereby making " S " turns down the runway. The throttle should be reduced slowly to prevent this.

I definitely recomend that you lift off and land straight ahead on the runway several times prior to full flight. I believe the best method of performing these lift offs, as it eleminates the need for attitude and control changes is as follows:

Accelerate down the runway using a intermediate amount of power (about 1800 RPM) with tail raised slightly off the ground. Your taxi runs will have given an idea of how much runway is required to accelerate and decelerate. Allow PLENTY of reserve runway. If at this RPM the aircraft does not become airborne, try again using slightly more power. When the plane is felt to be airborne slowly retard the throttle. As the plane is in the landing attitude it will settle back to the runway and roll out will be similar to a normal landing. As this type operation is entirely in ground effect you will find the air speed to be lower than anticipated. These lift offs will familiarise you with control responses, and also detect any misalighment of the landing gear.

Perhaps the one major differance in landing the MUSTANG as compared to most factory made planes is that the landing FLARE must me made much LOWER than you are used to doing. This is due to the fact that when you are sitting on the ground in the MUSTANG your eye level is much lower than in most standard type aircraft.

As a safety precaution in case of a unplanned go-around it is suggested that the plane be fully ready for flight, with sufficient fuel, during these taxi tests.

CAUTION - DO NOT blast down the runway with lots of power and with the stick full back during these tests.

Unless you are an experienced flyer I do not recomend that you simply take off on the first flight without the lift-off experience. In the event of engine operating difficulty you may need to make a quick return to the field, and would have no real idea as to approach speed, float characteristics, or runway required.

On the first flight feel out an APPROACH to a stall. This will give you a indication of the stall speed. Use about 20 MPH additional for final approach speed, slowing to 10 MPH more for a over the fence speed. I believe the main aspect of the landing, as with any landing, is to break the glide or "flare" as low as possible. (Remember you are sitting closer to the ground than you are generaly accustomed to.) I suggest using a little power for the initial landings, 1100 to 1200 RPM. This will flatten the glide and give more positive control of the approach.

After the taxiing and lift-offs you will be familiar with the three point attitude of the airplane. This will make three point landings simple. The method recommended is to use full flaps and a little power. Flare out the landing glide as normal, and after the flare set up the three point attitude. A slightly nose high attitude is satisfactory. After attaining the three point attitude just hold it there and let the plane settle in. If your flare is high and you feel the plane is settling too fast an additional 100 RPM will reduce the rate of deeent. If you feel the plane is floating too far, or wants to "balloon", slack off the power. I have watched a person make a good landing in a MUSTANG although he flared 12 ft. high, by just maintaining the attitude and regulating the rate of decent with power. He did use a lot of runway however.

As the above described approach using partial throttle (although only a small amount of power) results in a flat approach a clear runway approach is necessary. A completely power off approach is fine, but things happen a little quicker.

A go-around with full flaps down is satisfactory, and acceleration is quick. It is not necessary to raise the flaps.

One more comment on the above described three point landing proceedure. The ground attitude is approximately 5° less than the stall attitude. That is why this method workd well. However, if you were to become too engrosed in easing the plane down from a too high level off position it is easy to raise the nose high enough to get a stall. Caution should be used in this respect.