MX

Owner's Manual
Eipper Aircraft Inc.

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INTRODUCTION

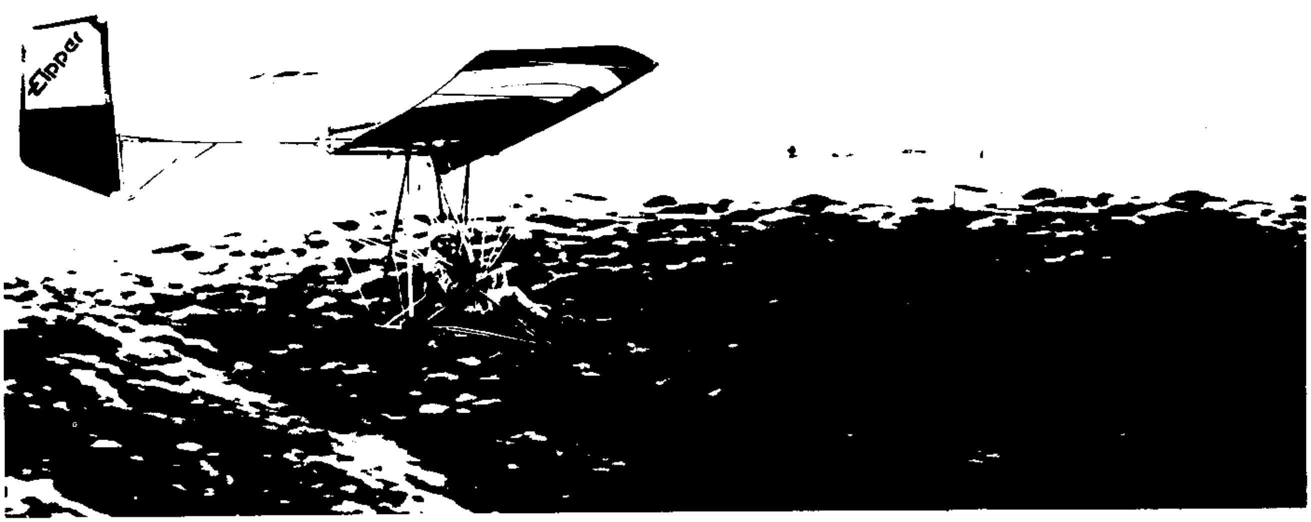
The ultralight aircraft has become a very important type of aircraft in terms of numbers, economic contributions, and public enjoyment. The Quicksilver, built and designed by Eipper Aircraft, Inc. is the leader and founder of this new world of sport aviation and ultralight aircraft. Its history and safety record are unsurpassed in the industry, making it one of the most popular aircraft in the world.

Incorporating a unique and highly functional control system, the Quicksilver MX is designed to allow the pilot who prefers conventional three-axis control to experience the utmost in ultralight aviation.

Eipper Aircraft has prepared this owner's manual as a guide to help you get the most enjoyment and utility from your MX. It includes information about your MX's equipment, construction, assembly, operation, specifications, limitations, flight training, maintenance and safety. We urge you to study it carefully and refer to it frequently.

Our interest in your flying pleasure has not ceased with your purchase of an Eipper Product. The Eipper Aircraft dealer organization is established world-wide for aircraft service and pilot training.

We at Eipper Aircraft, Inc., welcome you to the world of Ultralight Flying and congratulate you for joining thousands of satisfied Eipper customers.



CAUTION!!!

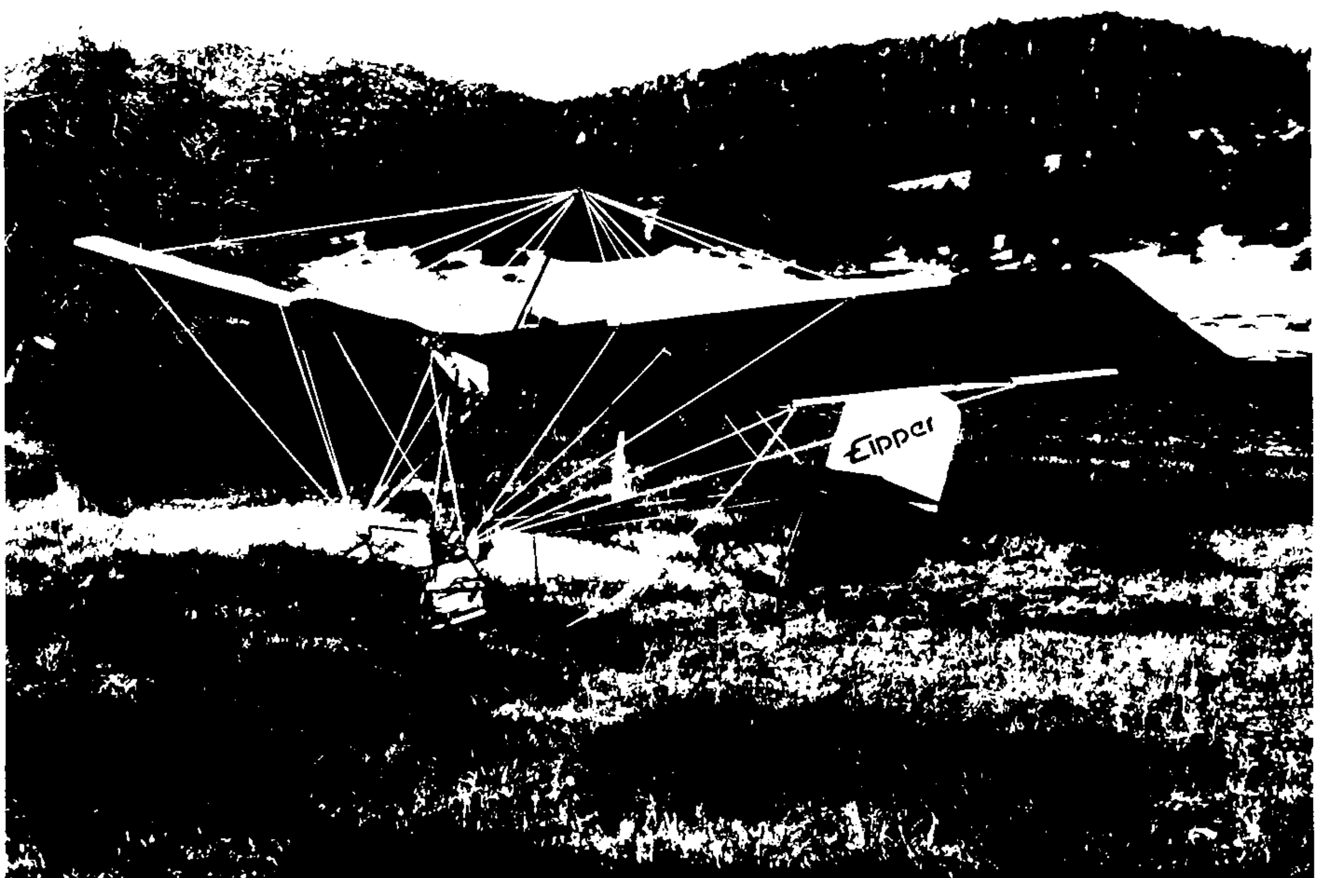
The Quicksilver MX
is not an
acrobatic aircraft.
Abrupt
maneuvers
should always
be avoided.

Flying microlight or ultralight aircraft involves travel in 3-dimensions, and that such activity is subject to mishap, injury and possibly even death.

The following create major HAZARDS and RISKS:
- AIR CURRENTS and TURBULENCE
- AIR TRAFFIC (Observe Air Space Regulations)
- ELECTRIC LINES, TREES and OTHER OBSTACLES
- PILOT ERROR—ENGINE STALL
- PANIC

The risks and hazards are real and you automatically assume those risks after you take-off. In order to minimize your risk you should read this manual, as well as your ground school training manual. DO NOT attempt flight without first receiving proper instruction from an Authorized Eipper Aircraft Dealer.

SECTION A
ASSEMBLY SPECIFICATIONS



Assembly Instructions

The "MX Assembly and Parts Manual" is located in your Customer Service Manual in the kit and includes sequences and procedures for construction as well as assembly illustrations. The assembly instructions are also reference material for repair or maintenance jobs and will help you find part numbers quickly when ordering from your dealer, so return them to the binder when initial construction is completed.

Construction Notes

Eipper's MX is available either in easy-to-build kit form or assembled by your local dealer. Assembly of your MX can be accomplished in approximately 20 hours. All of the difficult fabrication details have been pre-finished at the factory, including drilling, anodizing, cable swaging, sewing of wing and tail surfaces, etc. Work slowly and carefully and follow these assembly instructions closely. If you have any construction problems or questions, please feel free to call your local Eipper dealer or the factory for help.

Basic tools necessary for assembly include the following:

- One pair each of 3/8", 7/16", 1/2", 5/8" and 11/16" wrenches
- Torque wrench (Optional)
- Fine metal file
- Hacksaw
- Hand drill with 1/8", 3/16", 1/4", and 5/16" bits
- Pop rivet gun
- Sailmaker's "hot knife" or blade edged soldering iron
- Allen wrench 8 mm.
- Slot head screwdriver
- Center punch
- Tape measure
- Duct tape

Self-Locking nuts can be torqued to the standard values given below with several exceptions:

Bolts that pass through tubes with no solid internal support should be tightened until the tube shows a **slight** distortion. Back off nut slightly. Be particularly careful when installing the coarse thread grade 5 bolts in the main wing spars.

Where wing nuts are used, be certain to lock with a safety ring, cotter pin, etc.

Torque Values

3/16" (AN-3)	10-20 inch/lbs.
1/4" (AN-4)	30-50 inch/lbs.
5/16" (AN-5)	60-80 inch/lbs.

NOTE: Check engine owner's manual for proper torque values of engine bolts.

After installing bolts, check that the grip length is correct. With one washer under nut (unless otherwise indicated) at least two bolt threads should extend out of the nut. One or two washers may be added to prevent bolt from bottoming out before producing a snug fit. Eyebolts and fork bolts do not require a washer under the head.

Self-locking nuts should not be removed and reinstalled more than twice. Generally they become less vibration resistant with each removal.

Un-twist wires before final attachment. A twisted wire can alter the length significantly. A twisted wire will also be more prone to jamming or twisting a wire thimble during field assembly of your MX.

Basic MX Components

Become familiar with all of the ultralight's components and their functions. The basic MX components are listed below.

1. Rib
2. Trailing Edge Spar
3. Leading Edge Spar
4. Compression Strut
5. Kingpost
6. Spoiler
7. Wing Cover
8. Rudder Leading Edge
9. Rudder Frame
10. Rudder Compression Strut
11. Elevator Frame
12. Stabilizer
13. Tail Skid
14. Rudder Brace
15. Tail Brace
16. Tail Mount
17. Push/Pull Tube
18. Teleflex Cable
19. Tail Boom
20. Propeller
21. Reduction Unit
22. Root Tube
23. Landing Gear Down Tube
24. Seat Support Down Tube
25. Axle
26. Main Wheel
27. Axle Strut
28. Seat Mount Assembly
29. Tension Strut
30. Nose Strut
31. Nose Wheel
32. Foot Bar Assembly
33. Control Stick
34. Triangle Bar Down Tube
35. Engine
36. Fuel Tank
37. Diagonal Strut

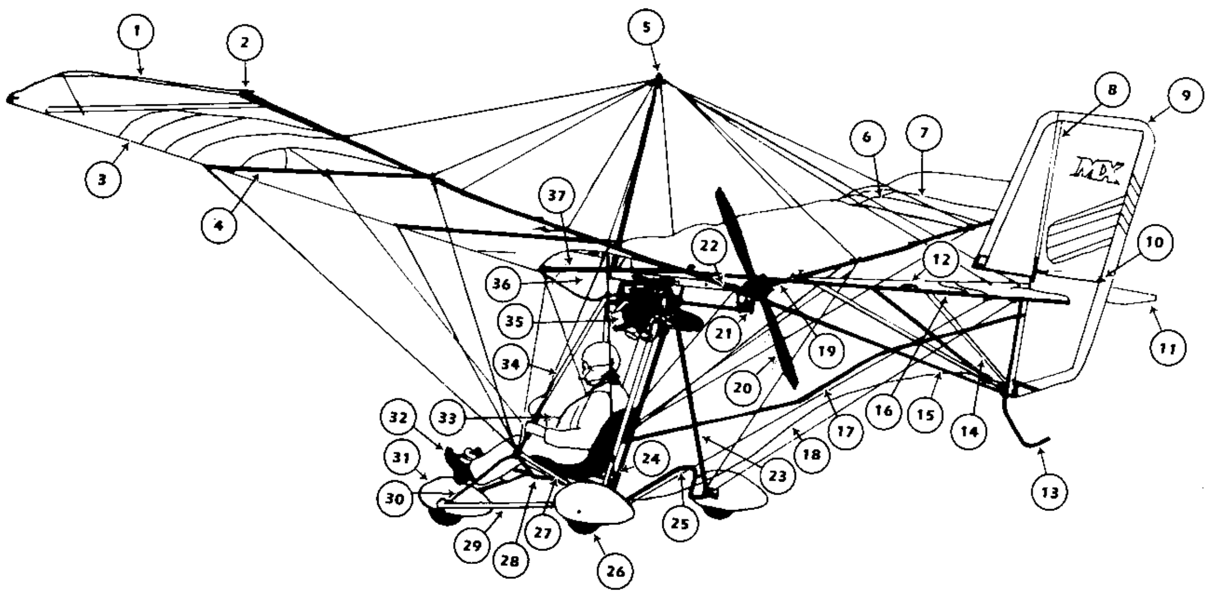
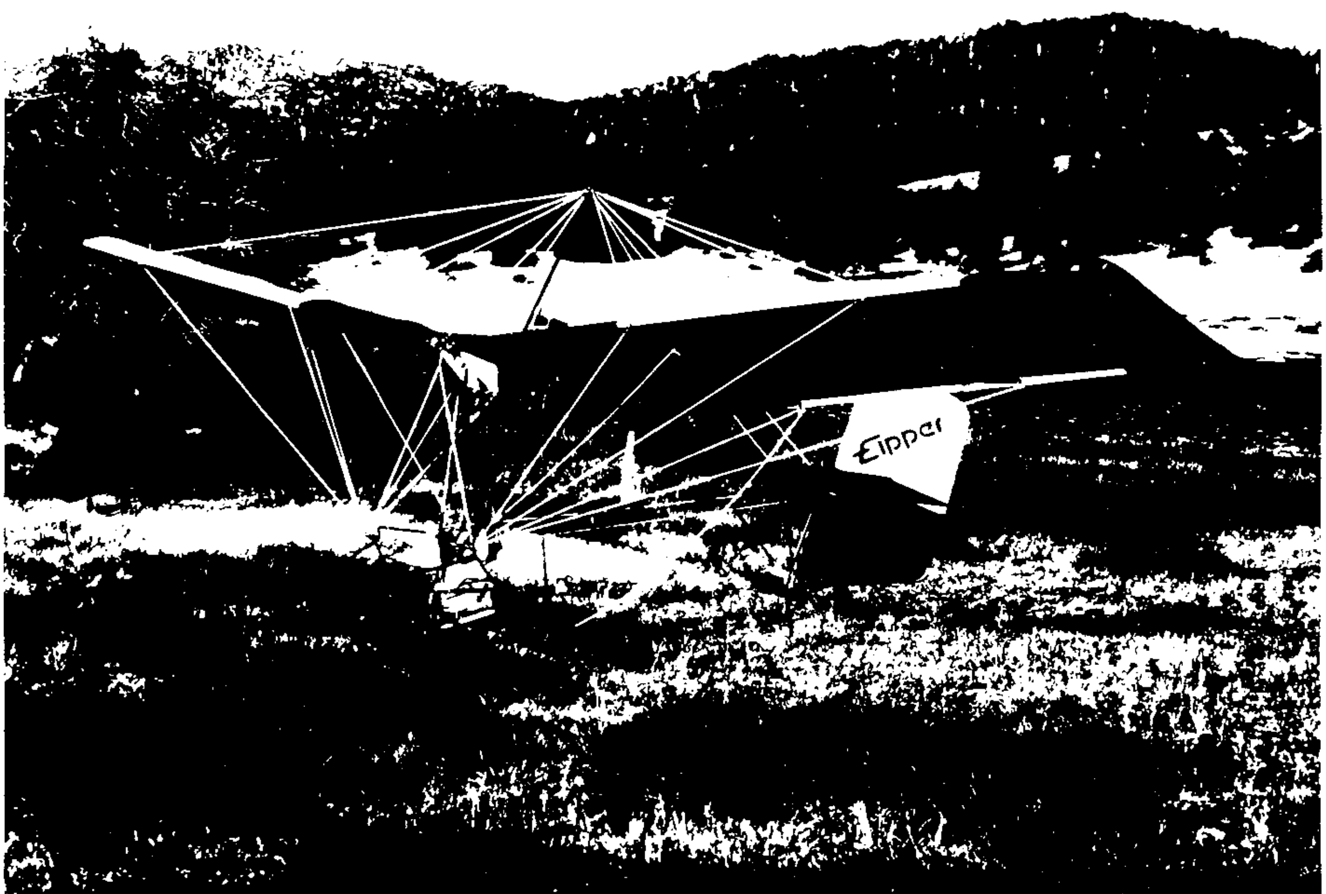
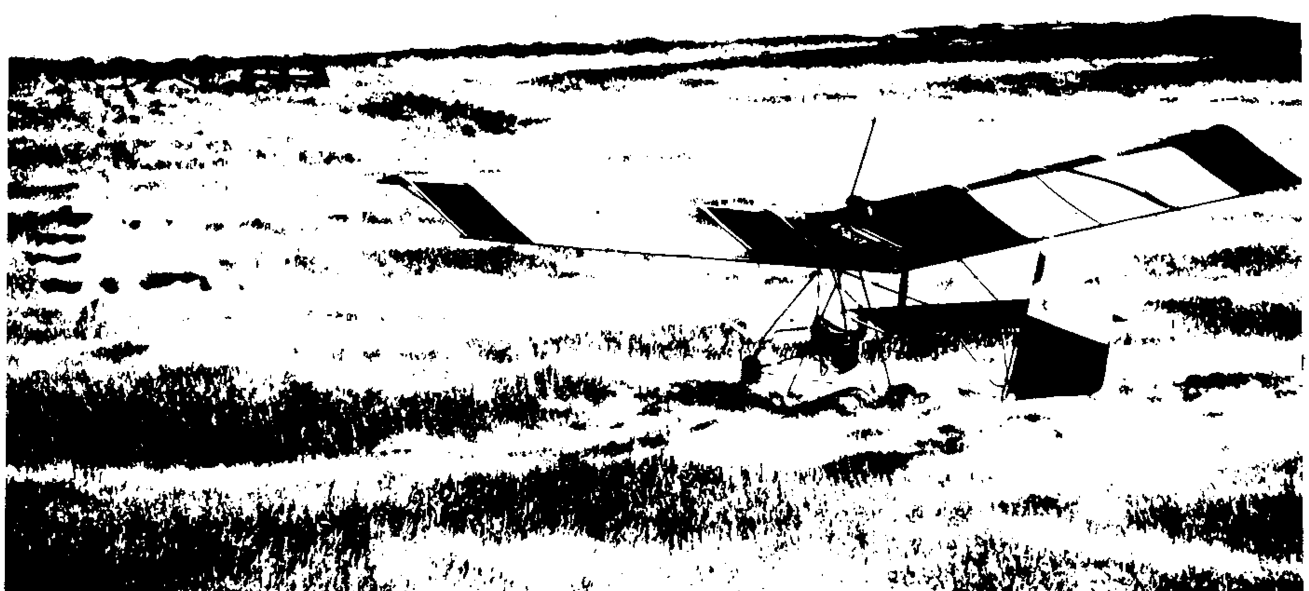


Figure 1.1 Basic Quicksilver MX Components

SECTION B
OPERATION SPECIFICATIONS



FIELD ASSEMBLY



Transporting

Extreme caution must be used when transporting ultralight vehicles. The MX, like other Eipper Aircraft models, should be carried on a trailer.

All wing and tail surfaces should be properly supported and secured. Check carefully that no excessive stress is placed on any airframe components. All MX parts making contact with each other or the trailer, as well as all supported areas, should be padded to prevent abrasion.

Remember, you are transporting a vehicle that flies! To keep it airworthy use good common sense, safe trailering techniques, and a thorough preflight.

Field Assembly I & II

The MX can be disassembled for transport or storage in two different ways.

I. Standard Assembly

The most "complete" disassembly procedure involves removing the wings, tail, landing gear, and powerplant and disassebling the fuselage, controls and tail surfaces. This break-down technique offers the most portable package and takes approximately one hour for field assembly.

II. Quick Set-Up Conversion Kit

For "quick set-up" and break-down the entire fuselage can remain intact leaving only the wing and tail components to be assembled and installed after transport by trailer. Set-up time is reduced to 30 minutes.

NOTE: When assembling your MX use these photos as a guide only. Due to constant updates, sequencing or hardware pictured may vary so follow the written descriptions, work closely with your dealer and, if necessary, refer to your Assembly and Parts Manual for details.

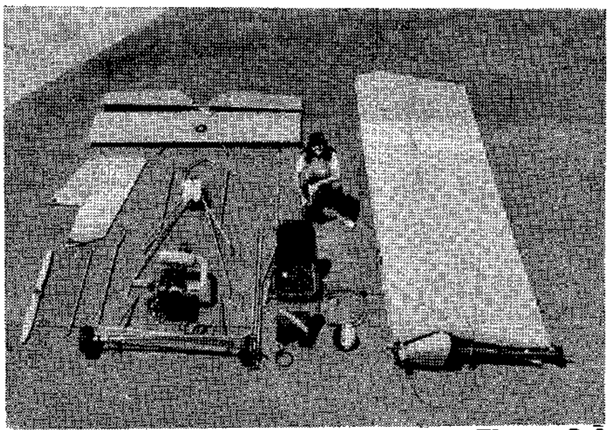


Figure 2.1

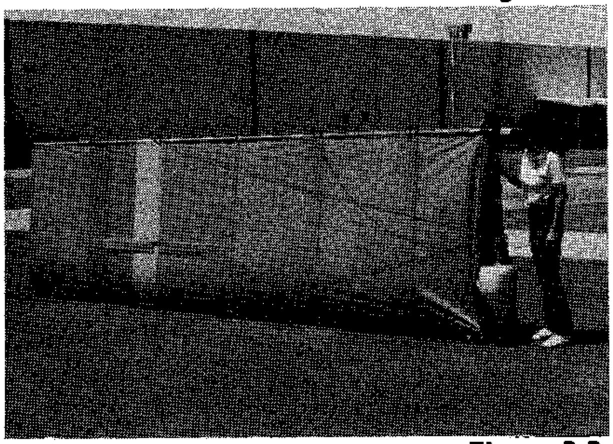


Figure 2.2

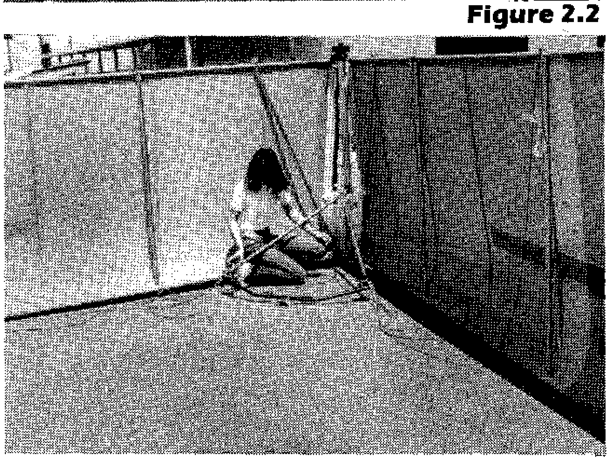


Figure 2.3

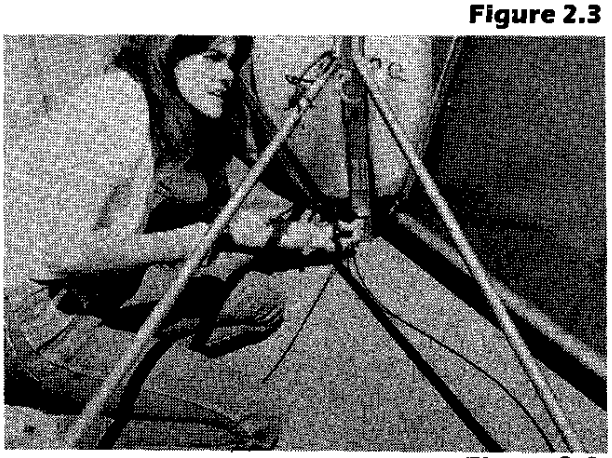


Figure 2.4

Field Assembly I

1. For assembly, carry Quicksilver MX to flat ground clear of obstacles.
2. Remove tail surfaces, and other parts from side pocket on storage cover.
3. Remove storage cover. **Figure 2.1**
4. Stand Quicksilver MX wings on leading edges and root tube. Protect sail with leading edge pads. **Figure 2.2**
5. Open wings to form a 90° angle. **Figure 2.3**
6. If ribs were removed for transport, install and swing out and attach tip struts to tip rib.
7. Rotate triangle bar to horizontal position and remove padded covers from corners.
8. Attach triangle bar nose wires to 75° tang on nose of root tube using 3/16" shackle, clevis pin and safety ring. **Figure 2.4**

9. Pull out wings as far as they go and insert kingpost through opening in wings. **Figure 2.5**

NOTE: Plan MX set-up so wings are parallel with the prevailing wind direction.

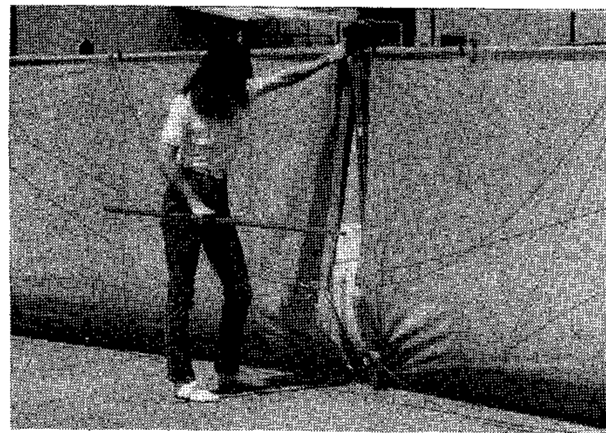


Figure 2.5

10. Thread kingpost into kingpost top fitting. **Figure 2.6**
11. Check integrity of AN4-17a and locknut.

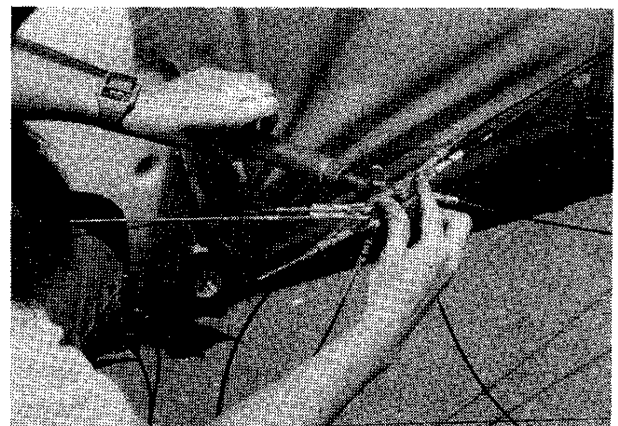


Figure 2.6

12. Check all wing wire ends for jammed or twisted ends and correct as necessary. **Figure 2.7**


Figure 2.7

13. Attach kingpost base to kingpost channel on root tube using 1/4" dia. T-handle pin and safety ring. **Figure 2.8**


Figure 2.8

Figure 2.9

14. Remove gas cap, slip tank spout through opening in wing cover, and reinstall gas cap. **Figure 2.9**

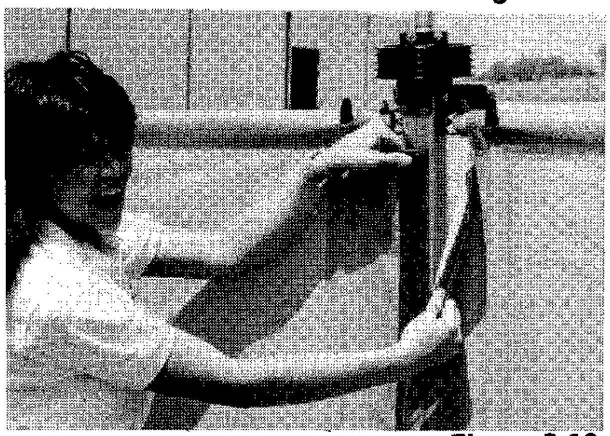


Figure 2.10

15. Connect velcro on right and left wing covers. Secure entire length of the root tube. **Figure 2.10**

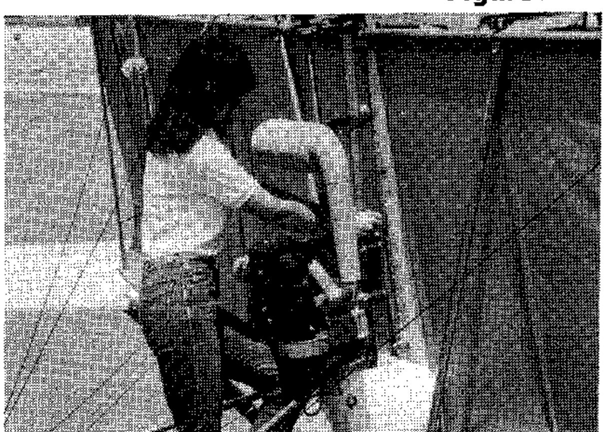


Figure 2.11

16. Lift powerplant into position on root tube. Insert (2) AN5-26a's through engine mount assembly and root tube. Leave locknuts loose to make powerplant alignment easier. **Figure 2.11**

Figure 2.12

17. Attach muffler strap using AN4-27a, washers and locknut. Be sure to insert nylon washers between root tube and straps. **Figure 2.12**

18. Install belt reduction assembly by sliding pillow block bearing with drive shaft onto (2) 7/16" bolts with lower bearing plate. Add flat washers, star washers and nuts. **Figure 2.13**

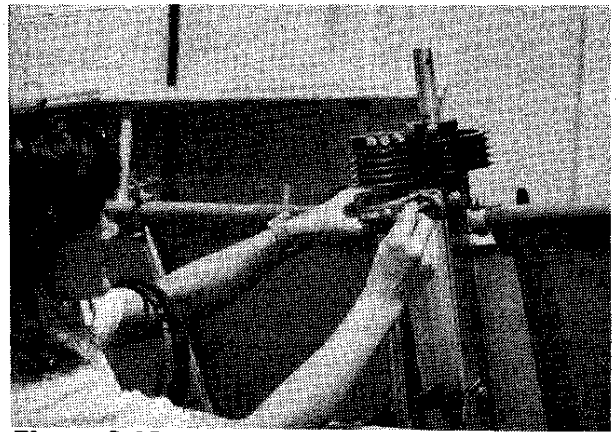


Figure 2.13

19. Secure engine mount assembly by tightening (2) 5/16" locknuts. **Figure 2.14**

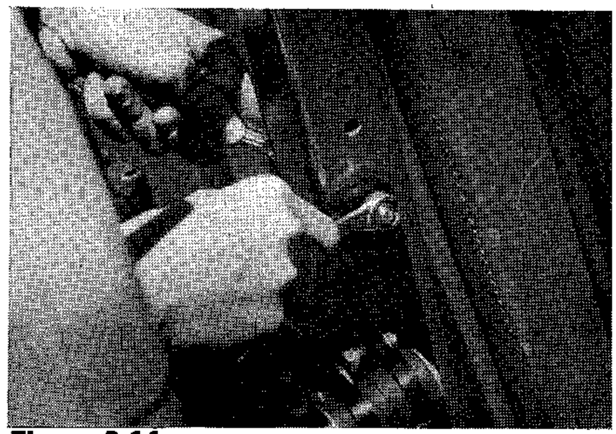


Figure 2.14

20. Install (4) 3VX250 belts on pulleys (in same sequence as break-in). **Figure 2.15**

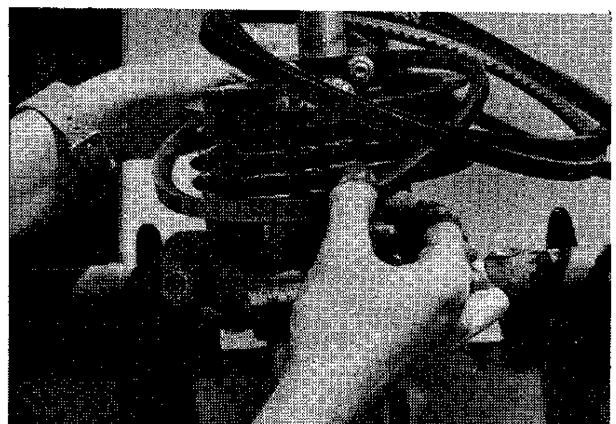


Figure 2.15

21. Unthread (2) lower inner locknuts evenly to adjust belt tension (see Assy. & Parts Manual for specifications). Tighten lower outer locknuts. **Figure 2.16**

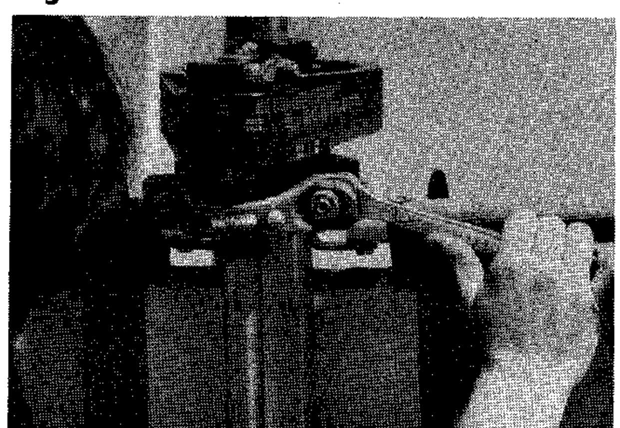


Figure 2.16

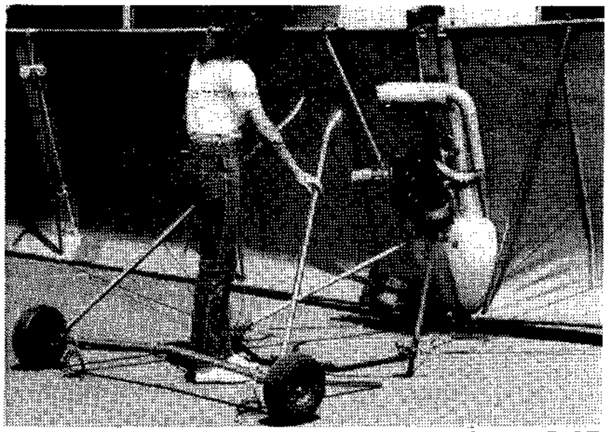


Figure 2.17

22. Position landing gear behind triangle bar, ready for installation. **Figure 2.17**

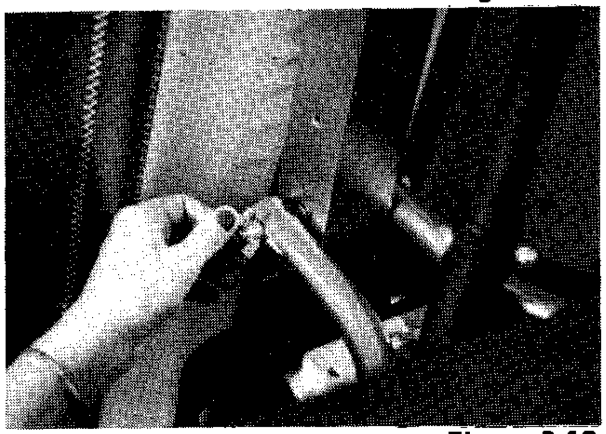


Figure 2.18

23. To help align downtubes, balance axle struts on 1" channels on each side of triangle bar crosstube.
24. Attach landing gear downtubes to each side of root tube using AN5-46, washer, wingnut and safety ring. Be sure to insert plastic saddle fittings. **Figure 2.18**

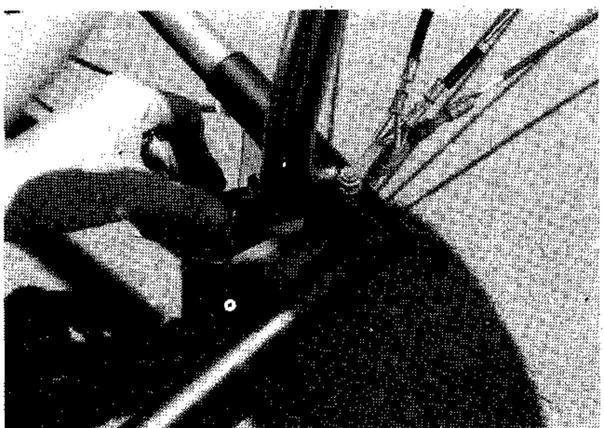


Figure 2.19

25. Attach right and left landing gear axle struts to 1" channels on each side of triangle bar crosstube using 1/4" dia. T-handle pins and safety rings. **Figure 2.19**

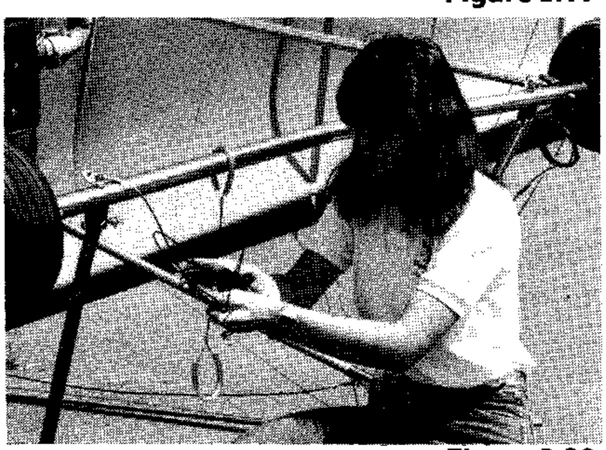


Figure 2.20

26. Uncoil landing gear side wires on axle. **Figure 2.20**

27. Connect landing gear side wires to flat tangs on right and left inboard trailing edge wire stations using 3/16" shackles, clevis pins and safety rings. **Figure 2.21**

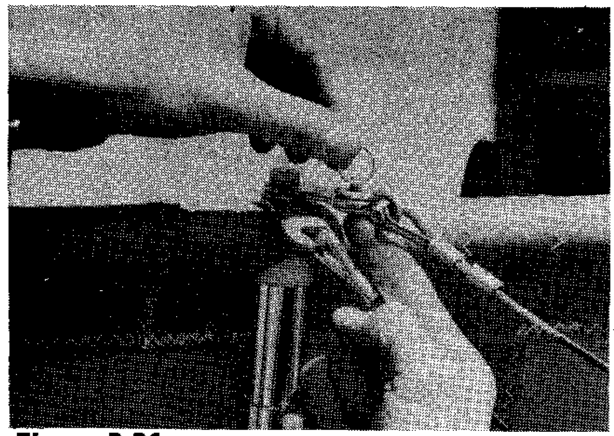


Figure 2.21

28. Attach tail skid to tail mount using AN4-26, wingnut and safety ring. Be sure to insert saddle fittings. **Figure 2.22**

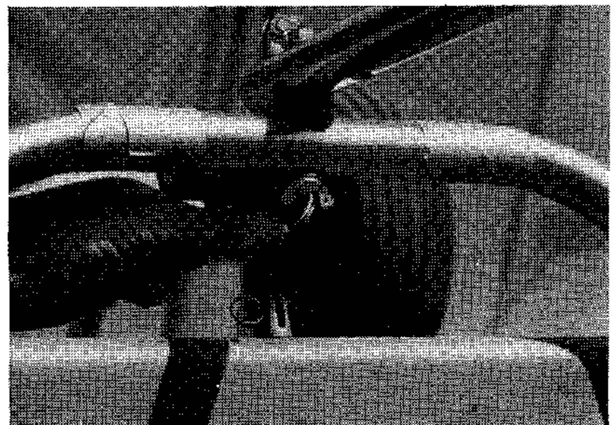


Figure 2.22

29. Attach rudder brace to tail skid using AN4-26, wingnut and safety ring. Be sure to insert saddle fittings. **Figure 2.23**

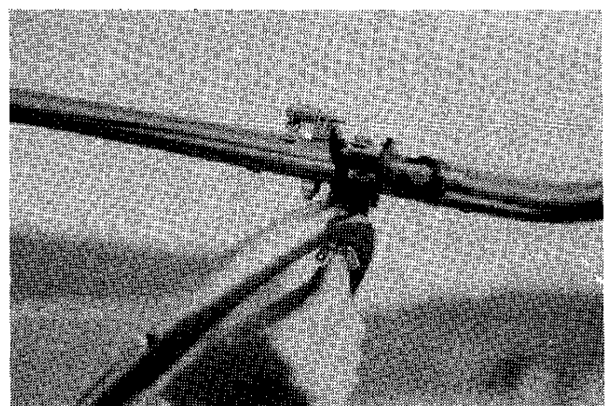


Figure 2.23

30. Prepare to install tail section by setting stabilizer on landing gear. Lean tail boom tubes against axle and uncoil upper and lower tail wires. **Figure 2.24**

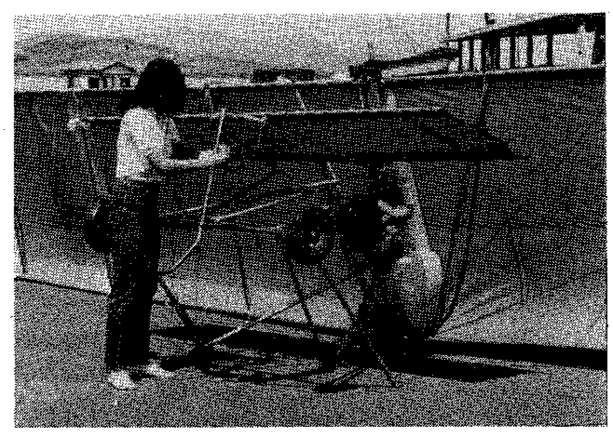


Figure 2.24

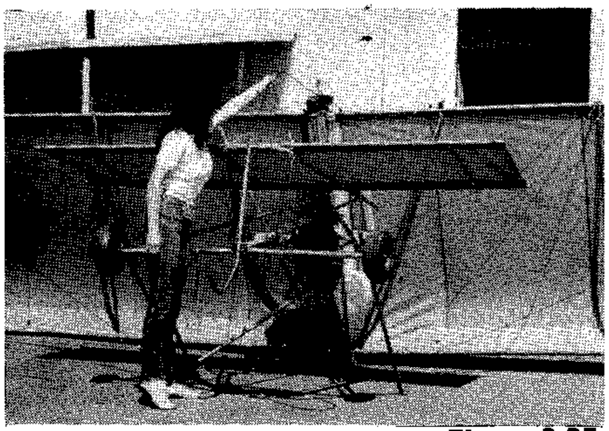


Figure 2.25

Figure 2.26

Figure 2.27

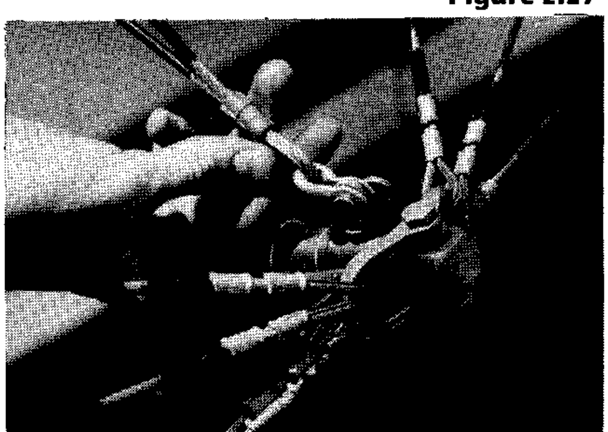


Figure 2.28

31. Toss right and left upper tail wires over wing, each to their side of propeller shaft. **Figure 2.25**

32. Route lower tail wires inside rudder brace. **Figure 2.26**

33. Attach right and left lower tail wires to axle eyebolts using (2) shackles, 3/16" clevis pins, and safety rings. **Figure 2.27**

34. Attach stabilizer upper wires to eyebolt on kingpost top fitting using 3/16" shackle, clevis pin, and safety ring. **Figure 2.28**

35. Insert right and left tail boom tubes into stabilizer tail mount. Be sure to rotate 1" channels on boom tubes towards wing tip. **Figure 2.29**

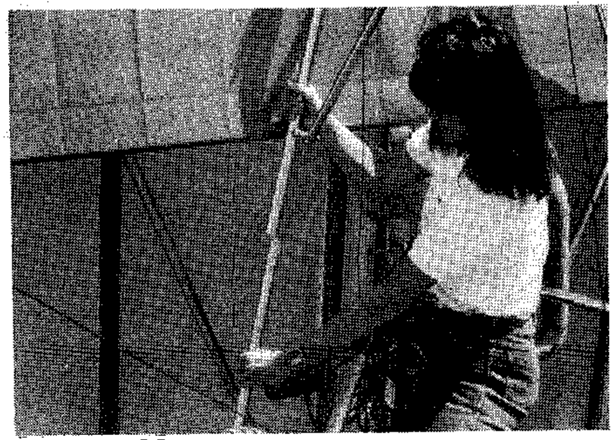


Figure 2.29

36. Stand inside wing cables and lift tail section by the boom tubes into position (best done with two people). **Figure 2.30**

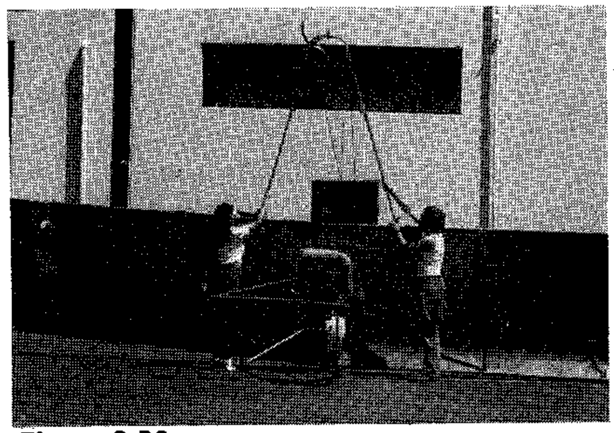


Figure 2.30

37. Attach right and left tail boom tubes to tail boom channels using (2) 1/4" dia. T-handle pins, and safety rings. **Figure 2.31**

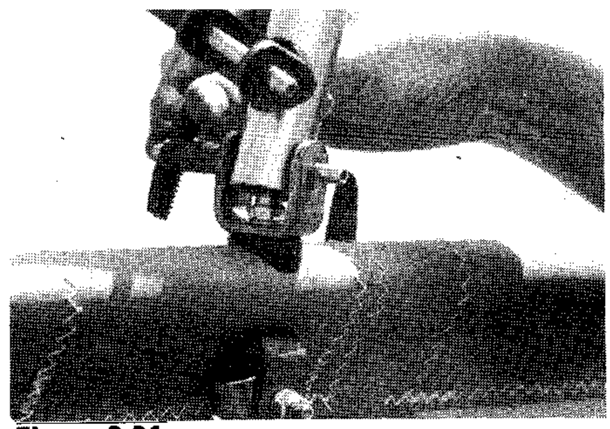


Figure 2.31

38. Check all wire ends for jammed or twisted ends, especially the lower nose, wires at triangle bar junctions. Correct as necessary. **Figure 2.32**

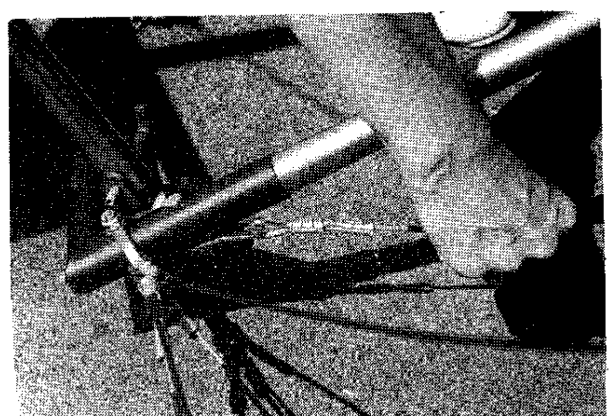


Figure 2.32

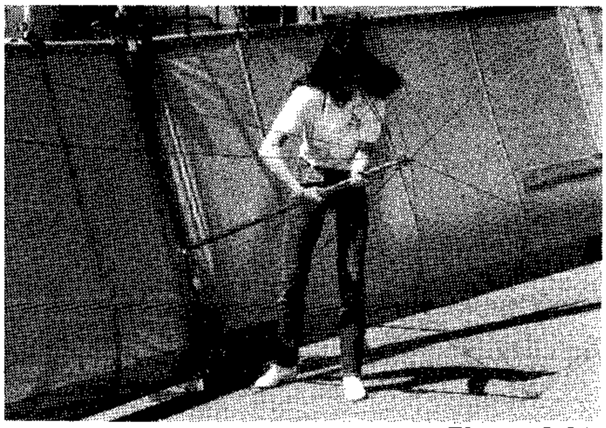


Figure 2.33

39. Twist up kingpost until sagging in wires is removed approximately 1/2"—3/4". DO NOT over-tighten. **Figure 2.33**

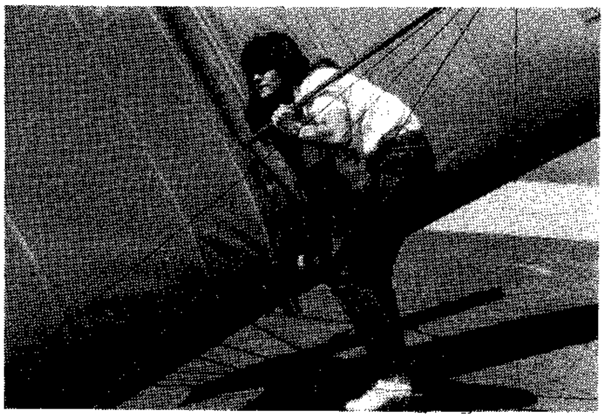


Figure 2.34

40. To rotate MX to its main gear pick-up nose from in front of wing. **Figure 2.34**

Figure 2.35

41. Tilt MX towards wing tip to avoid putting loads on triangle bar cross tube's spoiler pulley bracket. **Figure 2.35**

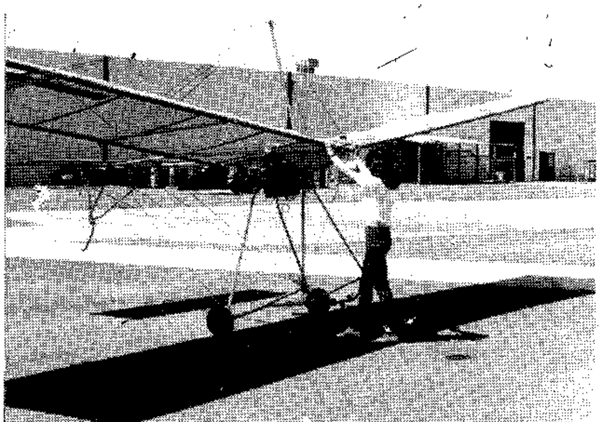


Figure 2.36

42. Rotate MX onto tail skid. Position tail into prevailing wind. **Figure 2.36**

43. Attach right and left tail brace tubes to 1" channels on tail boom tubes using (2) 1/4" dia. T-handle pins, and safety rings. **Figure 2.37**

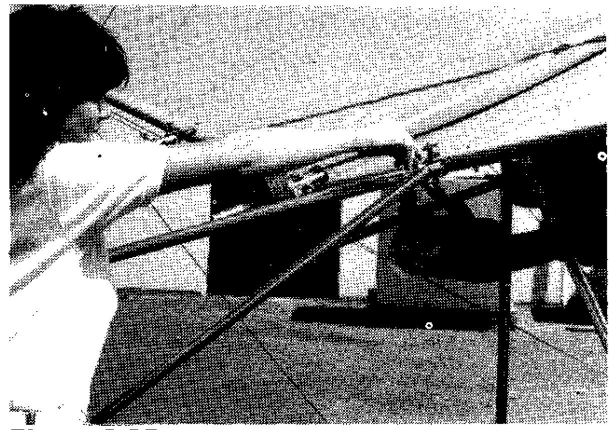


Figure 2.37

44. Attach opposite ends of right and left tail brace tubes to 1" channels on tail skid using (2) 1/4" dia. T-handle pins and safety rings. **Figure 2.38**

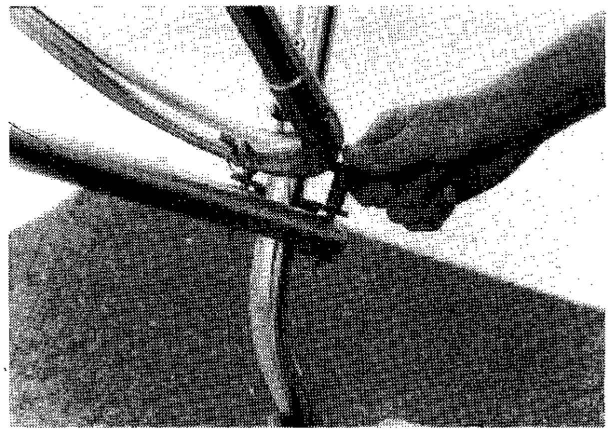


Figure 2.38

45. Position nose gear, seat assembly, and seat support down tube in front of MX, ready for installation. **Figure 2.39**

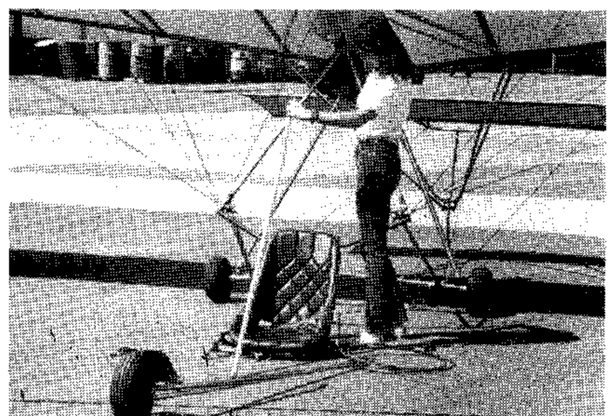


Figure 2.39

46. Attach seat support down tube to side of root tube (shoulder harness facing forward) using AN4-36, washer, wingnut and safety ring. Be sure to insert saddle fitting. **Figure 2.40**

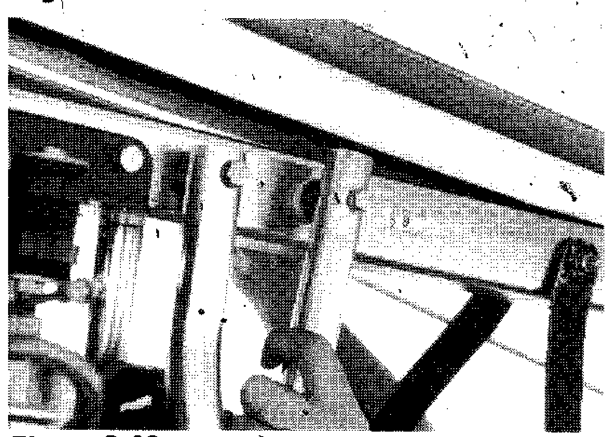


Figure 2.40

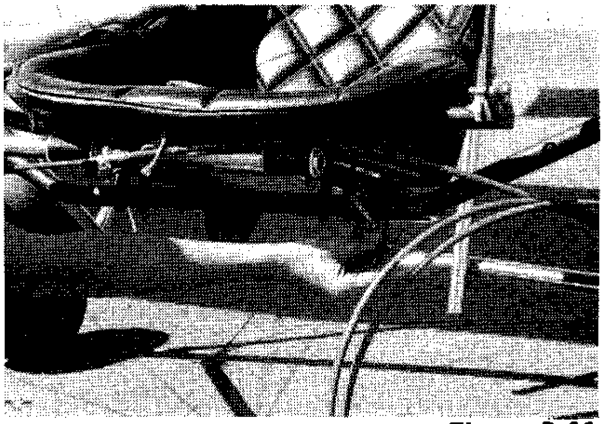


Figure 2.41

47. Set the seat mount assembly on triangle bar cross tube. **Figure 2.41**

NOTE: Determine proper seat position for your pilot weight. Adjustment fore and aft affects C.G.

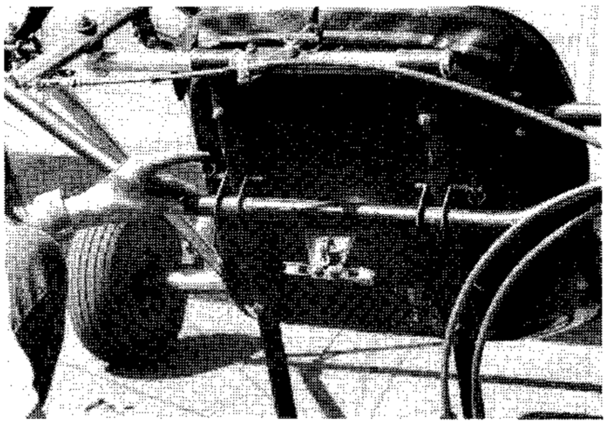


Figure 2.42

48. Attach seat using (2) 1/4" dia. T-handle pins and safety rings. **Figure 2.42**

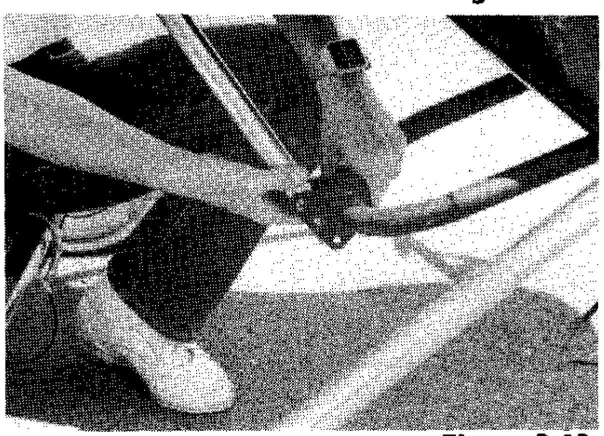


Figure 2.43

49. Attach seat support down tube to seat mount assembly bracket using AN4-17, washer, wingnut and safety ring. Choose an attach point which gives you proper seat adjustment and head clearance. **Figure 2.43**

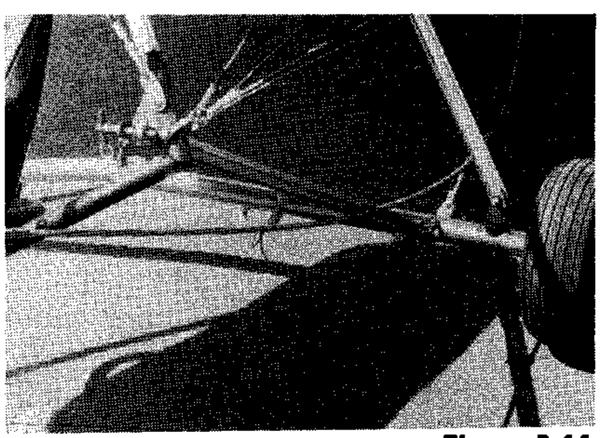


Figure 2.44

50. Route teleflex cable outside left axle strut, above axle and inside left landing gear down tube, below left landing gear side wire and along the left lower tail wire. **Figure 2.44**

51. Secure teleflex cable to axle strut and lower tail wire using Velcro tabs. **Figure 2.45**

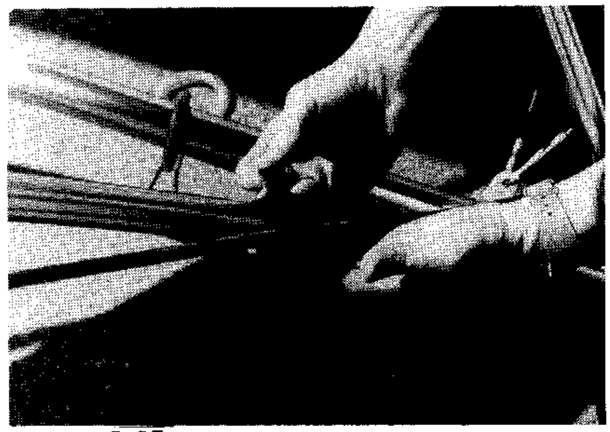


Figure 2.45

52. Slide teleflex cable bracket over sleeve of rudder brace. **Figure 2.46**

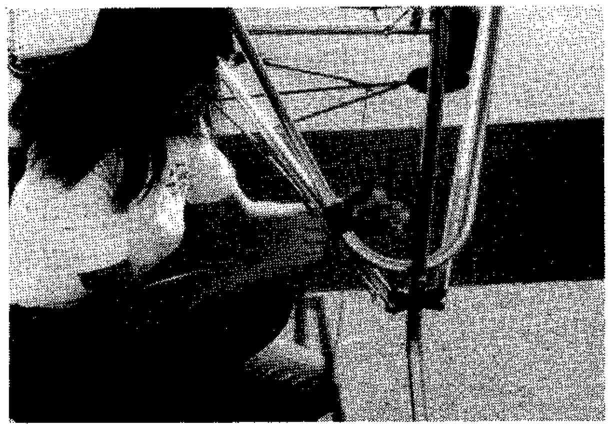


Figure 2.46

53. Attach bracket using AN4-20, wingnut, washer and safety ring. **Figure 2.47**

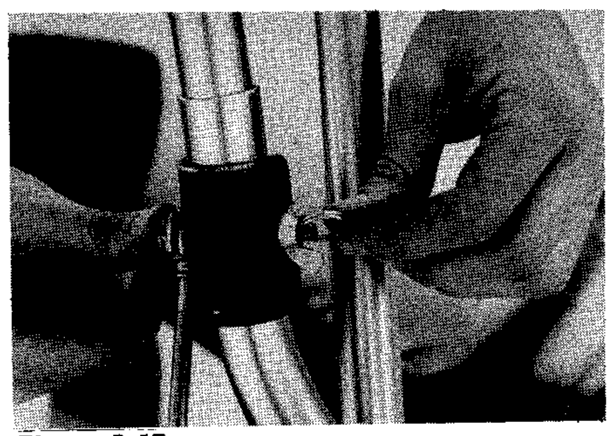


Figure 2.47

54. Attach right and left landing gear tension struts to inboard side of axle strut aft channels using (2) AN4-26's, washers, wingnuts and safety rings. Be sure to insert washer that goes between channel and strut. **Figure 2.48**

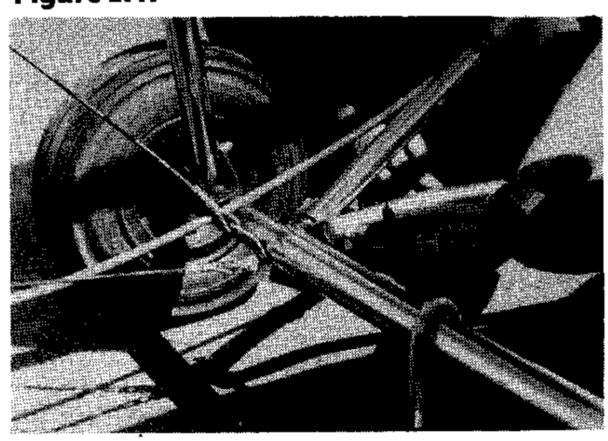


Figure 2.48

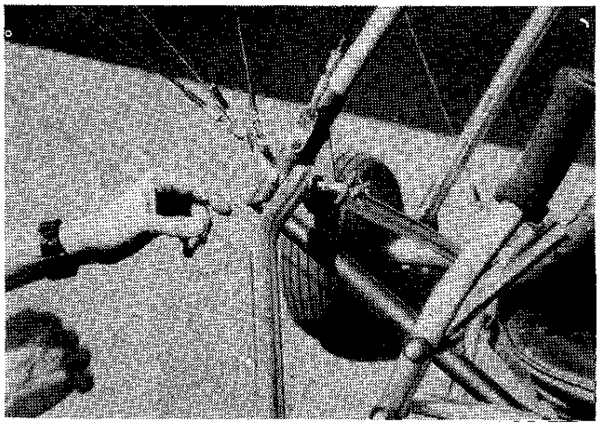


Figure 2.49

55. Attach right and left landing gear nose struts to 1" channels at corners of triangle bar using 1/4" dia. T-handle pins and safety rings. **Figure 2.49**

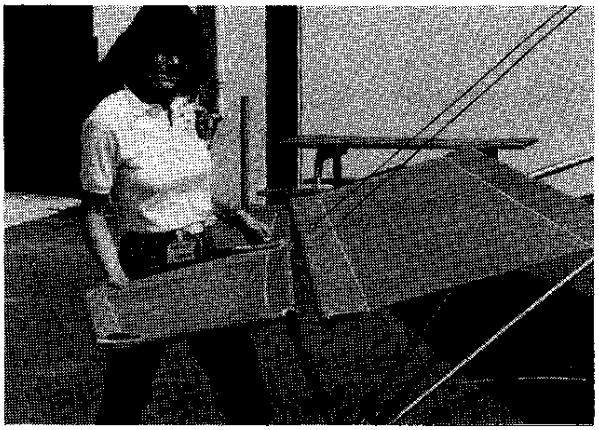


Figure 2.50

56. Position elevator by aligning elevator eyebolts with forks on stabilizer trailing edge. **Figure 2.50**

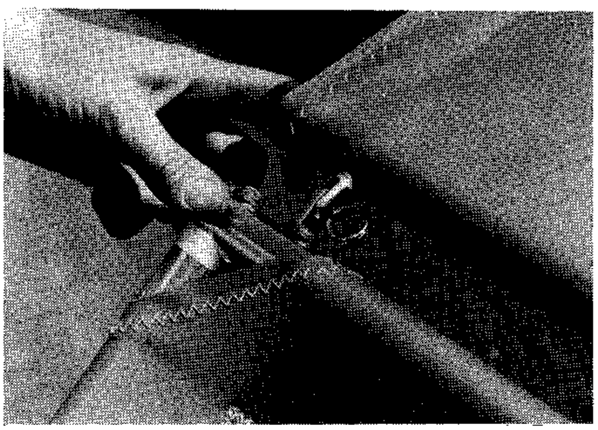


Figure 2.51

57. Attach elevator eyebolts to forks using (3) 3/16" clevis pins and safety rings. Be sure (2) outside pins point inward, with safety rings inboard. **Figure 2.51**

Figure 2.52

58. Position rudder by aligning rudder eyebolts with forks on tailskid. **Figure 2.52**

59. Attach rudder eyebolts to forks using (2) 3/16" clevis pins and safety rings. Be sure pins point downward. **Figure 2.53**

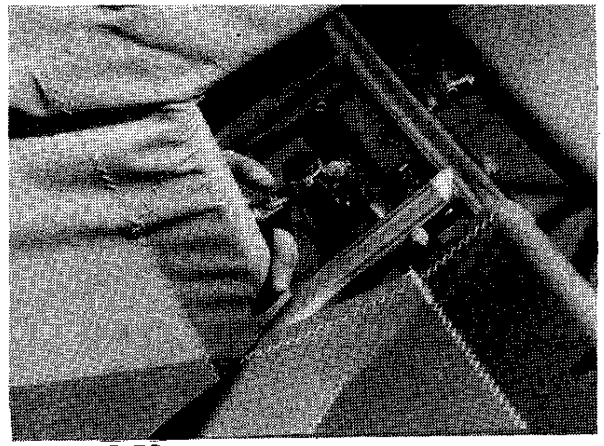


Figure 2.53

60. Adjust teleflex fork length to center rudder with control stick neutral. (Adjustment should not allow cable to extend too far out of teleflex cable housing.)
61. Attach fork to rudder horn using 3/16" clevis pin and safety ring. Be sure pin points downward. **Figure 2.54**

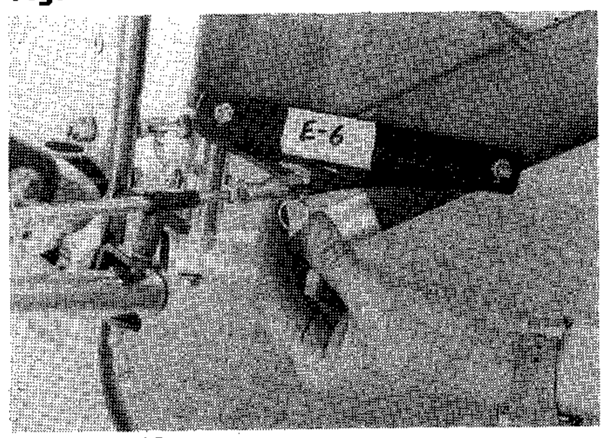


Figure 2.54

62. Route elevator push-pull tube through the loop of the push-pull safety cable. **Figure 2.55**

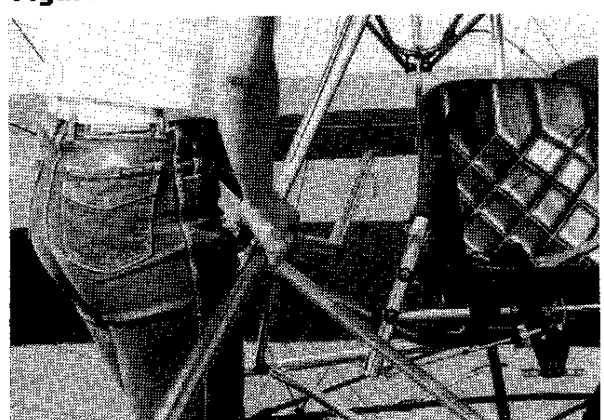


Figure 2.55

63. Continue to route tube inside tail brace, outside of rudder brace and above lower tail wire to align with elevator horn. **Figure 2.56**

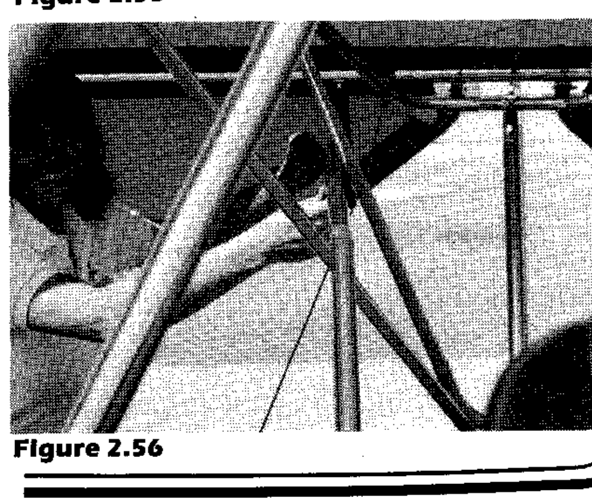


Figure 2.56

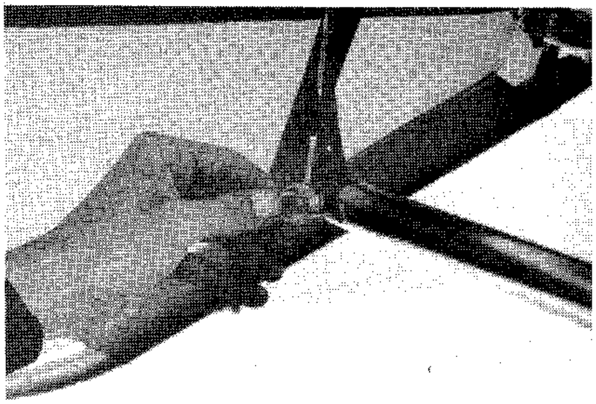


Figure 2.57

64. Attach elevator push-pull tube clevis to elevator horn using AN4-14, wingnut, and safety ring. **Figure 2.57**

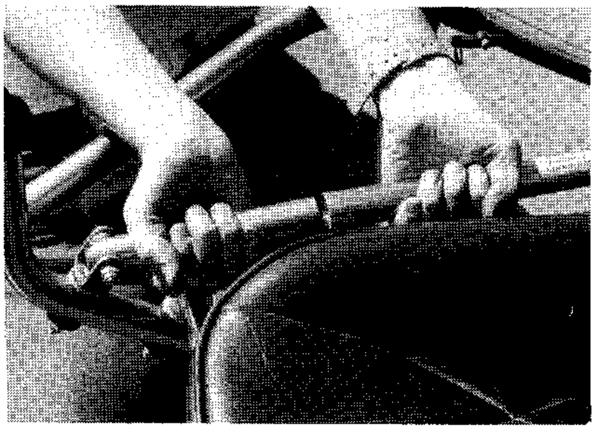


Figure 2.58

65. Slide elevator push-pull tube over adjust tube on control stick assembly and set length where neutral stick position achieves neutral elevator. **Figure 2.58**

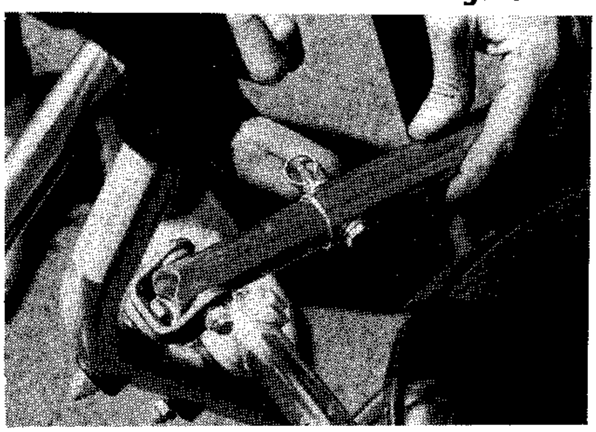


Figure 2.59

66. Attach push-pull tube using AN4-14, washer, wingnut and safety ring. Be sure to check both up (approx. 30°) and down (against stops) elevator travel when attached. **Figure 2.59**

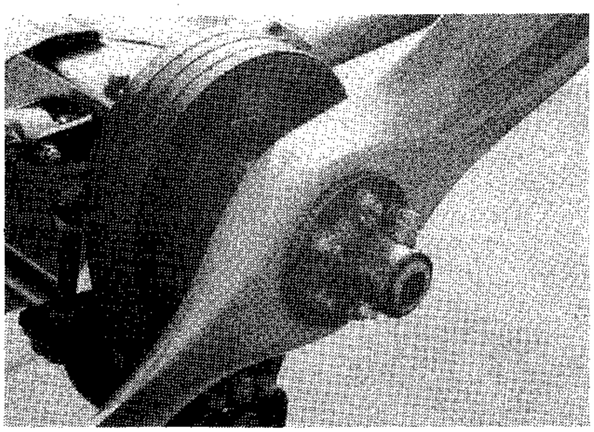


Figure 2.60

67. Remove padded storage cover and install propeller by sliding it onto prop shaft.

68. Attach prop hub with AN5-17a, washers and locknut. **Figure 2.60**

69. Route throttle cable end through conduit adjuster at base of throttle. **Figure 2.61**

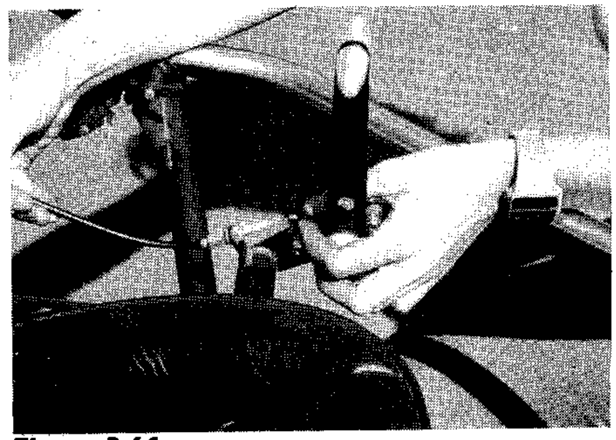


Figure 2.61

70. Press throttle cable into cable swivel on throttle lever assembly. Secure end by pulling cable aft. **Figure 2.62**

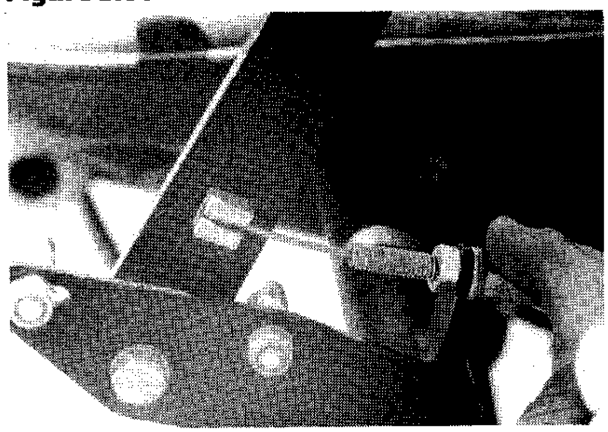


Figure 2.62

71. Secure throttle cable at diagonal strut using a Velcro tab. Be sure cable makes no tight bends. **Figure 2.63**

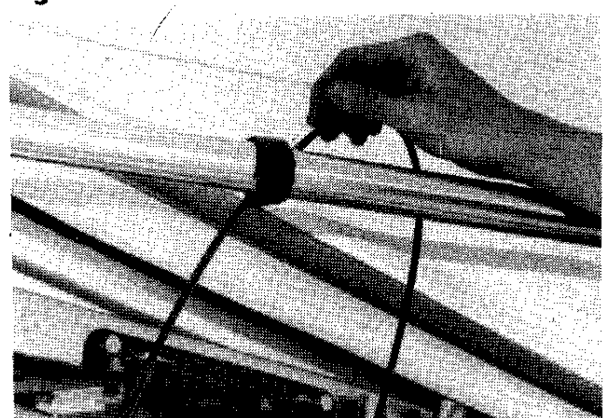


Figure 2.63

72. Hook-up kill switch electrical connectors. **Figure 2.64**

73. Be sure to secure all wires and fuel lines away from starter handle.

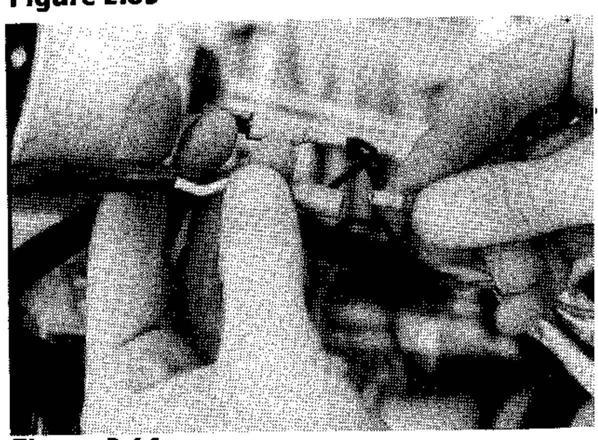


Figure 2.64

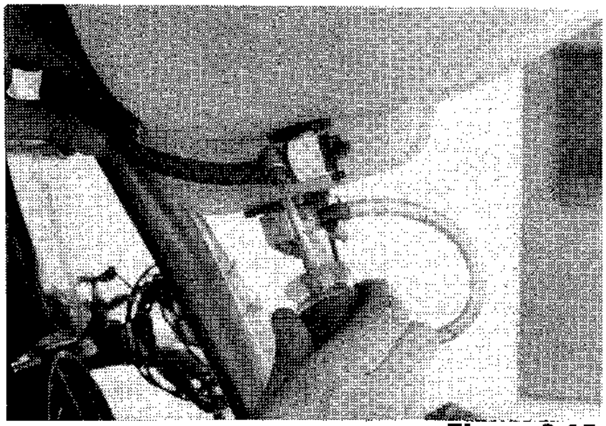


Figure 2.65

74. Route fuel line from engine to the on/off valve at base of fuel tank and secure with clamp. **Figure 2.65**
75. Check all fuel line connections to fuel pump, carburetor and tank. Secure as necessary.

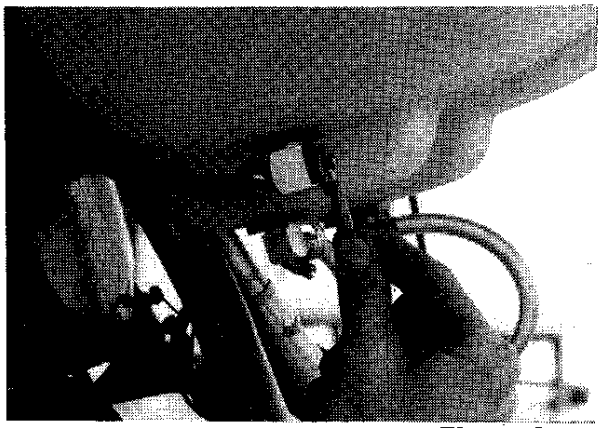


Figure 2.66

76. Turn fuel selector valve to ON by turning red handle "down". **Figure 2.66**
77. Check fuel line cross over for impurities and drain if necessary.

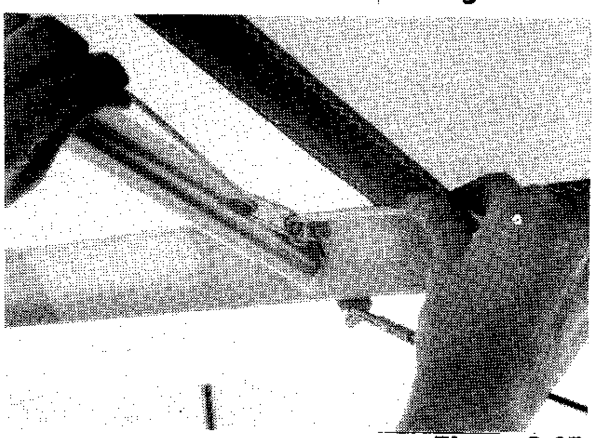


Figure 2.67

78. Uncoil spoiler control lines. Hook-up one side at a time. From spoiler control arm, route line through pulley at back of compression strut. **Figure 2.67**

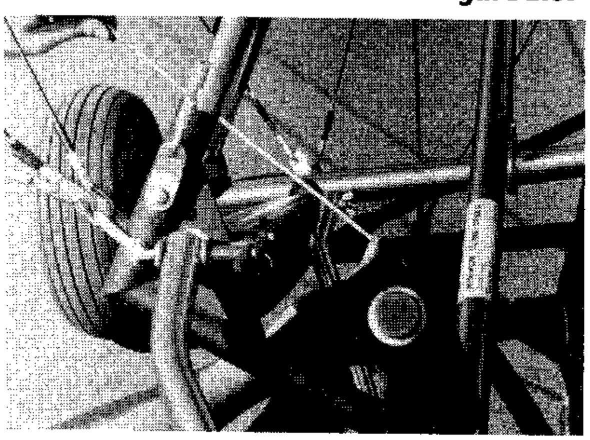


Figure 2.68

79. Continue line towards seat assembly above axle strut and behind tri-bar down tube. **Figure 2.68**

80. Route line through pulley on tri-bar bracket. **Figure 2.69**

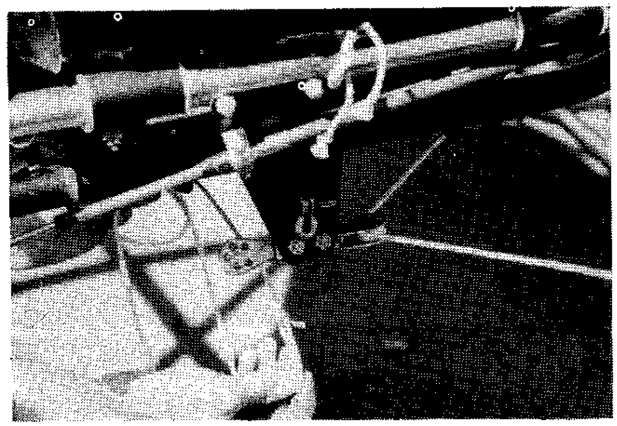


Figure 2.69

81. Continue line through pulley at spoiler pedal and back to tri-bar bracket. **Figure 2.70**

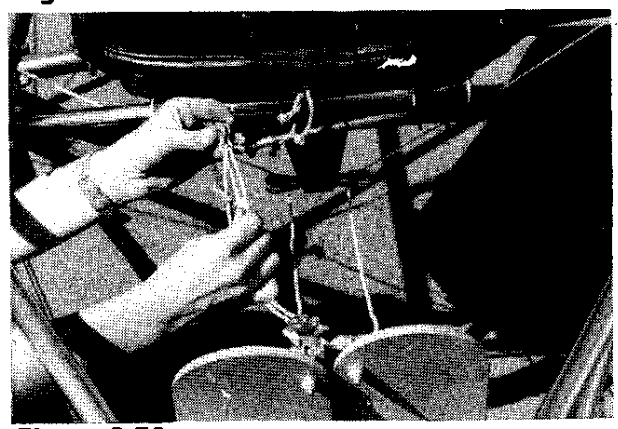


Figure 2.70

82. Slip loops at ends of spoiler control lines over shackle and attach to tri-bar bracket using 3/16" clevis pin and savety ring. **Figure 2.71**

83. Check adjustment of lines. Pedal full back—spoiler flat on wing surface. Pedal depressed—spoiler deploys 90° to wing surface.

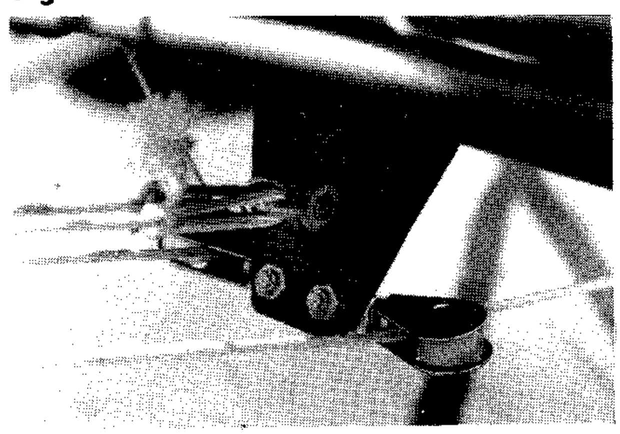


Figure 2.71

84. To attach your emergency recovery system, route the small end of parachute choker cable down through leading edge spar channel around root tube and back up through other L.E. spar channel. Route through larger thimble at other end of cable. **Figure 2.72**

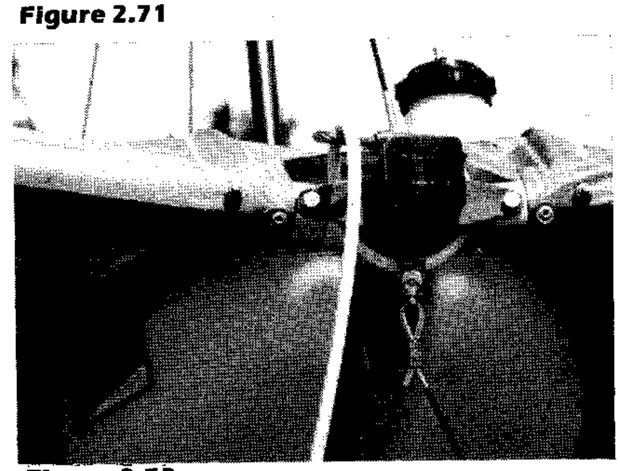


Figure 2.72

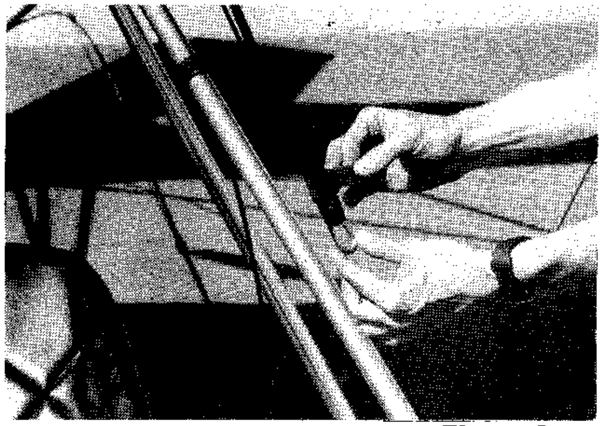


Figure 2.73

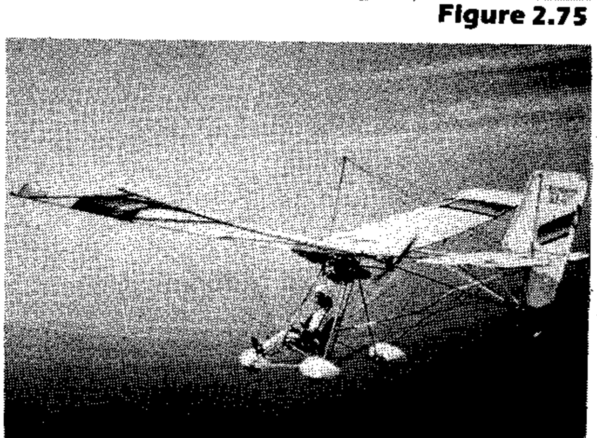
85. Secure choker cable to left lower nose wire using velcro tabs. **Figure 2.73**

Figure 2.74

86. Attach airspeed indicator to left nose strut using bracket and wing nut. Face airspeed opening directly to the front.
87. Check for proper fit of shoulder harness, seat belt and helmet.
88. Connect parachute D-ring to choker cable and twist up locking collar. **Figure 2.74**

Figure 2.75

89. Your Quicksilver MX is assembled and ready for preflight. Use procedures listed in Section B of this owner's manual. **Figure 2.75**



NOTE: Make sure the fuel valve is on the ON position. Be certain your MX has proper amount of negative incidence in horizontal stabilizer before attempting flight (Refer to Assembly & Parts Manual.) Do not fly an MX which has not been test flown by an authorized Eipper Aircraft Dealer. **Figure 2.76**

Figure 2.76 The Quicksilver MX

Field Assembly II

Quick-break-down cables must remain on MX for transport. For more detailed instructions refer to Assembly I.

1. Roll the MX fuselage to flat ground clear of obstacles for assembling. Remove wings, rudder, tail pieces and push-pull tube from trailer.
2. Remove propeller covers and other protective padding from MX components.
3. Attach tail mount, rudder brace and tail brace tubes to tail skid.
4. Attach elevator to horizontal stabilizer.
5. Attach rudder to tail skid.
6. Uncoil the lower tail wires and set the assembled tail section aside.
7. Set left wing into position at root tube and attach left wing leading edge channel to AN4-26 bolt using lock nut, washer and safety ring. Tighten with (2) 7/16" open end wrenches.
8. Attach left trailing edge spar to trailing edge channel using AN4-17 bolt, washer, castle nut, and safety ring. Repeat step 7 and 8 for right wing
9. Route kingpost up beside root tube and partially through opening in wing covers. Make sure the nose wire faces forward.
10. Attach upper wing wire sets [installed on (2) shackles] to kingpost top fitting using AN4-17 bolt, washer, wingnut and safety ring.
11. Attach upper tail wires and set one to each side of propeller. Make sure cables are not twisted.
12. Attach lower wing wire sets [installed on (2) shackles] to each side of triangle bar cross tube using (2) AN4-17 bolts, washers, lock nuts and safety rings.
13. **NOTE:** It is also possible to leave lower shackles disconnected until after the kingpost has been raised and attached.
14. Have two people lift wing tips (or use wing support tubes) till the wings are level, then raise kingpost and install its base in kingpost channel on root tube. Caution: fragile propeller.
15. Check all wire ends for jammed or twisted ends and correct as necessary.
16. Attach kingpost using 1/4" dia. T-handle pin and safety ring.
17. With fuselage and wing assembled set tail section on ground right behind the MX.

18. Route properly and attach lower tail wires to main axle.

19. Attach upper tail wires to horizontal stabilizer trailing edge using (2) shackles, clevis pins and safety rings.

20. Lift and position tail section so both boom tubes sit in boom tube channels. **NOTE:** Keep fuselage down on the nose wheel while attaching tail.

21. Attach boom tubes using (2) 1/4" dia. T-handle pins and safety rings.

22. **NOTE:** If tail is supported, T-handle pins will go in easier. Attach landing gear side wires to flat tangs on inboard trailing edge.

23. Stand on pilot's seat to twist up kingpost.

24. **NOTE:** Critical—DO NOT over tighten kingpost.

25. Install push-pull tube at control stick and elevator horn, including push-pull tube safety cable to main axle.

26. Attach spoiler control lines to pedals.

27. Attach rudder teleflex cable to rudder horn.

28. Join wing surfaces and secure Velcro.

29. Check reduction unit and adjust belt tension accordingly.

30. Slip airspeed indicator into its bracket on nose strut.

31. Hook-up your parachute system to the MX.

32. Follow all pre-flight procedures carefully as listed in Section B of this manual.

33. **NOTE:** Simply reverse the process for quick-break-down.

PRE-FLIGHT

The importance of a thorough pre-flight cannot be over emphasized. You should follow the factory recommended pre-flight many times and try to develop a systematic, habitual approach. Once established, never vary from your method and of course, **always** do your own pre-flight.

Start at the nose of the craft and during your pre-flight, work around the Quicksilver MX in a counter-clockwise manner. If any questions arise, consult the assembly instructions.

Note: Checking the "integrity" of a tube means to check for bends, dents, scratches, etc. Checking the "integrity" of a wire means to check wire ends for bolt and/or other fastener security, and to check for twisted or jammed thimbles. Wires should be free of kinks, frays, abrasions, broken strands, etc. Wires should be free of sagging, but not so tight that they "twang" when plucked.

1 a) Place helmet in seat.
- b) Check controls for free and correct movement.
- c) Check rudder (move stick side-to-side) teleflex cable integrity and connecting hardware.
- d) Check elevator (fore and aft with stick) and connecting hardware.
- e) Check spoilers (press pedals) and control line attachments and pulleys.
- f) Check integrity of seat, lever throttle, seat mount assembly and attach point hardware.
- g) Check seat support down tube integrity.
- h) Check integrity of nose wires.
- i) Check nose tire inflation and integrity of wheel pant.
- j) Check forward integrity of landing gear—nose struts, foot bar, tension struts and connecting hardware.
- k) Check integrity of triangle bar tubes and attach points including lower wing wire connections.

2 a) Walk under wing and check root tube integrity. Check all root tube bolts for security including kingpost attachment and height adjustment.
- b) Check fuel tank mounting security, on-off valve position for 'ON' and check fuel quantity.
- c) Check all fuel lines, the fuel pump and filter, and carburetor mount for integrity. Check the fuel tank cross over and if it contains impurities, drain until contamination is gone. Remember, water in the gas can cause engine failure!
- d) Check pull starter and all engine components for obvious problems. Check spark plug caps, all mounting bolts and hardware for security.

3 a) Walking to your right, or toward left wing, look and feel down leading edge spar checking for dents, bends, etc. that may not be visible because of sail cloth covering.
- b) Check integrity of leading edge wires.
- c) Check spoiler control arm, bungee return, and control line.
- d) Check integrity of compression struts and connecting hardware.

4 a) Walk around left tip and sight and feel down trailing edge spar. Check integrity of ribs, and make sure they are fully in position.
b) Check integrity of trailing edge wires.

5 a) Check left and right main tire inflation and integrity of wheel pants.
b) Check axle, axle shaft and axle hardware for integrity.
c) Check integrity of landing gear down tubes and wires.
d) Check integrity of reduction unit and condition of belts, belt tracking and tension.
e) Check propeller condition (switch off) looking for cracks or deep nicks. Check prop hub, mounting bolts, and tip clearance.
f) Check muffler bracket, shaft coupler and bearings for security.
g) Check integrity of tail brace tubes.
h) Check integrity of tail booms and attach points.
i) Check that teleflex cable is attached to lower tail wire.
j) Look up at kingpost and visually check that all hardware is secure.

6 a) Check horizontal stabilizer spar and hardware integrity.
b) Check upper and lower tail wire integrity.
c) Check rudder frame tube integrity and check rudder hinge assemblies carefully.
d) Check integrity of rudder control cables.
e) Check elevator frame tube integrity and check elevator hinge assemblies carefully.

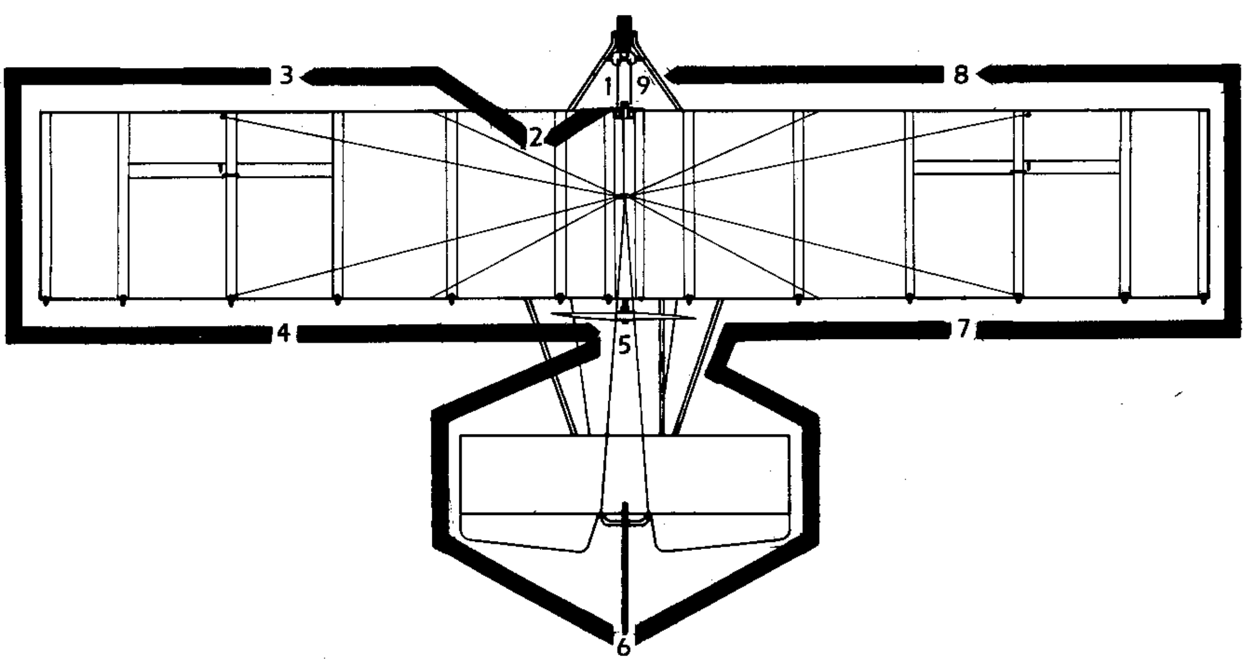


Figure 3.1 Exterior Inspection

f) Check integrity of elevator push/pull tube and hardware and security of safety cable.
g) Look up at spoilers and see that they lie flat against the wing surface.

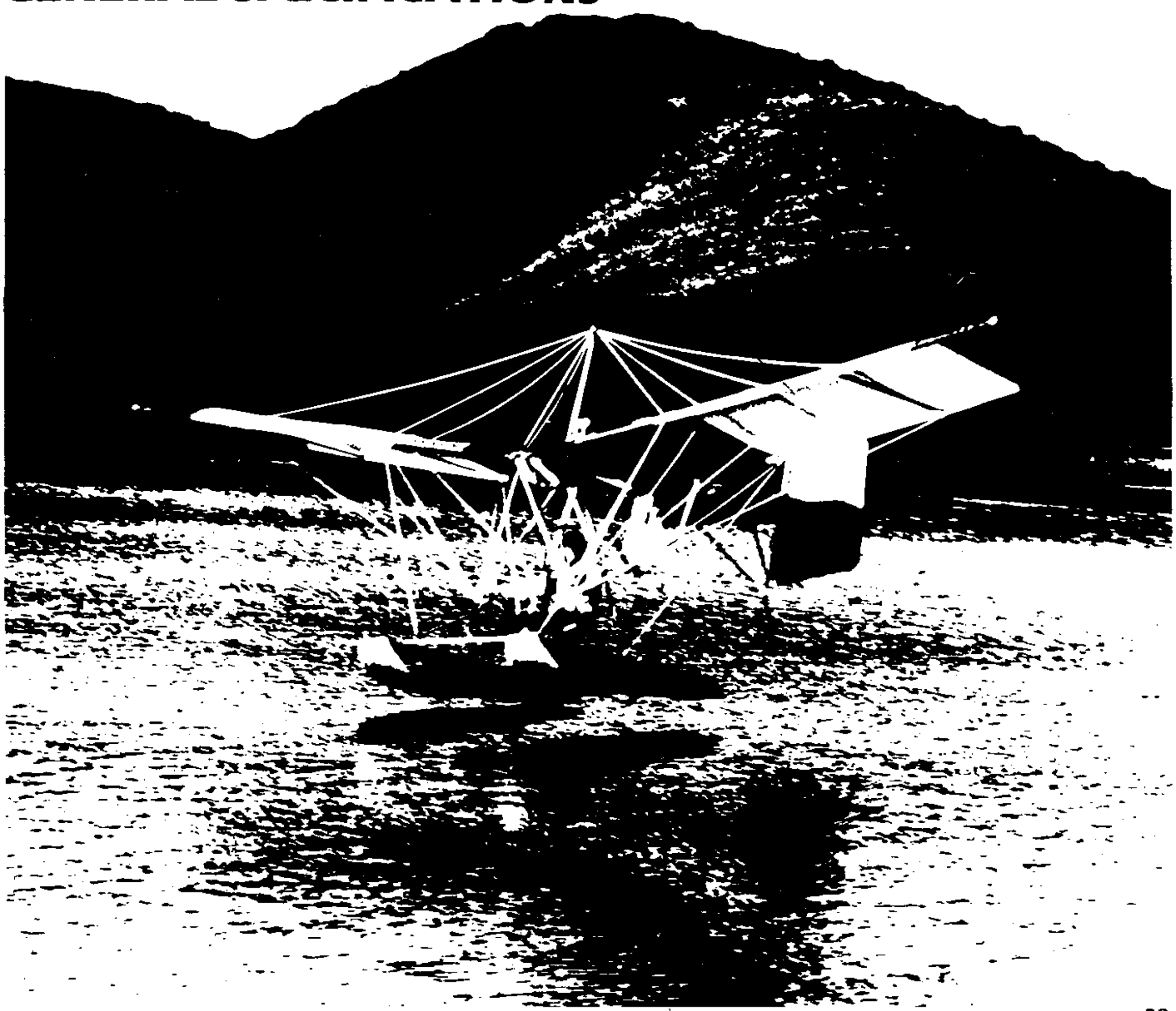
7 a) Move to right wing and check trailing edge spar and wire integrity.
b) Check all compression struts, ribs and spoiler lines for integrity.

8 a) Walk around right tip and check leading edge spar and wire integrity.

9 a) Check muffler integrity and attach point springs (safety wired).
b) Sit in the seat. Adjust and secure shoulder harness/seat belt.
c) Buckle your helmet (earplugs are suggested), and connect parachute "emergency recovery system" to aircraft in secure manner.
d) Check airspeed indicator integrity.
e) Check kill switch integrity.
f) Actuate all controls several times making sure you can comfortably reach throttle, control stick, spoiler pedals, pull starter and and kill switch.

NOTE: This suggested outline for a Pre-Flight Inspection generally covers the critical areas that MUST be checked prior to each flight. In addition, EVERY component must be examined after construction, properly maintained, and correctly stored or transported to ensure structural integrity and safe flying characteristics of your Quicksilver MX.

GENERAL SPECIFICATIONS



Engine Specifications

Engine[1]	ROTAX 377	Cuyana UL II-02
Displacement	368.3CC	428CC
Maximum h.p.	33.5/6500 rpm	32/6000 rpm
Spark plug	B8ES	Champion N-3 gap .016-.020
Type	2 cycle air cooled twin cylinder	2 cycle air cooled twin cylinder
Propeller		
Prop pitch	32 inches	32 inches
Maximum thrust	220 lbs. at 6500 rpm	220 lbs. at 6300 rpm
Prop dimension		
Maximum	52"	52"
Minimum	51"	51"
Type	wood fixed pitch	wood fixed pitch
Reduction		
Large pulley	6"	6"
Small pulley	3"	3"
Reduction	2 to 1	2 to 1
Belts (4)	3VX250	3VX250
Fuels		
Capacity (large tank)	5.0 gallons	5.0 gallons
Usable	4.8 gallons	4.8 gallons
Fuel Grade		
Good brand of regular or premium octain gasoline	85	85
Oil		
Recommended Oil	B.I.A—TCW 2 Cycle oil	B.I.A.—TCW 2 Cycle oil
Mixture		
Break-in	20-1	20-1
Normal	50-1	40-1
Weight		
Engine	59 pounds	58 pounds

[1] See specific equipment manuals.

* 5 gals. max. for proper venting and room for fuel expansion. Do not overfill.

Fuel tank specifications can change without notice and may vary due to serial number.

Engine Operating Procedures

See engine manual and maintenance section for carburetor and other pre-flight adjustments.

Before Starting the Engine

1. Seat belt and shoulder harness adjusted and buckled.
2. Fuel valve—"on".

Starting the Engine—Cold

1. Turn ignition to "on".
2. Actuate throttle control to be sure it is not sticking and return it to idle position.
3. Pull "Enrichener Valve Control" (choke) down.
4. Propeller area clear—shout "Clear Prop".
5. Grasp recoil starter handle, pull slowly to engage the mechanism, then pull sharply with HANDS OFF THROTTLE. This is important.
6. After several pulls and engine fails to start, release choke and repeat Step 5. If engine still fails to start see Flooded Starting Procedure or engine may not have spark. (See Service Manual)

NOTE: If engine is flooded: ignition switch—off, throttle—full open, choke—off and pull recoil until engine clears. Use restart procedure—warm.

Before Take-off

1. Warm engine for 2-3 minutes.
2. Check rudder, elevator and spoilerons for free and correct movement.
3. Apply brake and momentarily run up full power. All throttle settings should be applied smoothly.

Take-off

1. Craft pointed directly into wind.
2. Smoothly apply full throttle.
3. Pull stick back to lift nose wheel at approximately 25 mph.

Climb

1. Assume best rate of climb attitude.
2. Airspeed—37 mph
3. Power—full throttle until a safe altitude is reached.

NOTE: Avoid full power settings for long durations. Maximum cylinder head temperature 425°.

Cruising

1. Power—2,500-5,000 rpm.
2. Throttle setting—1/2 to 3/4.

In Flight Shut Down and Re-Start

1. Let engine run at low rpm for a short interval before shut down.
2. Ignition switch—"off".
3. Restart procedures—warm.
4. Turn ignition switch to "on".
5. Actuate throttle control approximately 1/4 open.
6. Pull recoil.
7. If engine fails to fire after several pulls, choke "on" and repeat pulling sequence with throttle in idle position. Choke "off" when restarted.
8. Smoothly apply cruise power.

OPERATIONS/EQUIPMENT SPECIFICATIONS

QUICKSILVER MX

Standard Weights	
Empty weight	235 lbs.
Pilot weight range	120-240 lbs.
Max takeoff weight	525 lbs.
†Limiting and Recommended Speeds	
Vs1 Stall speed, power off	24 mph
Vx Best angle of climb speed	35 mph
Vy Best rate of climb speed	37 mph
Vc Cruise climb speed	40 mph
Va Maneuvering speed	50 mph
Vno Max. structural cruise	45 mph
Vne Never exceed speed	61 mph
Maximum level flight speed	52 mph
****Cruise Performance** (Speed/Range at sea level)	
@ 55% power (18.43 hp)	38 mph/95 mi
@ 65% power (21.78 hp)	41 mph/66.1 mi
@ 75% power (25.13 hp)	46 mph/52.3 mi
Fuel	
Capacity (standard tank)	5 gal.
Usable	4.8 gal.
Flow @ 55% power	2.0 gph
Flow @ 65% power	3.1 gph
Flow @ 75% power	4.4 gph
Take-off (wind calm)	
Ground run	69 ft.
Total distance over 50 ft. obstacle	220 ft.
Landing (wind calm)	
Ground roll	60 ft.
Total distance over 50 ft. obstacle	150 ft.
Rate of Climb	800 ft./min.
Service Ceiling	12,000 ft.
Wingloading	
Pounds/sq. ft.	3.28
Power Loading	
Pounds/hp	15.6

* All performance specs. listed have been determined through tests using factory pilots and are not necessarily those numbers achieved by other operators. All performance figures are based on standard day, standard atmoshpere, at sea level and 175 lb. pilot weight, unless otherwise noted. Operations/equipment category reflects this aircraft's maximum potential.

† See Aircraft Performance section of this manual for Operating Limitations.

** Figures based on 5 gal. fuel.

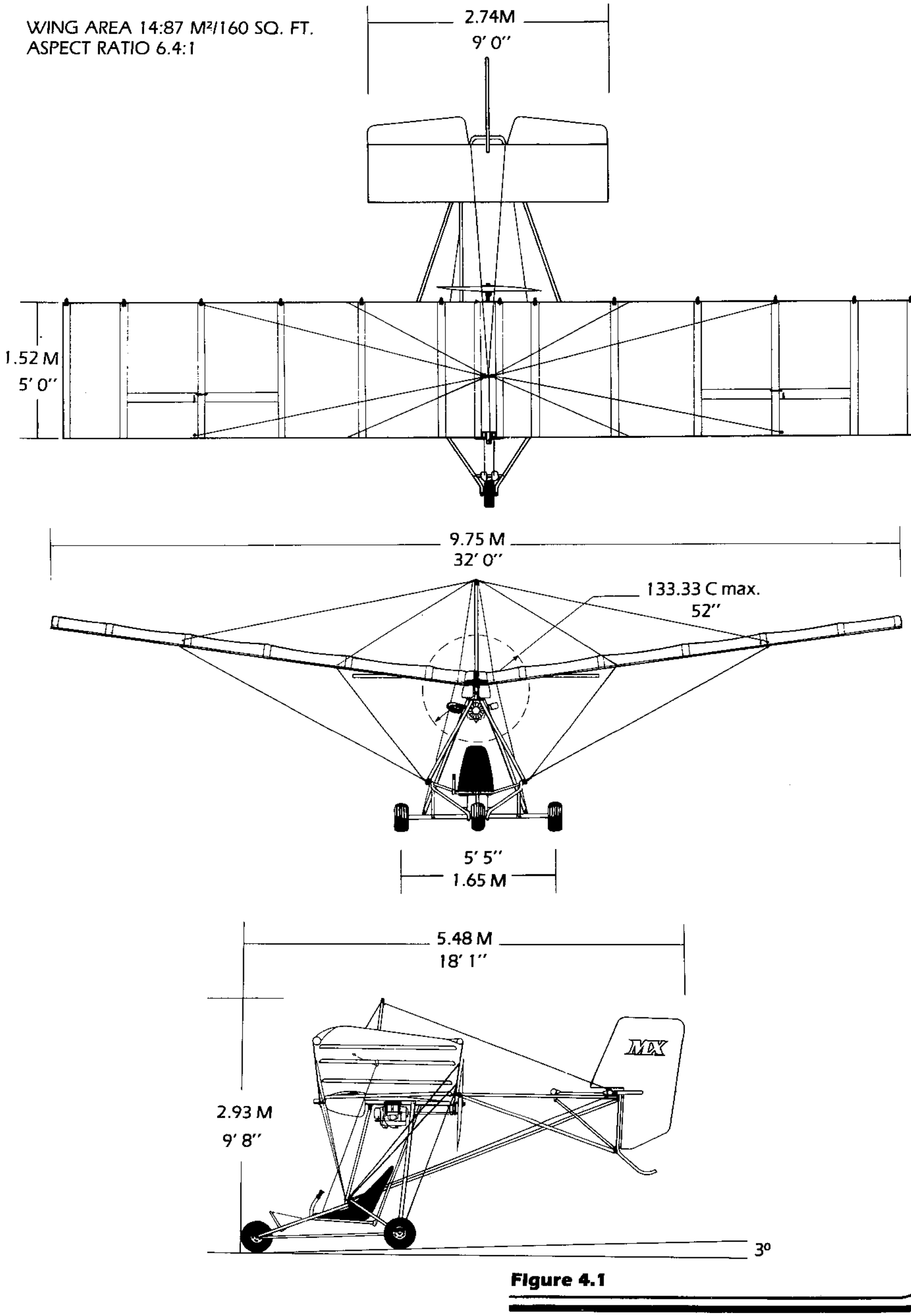
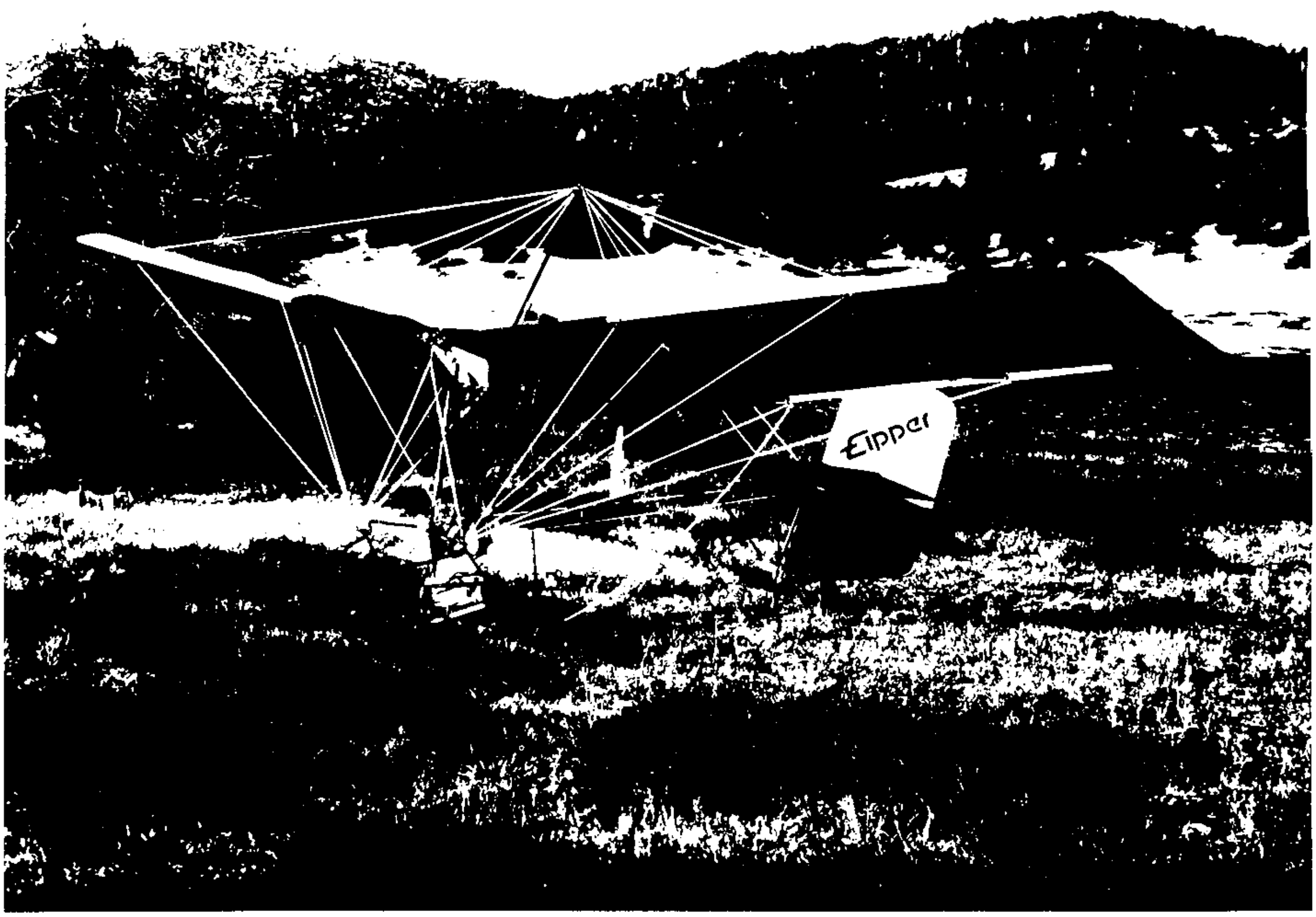

WING AREA 14:87 M²/160 SQ. FT.
ASPECT RATIO 6.4:1
2.74M
9' 0"
1.52 M
5' 0"
9.75 M
32' 0"
133.33 C max.
52"
5' 5"
1.65 M
5.48 M
18' 1"
2.93 M
9' 8"
MX
3°

Figure 4.1

SECTION C
FLIGHT TRAINING



CAUTION!!!

Operation of this machine
may be DANGEROUS.
Ground school and
flight instruction
by an authorized
Eipper Aircraft
dealer as well
as review of
Owner's Manual
are NECESSARY.

USE ONLY AT YOUR OWN RISK.

AIRCRAFT SYSTEMS

The Four Forces

An airplane in flight is acted upon by four forces: lift, weight, thrust, and drag. Lift is the upward acting force; weight is the downward acting force; thrust acts in a forward direction; and drag is the backward, or retarding, force. Lift opposes weight and thrust opposes drag. When an airplane is in straight-and-level flight, as shown in **Figure 5.1**, the opposing forces balance each other; lift equals weight and thrust equals drag. Any inequality between thrust and drag during straight-and-level flight results in acceleration or deceleration until the two forces again become balanced.

Aerodynamic Terms

As a basis for understanding lift and other aerodynamic forces, the terminology associated with airfoils is presented in **Figure 5.2**. An airfoil may be defined as any surface specifically designed to produce lift. The airplane wing and the blades of its propeller are examples of airfoils.

The **camber** is the curvature of a wing's upper and lower surfaces. Normally, the upper surface has a greater camber than the lower surface.

The **chord line** is an imaginary straight line joining the leading edge to the trailing edge. This line has significance only in determining the angle of attack of an airfoil and in determining wing area.

The **relative air flow** is the wind moving past the airfoil. The direction of this air flow is relative to and always parallel to the airplane's flight path. The velocity of the relative air flow is the speed of the airfoil through the air.

The **angle of attack** is the acute angle between the chord line and the direction of the relative air flow. This angle should not be confused with the airplane's **pitch angle,** which is the angle between the longitudinal axis and the natural horizon.

Lift

Efficient airplane operation depends on your knowledge of how lift is created and how it is sustained. There is only one condition that must be present for an airfoil to produce lift — the air pressure above the wing must be less than the air pressure below the wing. Due to the differential in air flow velocity above and below the wing, the lowest pressure is above the wing. Bernoulli's Principle can be used to explain how this occurs. As the air flow increases in velocity, it decreases in pressure. To illustrate this, examine the subsonic air flow as it passes through the venturi tube shown in **Figure 5.3**.

The air flow at point A has a given velocity, static pressure, and density. As it approaches the constriction at point B, a change in the velocity, pressure, or density must occur to maintain the original mass flow of air. In subsonic air flows, there is very little change in density; therefore, a change in the velocity and static pressure occurs. As the air flow reaches point B, the velocity increases, resulting in a decrease of the static pressure. The upper wing surface corresponds with the middle half of the tube and the decrease in static pressure above the wing results in the lifting action.

According to Bernoulli's Principle, if there is an increase in the velocity of air as the air flows around an airfoil, there

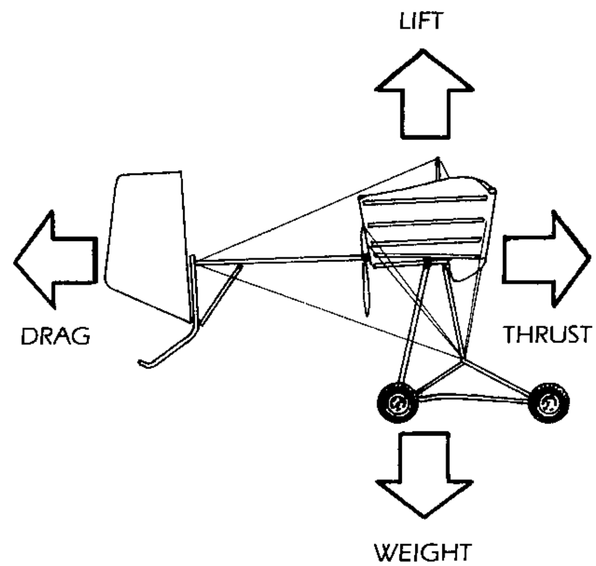


Figure 5.1 Four Forces in Straight and Level Flight

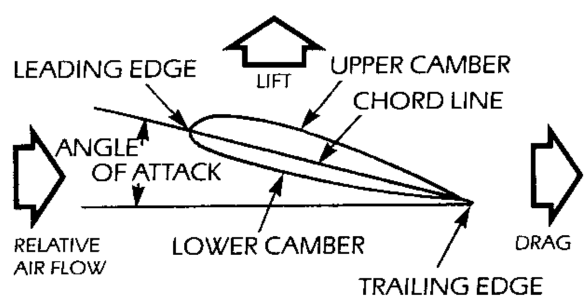


Figure 5.2 Airfoil Terminology

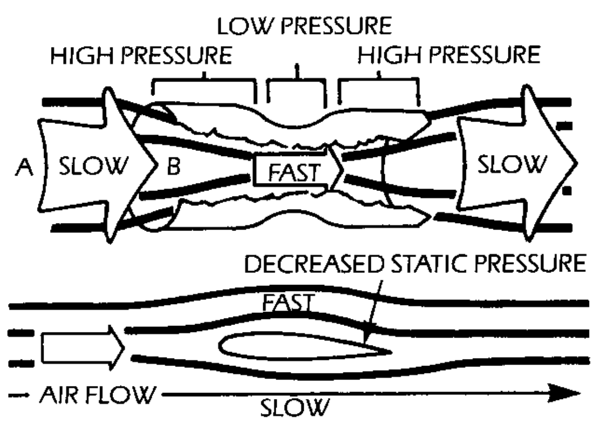


Figure 5.3 Illustration of Bernoulli's Principle

will be a decrease in pressure. Because the camber of the upper wing surface is greater than that of the lower surface, air flowing above the wing will be accelerated more than air flowing beneath the wing. As a result, the reduction in air pressure above the wing will be greater than the pressure reduction along the lower wing surface. This difference in pressure accounts for the upward force called lift.

Angle of Attack

At small angles of attack there is less lift than at greater angles. However, as shown in **Figure 5.4**, when the angle of attack is increased to the point where the air cannot smoothly follow the upper surface of the wing it will "burble" and the wing will lose most of its lift. This is known as a **stall.** The wing stalls due to an excessive angle of attack and not because the airspeed is too slow. Therefore, stall recovery is immediate when you reduce the angle of attack.

You can increase the force of lift by increasing the speed of the airplane or by increasing the angle of attack as long as a stall angle is not reached. You must remember as long as you maintain flying speed and do not have an excessive angle of attack you will never stall.

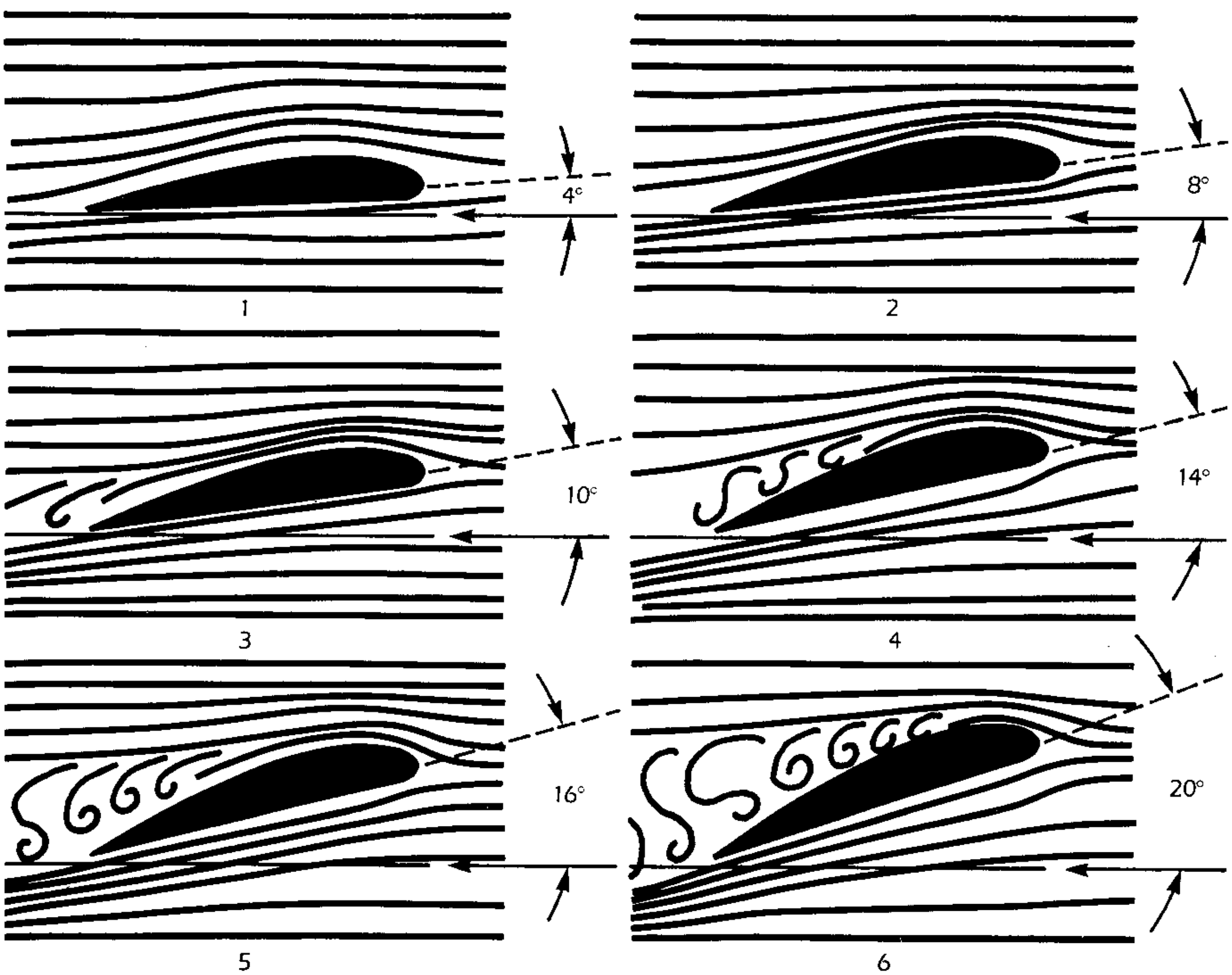


Figure 5.4 Stall Burble

Weight

The weight of an airplane is the force which acts vertically downward through the center of gravity. This is due to the action of gravity.

Thrust

Thrust is obtained through the use of a propeller and engine. During straight-and-level flight at a constant airspeed, thrust and drag are equal. When engine power is increased, thrust momentarily exceeds drag, and the airspeed increases. The increase in airspeed causes a corresponding increase in drag. As airspeed is increased, drag increases at a much faster rate until, at the new higher airspeed, thrust and drag forces again become equalized and speed becomes constant.

Drag

Drag may be subdivided into induced drag and parasite drag. **Induced drag** is simply the drag created in the process of developing lift. As shown in **Figure 5.5**, an increase in the angle of attack or increased lift will increase induced drag.

In addition to the induced drag caused by the development of lift, there is **parasite drag** due to skin friction and form. This term is used because parasite drag is not directly associated with the development of lift. Parasite drag is present any time the airplane is moving through the atmosphere, even in a zero-lift condition.

Components of the airplane, such as the wings, fuselage, tail, and landing gear, contribute to this type of drag because of their own forms. Additionally, any loss of momentum of the airstream due to openings or gaps, such as between the two wings, creates additional parasite drag. The sum of all the drag due to form, friction, leakage, momentum losses, and interference is termed total parasite drag.

The total drag of the airplane in flight is the sum of induced and parasite drag. Drag changes with speed for a given aircraft in level flight at a particular weight, configuration, and altitude.

Parasite drag increases with speed, while induced drag decreases with speed. The total drag component of the aircraft shows the predominant influence of induced drag at low speeds and parasite drag at high speeds.

Controls

In flight, any maneuver of the airplane will involve one or more of the three axes about which an airplane moves. Each passes through the center of gravity. **Figure 5.6** shows the three axes: the longitudinal (roll) axis, the lateral (pitch) axis, and the vertical (yaw) axis.

Flight controls and control surfaces cause movement about the three axes. Spoilerons applied right or left about the longitudinal axis; elevator up and down about the lateral axis; and the rudder controls movement about the vertical axis.

The Quicksilver MX uses a unique three-axis control system. The roll axis or banking right or left is controlled by the pilot as he actuates the spoileron foot pedals independently right or left. These spoilerons on the MX function the same as ailerons on a conventional aircraft. By actuating a spoiler lift is decreased on

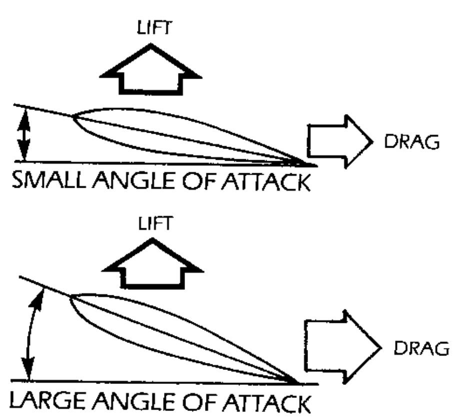


Figure 5.5 Increasing Induced Drag

that wing causing the aircraft to roll.

The yaw axis is controlled by the rudder which is connected to the control stick. The pilot moves the stick right or left which moves the rudder accordingly thus causing the aircraft to turn about the vertical axis.

The pitch axis is controlled by the pilot moving the stick forward or aft. Forward movement causes the nose to pitch down or descend, while moving the stick aft causes the nose to pitch up or climb. To achieve a co-ordinated turn in the MX the pilot will operate each flight control in conventional aircraft manner. For example, by applying right rudder and right spoileron while maintaining slight back pressure on the stick, the aircraft will make a co-ordinated turn to the right.

The Quicksilver MX has an additional control system advantage in that the pilot can actute both spoilerons with the foot peddals simultaneously. With spoilers deployed the aircraft can descend at a steep angle without excessive airspeed.

Load Factors

The load factor of an airplane is the actual load on the wings at any time, divided by the weight of the airplane. Load factors are usually expressed in "Gs" or g (gravity) forces. When an aircraft is in straight-and-level, unaccelerated flight the load factor is "one" or one G.

When a turn is made at a constant altitude, or when a pullout from a dive is executed, the load factor will increase due to centrifugal force. **Figure 5.7** shows that the load factor will be twice as much as in a 60

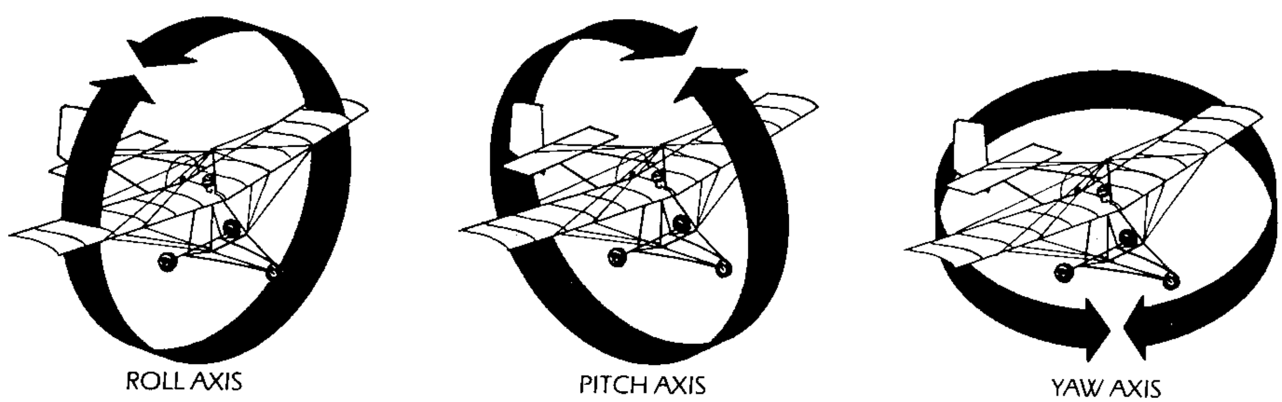


Figure 5.6 The Three Axes

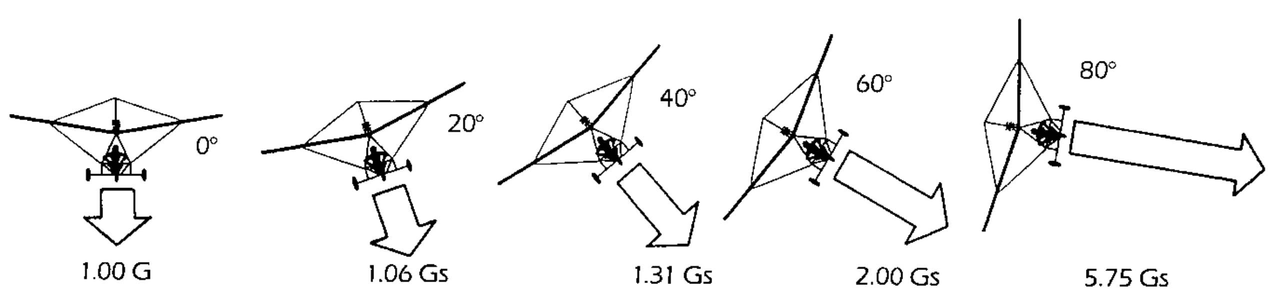


Figure 5.7 Load Factor in Bank

degree bank as when in level flight. As the bank increases, the load factor increases very rapidly. Turbulence also has a great effect on load factors in banks and in level flight, which means that the faster you hit a bump (turbulence is nothing more than bumps in the sky) the more it will jar the airplane. In severe turbulence the airspeed should be reduced to maneuvering speed. At this speed, abrupt control movements can be made without exceeding the load limit. A pilot should be familiar with basic components of his aircraft. See **Figure 5.8**

Ultralight Engines

Engines used on the Quicksilver are 2-cycle air cooled reciprocating engines. They are reliable engines but must be operated correctly to ensure performance and endurance. Refer to your specific engine manual or Gen. Oper. Spec. section for operating instructions. **Remember:** always fly within safe gliding distance of a landing area in case of engine failure.

Fuel System

Fuel is contained on the MX in a 5 gallon tank located on the main root tube. The fuel is fed to the engine by a fuel pump. All fuel lines must be specified in the Engine Operation Manual. The fuel tank is a transparent plastic and fuel quantity can be visually monitored at all times. A fuel tank cross over is fitted beneath the tank to collect any impurities in the gas, such as water. Drain here until contamination is gone. An on-off valve is located on the bottom of the tank. Always check it for the on position before flight. A fuel filter is connected between the carburetor and fuel tank to help insure clean fuel is supplied to the engine.

Oil System

Oil used primarily to lubricate the moving parts of the engine helps to reduce engine temperature. Always obtain the correct oil-fuel mixture and use a BIA-TCW rated oil. It is also a good safety precaution never to mix different brands of 2-cycle oil. The oil should be mixed thoroughly before being put in the fuel tank.

Electrical System

The only standard electrical system on the MX is an on-off switch. Never operate the aircraft without the switch working properly. Switch should be mounted well clear of pilot's helmet or anything movable which might unintentionally come in contact with the switch. See Assembly & Parts Manual.

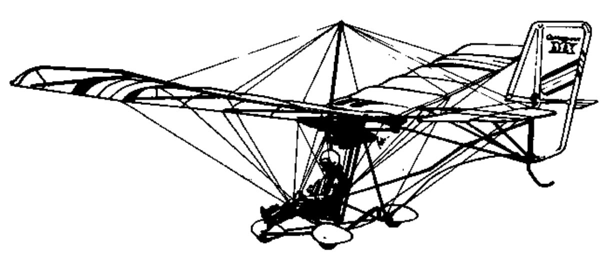
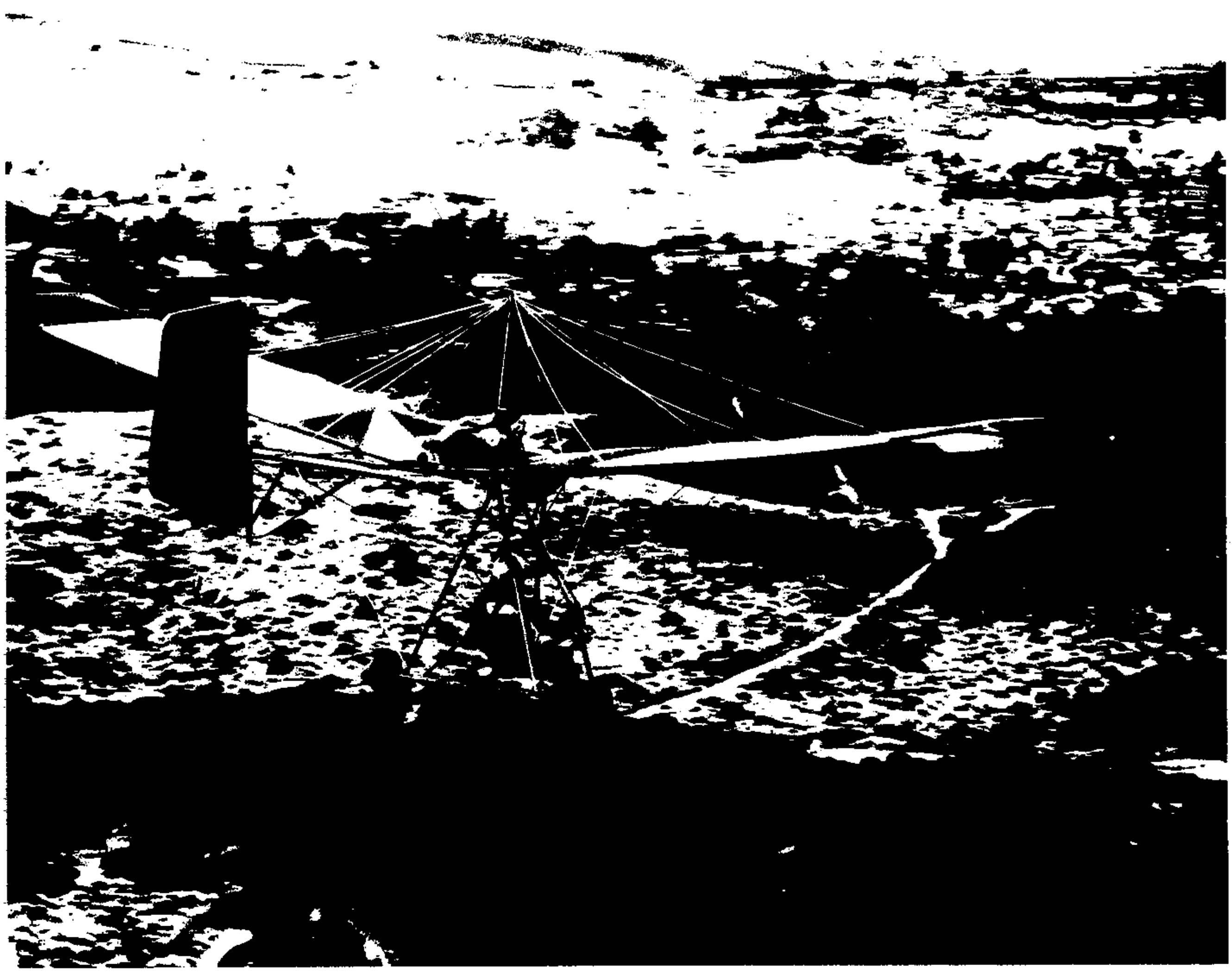


Figure 5.8 Basic Quicksilver MX

AIRCRAFT PERFORMANCE & OPERATING LIMITATIONS



Suggested Pilot's Checklist

Before starting engine

1) Pre-flight inspection	COMPLETE
2) Seat	ADJUST & LOCK

Note: After changing seat position, adjust elevator push-pull tube for correct elevator travel.

3) Seat belt/shoulder harness/ helmet	ADJUST & FASTEN
4) Brake	TEST & SET
5) Fuel Selector Valve	ON

Starting engine

1) Propeller	CLEAR
2) Throttle	CLOSED
3) Ignition Switch	ON
4) Choke	ON
5) Starter	PULL TO START

Before take-off

1) Flight controls	CHECK FREE FOR MOVEMENT
2) Altimeter	SET
3) Fuel	ON
4) Choke	OFF
5) Air Intake.............	CLEAR
6) Trim Tab (if applicable) ..	SET FOR TAKE-OFF
7) Cylinder Head Temperature	120° OR ABOVE

Before landing

1) Landing area	CLEAR
2) Throttle	CLEAR EVERY 30 SECONDS
3) Fuel Valve Check	ON

are at a high angle of attack and are producing greater drag. The best angle of climb (Vx) in the MX is 35 mpn which is just above stall speed. Caution must be used in this attitude because if a power failure is experienced the nose of the aircraft will pitch downward. Approx. 50 ft. of altitude is required to recover to a level attitude. See **Figure 6.2**. If possible it is better not to use best angle of climb until a 75 ft. altitude is reached.

Best Rate of Climb—Vy

The best rate of climb speed provides the greatest gain in altitude per unit of time. The angle of attack employed in the best rate of climb speed is usually an angle that provides the greatest ratio of lift to drag. The best rate of climb speed is often employed to reach a desired altitude in the least amount of time. This climb speed is slightly higher than that of the best angle and should be most used after takeoff. The angle of attack is lower than that of best angle thus if an engine failure is experienced after takeoff there is suppicient airspeed to land the aircraft safely. Best rate pf climb: (Vy) in the MX is 37 mph.

Cruise Climb—Vc

A cruise climb speed maintains an angle of attack just above level flight. The power setting is usually about 75% providing better engine cooling and longer engine life. Cruise climb air speed (Vc) is approximately 40 mph.

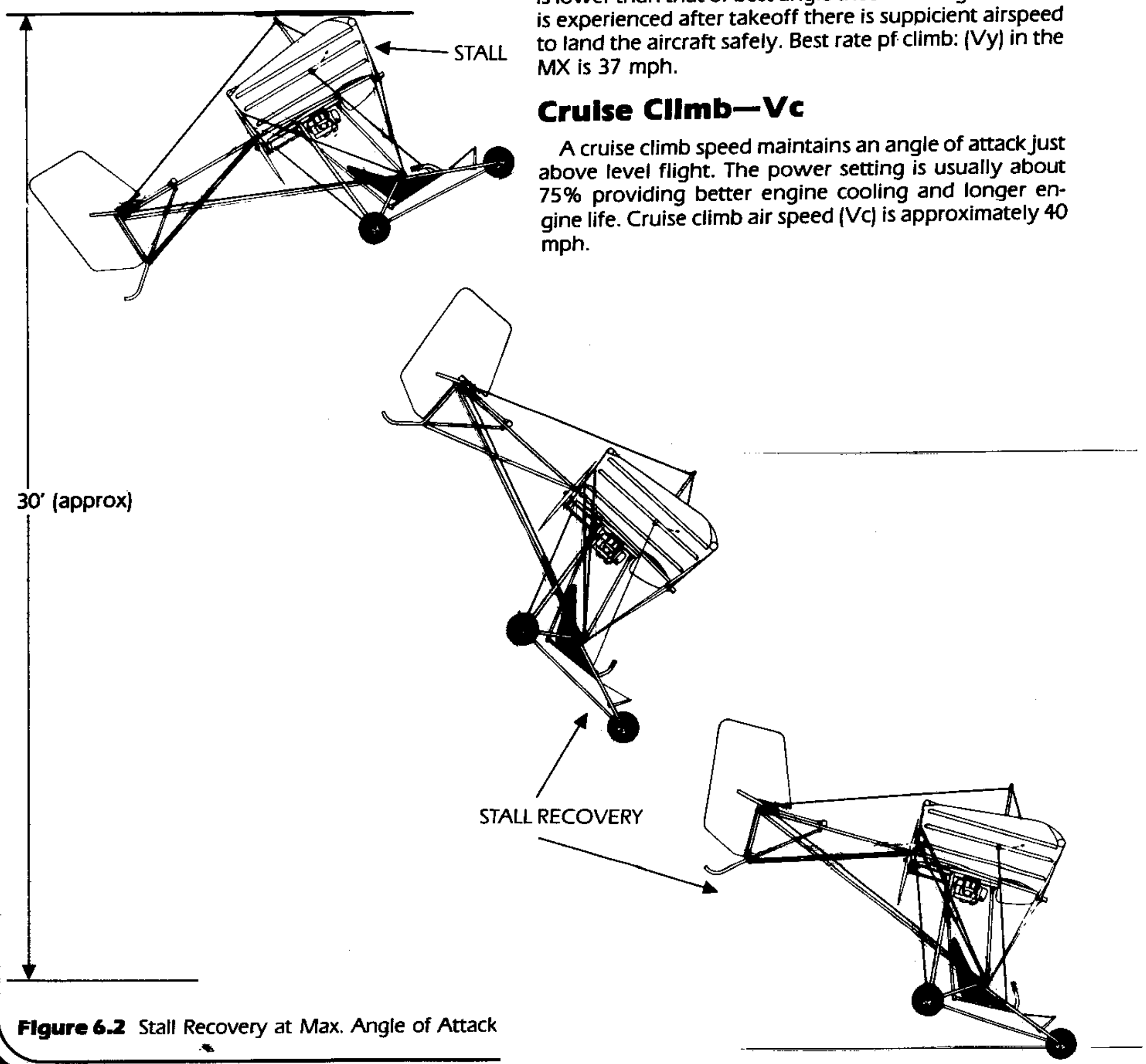


Figure 6.2 Stall Recovery at Max. Angle of Attack

It is extremely important that you understand the factors which affect the aircraft performance. Remember all air speeds relating to Operating Limitations and follow accordingly.

Takeoff

There are several conditions which affect aircraft performance: engine condition, surface winds, runway condition, density altitude, and gross weight.

1) Engine Performance—the engine should be adjusted to Manual Specifications. If inadequate power, it is suggested to check engine tuning.
2) Surface Winds—always perform your takeoff into the wind. This will greatly shorten the takeoff roll and climb out. Caution should be taken in flying in windy conditions. Excessive ground speed should be obtained in taking off in windy condition and a low angle of attack maintained if possible until sufficient altitude (approx. 75 ft.) is gained.
3) Airspeed-the speed the aircraft moves through the air. This is not to be confused with ground speed. A ground track example: If you are flying at a cruise speed of 40 mph airspeed in a direct 10 mph head wind your ground speed would be 30 mph. With the wind blowing in the same direction you are traveling your air speed would be 40 mph and your ground speed would be 50 mph.

Density Altitude

Remember as the air temperature increases the air becomes thinner thus an aircraft wing will develop less lift. Extra air speed is required to develop lift. To gain this extra airspeed more runway and climbout clearance are required. On a 100 degree F. day your aircraft will require more runway than on a 60 degree F. day.

Altitude and temperature also affect your engine performance. Your Eipper Dealer will assist you with fine tuning of the main jet in the carburetor.

Climb Performance

The type of climb and therefore, the climb performance, are based on airspeed. Basically there are three different types of climb airspeed. See **Figure 6.1.**

Best Angle of Climb—Vx

The best angle of climb speed will produce the greatest gain in altitude over a given distance. Most often this speed is used immediately after takeoff in order to clear obstacles. The best angle of climb speed requires full power and reduces the rate of climb since the wings

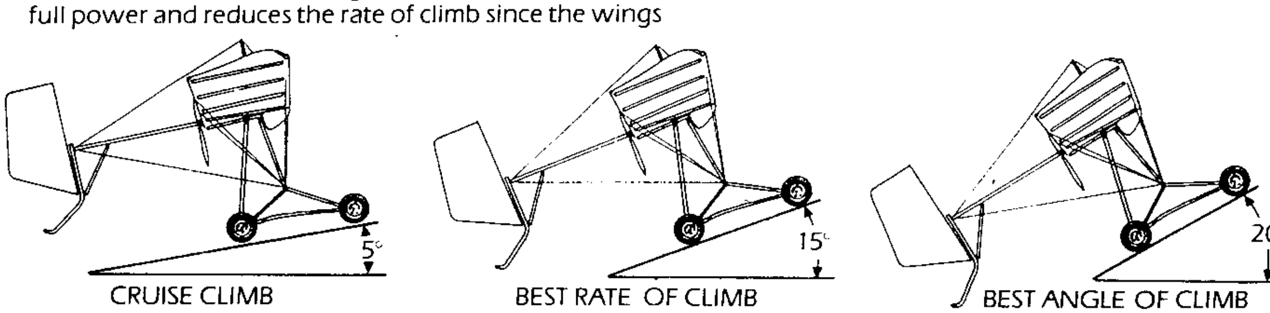


Figure 6.1 Different Types of Climb Attitude

Cruise Performance

Cruise is when the aircraft is in straight and level flight. Usually a power setting of about 50% will result in best economy and engine life. The cruise speed range on the MX is 35-52 mph. The maximum level flight speed for the MX is 52 mph. Consult the Gen. Op. Specs section for appropriate fuel consumption figures.

Max. Structural Cruising Speed—Vno

Maximum structural cruising speed is the highest airspeed which can be used for cruise speed in rough air conditions. The maximum structural cruising speed (Vno) for the MX is 45 mph.

Never Exceed Speed—Vne

Remember, the operating limitations of this vehicle prohibit flying at a speed above the never exceed speed (Vne) at any time. No abrupt maneuvers should be attempted at Vne. Resulting loads could induce a structural failure.

During flight maneuvers excess speed can build up rapidly so caution must be used with extreme nose low attitudes or high power settings. The never exceed speed (Vne) for the MX is 63 mph. Operation of the MX at this speed should be avoided.

Maneuvering Speed—Va

The maneuvering speed allows for maximum controllability without exceeding the design load factor for the vehicle. The maneuvering speed should not be exceeded when performing abrupt maneuvers. The best maneuvering speed (Va) for the MX is 50 mph.

Stall Speeds—Vs1

Stall speeds change with angle of bank, gross weight, and power configuration. As the angle of bank increases stall speed increases. When making steep turns maintain more airspeed in relation to angle of bank. This is usually accomplished with a more low attitude or extra power or a combination of both.

Gross weight can change stall speeds and characteristics. The MX has a very gentle stall and slow stall airspeed so extra weight increases stall speed and stall characteristics. Less gross weight will lower stall speed and stall characteristics.

Maintaining power will lower stall speed and increase the angle of attack. The MX will experience a slight descent with power in a stall attitude. When in doubt of stall conditions push the control stick forward. This lowers the nose and aircraft will recover airspeed. Normal flight conditions can then be resumed.

At gross weight the power-off stall speed (Vs1) of the MX is 24 mph.

NOTE: The Quicksilver MX will not spin due to the dihedral and washout in the main wing.

Descending

When descending your aircraft with power reduced, your engine will cool rapidly. To reduce wear and extend engine life, it is advisable to let the engine cool slowly by operating at 50% for 1 to 2 minutes.

Landing

When approaching your landing area check objects on the ground (flags, smoke, ripples on water, blowing debris, etc.) to help determine wind direction. Always land as directly into the wind as is practicable. Check for obstacles. Remember with power off, stall airspeed is higher thus a lower angle of attack must be maintained. Maintain a minimum approach speed of 30 mph.

Weight and Balance

All aircraft pivot around what is called the center of gravity. The MX is designed to carry pilots ranging from 120 lbs. minimum to 240 lbs. maximum weight. Deviations from these limitations could cause the aircraft to move out of its center of gravity envelope causing an unstable pitching condition.

FLIGHT MANEUVERS

CAUTION!!!

Operation of this machine
may be DANGEROUS.
Flight instruction and
review of Owners' Manual
are NECESSARY.

USE ONLY AT YOUR OWN RISK.

One of the most important facets of learning to fly is developing good habits. This is true whether you are performing a preflight inspection or flight maneuvers. This section covers the basics of Flight Maneuvers and will help prepare you for your flight training. Never attempt flight without proper instruction from an Authorized Eipper Aircraft Dealer.

Preparing for Flight:

In order for you to benefit from each lesson, you should be in good physical and mental condition.

Aircraft Preflight Inspection

A preflight inspection should be conducted before each flight. (Field Assembly of the aircraft and Preflight is explained in Section B of this manual.) The habits you establish during the initial phases of your training will set the precedent for your future aviation experience.

Starting the Engine:

After the preflight inspection iscomplete, you are ready to begin the prestarting checklist.

1) The MX can be started either by standing beside the landing gear or after the pilot is seated. The fuel valve should be on, the choke in "on" position," and throttle should be at idle setting. Before pulling the recoil starter, clear the area by shouting, **CLEAR PROP**, and make sure no one is in the prop area. Make sure you have secured the aircraft so it will not roll forward after the engine starts. Turn on the ignition switch, pull recoil. Once the engine has started, let it warm up for 1-2 minutes. **NOTE:** Practice area should be a flat surface, minimum 1000 ft. square with no obstructions on either side.

Taxiing:

Before taxiing, check

1) Helmet on—parachute on
2) Shoulder harness/seat belt securely fastened
3) Once sitting in seat, check control movement: Is rudder adjusted properly? With control stick centered, the rudder should be pointed directly aft and the tail of the rudder should move in the same direction that you put the stick; right or left. Is elevator adjusted properly? With stick centered, elevator should be directly in line with stabilizer and move up with stick back and down with stick forward. Are spoiler cables adjusted? The spoiler panels should stand vertically on wing with foot pedals down, and flat against wing with pedal back.
4) Check the throttle for movement

In general, good throttle usage is based on smooth adjustment of power. Erratic throttle movements are not recommended for engine and equipment life.

Power control is important for correct Taxi Techniques. For example, more power is required to start the airplane moving than to keep it moving. Power should be added slowly until the airplane starts rolling, then reduced to attain the desired taxi speed. In addition, a greater amount of power is required to start and sustain an airplane in motion on a soft surface than on a hard one.

The Quicksilver sits on its tail until weight is applied forward then the aircraft sits on all three (3) wheels. You control taxi speed with power and by applying main brakes or nose wheel brake. **NOTE:** DO NOT attempt to stop the aircraft by putting your feet against the ground.

Lateral control during taxi is controlled by stick movement right or left with stick back. The propeller blasting air across the rudder causes turning while the up elevator takes weight off the nosewheel allowing aircraft to pivot easily on the main wheels.

The pilot should taxi the aircraft and move the stick right or left making turns. The pilot should practice this maneuver until he can guide the aircraft accurately on the ground. Caution should be used when taxiing the MX in a crosswind condition. The upwind wing will have a tendency to rise. Remember the Quicksilver MX, with power, will fly at 24 mph, so be alert.

Typical Flight Conditions

A typical flight usually consists of takeoff and departure, a climb, straight & level flight, turns, a descent, approach to landing and landing.

Be familiar with the MX Operating Limitations as described in the Aircraft Performance section of this manual.

Be sure to record all of your flying time, the sites, and conditions you encounter piloting ultralight aircraft. This Ultralight Pilot Flight Log (see **Figure 7.1**) is designed for the MX pilot and available at Eipper dealerships.

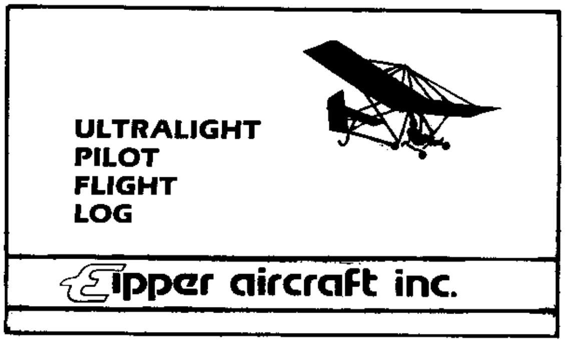


Figure 7.1 Ultralight Pilot Flight Log

Takeoff & Departure

The takeoff will begin with a smooth application of power. The aircraft should be pointed directly in the wind. **NOTE:** A first-time pilot should not conduct his first flight in windy conditions. It is much more desirable if there is NO WIND at all. Also use of spoilerons for initial flight training is not necessary. Excellent yaw and roll control is achieved by stick (rudder) movement alone. Position feet off pedals to avoid spoiler deployment during first flight. As the aircraft begins the takeoff roll, the pilot should pull the stick full aft and hold it there until the nosewheel lifts off the ground; approximately 4-6". When this happens, he should relieve the back pressure on the stick to the neutral position, holding the nose slightly off the ground.

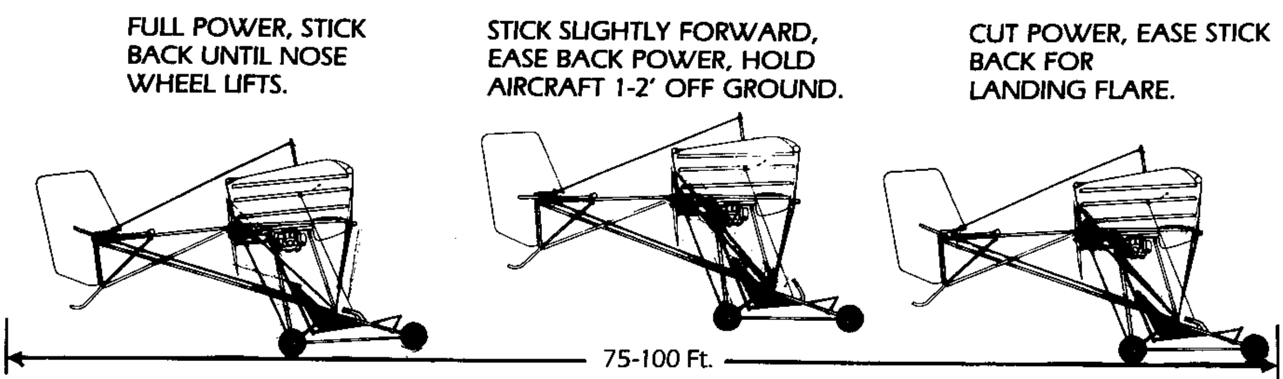


Figure 7.2 First Take-Off and Landing

Glides

In a power-off glide, the combination of maximum forward travel and minimum sink rate of the aircraft can only be obtained at a speed usually near the maximum rate-of-climb airspeed.

The best glide speed or attitude will vary slightly with aircraft weight at density altitude but its approximate value is important to know so the most efficient glide can be established immediately when practicing forced landings.

The best rule of thumb for maximum glide is to use the stick position slightly forward of cruise position. Maintain approximately 37 mph during glide.

Approaches

The approach is the glide toward the intended landing point. Well planned and executed approaches make landing much easier.

Figure 7.4 shows a standard traffic pattern; although this is not required it is a good procedure to use in flying. Always be alert for other traffic in the area. The pattern will help give good visibility.

Always plan your approach and landing into the winds. Never land with a tailwind if at all possible. Determine wind direction by the wind sock, blowing dust, tree and ground tracks in crosswind position.

The Downwind leg is flown at a constant altitude parallel and in the opposite direction to the landing area in use. The descent is begun directly opposite (key position) the intended landing spot. Adjust length of Downwind leg for wind conditions and safe spacing from other aircraft in the traffic pattern. The Base leg turn to Final should not be below an altitude of 50 feet.

The last part of the final approach should be a shallow, stabilized glide. Use power and pitch control to establish and maintain the final approach glide path.

NOTE: It is very important to keep the aircraft in a nose low attitude with adequate airspeed (minimum 30 mph) to avoid stall or excessive sink rate.

The value of a stabilized approach cannot be overemphasized. It is very difficult to execute a good landing while constantly attempting to adjust the glide

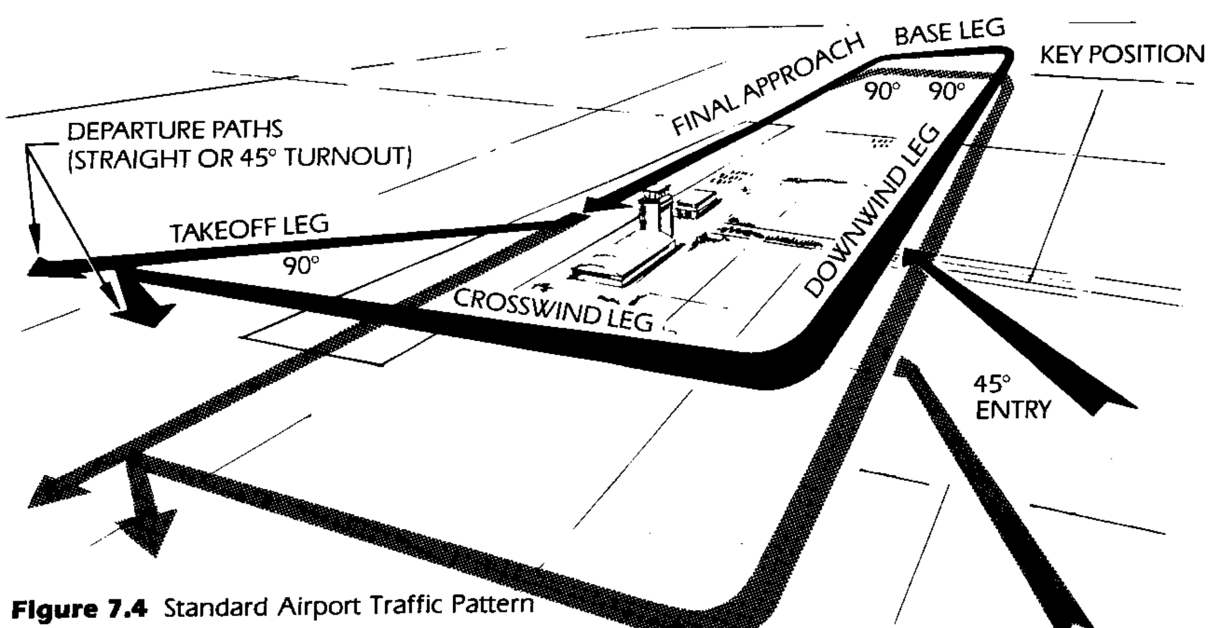


Figure 7.4 Standard Airport Traffic Pattern

When the Main wheels lift off the ground, the pilot should not climb over 1-2 feet off the ground. It is preferable to fly the aircraft a short distance at this altitude, holding the wings level by moving stick right or left, then the pilot should let off the power and the aircraft will settle to the ground. This should be practiced several times. See **Figure 7.2**. The pilot is now ready for his first departure. Check for Traffic on the ground and in the air. The Pilot should execute his takeoff and liftoff as described above. Once the aircraft is airborne, the best rate of climb attitude should be used until an altitude of 100 feet is attained. (The aircraft should be climbed straight ahead.) The pilot should always be aware of possible engine failure and have a suitable landing site located.

Straight & Level Flight

The objective of straight and level flight is to point the airplane in a particular direction, maintain that direction, and fly at a predetermined altitude. The best way to maintain straight and level flight is use the technique called Attitude Flying. In straight and level flight, the wing tips will be an equal given distance above the horizon and the bottom wing surface parallel to the horizon, and the compression struts parallel to the horizon.

Turns

Turns are accomplished in the Quicksilver MX by moving the control stick right or left. Coordinated input of spoilerons gives additional roll rate as well as a back-up control system. The Quicksilver MX has a very good roll and turning rate, thus, it is very easy and safe in making turns. But the pilot should be aware of the force acting on a aircraft in a turn.

Lift acts approximately straight up the vertical axis of the airplane at all times, so the total lift vector can be resolved in vertical and horizontal components when considering its action in a turn. In a properly executed turn, the centrifugal force tending to pull the airplane toward the outside of the curving flight path is balanced by the horizontal component of lift. To maintain the original altitude or vertical velocity that existed before the turn, total lift must be increased while turning. It must be increased until it equals the weight of the aircraft plus the centrifugal force produced by the turn. See **Figure 7.3.**

For this reason, an airplane, which has just been placed in a turn, will lose altitude unless the angle of attack is increased to produce more total lift. This increased angle of attack increases drag, so airspeed will be lost if power is not increased. Thus, when making steep turns to maintain altitude, you must increase power and maintain slight back pressure on the stick.

Turns are classified into three categories:

1) Shallow turn: up to 20° (there is the angle in degrees between the Horizon and the Leading Edge of the wings)
2) Medium Turn: 20°-35°
3) Steep Turn: 35° and more

When making a turn close to the ground, **shallow turns should be used.** Extreme caution should be used when turning downwind at low altitudes. On windy days, (5 mph or greater) low (75') downwind turns should be avoided.

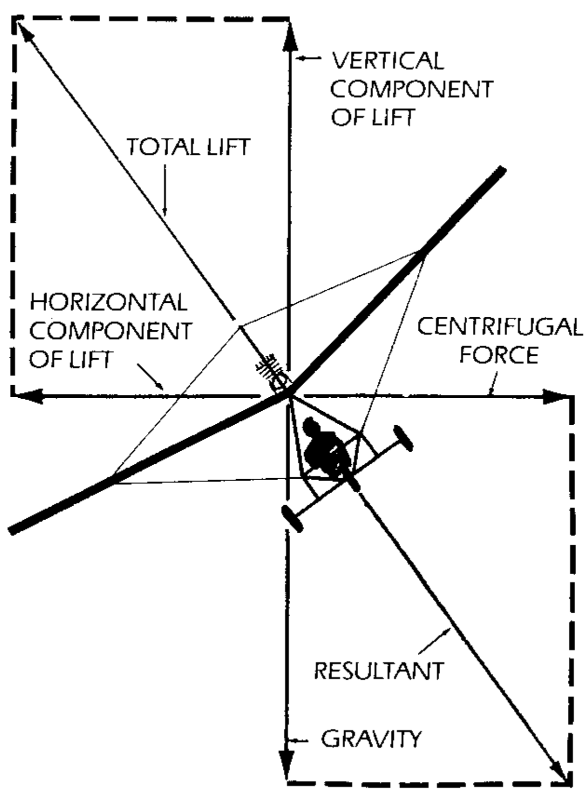


Figure 7.3 Forces Acting on a Turning Airplane

path: therefore, all maneuvering should be accomplished as early as possible on the final approach. Your goal should be to establish the correct airspeed and glide path during the first portion of the final approach, using only minor corrections during the last segment.

During early landing practice, it is common to overcontrol and make corrections that are in excess of those required. As a guide, visualize the normal or standard pattern and make smooth positive corrections back to that pattern. If you are low, for example, it usually is not necessary to make an abrupt correction and climb back to the standard pattern. Instead, reduce the rate of descent or use level flight for a short period until the desired approach angle is regained.

If the airplane is low and slow, power must be added and the nose lowered. Lowering the nose when the airplane is low is sometimes a difficult response but it must be practiced and learned.

Approach speed is frequently near the best angle-of-glide speed. This means that any other airspeed results in a higher rate of descent. If the airplane is short of the desired touchdown spot, the glide cannot be "stretched" by raising the nose and slowing the airspeed; instead, power must be added.

If the approach is extremely high, there is very little value in entering a steep descent, and a go-around is generally required. Although it appears the airplane will reach the desired point of touchdown, a dive causes excessive airspeed which must be dissipated in the flareout. The result is that a greater distance is covered as the airplane floats down the runway, usually well beyond the desired landing point.

For an excessively high approach in which you do not make the decision to go-around,the MX is equipped with foot actuated spoilerons. When the aircraft is on final approach with reduced throttle setting,, deploying both spoilers kills lift on both wing surfaces allowing for the necessary steep descent but at low airspeed. A steep approach can continue as needed to lose altitude. Spoilerons must be released no later than 10 ft. above the surface, at which point normal landing procedure is resumed.

Normal Landings

If the final approach glide were continued all the way to the runway without any change, the result would be a hard landing. The objectives of every landing, though, are to touch down while moving forward and downward as slowly as possible, but still to maintain enough airspeed for good control. This is accomplished by interrupting the approach angle and reducing airspeed close to the ground.

To begin the flareout, the airplane should be leveled off when the wheels are just above the runway (approximately 3 feet). Continued stick movement aft while easing off any remaining power will allow the airplane to settle to the runway. It is advisable to keep your feet on the pedals until the aircraft is on the ground and stopped.

Stall

Any aircraft with an airfoil will stall. Although some aircraft will stall more abruptly and have very radical stall characteristics, the Quicksilver MX is very gentle and has extremely safe, predictable stall characteristics.

Although stalls are practiced in an attempt to control airspeed, altitude and attitude precisely, they are not practiced simply for the sake of stalling the airplane with perfection. Stalls are practiced to accomplish two main objectives. First, to enable you to become familiar with the stall warning and handling characteristics of an airplane as it transitions from cruise to slow flight and approaches a stall; and second, to teach you the proper techniques for prompt and efficient recovery from inadvertent stalls with only a minimum loss of altitude.

Before stall practice begins, the factors which cause a stall should be reviewed. Simply stated, a stall is caused by an excessive angle of attack which causes the smooth air flow over the upper wing surface to break away, resulting in a loss of lift.

The angle of attack is the angle between the wing chord line and the direction the wing is moving. Air moves toward the wing from the direction in which the wing is moving, or along the flight path of the airplane. This air flow is called relative wind. Therefore, the angle of attack is the angle between the wing chord line and the relative wind.

The wing can move through the air at several different angles with respect to the relative wind. It is important to remember that the relative wind is seldom parallel to the horizon and that the angle of attack is measured between the chord line and relative wind, not the horizon. This means it is possible to have a high angle of attack with the nose low or a low angle of attack with the nose high.

In normal flight, the air flows smoothly over the top of the wing. However, even in cruise flight, the smooth air eventually separates from the wing at a point called the separation point.

As the angle of attack increases, the separation point moves forward, as shown in **Figure 7.5.**

As the separation point moves forward, it eventually reaches a point where too much air has separated from the wing. There is no longer sufficient lift to support the airplane and the resulting drag has increased greatly, so the wings stall. It should be noted that all of the lift is not destroyed; however, the remaining lift is not sufficient to support the airplane. Stalls should not be practiced by a new pilot or without instructions.

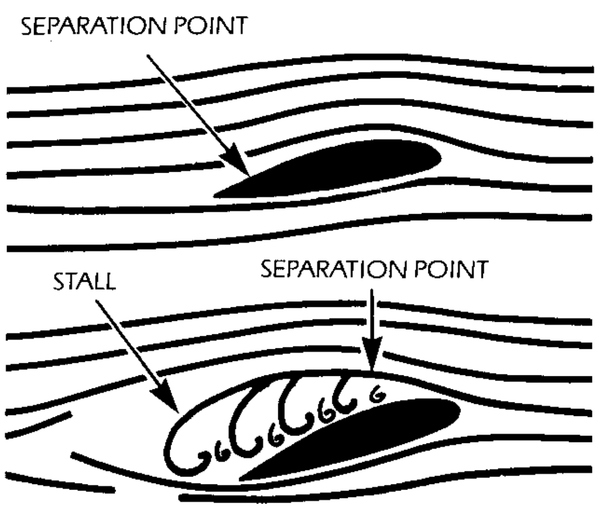


Figure 7.5 Separation Point Moves Forward as Angle of Attack Increases

Stalls should be practiced in an area away from other air traffic and at an altitude that generally permits stall recovery at least 200 feet above the ground.During stall practice, as well as in other maneuvers, the area must be "cleared" of other airplanes. Make clearing turns a part of each maneuver, by first making two medium banked 90° turns in opposite directions. The object of these clearing turns is to look over the entire area, especially at your flight altitude, to assure yourself there are no other airplanes in the area. If there are airplanes nearby, wait until they are well clear before performing the maneuver.

As a stall is approached, there are other cues that inform you the airplane is slowing. For example, the tone and intensity of the slipstream noise.

Stall warnings are 1 to 2 mph before the stall. The warning indications are buffeting at a high angle of attack. One of the purposes of stall practice is to recognize the indications applicable to your airplane.

Take Off/Departure Stalls

Although the Quicksilver MX has a very slight power on stall it is important to be familiar with its characteristics. A power on climb should be entered slowly moving control stick back, the pilot should notice that with stick full back the aircraft climb rate is considerably less than when at normal climb attitude (**Figure 6.1**). The aircraft will also have a buffeting or shudder feel to it while in a departure stall condition. Actually the aircraft will lose altitude at a slow rate. Recovery is accomplished by moving the stick forward lowering the nose to increase airspeed and climb rate.

Approach Stalls

After a satisfactory altitude is established and the area has been cleared, the stall usually is introduced from a power-off, wings-level glide, such as that used when landing the airplane. To enter the stall, reduce power to idle, establish a normal glide. Next, pull the stick back to increase the pitch angle.

As the airspeed slows, one objective of the maneuver is to gain a "feel" for the control pressures and responses as the airplane approaches the stall. As speed slows, the response of the airplane to control pressures becomes slower. The feeling is sometimes called "mushy" or "soft", as compared to the more solid feel of the controls at cruise speed. In addition, more up elevator is required to maintain the desired pitch attitude. Recovery should be initiated at the first indication of the stall by reducing the pitch attitude smoothly to decrease the angle of attack and simultaneously applying full power.

Special Takeoff and Landings

With the variety of airstrips available, you must be prepared to operate on every type of surface ranging from grass fields to paved runways. For that reason, it is important to practice various types of takeoffs and landings.

Crosswind Takeoffs

Crosswind takeoffs should not be performed except by an experienced pilot and with extreme caution. The technique for a crosswind takeoff involves correcting for the effects of the wind. First, the airplane is aligned with the centerline of the runway. Full power is then applied in the normal manner. As speed increases, the pilot holds the aircraft on the ground with stick in neutral or slightly forward position. The airplane is held on the runway until a slightly higher-than-normal liftoff speed is attained. At this point, the airplane is lifted off the runway promptly and a normal climb attitude is established into the wind. This technique reduces the chance of the airplane being lifted off the runway prematurely by a sudden gust of wind before it has attained sufficient airspeed to remain airborne.

When you are airborn and a positive rate of climb is established, a crab is entered by making a coordinated turn into the wind. This technique allows the airplane to track straight out on an imaginary extension of the runway centerline.

Short Field Takeoffs

During short-field practice sessions, it is usually assumed that, in addition to a short runway, there is an obstruction on each end of the runway that must be cleared. The obstruction is considered to be approximately 50 feet in height.

The short-field takeoff should be initiated by holding the aircraft applying full power, and then releasing the brakes. This procedure does not necessarily shorten the total takeoff ground run, but it will help you determine that the engine is functioning properly before taking off from a field where power availability is crucial.

The airplane should be allowed to roll on the full weight of its wheels at an attitude that results in minimum drag.

The initial takeoff roll involves little or no use of elevator beyond permitting it to assume a neutral position. Shortly before the best angle-of-climb airspeed is reached, up elevator is applied smoothly and promptly so that the airplane lifts off near the best angle-of-climb speed. This attitude and airspeed are held until the obstacle is cleared. Caution should be used climbing at this attitude. A pitch down condition will occur if a power failure is experienced. (See **Figure 6.2.**)

After the obstacle has been cleared, the pitch is adjusted to the normal climb attitude.

Soft Field Takeoffs

The objective of the soft-field takeoff is to transfer the weight of the airplane from the main landing gear to the wings as quickly and smoothly as possible. The soft-field takeoff procedure requires accelerating the airplane a nose-high attitude with the nosewheel clear of the surface during most of the takeoff ground run. This technique keeps the nosewheel from sinking into the soft runway surface and allows the airplane to accelerate to liftoff speed. If the pitch attitude is established properly during the ground run, the airplane will lift off at or slightly below the power-off stall speed. After liftoff, the pitch attitude is reduced gradually to level flight, allowing the airplane to accelerate within ground effect to the normal climb airspeed.

Soft Field Landing

The soft field landing objective is to land the aircraft on soft terrain preventing the aircraft from turning over or becoming stuck. A flat slow approach with power is required. The main wheel touch first and the pilot should hold the nose off the ground with stick back and partial power applied until a hard surface is reached.

Short Field Landing

Short field landings are performed assuming there are obstacles to be cleared. A power off (idle) nose down attitude is used with both spoilers applied. When nearing the ground, release spoilers. Approximately 5-10 feet above ground the pilot should begin to move the stick back letting airspeed bleed-off. Just above stall speed tha aircraft should be 1-2 feet off the ground the pilot should then ease the stick all the way back and land applying brake and stopping as soon as possible.

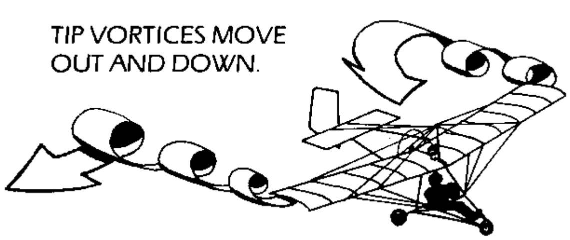


Figure 7.6 Wing Tip Vortices

Wake Turbulence

Wake turbulence is produced to some degree by all airplanes developing lift. Air tends to flow from the bottom of the wing over the wingtip into the area of low pressure at the top of the wing. This circulation causes a whirlpool, or vortex, of air to form behind the tip of each wing, as shown in **Figure 7.6.** The intensity of these vortices depends upon the aircraft's weight, speed, and configuration. When an airplane is heavy and slow, it generates the greatest wake turbulence. Tests have shown the turbulence can reach very high spin velocities.

Although heavily loaded commercial jet aircraft pose the greatest danger, wake turbulence is hazardous to any aircraft with a wingspan smaller than that of the generating aircraft. Flight tests have shown that wake turbulence from larger airliners can induce uncontrollable roll rates in most smaller commercial jets, business jets, and general aviation aircraft.

At the present time, the only reliable way to combat wake turbulence is to know and avoid areas where it is likely to be encountered. You should, therefore, avoid the area directly behind and below the generating aircraft. As shown in **Figure 7.7**, when landing behind a large aircraft fly above the larger aircraft's flight path and land beyond its touchdown point, when possible, or allow sufficient time for the vortex to dissipate prior to entering the landing pattern. When taking off behind a larger aircraft, you should wait two or three minutes or plan to lift off prior to reaching the point where the preceding aircraft lifts its nose (or tail) wheel from the runway. This is particularly important if there is little wind to carry the disturbance down the runway.

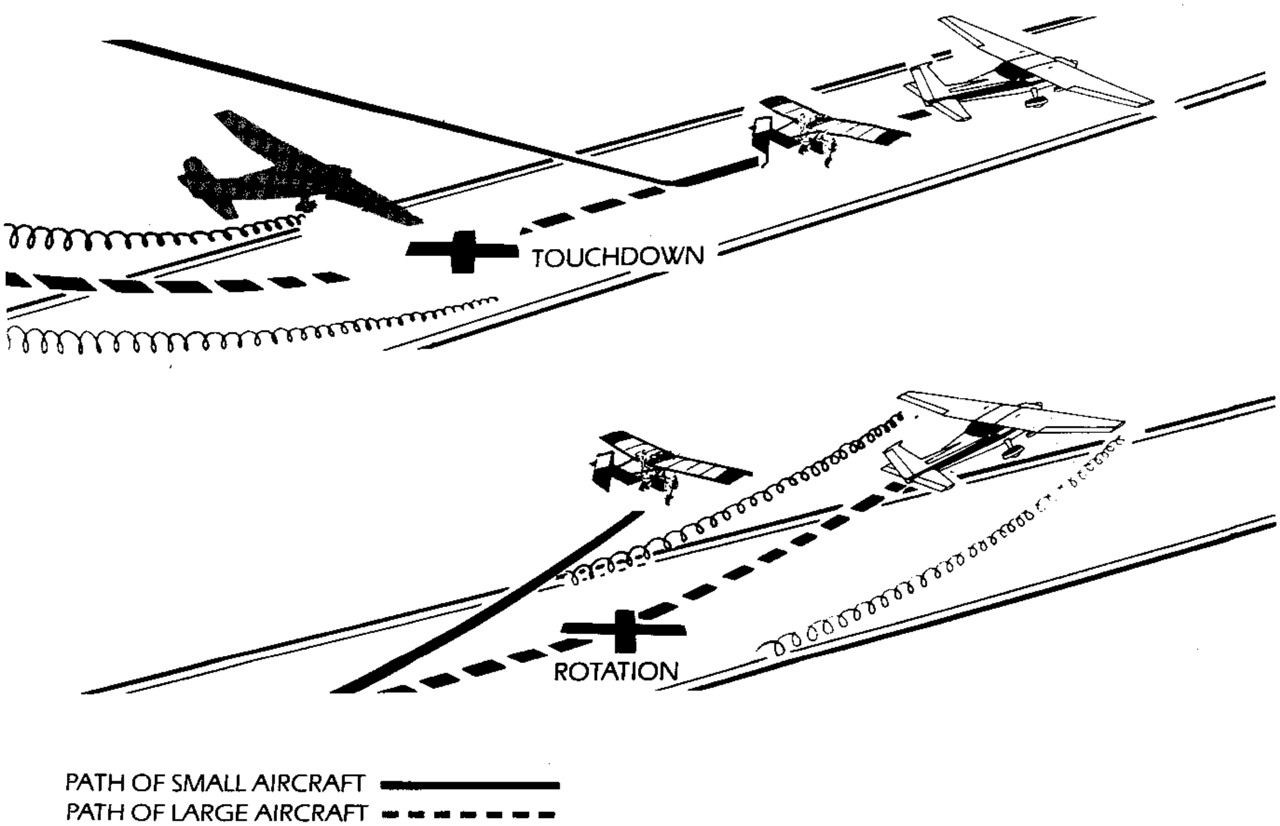
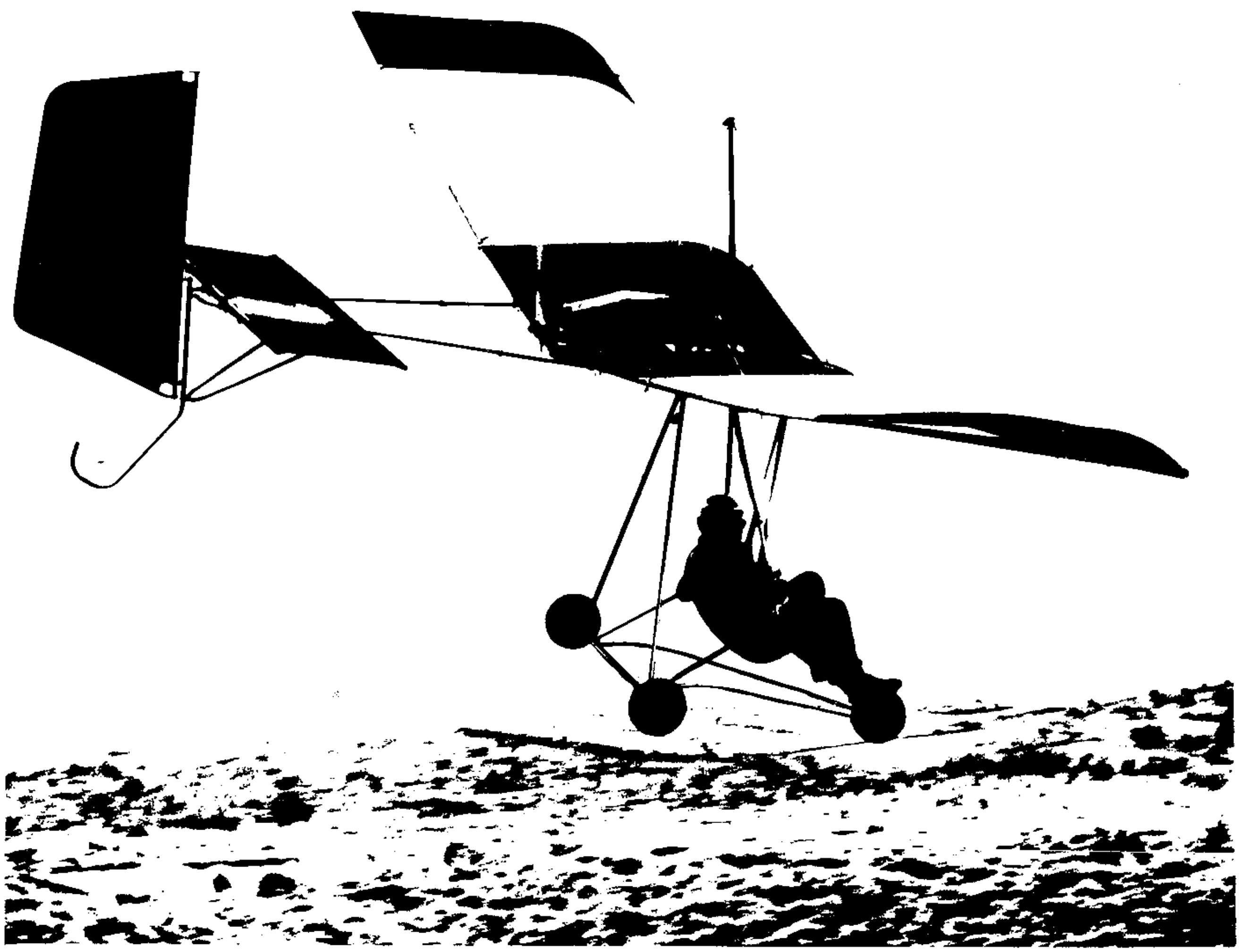


Figure 7.7 Wake Turbulence Avoidance

METEOROLOGY



An understanding of meteorology is one of the most important areas of aviation knowledge. Throughout the history of aviation, adverse weather has hampered flight operations and has been the cause of accidents for "un-weather-conscious" pilots. Today, modern aircraft are capable of flying in most kinds of meteorological conditions. However, you ability to recognize and use weather situations will determine how well you can utilize a flying vehicle such as the Quicksilver MX. Since the Quicksilver MX is an ultralight aircraft, it is more sensitive to weather conditions than normal aircraft and should never be flown in adverse weather conditions.

The Earth's Atmosphere

The atmosphere is, for all practical purposes, an ocean, with the earth's land and water surfaces as the bottom, as shown in **Figure 8.1**. At sea level, the air is heavy and more dense (or thick) because of the weight of all the air above. At sea level the pressure exerted by this sea of air is 14.7 p.s.i. At 18,000 feet the air is approximately one-half as dense as air at sea level.

The composition of the atmosphere is primarily nitrogen, oxygen, carbon dioxide, and water vapor. Carbon dioxide and water vapor content, which affects mostly the lower levels, changes with local conditions. The 78% nitrogen and 21% oxygen content remains relatively constant. The ratio of oxygen and nitrogen is the same at any altitude from sea level up.

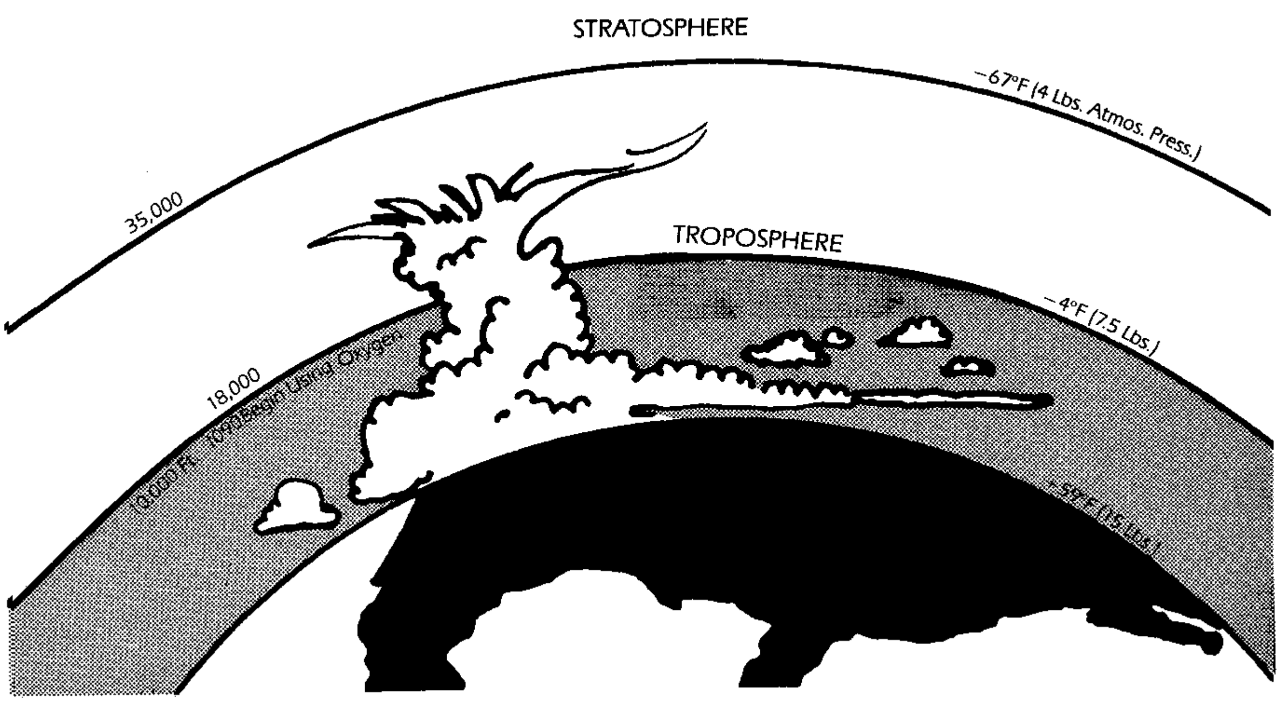


Figure 8.1 Earth's Atmosphere

Circulation of the Atmosphere

The earth and its atmosphere are heated unevenly by the sun. The uneven heating combined with the earth's rotation causes a constant circulation of the atmosphere which produces most of the earth's weather. The major circulation pattern for equalization of pressures is between the poles and the equator. The temperature at the equator is high and the warm air rises, creating a low pressure area; the colder air from the poles moves along the surface and into the low pressure area to equalize the pressure. This air is heated at the equator, rises aloft, and returns to the poles as shown in **Figure 8.2**.

Circulation is also affected by the rotation of the earth and localized conditions. This same pattern occurs on the local level in the United States. For example, when low pressure is created by the heating of the central plains, colder air from the north moves under the rising warm air setting up a local circulation pattern that produces varying wind and weather conditions. The wind patterns of the pressure areas are standard and can be used as an aid by the pilot. The wind circulation around a high pressure area in the northern hemisphere is clockwise and outward; around a low pressure area, counterclockwise and inward, as shown in **Figure 8.3**.

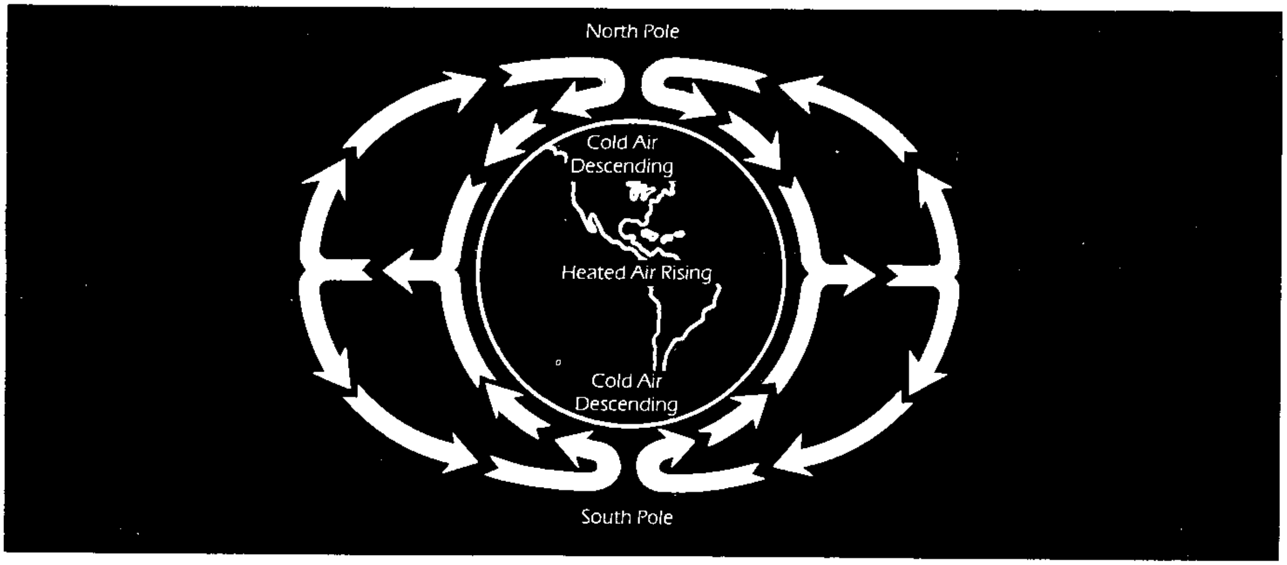


Figure 8.2 World Air Circulation Pattern

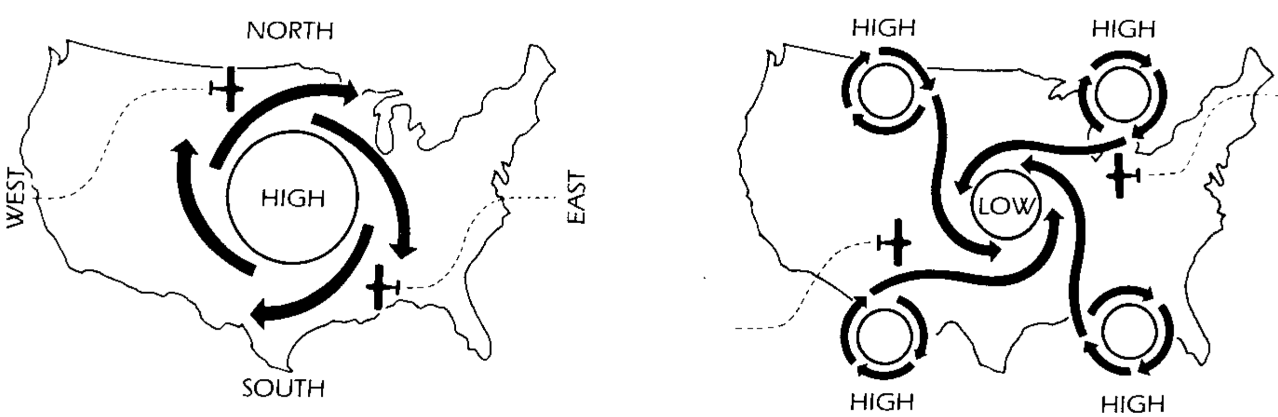


Figure 8.3 High-Low Pressure Wind Circulation

Weather in the United States generally moves from west to east due to the influence of the earth's rotation on the major circulation patterns. If your flight is a fairly long one, you can plan to take advantage of the easterly flow to insure a tailwind or to avoid a headwind. If you can keep in-flight winds to your right, it follows that you will continually fly toward higher pressure and associated better flying weather.

The temperature of the air near the earth's surface is relatively warm. As altitude increases, the temperature normally decreases by about 3-1/2° Fahrenheit for every 1,000 feet. This is called the normal lapse rate.

Atmospheric Pressure

The movement, cooling, and heating of air cause changes in the air pressure. The changes in atmospheric pressure are measured in inches of mercury. If a tube containing mercury is placed in an upright position at sea level on a standard day, there is enough atmospheric pressure (14.7 p.s.i.) to force the mercury to a height of 29.92 inches. This is shown in **Figure 8.4**. If the pressure is higher than standard, the mercury in the tube will measure higher, and if lower than standard, it will measure lower than 29.92 inches.

These pressure readings are taken at weather stations all over the world at varying elevations.

Since air becomes thinner with altitude, there will be less force exerted on the column of mercury at 5,000 feet than at sea level.

Below 10,000 feet, the force exerted by the atmosphere decreases by approximately one inch of mercury for each 1,000 foot rise in altitude. If the pressure at sea level is 29.92 inches of mercury the pressure would be approximately 24.92 at 5,000 feet; however, all stations correct their atmospheric pressure to relate to sea level. See **Figure 8.5**. For uniformity and safety, airplanes should fly with

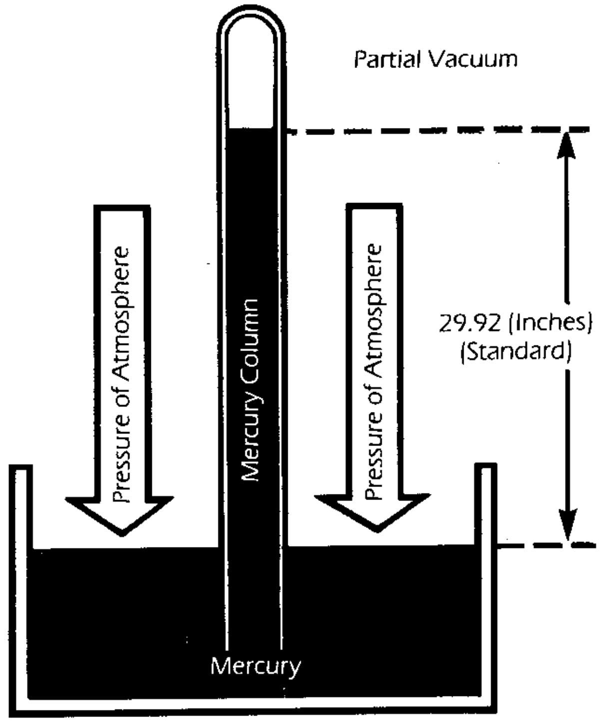


Figure 8.4 Mercury Barometer

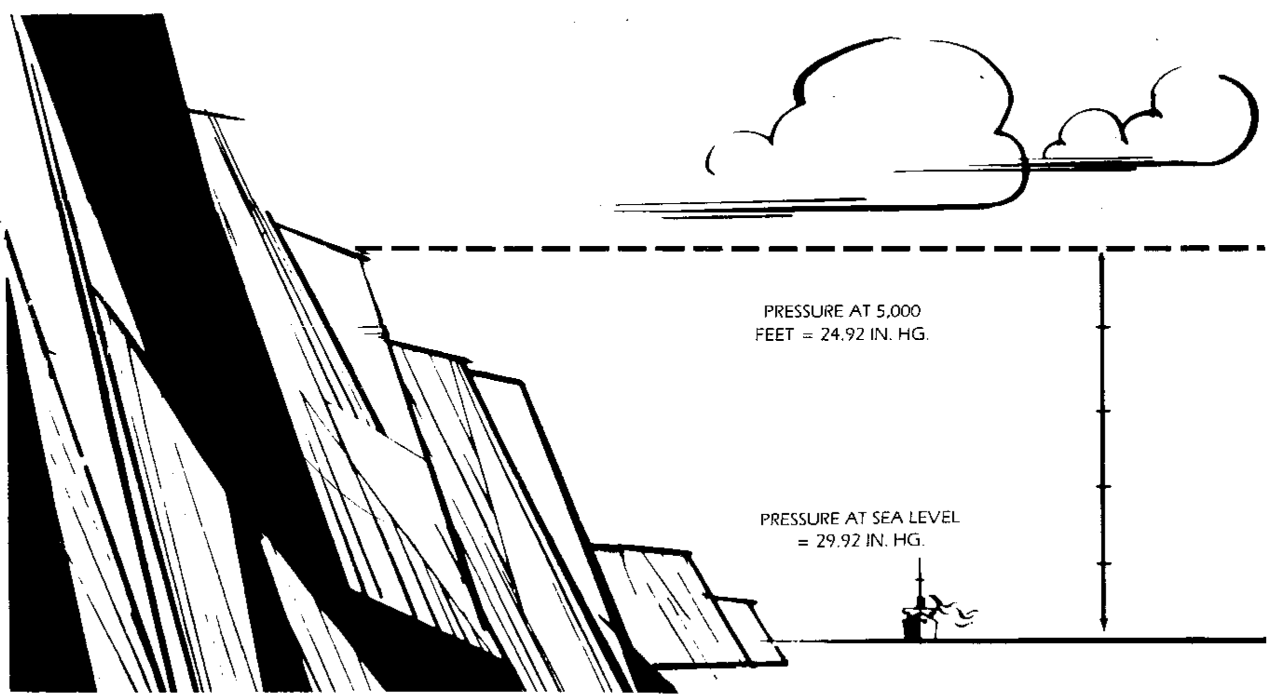


Figure 8.5 Barometer Pressure Comparison

the altimeter setting obtained from stations enroute. Each altimeter has a control knob to allow the pilot to change the pressure setting. The pressure used for this adjustment is read on the altimeter setting window. The altimeter altitude reading is in feet above mean sea level (MSL) and not above ground level (AGL).

Airmasses

An airmass is any huge body of air with fairly uniform temperature and humidity. The region where an airmass acquires its identifying properties of temperature and moisture is called its source region. As you can see in **Figure 8.6**, source regions for airmasses which move into the United States are the plains of northern Canada, the polar ice cap, the broad ocean areas of the North Atlantic and North Pacific, and the Gulf of Mexico. The only real airmass source region in the United States is the arid southwest. Air over the United States generally is too active for substantial airmass formation, since it takes several days of stagnation for surface characteristics to reach into the upper layers of a mass of air.

Although the United States is not a significant source region, fully developed airmasses from the source regions mentioned above, regularly transit our latitudes. When they do, weather becomes the direct result of interaction of warm and cold, as well as saturated and dry conditions. Warm airmasses from the south are predominant in the summer and cold airmasses are predominant in the winter. However, both cool and warm air may prevail almost anywhere in the United States in any season.

When an airmass starts to move, its characteristics usually are modified by the terrain and existing conditions of the area it crosses, gradually changing its temperature and moisture content. It is the interaction between the invading airmass and the airmass being displaced that creates most weather phenomena. An understanding of airmass characteristics will give you an idea of what flying conditions to expect.

Within an airmass, weather is controlled primarily by the moisture content of the air, the relationship between surface temperature and high altitude air temperature

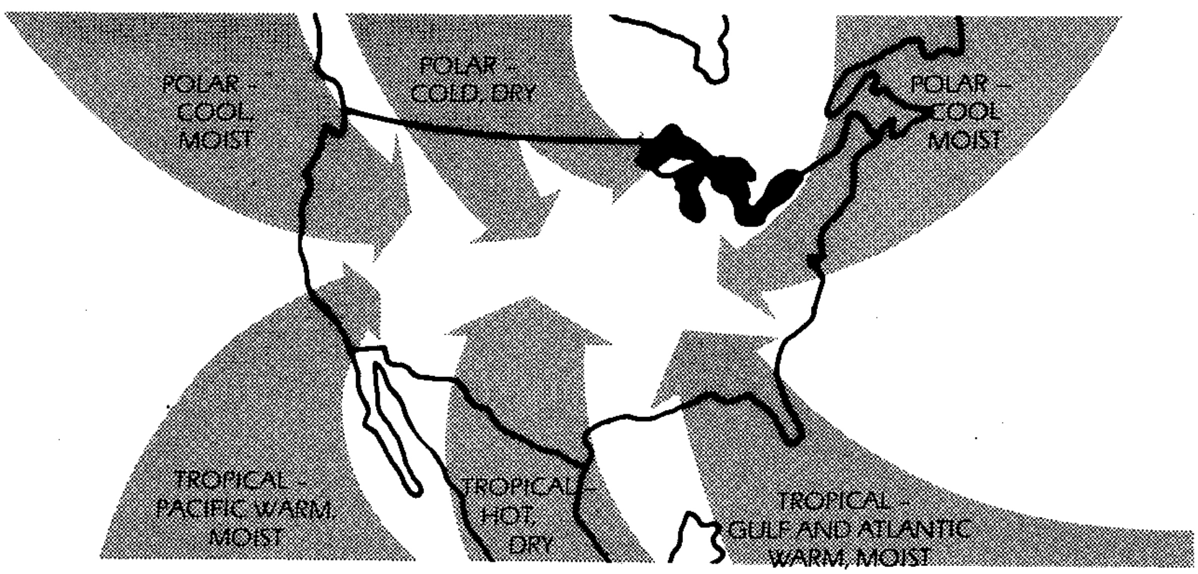


Figure 8.6 North American Airmass

(energy imbalance), and terrain (up and down slope). By noting which factors are present in a given situation, and by remembering the tendency large masses of similar characteristics have to remain as one mass, you can draw up a simple scorecard to tell just what any given mass of air is expected to produce in the way of weather.

Stable and Unstable Airmasses

An airmass can be either stable (resistant to vertical displacement) or unstable (nonresistant). When stability is considered along with the vertical temperature distribution and the amount of moisture in an airmass, you can discern some idea of what type of weather to expect. For example, if you notice warm moist surface air during your preflight planning, you know you can expect instability and rough flying conditions. If the temperature decreases uniformly and rapidly (approximately 3°C per thousand feet) during climbout, you have a good indication of unstable air since nature will not permit this high a lapse rate without major adjustments taking place in the atmosphere.

Humidity

Water from the earth's surface (oceans, lakes, rivers, moist soil, etc.) is vaporized and carried into the atmosphere by air currents. The water vapor content of the atmosphere is called humidity. Relative humidity is the ratio of actual water vapor content of the air to the maximum amount the air can hold, or its saturation point. As temperature increases, so does the amount of water vapor the air can hold.

The dewpoint is the temperature, at a given pressure, to which air must be cooled to become saturated. The difference between the dewpoint and the actual temperature is called the "spread." For example, if the dewpoint is 50° Fahrenheit and the actual temperature is 52° Fahrenheit, the spread is 2° Fahrenheit. If the temperature falls two degrees, the air would be saturated and water vapor in the air would take the form of visible moisture. As the temperature and dewpoint become closer (4°F or less), precipitation, low clouds, or fog should be expected. Likewise, no precipitation, low clouds, or fog should be expected with a wide temperature "spread."

Clouds

The Quicksilver should never be flown in clouds but a pilot should understand their formations and types.

Formation

The process by which water vapor becomes visible moisture in the form of fog, clouds, or liquid precipitation is called condensation. Condensation takes place when water vapor content is high and air is sufficiently cooled to become saturated. See **Figure 8.7**.

By far the greatest number of clouds are the result of cooling from some lifting process such as surface heating, movement across a mountain range or area of high elevation, or by a wedge of cold dense air. Lifted air which contains moisture becomes saturated as it rises and the moisture changes its physical state into visible liquid water droplets which are too small to fall to the earth.

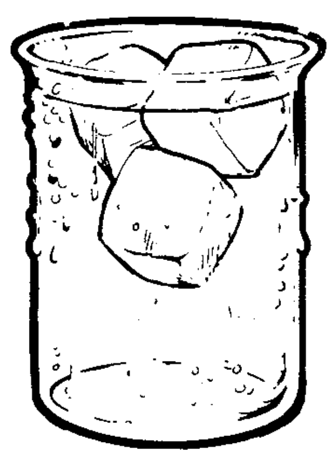


Figure 8.7 Condensation

Classification

Clouds are usually classified as cumuliform and stratiform, depending on their appearance. As shown in **Figure 8.8**, cumuliform clouds are billowy and dome-shaped. They are formed by rising air currents. Stratiform clouds usually form in horizontal sheets like layers, and vary in thickness with little vertical buildup. See **Figure 8.9**.

Nimbo, or nimbus are added to the names of basic clouds to indicate rain. A heavy stratified cloud with visible moisture is an nimbostratus cloud, and a swelling cumulus cloud is termed cumulonimbus. Clouds that are broken or fragmented are denoted by the suffix fractus, as in cumulus fractus.

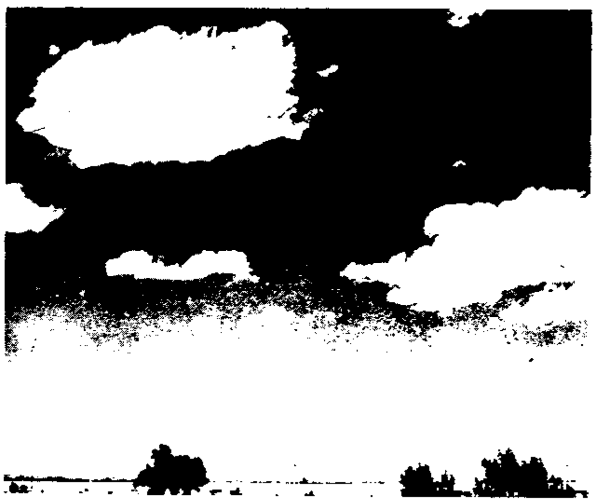


Figure 8.8 Cumulus Clouds

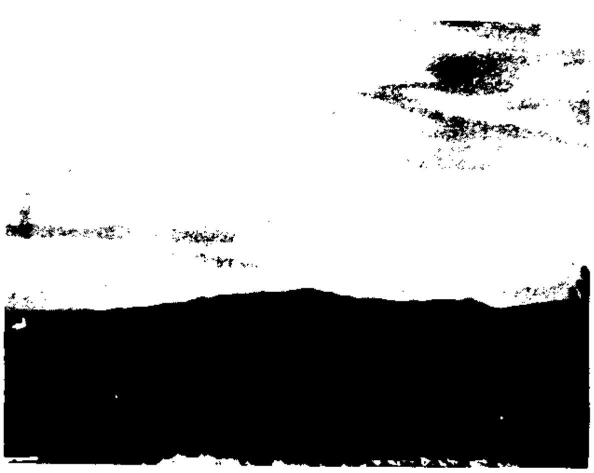


Figure 8.9 Stratus Clouds

Fog

Fog is composed of water droplets which form on small particles of solid matter such as dust, smoke, and salt sea spray. These particles are called condensation nuclei. Condensation rarely begins until a suitable concentration of nuclei are available in the air. As the air is cooled, the nuclei begin to absorb water. When the concentration of the water is great enough, condensation may occur before the saturation point is reached.

Industrial areas and sea coasts have more ground fog and low cloud conditions than other areas due to the abundance of particles in the air. Be particularly wary of small temperature/dewpoint spreads when flying in these areas.

Fog types include radiation, advection, upslope and ice. Notice that these classifications hint at the main processes which cause the fog to form. Every condition of fog is the result of moisture, stability, and cooling. Remember this each time you encounter a situation where fog may occur or is occurring.

Haze and Smoke

Haze is a concentration of salt or other dry particles not classified as dust. Haze occurs in stable air and, although it usually is only a few thousand feet thick, sometimes extends as high as 15,000 feet. You can expect visibility to be worse when flying in haze toward the sun.

When skies are clear above haze or smoke, generally you can expect surface visibility to improve during the day. This improvement will be noticeably slower than the clearing of fog, since fog evaporates and haze or smoke must be dispersed by air movements or convection.

Low Clouds

The low cloud group consists of stratus, stratocumulus, and fair weather cumulus clouds with bases from near the surface to about 6,500 feet, as shown in **Figure 8.10**. These clouds are almost entirely water which may be supercooled to below-freezing temperatures. Watch for ice when flying in low clouds or precipitation with temperatures near the freezing point. See **Figure 8.11**

Middle Clouds

Figure 8.10 shows that the bases of clouds in the middle group can range from 6,500 feet to around 16,500 feet. The middle clouds (altostratus, altocumulus, and nimbostratus) tend to restrict visibility and, therefore, are of utmost importance to you during flight. The middle clouds are mostly liquid water, much of which may be super-

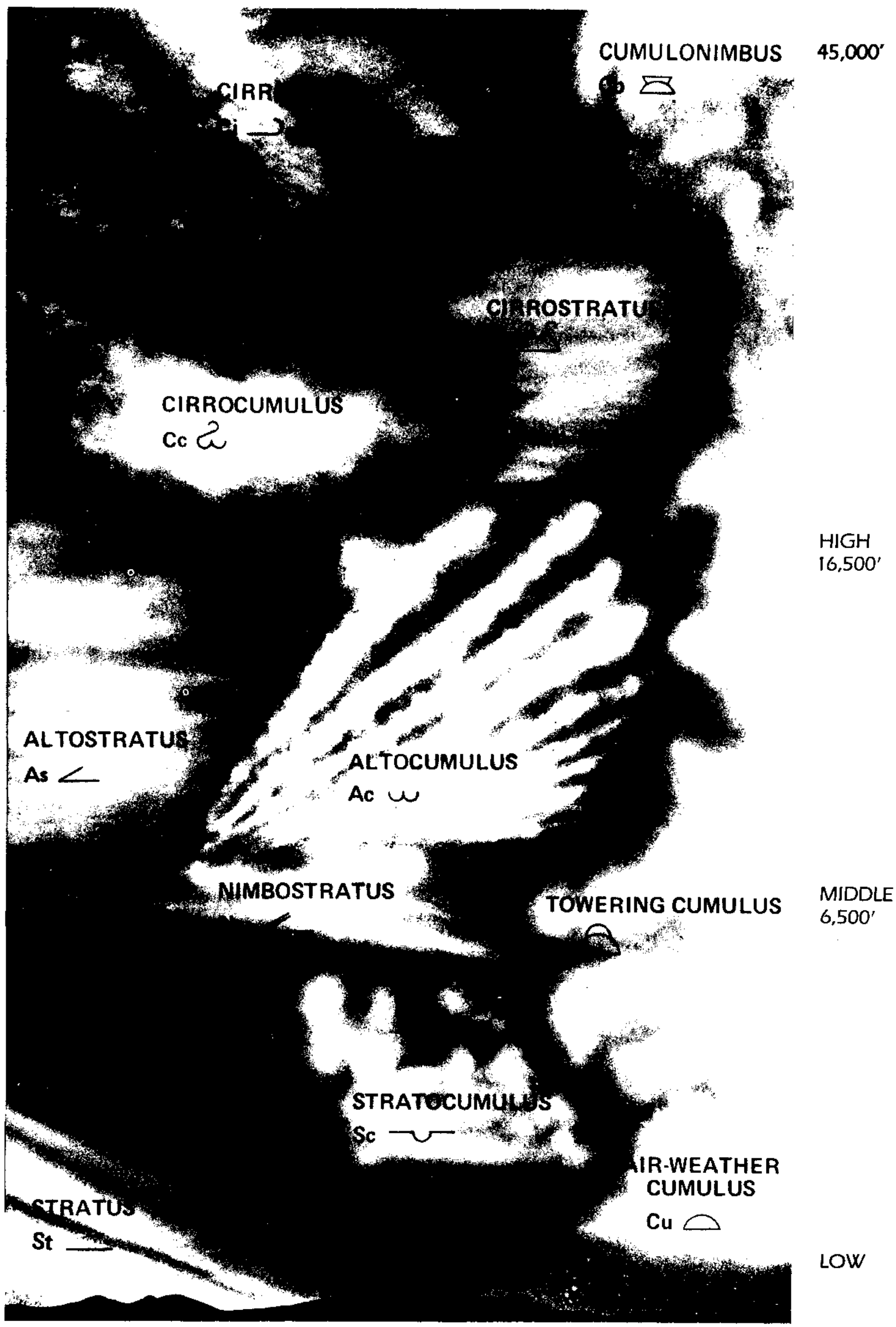


Figure 8.10 Cloud Classification

cooled and capable of producing ice.

With unstable air and adequate moisture, small cumulus clouds can grow into towering cumulus in a very short time. Towering cumulus and cumulonimbus clouds usually contain supercooled water and the upper parts of these clouds usually contain ice crystals and hail. As you can see in **Figure 8.10**, vertically developed clouds may have bases too low to fly under and tops too high to fly over.

High Clouds

The high cloud group includes cirrus, cirrocumulus, and cirrostratus. These clouds are made up almost entirely of ice crystals and, as you can see in **Figure 8.10**, are found between 16,500 and 45,000 feet. Cirrus clouds normally do not present any weather problems for most general aviation flight operations.

Fronts and Frontal Conditions

As airmasses move out of their source regions, they come into contact with other airmasses which have different temperatures, pressures, and moisture contents. Airmasses from the north have opposite properties from airmasses originating in the tropics and, when they meet, they clash with each other just as opposing military forces in a war. Airmasses usually cover many thousands of square miles and, therefore, the "front" at which they meet can be hundreds of miles long.

Frontal "zones" are narrowest when the airmasses have vastly different properties and are moving rapidly. Since airmasses have depth, the zone of transition between them exists not only at the surface, as shown in **Figure 8.12**, but for a considerable distance upward from the surface as well.

Wind

Always expect a change or "shift" in the speed and direction of the wind across a front.

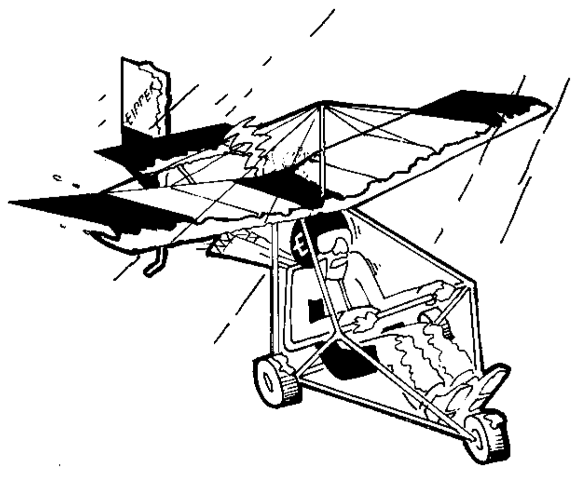


Figure 8.11 Unexpected Icing

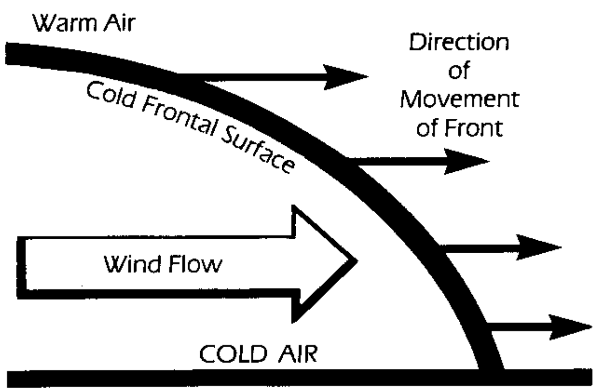


Figure 8.12 Standard Cold Front Profile

Figure 8.13 Standard Low Pressure Model

Pressure

A front lies in a low pressure trough and pressure generally is higher on both sides. When you cross a front into colder air, expect the pressure to rise abruptly. When you approach a warm front, pressure generally falls until you cross the front and then remains steady or rises slightly in the warm air.

Many people associate fronts only with the most violent types of weather. This is simply not true. While many of the most violent types of weather occur in fronts, they are not necessarily violent nor do they always produce clouds and/or precipitation.

All fronts radiate from a low pressure area. Therefore, you can look for frontal weather (when it is present) to be more intense near this low center, as shown in **Figure 8.13**. If there are ice clouds or thunderstorms present, they will be more pronounced in the area along a front.

Temperature

A change in temperature is one of the most easily recognizable changes you will encounter as a front passes or as you fly through one. Also, look for a change in the temperature/dewpoint spread to obtain a clue to cloudiness or fog potential.

Cold and Warm Fronts

Fronts are designated as being either cold or warm, depending upon the properties of the invading airmass. The severity of weather created by a front varies and depends upon the slope, moisture content, stability of the airmasses, temperature different'al, and the speed of frontal movement. A cold front is created when a cold airmass replaces warm air at the surface, as shown in **Figure 8.14**. The movement of a cold front is usually faster and has a steeper slope than a warm front. The weather associated with a cold front is usually contained in a narrow band. Warm fronts move slower and have a more gradual slope than cold fronts. As shown in **Figure 8.15**, the invading warm air moves faster than the cold air it replaces at the surface and the upper portions slide over the top of the cold air. This produces a widespread cloud system far in advance of the actual front.

Occlusion

If a low pressure system of fronts has a strong beginning and a favorable condition en route (particularly if there is a strong jetstream system aloft), the faster-moving cold front may catch up with the warm front. The two fronts gradually diverge from the low pressure, enter outward and form an occlusion.

When an occlusion happens, or is forecast, do not assume that this is the end of the systems, although it may well be. The easiest way to understand what happens in an occlusion is to remember what happens any time airmasses of different temperatures come together. The airmass with the coldest temperature will remain at the lowest level and everything will have to go up — sometimes way up. The result is that you can expect anything from imbedded cumulus to widespread precipitation and low clouds or fog conditions.

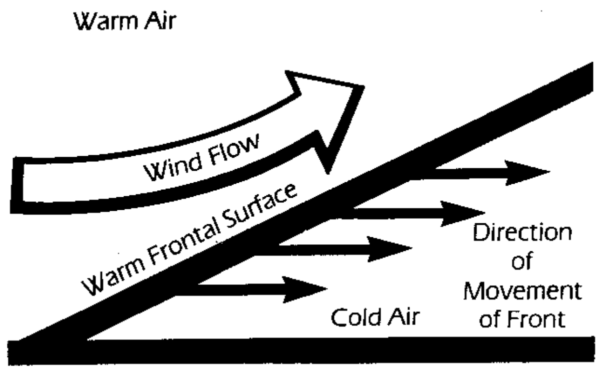


Figure 8.14 Standard Warm Front Profile

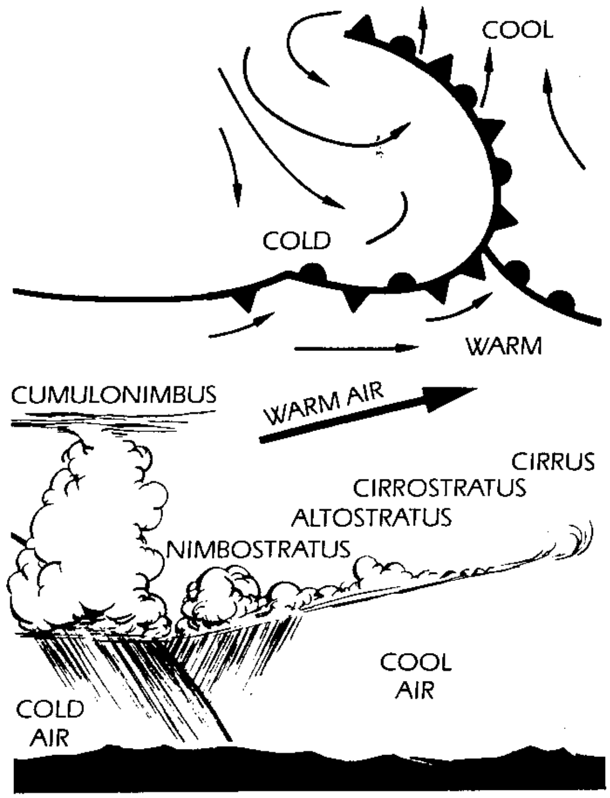


Figure 8.15 Occluded Front Profile and Plan View

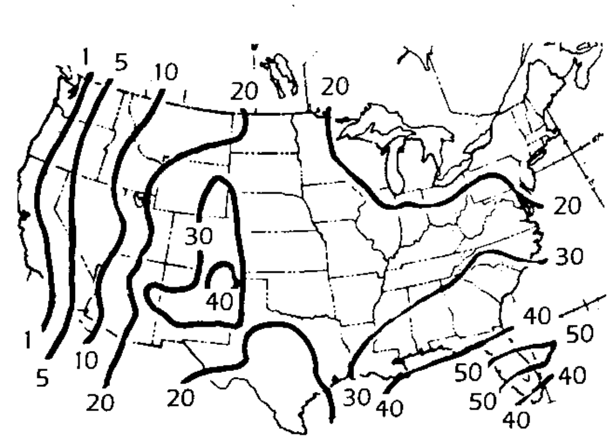


Figure 8.16 Summer Thunderstorm Frequencies

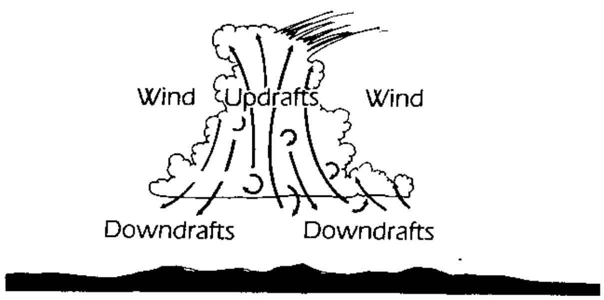


Figure 8.17 Cross Section of a Thunderstorm

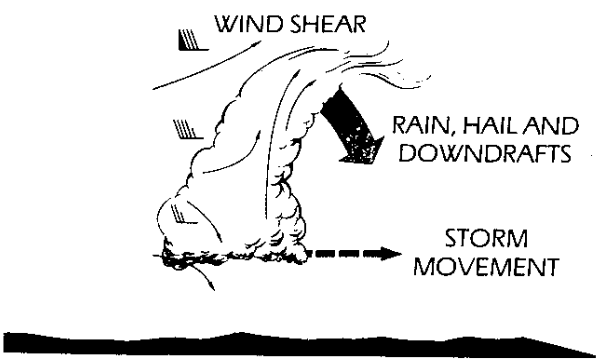


Figure 8.18 Steady State Thunderstorm

Figure 8.19 Cumulonimbus Mamma Clouds

Thunderstorms

Most thunderstorms develop during June, July, and August in the areas and with the frequency shown in **Figure 8.16**. Generally, thunderstorms form in mid-afternoon when there are many convective currents. When thunderstorms are present, you should be very cautious. They are the most dangerous of flying conditions.

Cold and warm front, thermal, and orographic are words used to describe possible "triggering" actions. These terms do not necessarily indicate differences in weather intensity. The exception, however, is the steady-state thunderstorm which feeds on itself and plays havoc with any attempts to forecast its life span.

The principal dangers of thunderstorms are severe turbulence, icing, and hail. Turbulence is a product of the severe up and down drafts shown in **Figure 8.17**, which can cause structural failure of an airplane. Hail is formed within the thunderstorm by the freezing of water droplets. As these frozen droplets are carried up and down within the thunderstorm they increase in size, until they are too heavy to be supported by the air currents and fall to earth. The hail can fall directly out of the thunderstorm or be thrown out by strong vertical currents.

When two or more streams of air flow over each other with different speeds, directions, or a combination of the two, they are termed shears. There is a growing amount of evidence that the presence of these shears within a thunderstorm prevents mature stage downdrafts from destroying the storm. They accomplish this by throwing precipitation out the top of the storm. This type of situation has led to the rule "avoid flight underneath thunderstorm overhangs."

Figure 8.18 illustrated the principle behind the shear theory and also suggests the "leaning" appearance which is characteristic.

Cumulonimbus mamma clouds frequently occur in the same area as severe thunderstorms and tornadoes. These clouds have rounded, irregular pockets or festoons from their bases, as shown in **Figure 8.19**, and are a signpost of violent turbulence.

Another real danger associated with a thunderstorm is gust fronts. When rain or hail is falling in a thunderstorm, tons of air is dragged downward. These downdrafts reach the ground and spread outward rapidly. The spreading air may advance ten or more miles in front of a thunderstorm, arriving with a sudden blast of cold turbulent air. Needless to say, an ultralight aircraft would encounter severe control problems in a gust front. For all the above reasons, it is necessary to avoid flying in the vicinity of thunderstorms.

Turbulence

Often the air will exhibit turbulence in the form of swirls or vortices. The surges in the wind we feel on a gusty day are really these swirls passing by. In the air, a pilot feels turbulence as bumps that require continual control movement as the aircraft pitches and rolls around. As the strength and frequency of turbulence increases, our ability to maintain control is hampered. A pilot of ultralight aircraft such as the Quicksilver MX should not fly in strong turbulence.

There are three sources of turbulence important to pilots of small aircraft: thermals, shear, and mechanical mixing. The first two are described later. Mechanical mixing refers to the tendency of the air to form swirls when it passes over rough terrain. In fact, turbulence should be expected downwind from any solid object such as buildings, hills, trees or shrubs as shown in **Figure 8.20.** To visualize such turbulence, imagine the swirls and eddies in water downstream from submerged logs and rocks.

Turbulence due to mechanical mixing may extend as high as 2,000 ft., but is usually confined to the lower few hundred feet. Air movement (wind) is necessary to form such turbulence; the stronger the wind, the stronger the turbulence. Consequently, a beginning pilot should only fly in calm or light wind conditions.

Ice

Types of Icing

Clear or glaze ice is the most serious of the various forms of ice encounterd in flying. It is formed either by the rapid freezing of large supercooled water droplets on the surface of the airplane or by water droplets flowing over the aircraft and freezing at a slower rate. This type of ice is encountered in cumulus clouds and in areas of freezing rain. When a pilot encounters icing conditions (**Figure 8.11**), he should immediately make a 180° turn since ice not only increases weight but also decreases lift.

Rime ice is formed by partially frozen water droplets, snow, or slush. Since it is partially frozen upon contact, it does not spread out evenly over the surface, but forms a rough coating, primarily along the leading edges of the airplane. Rime ice is encountered most frequently in stratiform clouds.

Frost can form on an airplane left outside overnight, or one flown from a cold area into warm moist air. The airflow over the wings is disturbed by the frost with a resultant decrease in lift. For this reason, all ice or frost must be removed prior to flight.

Dangers of Icing

Ice increases drag and reduces the lift of the airplane by preventing the air from flowing smoothly over the wing. The effects of icing are shown in **Figure 8.21.** Ice can form on the propeller blades, reducing their efficiency, decreasing airspeed, and increasing fuel consumption. Propeller ice can cause severe propeller vibration. Also, ice may form on the pitot tube and render the airspeed indicator inoperative or unreliable.

If icing is encountered, the pilot must take immediate action, beginning with 180° turn and land as soon as possible.

Thermal Activity

When the surface of the earth is heated, the air is warmed and rises. These rising currents of air are called convection currents and their strength depends upon the degree to which the air is heated. **Figure 8.22** shows the difference in vertical currents due to the amount of heating. The uneven vertical currents create turbulence. As shown in **Figure 8.23,** terrain around an airport has an effect on airplanes in the traffic pattern due to thermal turbulence.

When the heating effect of the sun is strong, the warm air may suddenly break away from the ground and rise in the form of a bubble. We call these bubbles

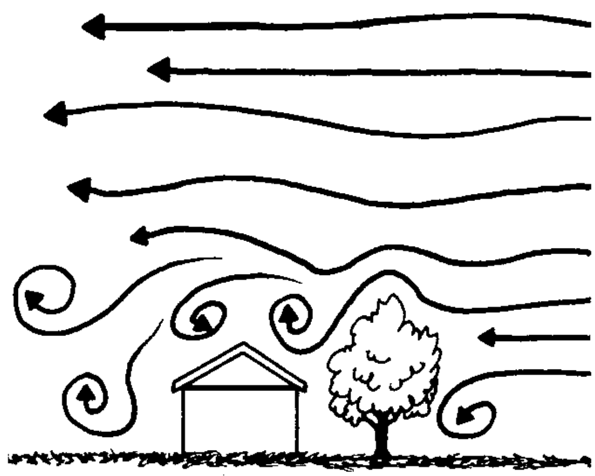


Figure 8.20 Turbulence resulting from Mechanical Mixing

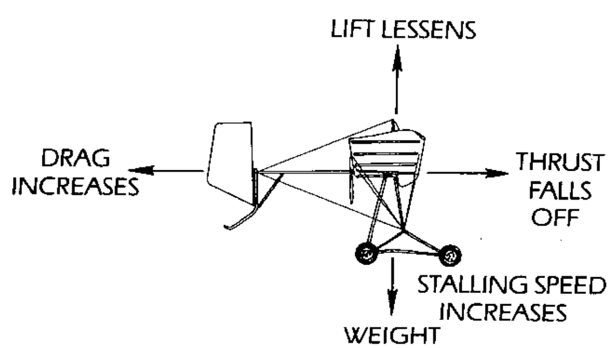


Figure 8.21 Effects of Icing

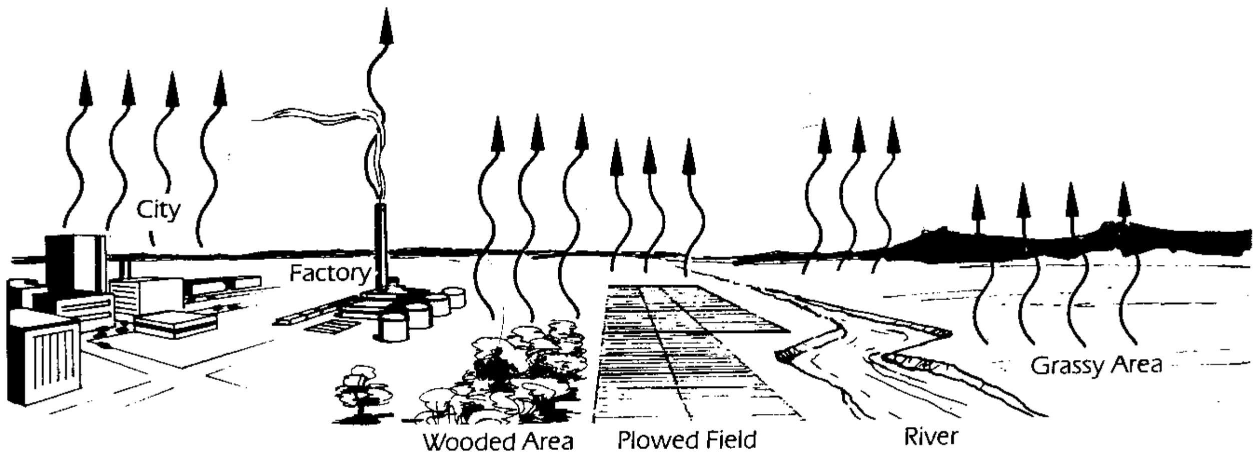


Figure 8.22 Uneven Surface Heating

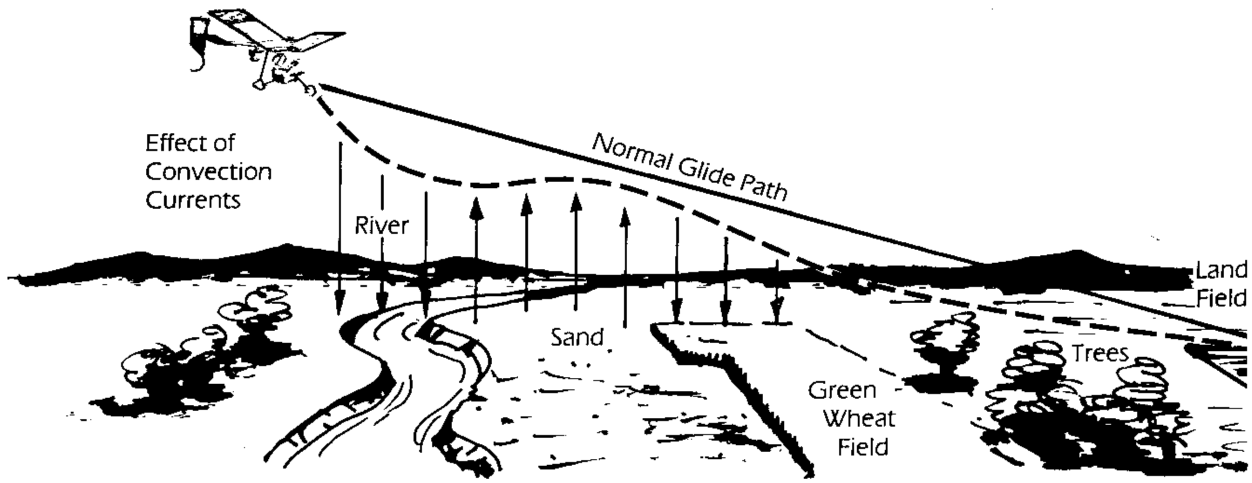


Figure 8.23(a) Convective Currents

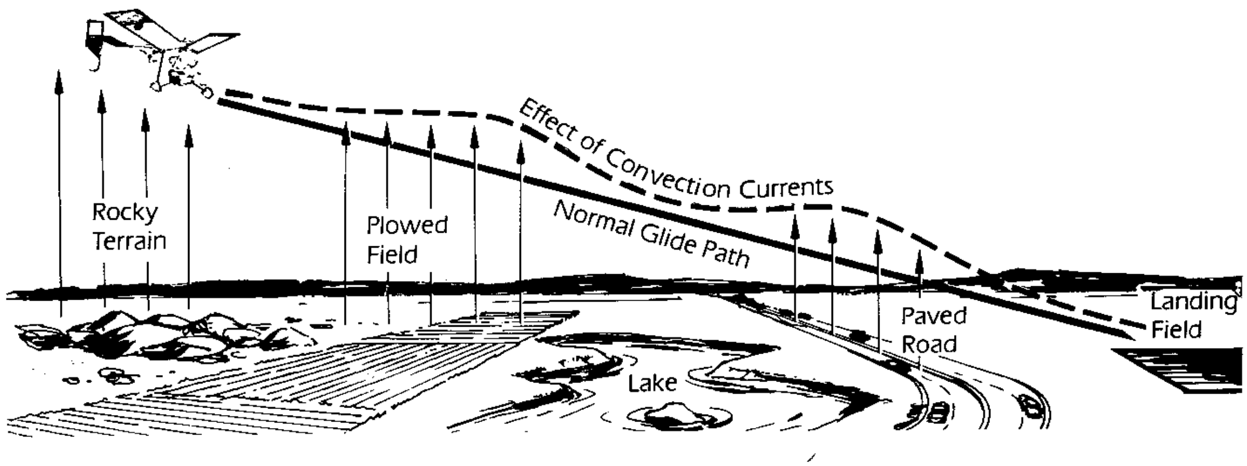


Figure 8.23(b) Convective Currents

thermals. Strong thermals are most common when the air mass is cool (such as after a cold front passes) and clear. Thermals are most prevalent in Spring and Fall at midday (the air is cool and the sun is hot). However, mild thermals can be present anytime, any season. Thermals are quite common on a hot summer day.

Sailplane pilots and hang glider pilots regularly use the lift in a rising thermal to climb many thousands of feet. A Quicksilver MX pilot can also utilize this thermal lift. However, strong thermals are often accompanied by strong turbulence which can be unnerving to an inexperienced pilot. Maintaining control and locating the lift on a strong thermal day requires considerable flying skill, so beginning pilots are advised to fly in the morning or evening hours when thermals are weaker and less common.

If it becomes necessary to avoid thermals due to their turbulence, remember, they are produced over ground surfaces that heat readily such as dry fields, parking lots, houses, beaches, rocky areas and dry crops. Large grassy areas, woods and stretches of water are surfaces that suppress thermal production. Remember, thermals drift with the wind, so fly upwind of thermal production areas to avoid the turbulence. For more information concerning thermal flying, consult the many soaring and hang gliding books.

Shears

As mentioned earlier, when layers of air are moving with different speeds or in different directions, a shearing action occurs between the layers which generates turbulence. This turbulence can be quite strong so pilots must recognize conditions that are apt to produce shears.

Shear turbulence generally is present at the interface between cold and warm masses of air. Thus, an area of turbulence is encountered at the edge of an advancing cold or warm front. These frontal surfaces extend upward from the ground, as shown in **Figure 8.12** and **8.14**, so a pilot may fly into such an area of shear. However, clouds usually accompany the leading edge of a front, so a general policy of staying away from all clouds will help keep a pilot out of trouble.

In mountainous country, a shear layer can occur at the top of a cool pool of air that settles in a valley floor in the evening. Even over open terrain, the same situation occurs on a sunny strong-wind day. As the sun suddenly drops, the ground cools rapidly, creating a layer of cool air above the surface. The surface wind may become calm, but at some level the wind is still blowing and a layer of shear turbulence exists between the surface cool air and the warm air moving above. This type of stratified air is known as an inversion. Learn to recognize inversions and other shear related conditions and avoid them when flying.

Valley and Mountain Winds

In hilly or mountainous terrain, a normal daily cycle of winds occur due to the sun's heating, as shown in **Figure 8.24.** In the morning the wind begins to move up the slopes of the mountains and down in the center of the valley. This upslope or "valley" wind reaches a peak in the early afternoon and usually dies out by early evening. Just before sunset, the air begins to flow

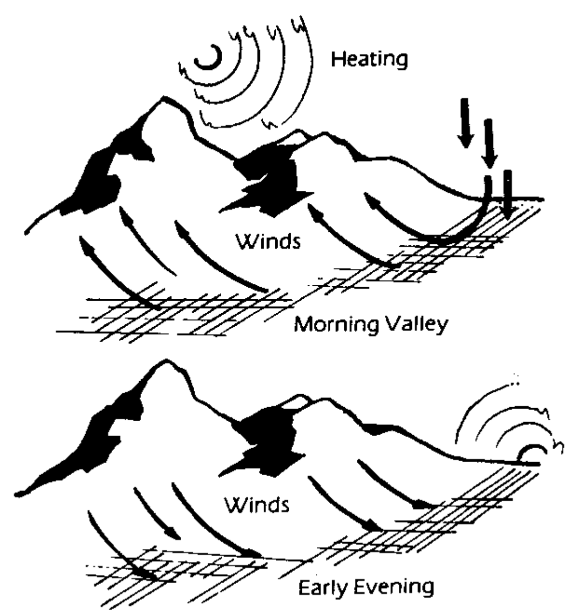


Figure 8.24 Daily Cycle of Valley and Mountain Winds

downhill, filling the valleys with cool air. The downslope or "mountain" wind reaches a peak velocity some time after midnight.

The higher and steeper the mountains, the more dramatic these daily winds will be. Upslope winds can provide lift when flying near the mountain sides. The slow sinking in the valley may hamper the climb rate of a small aircraft.

In the evening, the downslope wind may set in suddenly and arrive in the valley in a sudden rush. This is especially true in very high mountainous areas. This sudden incursion of cool mountain air will act like a minature cold front, forcing up the warm air ahead of it and creating shear turbulence where the air masses meet. Watching natural wind indications (trees, dust, smoke, etc.,) will keep a pilot informed of these varying conditions.

A similar type of daily circulation is set up wherever an area of general heating is next to a cooler area. For example, near large bodies of water, a wind blows from the cool water to the relatively hot shore by day, then reverses in the evening as the land cools rapidly. These winds are called the "sea breeze" and "land breeze", respectively. When flying near large bodies of water, expect these daily changes and keep an eye on wind socks to land in the proper upwind direction. Note that this circulation may occur on a small scale in the case of large hot fields lying next to cool forested areas.

Wind Gradient

When the wind flows over the earth's surface it is slowed by drag created by surface objects. This slowing of the wind at the earth's surface is called the "wind gradient". The amount of roughness on the surface determines how abruptly the wind gradient occurs. For example, wind moving over water will be slowed only very near the surface, while wind blowing over land with houses, trees or hills in its path will be slowed (as well as turbulent) for hundreds of feet above the surface.

The problem with wind gradient occurs during landing. A pilot may approach into a 15 m.p.h. wind 50 feet above the ground and gradually descend into slower and slower moving air as in **Figure 8.25** until the angle of attack of the wing increases to the point of stall. The danger here is that the stall occurs close to the ground, leaving little room for recovery. To avoid such a danger, always maintain a little extra speed when approaching a landing on days when significant wind gradient is expected.

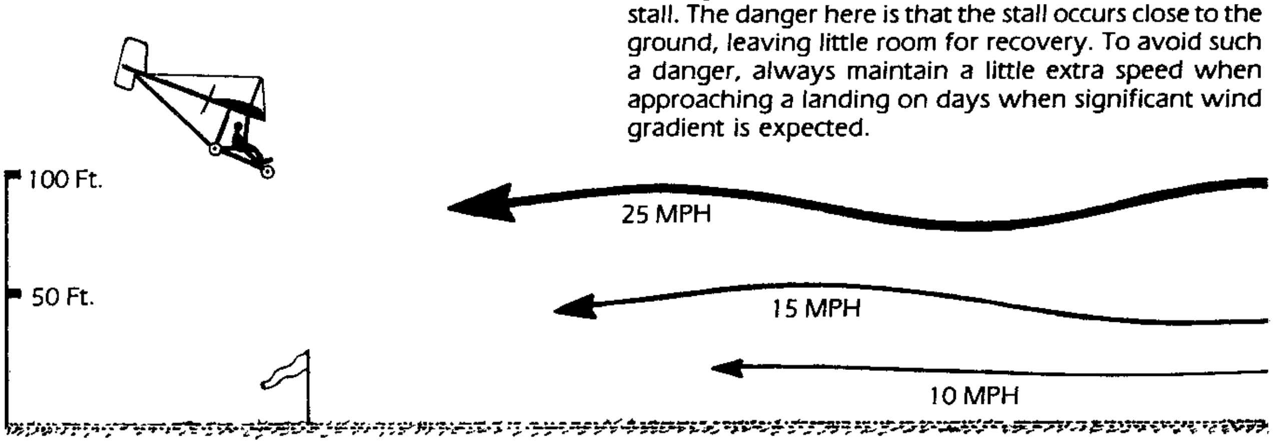


Figure 8.25 Effect of Wind Gradient

A wind gradient is obviously present when it is calm on the surface, but blowing significantly 20 or 30 feet up. Also, stable days without much vertical mixing are most apt to produce the greatest wind gradient effects. Likewise, a wind gradient should be expected in the evening when the diminishing sun makes the air more stable and surface winds calm.

Mountain Waves

When strong winds blow across mountains, "mountain waves" usually will be established. As the wind strikes the mountains, it rises over the peak. On passing the peak, the flow breaks down into a complicated pattern with downdrafts being predominant on the leeward side, as in **Figure 8.26**. Downdrafts and turbulence extend many miles on the leeward side of mountains and several thousand feet above the peaks. Effects of the mountain waves are dangerous and the pilot should avoid flight in mountainous areas when strong winds are present.

Also turbulent wind condition as exist among other structures such as buildings and trees. The activity of the wind on the downwind side of these structures are known as "Rotors" and must be approached with great caution. Rotors have the same characteristics as mountains and should be avoided if at all possible.

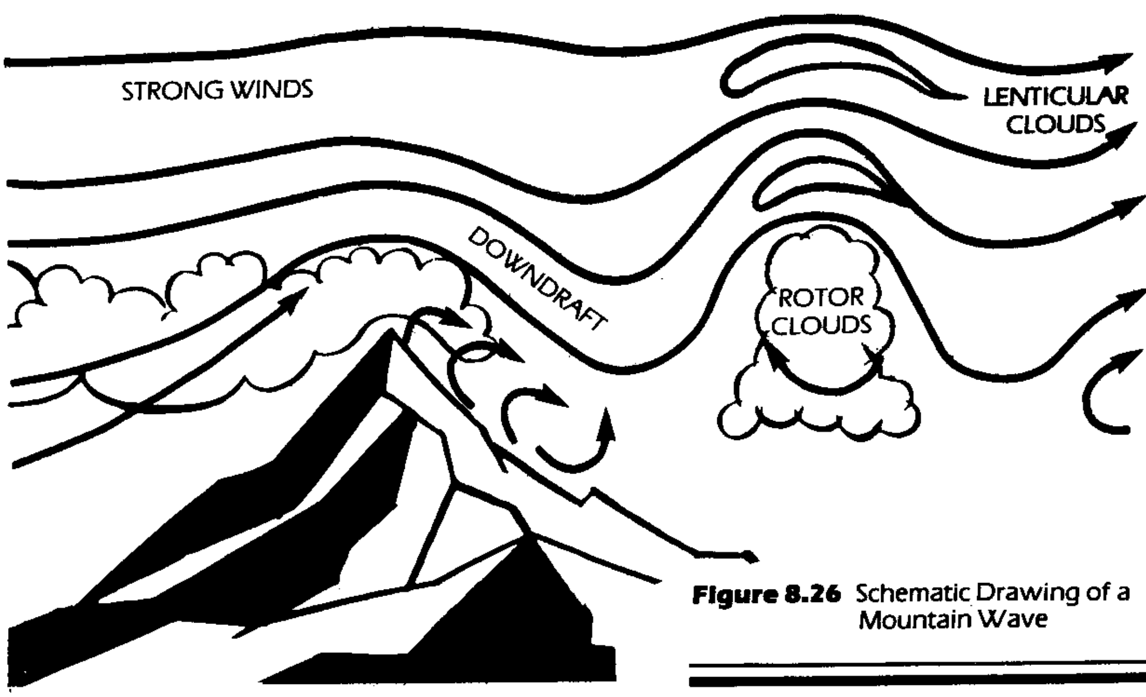


Figure 8.26 Schematic Drawing of a Mountain Wave

FEDERAL AVIATION REGULATIONS

The following list of Regulations is selected from the Federal Aviation Regulations manual to inform the ultralight pilot of his/her responsibility to the aviation industry and public. The more related sections of FAR 91 Subpart B have been selected for this manual as well as Part 103, which pertains directly to ultralight vehicles. The ultralight pilot must abide by all regulations contained in FAR 91 Subpart B and FAR 103. It is advised you purchase a copy of the FAR's at your local airport or Eipper dealer and study these sections.

Definitions and Abbreviations

"**Aircraft**" means a device that is used or intended to be used for flight in the air.

"**Aircraft engine**" means an engine that is used or intended to be used in propelling aircraft. It includes engine appurtenances and accessories necessary for its functioning, but does not include propellers.

"**Airframe**" means the fuselage, booms, nacelles, cowlings, fairings, airfoil surfaces (including rotors but excluding propellers and rotating airfoils of engines), and landing gear of an aircraft and their accessories and controls.

"**Airport**" means an area of land or water that is used or intended to be used for the landing and takeoff of aircraft, and includes its buildings and facilities, if any.

"**Airport traffic area**" means, unless otherwise specifically designated in Part 93, that airspace within a horizontal radius of 5 statute miles from the geographical center of any airport at which a control tower is operating, extending from the surface up to, but not including, an altitude of 3,000 feet above the elevation of the airport.

"**Air-traffic**" means aircraft operating in the air or on an airport surface, exclusive of loading ramps and parking areas.

"**Air traffic clearance**" means an authorization by air traffic control, for the purpose of preventing collision between known aircraft, for an aircraft to proceed under specified traffic conditions within controlled airspace.

"**Air traffic control**" means a service operated by appropriate authority to promote the safe, orderly, and expeditious flow of air traffic.

"**Glider**" means a heavier-than-air aircraft, that is supported in flight by the dynamic reaction of the air against its lifting surfaces and whose free flight does not depend principally on an engine.

"**Load Factor**" means the ratio of a specified load to the total weight of the aircraft. The specified load is expressed in terms of any of the following: aerodynamic forces, inertia forces, or ground or water reactions.

"**Pitch setting**" means the propeller blade setting as determined by the blade angle measured in a manner, and at a radius, specified by the instruction manual for the propeller.

"**Prohibited area**" means designated airspace within which the flight of aircraft is prohibited.

"**Propeller**" means a device for propelling an aircraft that has blades on an engine-driven shaft and that, when rotated, produces by its action on the air, a thrust approximately perpendicular to its plane of rotation. It includes control components normally supplied by its manufacturer, but does not include main and auxiliary rotors or rotating airfoils of engines.

"**Restricted area**" means airspace designated within which the flight of aircraft, while not wholly prohibited, is subject to restriction.

"**Traffic pattern**" means the traffic flow that is prescribed for aircraft landing at, taxiing on, or taking off from, an airport.

Abbreviations and Symbols

"**ATC**" means air traffic control.
"**FAA**" means Federal Aviation Administration.
"**AIM**" means Airman's Information Manual.

General Operating and Flight Rules

Dropping objects: 91.13

No pilot in command of a civil aircraft may allow any object to be dropped from that aircraft in flight that creates a hazard to persons or property. However, this section does not prohibit the dropping of any object if reasonable precautions are taken to avoid injury or damage to persons or property.

Applicability: 91.61

This subpart prescribes flight rules governing the operation of aircraft within the United States.

Right-of-way rules; except water operations: 91.67

(a) **General.** When weather conditions permit, regardless of whether an operation is conducted under Instrument Flight Rules or Visual Flight rules, vigilance shall be maintained by each person operating an aircraft so as to see and avoid other aircraft in compliance with this section. When a rule of this section gives another aircraft the right of way, he shall give way to that aircraft and may not pass over, under, or ahead of it, unless well clear.

(b) **In distress.** Any aircraft in distress has the right of way over all other air traffic.

(c) **Converging.** When aircraft of the same category are converging at approximately the same altitude (except head-on, or nearly so) the aircraft to the other's right has the right of way. If the aircraft are of different categories —

1) A balloon has the right of way over any other category of aircraft;
2) A glider has the right of way over an airship, airplane or rotocraft; and
3) An airship has the right of way over an airplane or rotocraft.

However, an aircraft towing or refueling other aircraft has the right of way over all other engine-driven aircraft.

(d) **Approaching head-on.** When aircraft are approaching each other head-on, or nearly so, each pilot of each aircraft shall alter course to the right.

(e) **Overtaking.** Each aircraft that is being overtaken has the right of way and each pilot of an overtaking aircraft shall alter course to the right to pass well clear.

(f) **Landing.** Aircraft, while on final approach to land, or while landing, have the right of way over other aircraft in flight or operating on the surface. When two or more aircraft are approaching an airport for the purpose of landing, the aircraft at the lower altitude has the right of way, but it shall not take advantage of this rule to cut in front of another which is on final approach to land, or to overtake that aircraft.

(g) **Inapplicability.** This section does not apply to the operation of an aircraft on water.

Right-of way rules; water operations: 91.69

(a) **General.** Each person operating an aircraft on the water shall, insofar as possible, keep clear of all vessels and avoid impeding their navigation, and shall give way to any vessel or other aircraft that is given the right of way by any rule of this section.

(b) **Crossing.** When aircraft, or an aircraft and a vessel are on crossing courses, the aircraft or vessel to the other's right has the right of way.

(c) **Approaching head-on.** When aircraft, or an aircraft and a vessel, are approaching head-on or nearly so, each shall alter its course to the right to keep well clear.

(d) **Overtaking.** Each aircraft or vessel that is being overtaken has the right of way, and the one overtaking shall alter course to keep well clear.

(d) **Special circumstances.** When aircraft, or an aircraft and a vessel, approach so as to involve risk of collision, each aircraft or vessel shall proceed with careful regard to existing circumstances, including the limitations of the respective craft.

Acrobatic flight. 91.71

No person may operate an aircraft in acrobatic flight —

(a) Over any congested area of a city, town, or settlement;
(b) Over an open air assembly of persons;
(c) Within a control zone or Federal airway;
(d) Below an altitude of 1,500 feet above the surface; or
(e) When flight visibility is less than three miles.

For the purposes of this section, acrobatic flight means an intentional maneuver involving an abrupt change in an aircraft's attitude, an abnormal attitude, or abnormal acceleration, not necessary for normal flight.

ATC light signals. 91.77

ATC light signals have the meaning shown in the following table.

Color and type of signal	**Meaning with respect to aircraft on the surface**	**Meaning with respect to aircraft in flight**
Steady green.	Cleared for takeoff	Cleared to land.
Flashing green.	Cleared to taxi.	Return for landing (to be followed by steady green at proper time).
Steady red.	Stop.	Give way to other aircraft and continue circling.
Flashing white.	Return to starting point on airport.	Not applicable.
Flashing red.	Taxi clear of runway in use.	Airport unsafe — do not land.
Alternating red and green.	Exercise extreme caution.	Exercise extreme caution.

Operating on or in the vicinity of an airport; **general rules.** 91.85

Each person operating an aircraft on or in the vicinity of an airport shall comply with the requirements of this section and of 91.87 and 91.89.

Unless otherwise authorized or required by ATC, no person may operate an aircraft within an airport traffic area except for the purpose of landing at, or taking off from, an airport within that area. ATC authorizations may be given as individual approval of specific operations or may be contained in written agreements between airport users and the tower concerned.

Operation at airports with operating control towers. 91.87

(a) **General.** Unless otherwise authorized or required by ATC, each person operating an aircraft to, from, or on an airport with an operating control tower shall comply with the applicable provisions of this section.

(b) **Communications with control towers operated by the U.S.** No person may, within an airport traffic area, operate an aircraft to, from, or on an airport having a control tower operated by the United States unless two-way radio communications are maintained between that aircraft and the control tower. However, if the aircraft radio fails in flight he may operate that aircraft's basic VFR weather minimums, he maintains visual contact with the tower, and he receives a clearance to land. If the aircraft radio fails while in flight under IFR, he must comply with 91.27.

(c) **Communication with other control towers.** No person may, within an airport traffic area, operate an aircraft to, from, or on an airport having a control tower that is operated by any person other than the United States unless —

1) If that aircraft's radio equipment so allows, two-way radio communications are maintained between the aircraft and the tower; or
2) If that aircraft's radio equipment allows only reception from the tower, the pilot has the tower's frequency monitored.

(d) **Minimum altitudes.** When operating to an airport with an operating control tower, each pilot of—

1) A turbine-powered airplane or a large airplane shall, unless otherwise required by the applicable distance from cloud criteria, enter the airport traffic area at an altitude of at least 1500 feet above the surface of the airport and maintain at least 1500 feet within the airport traffic area, including the traffic pattern, until further descent is required for a safe landing;
2) A turbine-powered airplane or a large airplane approaching to land on a runway being served by an ILS, shall, if the airplane is ILS equipped, fly that airplane at an altitude at or above the glide slope between the outer marker (or the point of interception with the glide slope, if compliance with the applicable distance from clouds criteria requires interception closer in) and the middle marker; and,
3) An airplane approaching to land on a runway served by a visual approach slope indicator, shall maintain an altitude at or above the glide slope until a lower altitude is necessary for a safe landing.

However, subparagraphs (2) and (3) of this paragraph do not prohibit normal bracketing maneuvers above or below the glide slope that are conducted for the purpose of remaining on the glide slope.

(e) **Approaches.** When approaching to land at an airport with an operating control tower, each pilot of —

1) An airplane, shall circle the airport to the left; and
2) A helicopter, shall avoid the flow of fixed-wing aircraft.

(f) **Departures.** No person may operate an aircraft taking off from an airport with an operating control tower except in compliance with the following:

1) Each pilot shall comply with any departure procedures established for that airport by the FAA.

Minimum safe altitudes; general. 91.79

Except when necessary for takeoff or landing, no person may operate an aircraft below the following altitudes:

(a) **Anywhere.** An altitude allowing, if a power unit fails, an emergency landing without undue hazard to persons or property on the surface.

(b) **Over congested areas.** Over any congested area of a city, town, or settlement, or over any open air assembly of persons, an altitude of 1,000 feet above the highest obstacle within a horizontal radius of 2,000 feet of the aircraft.

(c) **Over other than congested areas.** An altitude of 500 feet above the surface, except over open water or sparsely populated areas. In that case, the aircraft may not be operated closer than 500 feet to any person, vessel, vehicle, or structure.

2) Unless otherwise required by the departure procedure or the applicable distance from clouds criteria, each pilot of a turbine — powered airplane and each pilot of a large airplane shall climb to an altitude of 1500 feet above the surface as rapidly as practicable.

(g) **Noise abatement runway system.** When landing or taking off from an airport with an operating control tower, and for which a formal runway use program has been established by the FAA, each pilot of a turbine-powered airplane and each pilot of a large airplane, assigned a noise abatement runway by ATC, shall use the runway. However, each pilot has final authority and responsibility for the safe operation of this airplane and if he determines in the interest of safety that another runway should be used, ATC will assign that runway (air traffic and other conditions permitting).

(h) **Clearances required.** No pilot may, at an airport with an operating control tower, taxi an aircraft, unless he has received an appropriate clearance from ATC. A clearance to "taxi to" the runway is a clearance to cross all intersecting runways but is not a clearance to "taxi on" the assigned runway.

Operation at airports without control towers. 91.89

Each person operating an aircraft to or from an airport without an operating control tower shall —

(a) In the case of an airplane approaching to land, make all turns of that airplane to the left unless the airport displays approved light signals or visual markings indicating that turns should be made to the right, in which case the pilot shall make all turns to the right;

(b) In the case of a helicopter approaching to land, avoid the flow of fixed-wing aircraft; and

(c) In the case of an aircraft departing the airport, comply with any FAA traffic pattern for that airport.

Terminal control areas. 91.90

(a) Group 1 terminal control areas.

1) **Operating rules.** No person may operate an aircraft within a Group 1 terminal control area, except in compliance with the following rules:

(a) No person may operate an aircraft within a Group 1 terminal control area unless he has received an appropriate authorization from ATC prior to the operation of that aircraft in that area.

(b) Unless otherwise authorized by ATC, each person operating a large turbine engine powered airplane to or from a primary airport shall operate at or above the designated floors while within the lateral limits of the terminal control area.

2) **Pilot requirements.** The pilot in command of a civil aircraft may not land or take off that aircraft from an airport within a Group 1 terminal control area unless he holds at least a private pilot certificate.

Restricted and prohibited areas. 91.95

(a) No person may operate an aircraft within a restricted area contrary to the Restrictions imposed, or within a prohibited area, unless he has the permission of the using or controlling agency as appropriate.

(b) Each person conducting, within a restricted area, an aircraft operation (approved by the using agency) that creates the same hazards as the operations for which the restricted area was designated, may deviate from the rules of this subpart that are not compatible with his operation of the aircraft.

Airspace

Airspace users' operations and needs are varied. Because of the nature of some operations, restrictions must be placed upon others for safety reasons. The complexity or density of aircraft movements in other airspace areas may result in additional aircraft and pilot requirements for operation within such airspace. It is of the utmost importance that all pilots be familiar with the operational requirements for the various airspace segments.

Warning Area.

The main areas in which the ultralight aircraft is not authorized to fly are listed below.

(a) Warning areas is that airspace which may contain hazards to nonparticipating aircraft in international airspace. Warning areas are established beyond the 3 mile limit. Though the activities conducted within warning areas may be as hazardous as those in Restricted areas, Warning areas cannot be legally designated because they are over international waters. Penetration of Warning areas during periods of activity may be hazardous to the aircraft and its occupants. Official descriptions of Warning areas may be obtained on request to the FAA, Washington, D.C.

(b) Intensive student jet training area is that airspace which contains the intensive training activities of military student jet pilots and in which restrictions are imposed on IFR flight. Information on these training areas may be obtained from an FSS within 100 miles of the area.

(c) Alert areas contain airspace which is depicted on aeronautical charts to inform nonparticipating pilots of areas that may contain a high volume of pilot training or an unusual type of aerial activity, and pilots should be particularly alert. All activity within an Alert Area shall be conducted in accordance with Federal Aviation Regulations, without waiver, and pilots of participating aircraft as well as pilots transiting the area shall be equally responsible for collision avoidance. Information concerning these areas may be obtained upon request to the FAA, Washington, D.C.

Prohibited Area

1) Prohibited areas contain airspace of defined dimensions identified by an area on the surface of the earth within which the flight of aircraft is prohibited. Such areas are established for security or other reasons associated with the national welfare. These areas are published in the Federal Register.

2) An example of a prohibited area is the area that encompasses the White House and the Capitol buildings in Washington, D.C. This area is identified on charts and carries the designation of -56. Aircraft operations are prohibited in P-56 from the surface up to 18,000 feet MSL. Another example is P-205, located southeast of International Falls, Minnesota. P-205 extends from the surface to 4,000 feet, and contains part of the Superior National Forest. This prohibited area was established to safeguard the forest and wildlife in one of the few remaining wilderness areas in the U.S.

Restricted Area

Restricted areas contain airspace identified by an area on the surface of the earth within which the flight of aircraft, while not wholly prohibited, is subject to restrictions. Activities within these areas must be confined because of their nature or limitations imposed upon aircraft operations that are not a part of those activities or both. Restricted areas denote the existence of unusual often invisible, hazards to aircraft such as artillery firing, aerial gunnery, or guided missiles. Penetration of restricted areas without authorization from the using or controlling agency may be extremely hazardous.

Airport Traffic Areas

No aircraft of any type is authorized to fly in airport traffic area without prior approval.

The rules prescribed for airport traffic areas are established in 91.85 and 91.87. They require, in effect, that unless a pilot is landing or taking off from an airport within the airport traffic area, he must avoid the area unless otherwise authorized by ATC. If operating to, from or on the airport served by the control tower, he must also establish and maintain radio communications with the tower. The areas are **not depicted** on charts. The airport traffic area is illustrated below:

Terminal Control Area

A Terminal Control Area (TCA) consists of controlled airspace extending upward from the surface or higher to specified altitudes, within which **all aircraft** are subject to operating rules and pilot and equipment requirements specified in Part 91 of the FAR's. Each such location is designated as a Group 1 or Group 2 terminal control area, and includes at least one primary airport around which the TCA is located.

1) Group 1 terminal control areas represent some of the busiest locations in terms of aircraft operations and passengers carried, and it is necessary for safety reasons to have stricter requirements for operation within Group 1 TCA's. (See FAR 91.90)

2) Group 2 terminal control areas represent less busy locations, and though safety dictates some pilot and equipment requirements, they are not as stringent as those for Group 1 locations. (See FAR 91.90)

3) As terminal control areas are activated they will be depicted in graphic form in AIM Part 4 and charted by the National Ocean Survey in their VFR Terminal Area Charts Series.

The following areas have been designated as Group 1 Terminal Control Areas and are depicted on the TCA charts:

Atlanta	Miami
Boston	Newark
Dallas	O'Hare
JFK International	San Francisco
La Guardia	Washington, D.C.
Los Angeles	

Group 2 TCA's will be charted as they are established and will include the following areas:

San Diego, California

Cleveland	Minneapolis
Denver	New Orleans
Detroit	Philadelphia
Houston	Pittsburgh
Kansas City	Seattle
Las Vegas	St. Louis

The most appropriate means for the ultralight pilot to identify airspace types is that of Aeronautical charts applicable to the area he will fly in.

These charts are published by the National Ocean Survey and usually can be found at any airport. Every ultralight pilot should purchase the appropriate "Sectional Chart" for the area he will be flying in.

Sectional Charts are the charts most commonly used by private pilots. Each sectional chart shows a portion of the United States and, as shown in **Figure 9.1,** is identified by the name of a principal city. The scale on the sectional chart is 1:500,000, or about eight miles to one inch. The sectional chart contains topographical information which features the portrayal of terrain relief and also includes visual checkpoints, such as cities, towns, villages, drainages, roads, railroads, and other distinctive landmarks used in flight. The aeronautical information on the sectional chart includes airports, controlled airspace, special use airspace, obstructions, and related data. Sectional charts are revised and issued every six months. The legend on the chart will aid the pilot in locating appropriate information. The chart should be studied carefully.

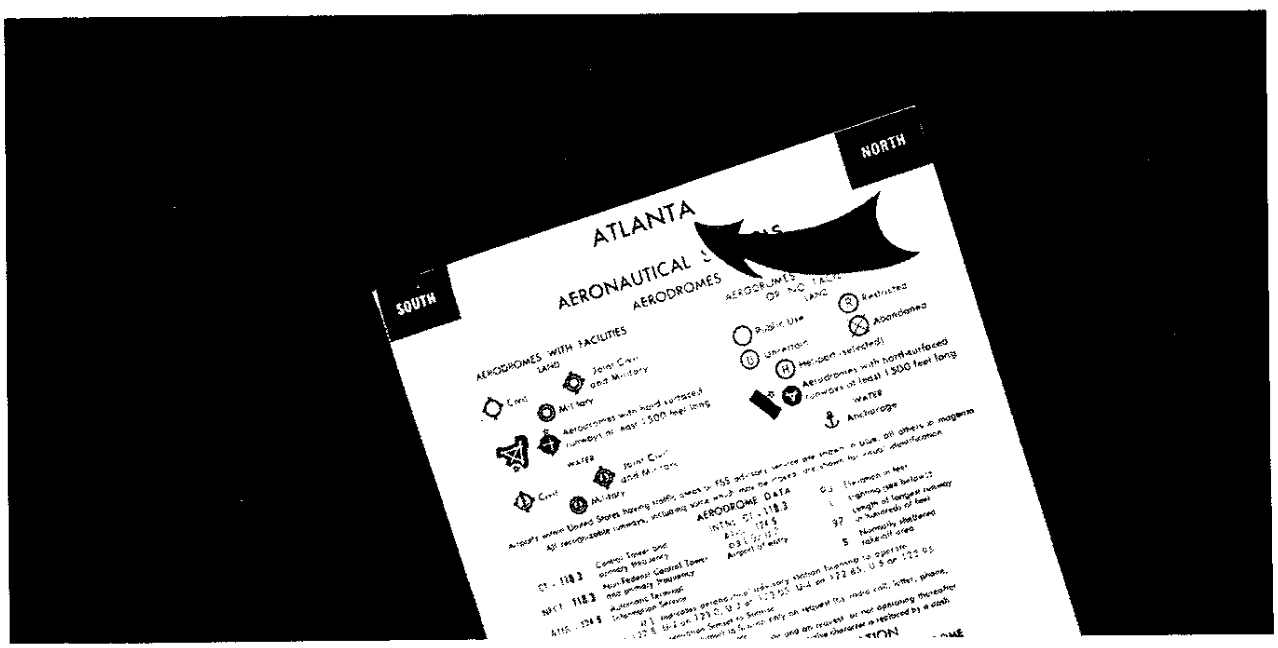


Figure 9.1 Sectional Chart

Part 103—Ultralight Vehicles

Authority: Secs. 307, 313(a), 601(a), 602 and 603, Federal Aviation Act of 1958 (49 U.S.C. 1348, 1354(a), 1421(a), 1422, and 1423); sec. 6(c). Department of Transportation Act (49 U.S.C. 1655(c)

Subpart A—General

103.1 Applicability.

This part prescribes rules governing the operation of ultralight vehicles in the United States. For the purposes of this part, an ultralight vhicle is a vehicle that:

(a) Is used or intended to be used for manned operation in the air by a single occupant;
(b) Is used or intended to be used for recreation or sport purposes only;
(c) Does not have any U.S. or foreign airworthiness certificate; and
(d) If unpowered, weighs less than 155 pounds; or
(e) If powered:
 (1) Weighs less than 254 pounds empty weight, excluding floats and safety devices which are intended for deployment in a potentially catastrophic situation;
 (2) Has a fuel capacity not exceeding 5 U.S. gallons;
 (3) Is not capable of more than 55 knots calibrated airspeed at full power in level flight; and
 (4) Has a power-off stall speed which does not exceed 24 knots calibrated airspeed.

103.3 Inspection requirements.

(a) Any person operating an ultralight vehicle under this part shall, upon request, allow the Administrator, or his designee, to inspect the vehicle to determine the applicability of this part.
(b) The pilot or operator of an ultralight vehicle must, upon request of the Administrator, furnish satisfactory evidence that the vehicle is subject only to the provisions of this part.

103.5 Waivers.

No person may conduct operations that require a deviation from this part except under a written waiver issued by the Administrator.

103.7 Certification and registration.

(a) Notwithstanding any other section pertaining to certification of aircraft or their parts or equipment, ultralight vehicles and their component parts and equipment are not required to meet the airworthiness certification standards specified for aircraft or to have certificates of airworthiness.
(b) Notwithstanding any other section pertaining to

airman certification, operators of ultralight vehicles are not required to meet an aeronautical knowledge, age, or experience requirements to operate those vehicles or to have airman or medical certificates.

(c) Notwithstanding any other section pertaining to registration and marking of aircraft, ultralight vehicles are not required to be registered or to bear markings of any type.

Subpart B—Operating Rules

103.9 Hazardous operations

(a) No person may operate any ultralight vehicle in a manner that creates a hazard to other persons or property.

(b) No person may allow an object to be dropped from an ultralight vehicle if such action creates a hazard to other persons or property.

103.11 Daylight operations

(a) No person may operate an ultralight vehicle except between the hours of sunrise and sunset.

(b) Notwithstanding paragraph (a) of this section, ultralight vehicles may be operated during the twilight periods 30 minutes before official sunrise and 30 minutes after official sunset, or, in Alaska, during the period of civil twilight as defined in the Air Almanac, if:

 (1) The vehicle is equipped with an operating anticollision light visible for at least 3 statue miles; and

 (2) All operations are conducted in uncontrolled airspace.

103.13 Operation near aircraft; Right-of-way

(a) Each person operating an ultralight vehicle shall maintain vigilance so as to see and avoid aircraft and shall yield the right-of-way to all aircraft.

(b) No person may operate an ultralight vehicle in a manner that creates a collision hazard with respect to any aircraft.

(c) Powered ultralights shall yield the right-of-way to unpowered ultralights.

103.15 Operations over congested areas.

No person may operate an ultralight vehicle over any congested area of a city, town, or settlement, or over any open air assembly of persons.

103.17 Operations in certain airspace.

No person may operate an ultralight vehicle within an airport traffic area, control zone, terminal control area, or positive control area unless that person has prior authorization from the air traffic control facility having jurisdiction over that airspace.

103.19 Operations in prohibited or restricted areas.

No person may operate an ultralight vehicle in prohibited or restricted areas unless that person has permission from the using or controlling agency, as appropriate.

103.21 Visual reference with the surface.

No person may operate an ultralight vehicle except by visual reference with the surface.

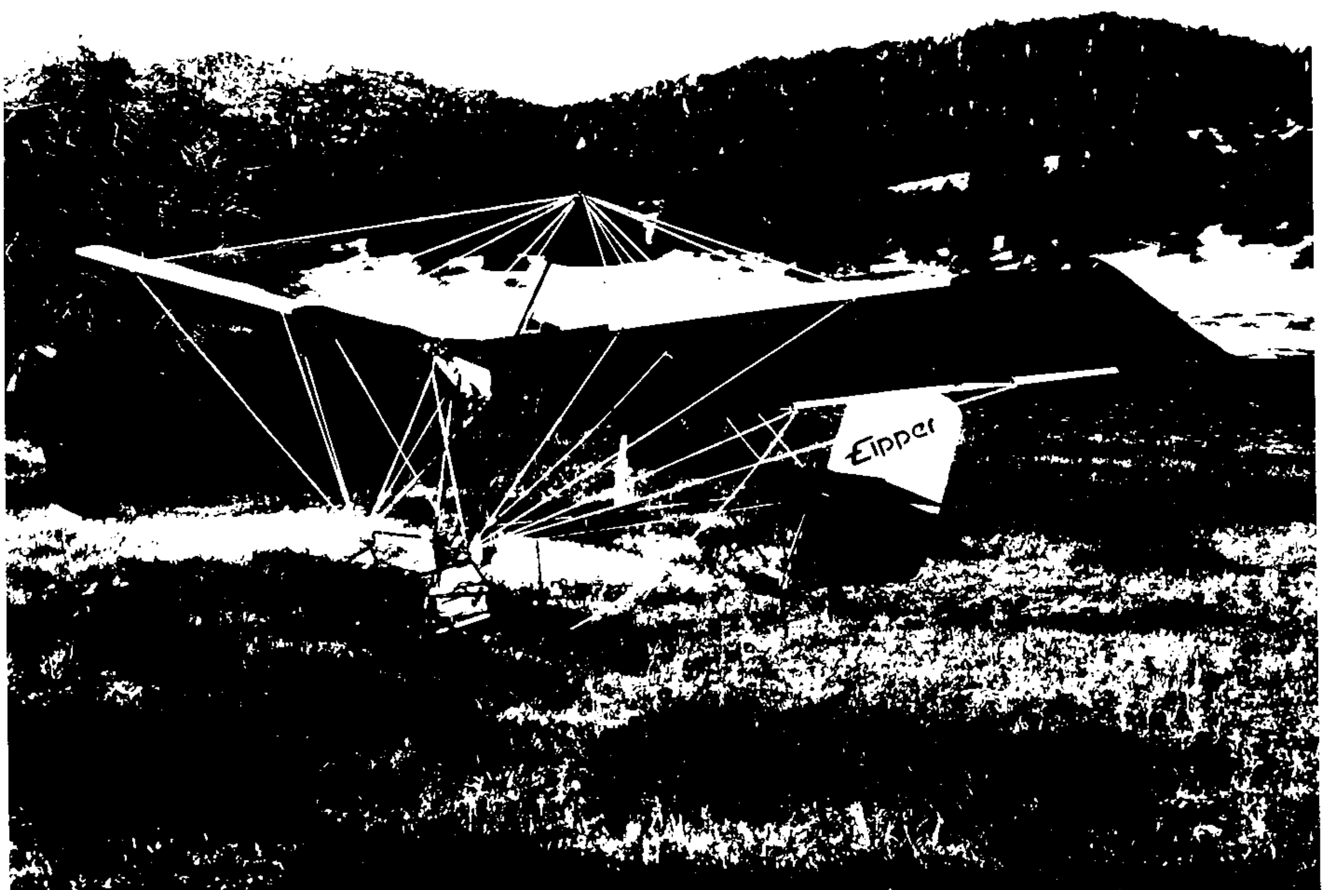
103.23 Flight visibility and cloud clearance requirements.

No person may operate an ultralight vehicle when the flight visibility or distance from clouds is less than that in the following table **(Figure 9.2)** as appropriate.

Flight altitudes	**Minimum flight visibility** (Statute Miles)	**Minimum from clouds**
1,200 feet or less above the surface regardless of MSL altitude		
(1) Within controlled airspace	3	500 feet below, 1,000 feet above, 2,000 feet horizontal
(2) Outside controlled airspace	1	Clear of clouds
More than 1,200 feet above the surface but less than 10,000 feet MSL		
(1) Within controlled airspace	3	500 feet below, 1,000 feet above, 2,000 feet horizontal
(2) Outside controlled airspace	1	500 feet below, 1,000 feet above, 2,000 feet horizontal
More than 1,200 feet above the surface and at or above 10,000 feet MSL	5	1,000 feet below, 1,000 feet above, 1 statute mile horizontal

Figure 9.2

SECTION D
MAINTENANCE



GENERAL POWERPLANT MAINTENANCE

Your MX powerplant requires a minimum of maintenance. Included are some helpful procedures for maintenance of the powerplant system. Your Eipper Aircraft dealer is always available to do maintenance or answer questions regarding service of your MX.

Engine

Refer to your Engine Service Manual for engine information listed below. Be sure to read through the entire manual before operating your powerplant. See Owner's Manual and Service Manual for: Engine Specifications, Break-In Procedure, Mixing Fuel, Starting Procedures, Spark Plug Replacement, Trouble Shooting, Service For All Engine Components.

Use your dealer as a source of current maintenance information. Be aware of Service Bulletins regarding powerplant components.

YOU SHOULD NOT exceed cylinder head temperature of 425° or engine r.p.m. of 6,500.

The gas mixture is 50:1/gas:oil. Use only BIA-TCW approved oil and a good brand of regular or premium grade gasoline.

Drive Reduction

The V-belt drive uses four 3VX250 belts. Inspect belts carefully every pre-flight for signs of wear, proper tracking, and correct tension. When removing belts always make sure they are reinstalled on the drive pulley in the same order and turning the same direction as they were. These belts will slip for the first 2 to 3 hours, so caution should be used not to overspeed engine. Belts need to be retensioned every 5 hours for the first 15 hours of use, inspected at 50 and 100 hours, and belt replacement is recommended at 200 hours.

When installing a new set of belts, force pulleys as close together as possible to get belts in position, then check alignment of the two pulleys. Tension belts by lowering right and left tensioning nuts evenly back and forth. Use the belt tension tester for final adjustment as shown in your Assembly & Parts Manual.

Propeller

When installing the prop hub on the prop, tighten the bolts in the sequence shown in **Figure 10.1.** Lightly snug the bolts the first time around the sequence. Use the sequence a second time for final tightening. Do not distort the wood when tightening. When inspecting the prop, look for cracks and abrasions. All cuts must be removed by sanding or filing until smooth and then surface refinished. Remove propeller periodically to check for balance. Install a 12"x1" shaft in the propeller and hub. Place two pieces of tubing approximately 1" diameter parallel to the prop, exactly level. If the prop is balanced it will be horizontally level. If not the heavy side will be low. Use a file to remove tip surface until the prop will balance. Also clear lacquer paint spray may be added to the light blade. The maximum length is 52" and minimum is 51".

When your MX is not being flown, you should always keep its propeller covered and sitting in a horizontal position.

Carburetor Calibrations

This calibration system may periodically be updated. Note your carburetor type, mount type, main jet, needle jet, jet needle, throttle valve, pilot jet and air

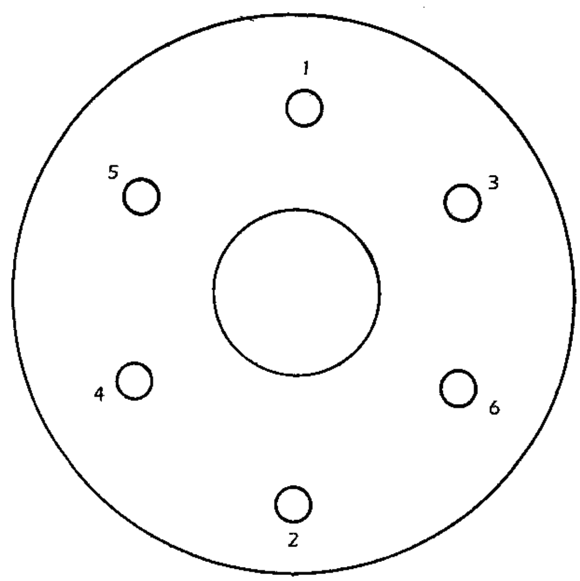


Figure 10.1

screw and obtain current information from your dealer or Eipper Aircraft, Inc.

The air filter type furnished by Eipper must be used on the carburetor at all times and kept clean and dry.

Carburetor jetting can be affected by changes in altitude, temperature and humidity. The fuel mixture will richen with: a gain of altitude, an increase in temperature, and high humidity. The fuel mixture will become more lean with: a loss of altitude, a decrease in temperature, and low humidity.

Transport/Storage

When you transport the powerplant be careful not to damage vulnerable engine components. If breakdown method II is used, check these items before trailering: quick-set-up cable integrity, padded propeller covers secure, fuel cap on, fuel valve off, MX fuselage secure, tied rigid to trailer platform to avoid stress from bouncing.

If your MX remains in storage, remember it is not good for your 2-stroke engine to go months without use. Periodically start and run the engine.

Engine Log Book

Always keep your engine's logbook entries up to date. As you follow the suggested maintenance schedule, fill in the Aircraft & Engine Log to insure an organized record of the number of hours on the engine and work done on powerplant components. See **Figure 10.2.**

Maintenance

Review the Powerplant Maintenance Schedule (**Figure 10.3**) and become familiar with all other powerplant components. Pay attention to the type of maintenance prescribed and how long you should operate between service checks.

Figure 10.2 Ultralight Aircraft and Engine Log.

PowerPlant Maintenance Schedule

Component	25 hr.	50	75 hr.	100	125	150	175	200	225	250	275	300	325	350	375	400
Engine Overhaul																3
***Spark Plug**		3		3		3		3		3		3		3		3
Air Filter	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	3
Fuel Filter		3		3		3		3		3		3		3		3
Fuel Pump																3
Fuel Pump Line				2				2				2				3
Drive V Belts	1	1	1	2	1	1	1	3	1	1	1	2	1	1	1	3
Reduction Pulleys								2								3
Drive Shaft Bearing				1				3				1				3
Drive Shaft								2								3
Propeller Shaft								2								3
Radial Bearing				1				3				1				3
Thrust Bearing								2								3
Fuel Lines				2				2				2				3
Propeller				2				2				2				2
Rubber Mounts								3								3
Muffler		2		2		2		3		2		2		2		3
Muffler Springs				3				3				3				3
Throttle Cable		1		2		1		2		1		2		1		3
All Engine Hardware		4		4		4		2		4		4		4		2
Lever Throttle								2								2

Legend:
1. Oil, lube, clean or service.
2. Remove, inspect & replace if necessary.
3. Recommend replacement or overhaul.
4. Check bolt or nut tension.

*Clean spark plugs every 10 hours.

NOTE:
When maintenance is performed, check appropriate square and make log book entry.

Figure 10.3 Powerplant Maintenance Schedule.

GENERAL AIRFRAME MAINTENANCE

The MX Ultralight vehicle requires little maintenance as compared to conventional light aircraft requirements. The following suggested maintenance will help keep your MX in airworthy condition. Preferably keep your Ultralight stored in a storage bag when not in use, and in a dry place. If it is ever subjected to salt water, rinse as soon as possible with fresh water and dry as soon as possible. Be especially careful when storing wing panels. Impact can result in punctures in the wing coverings and damage to the ribs.

Your Eipper dealer is available to perform routine maintenance, replace parts and give advice on servicing airframe components.

Tubing

Installation & Removal: When removing tubing do not bend or force tubes. When installing do not distort tubing from its original shape.

Inspection: Inspect tubing for cracks, damage, abrasion, elongated holes or distortion in tube surface. Never attempt to repair tubing, always replace with new part. Inspect tubing for corrosion in and out. If corrosion is present it must be carefully removed with steel wool or sandpaper, or be replaced with a new part.

Bolts

Installation & Removal:

1) After tightening, all bolts should have at least 2 threads showing.
2) All self-locking nuts should not be installed more than 2 times.
3) If grip length is too long, washers may be added. No more than 3 washers should be used.
4) A washer should always be installed under the nut.
5) Be sure not to over-torque bolts when installing.
6) Check assembly instructions for correct bolt placement.

Inspection: Check bolts for worn shanks, bad threads or corrosion.

Wing Covers

Installation & Removal: When installing or removing the cover make sure there are no sharp edges or burrs that will tear the sail. See the Assembly & Parts Manual for complete instructions.

Inspection: Check for tears in the sail cloth or any loose or unravelled seams. Inspect velcro strips on inboard panels for wear or frayed edges.

Sail may be repaired with appropriate sail tape or a sewn on patch. Keep the sail clean of oil and dirt by washing the sail with soap and water. Keep the sail covered when not in use. Continued exposure to sun dramatically shortens the life of wing and tail covers.

Cables

Installation & Removal: When installing cables make sure they are not twisted or kinked. Never install cables with the thimble "popped" out of place.

Inspection: Inspect cables for tears or cuts in the vinyl covering. If abration are found remove the covering around the cut and inspect the cable for broken strands or kinked wores. Always replace with new part if any damage is present. Check thimbles for correct shape. If thimble does not have a teardrop shape and is flattened, replace with new part. Also this could indicate another part of the strucure has been overloaded. Check carefully.

Hardware

Plastic hardware:

Installation & Removal: Make sure plastic saddles are seated correctly when installing.

Inspection: Check for cracks and wear.

Formed channels & elbows:

Installation & Removal: When installing make sure a washer is placed between nut and channel. Never overtighten bolts causing the channel to distort. Never turn channel when removing.

Inspection: Check for cracks and distortion of channel.

Never! reshape channels if bent. Always replace any damaged part with a new part.

Shackles:

Installation & Removal: Make sure shackles have correct pin or bolt size. Never spread or bend shackle.

Inspection: Check shackles for hole elongation and stretching.

King Post Fitting

Installation & Removal: Make sure king post fitting is properly oiled at all times. Keep fitting screwed shut when not in use.

Inspection: Inspect threads for wear. Never allow fitting to be used in flight with more than 7/8" thread showing on either end. NEVER OVERTIGHTEN. (See Assembly & Parts Manual).

Pip Pins

Installation & Removal: Check pip pins for safety ball and spring tension.

Inspection: If pip pins are bent or damaged at all they must be replaced with new ones.

Other:

Check all other hardware for normal wear or damage. After hard landings, the airframe should be inspected carefully. The control bar and landing gear fittings and tubing should be inspected for distortion and replaced if necessary.

If the aircraft is ground looped (or the wing tip distorted beyond normal flight), the two outboard compression strut grade 8 attach bolts should be replaced.

Airframe Log Book

Always keep your aircraft's log book, as shown in **Figure 11.1**, up to date by making current entries as you follow the airframe maintenance schedule. The Ultralight Aircraft and Engine Log is designed to help organize proper servicing of the MX airframe while supplying written records of airworthiness.

Maintenance

Review the Airframe Maintenance Schedule (**Figure 11.2**) and become familiar with all the airframe components. Pay attention to the type of airframe maintenance prescribed and when the service usually needs to be done.

Figure 11.1 Ultralight Aircraft and Engine Log.

Airframe Maintenance Schedule

Component	25hr.	50	75hr.	100	125	150	175	200	225	250	275	300	325	350	375	2 yrs. or 400hr.
†Root Tube								2								3
All Spars								2								2
Compression Struts								2								2
Diagonal Struts								2								2
*Tri Bar Down Tubes				2				2				2				3
*Tri Bar Cross Tube								2								3
*Seat Mount				2				2				2				3
*Seat																2
*Seat Support Tube				2				2				2				3
*King Post								2								3
*King Post Fittings	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3
Tail Booms & Braces								2								2
Tail Mount								2								2
Rudder Brace					2								2			
Rudder Frame				4				2&4				4				2&4
Elevator Frame				4				2&4				4				2&4
Tail Skid		2		2		2		3		2		2		2		3
Ribs	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
All Cables				2				2				2				2
Wing & Tail Covers								2								3
*All Landing Gear Parts		4		2		4		2		4		2		4		2
Elevator Push-Pull Tube		2		2		2		2		2		2		2		2
Control Stick		1&4		2&4		1&4		2&4		1&4		2&4		1&4		2&4
Spoiler Pedals								2								2
Spoilers								2								2
Teleflex Rudder Cable	1	1	1	2	1	1	1	2	1	1	1	2	1	1	1	3
*All Control Lines				2				2				2				2
Wheel Bearings				1				2				1				2
All Formed Channels				2				2				2				2
5-32A Heart Bolt		4		2		4		3		4		2		4		3
Triangle Bar Bolts		4		2		4		3		4		2		4		3
All Other Bolts		4		4		4		2		4		4		4		2
*Grade 8 Bolts		4		2		4		2		4		2		4		3
All Other Hardware		4		4		4		2		4		4		4		2
*Wheel Pants				2				2				2				2
Harness/Seat Belt				2				2				2				2

Legend:

1. Oil lube service
2. Remove (if necessary for inspection, inspect & replace if necessary
3. Recommended replacement or overhaul
4. Check bolt or nut tension

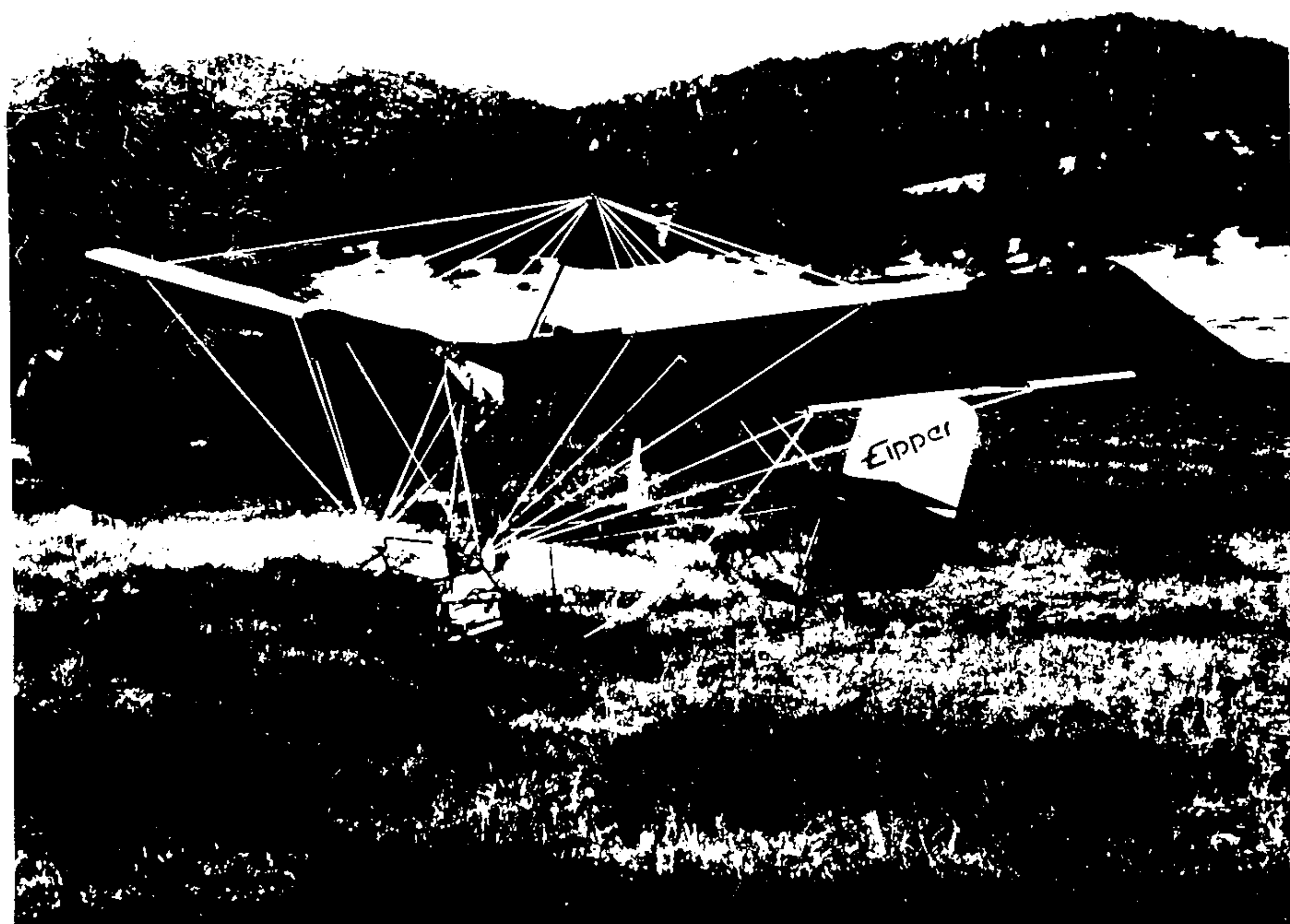
* Should be inspected closely after any hard landing.

† Check shaft for smooth free spinning of bearings.

Note:
When maintenance is performed check appropriate square and make log book entry.

Figure 11.2 Airframe Maintenance Schedule

SECTION E
SAFETY HINTS



This section includes ideas and procedures dealing with additional aspects of safe and courteous flying. The following information has been learned and gathered through the Eipper pilots' many years of ultralight flying experience.

Airworthiness

Never fly your aircraft unless it is in airworthy condition. Follow the maintenance schedule very closely. The best way to perform preventative maintenance is in a thorough pre-flight check and, of course, always do your own pre-flight

Make sure you, the pilot, are also in an airworthy condition. Good health, adequate sleep, and, of course, no alcohol or drugs before flight will keep you at your best to enjoy safe flying.

Wind

Experience has shown that wind is by far the greatest factor in causing and contributing to accidents. How much wind is safe? There are two main considerations in determining wind safety values. The first is velocity, the second is gust differential. An inexperienced pilot (0-15 hrs. flight time) would do well to confine flying to winds of less than 8 mph. This will reduce or eliminate the associated problems of crosswind takeoffs and landings, misjudging wind drift during turns, downwind stalls, wind-gradients on approach, etc. Gust differential is the wind speed difference between the lulls, and the peak gusts. For example: You are cruising at 35 mph and your craft has a stall speed of 25 mph. If you are flying into a wind of 15 mph and there is a sudden wind reduction to 5 mph, your airspeed has suddenly dropped to 25 mph—stall speed. This provides obvious dangers when flying close to the ground and/or obstacles. Wind gusts from the side will also bank the aircraft away from the gust, bank displacement being determined by the gust velocity. For these reasons wind speed, angle and gusts should be checked for several minutes prior to flight.

Wind Associated Turbulence

Turbulence near the ground is usually associated with the flow of wind over trees, buildings, hills and other obstructions. This localized turbulence becomes increasingly dangerous as the wind velocity moves beyond 10 mph. Try to visualize wind flow over various obstructions and avoid flight in areas that appear to be hazardous. Stay upwind of possible wind blocking sources, and if you must fly into the leeward area of an obstruction, continue as far downwind as possible as rotors and turbulence can continue downwind for miles if the obstruction is large enough, and the wind velocity is sufficiently high.

Ground Handling

Taxiing in winds over 10 mph can present problems, particularly for light-weight pilots. As windspeed increases, the aircraft must taxi more directly into the wind. If you must turn crosswind in winds over 10 mph, have a bystander hold down the upwind wing.

Never leave your MX unattended if winds are much over 6-8 mph. The nose should be pointed directly into the wind and the nose, wings and tail tied down securely for winds in the 10-15 mph range. Never leave the MX set up outdoors in winds over 15 mph.

Cross Country Flight

Before attempting any cross-country flight, you should be completely familiar with part 103-Ultralight

Vehicles, and part 91B of the FAR's. Also you should have a sectional map of your area, and familiarize yourself with the various symbols and other information on it. Copies of the FAR's and flight sectionals are available inexpensively at any airport facility that offers flight instruction. If time permits it is a good idea to take a private pilot ground school course to familiarize yourself with accepted flight methods, and learn to use the many flight services offered by the FAA.

Always notify a friend of your intended flight, and if possible give them the flight route you intend to follow. Pick a flight route that will allow ample emergency landing sites, and avoid mountainous or remote areas that would be difficult to walk out of in the event of an unplanned landing. If you must fly alone in remote areas be sure to carry plenty of drinking water, and signalling devices such as a mirror, flashlight, flare, etc.

Emergency Landings

During flight training the pilot should practice simulated emergency landings. Pick a landing spot from several hundred feet A.G.L., reduce power to idle and try to touch down on the intended site. As experience is gained, practice power-off landings in a large open, unobstructed area.

Emergency landings normally present very little problem as the MX can be put down in relatively small areas. However, it is strongly recommended that you keep a suitable landing site within gliding distance at all times, particularly over tree covered or other obstacle riddled areas. If a wind is present be sure to land as closely as possible into it. Learn to read wind velocity and direction from the air using your flight crab angle, smoke, dust ripples on water, leaves on trees etc. Select an area with a clear approach area, and as smooth a surface area as possible. Be particularly careful about wires and other low visibility obstructions around the approach area.

The following procedures will help you to guard against unplanned engine-out landings. Check for water in the gas tank and drain impurities as necessary. Design your flight plan where an adequate reserve of fuel is always on board your MX. Also monitor engine temperatures in flight for signs of overheating.

Essentially, for safe flying you should assume that the engine can stop running at **any** time. **Never** let yourself be caught outside of gliding distance of a safe landing area.

Acrobatic Flight

Acrobatic flight is not recommended or approved in your MX. The FAA defines acrobatic flight as "intentional maneuver involving an abrupt change in an aircraft's attitude, an abnormal attitude, or abnormal acceleration not necessary for normal flight."

Night Flying

With proper lighting on your MX you are allowed to operate during the twilight periods as stated in FAR part 103.11. It is illegal to fly any ultralight vehicle at night. Due to the nature of two cycle engines, reliability is not as great as the four stroke, detuned, dual ignition aircraft engines in use on modern light planes. A forced landing in darkness contains obvious dangers.

Safety Gear

To be safe and comfortable while flying your MX you should wear the following items; a light weight full-coverage helmet that fits, ear plugs, eye protection in the form of a face shield, goggles or glasses, foot wear with low heels, and gloves. Consider the outside air temperature before each flight and dress accordingly. (Remember, the temperature will decrease as you increase in altitude.)

You should always carry an emergency recovery system every time you fly. The parachute is easy to attach to the MX, comfortable to wear, and could save your life should the ultralight become disabled in the air. (For example, the parachute would be used in case of a mid-air collision.) Get instruction from your dealer or contact Eipper Aircraft, Inc. on these five points. (1) When the parachute becomes necessary. (2) How to properly deploy the parachute pack. (3) How to wear the parachute and secure it to your ultralight. (4) How to have a professional rigger repack your parachute. (5) How to store your recovery system.

If your parachute pack ever gets wet or damp IT MUST BE REPACKED immediately or damage to the canopy may result.

Be aware of the potential dangers in flying over water with your parachute attached to the MX. If you are going to force land in deep water YOU MUST disconnect the parachute from the plane **BEFORE** touchdown.

Courtesy

Common courtesy dictates that you fly well away from populated areas, and stay well clear of structures, vehicles, etc. People on the ground have a right to peace and quiet and this should be respected by all pilots. Any violation of these guidelines can result in complaints to the FAA, which in time could bring about strict restraints on our sport as well as legal action against the pilot.

Parts of the FAR's printed below, are an excellent as well as legal guide to courteous and safe flight.

Except when necessary for takeoff or landing, no person may operate an aircraft below the following altitudes:

(a) **Anywhere.** An altitude allowing, if a power unit fails, an emergency landing without undue hazard to persons or property on the surface.

(b) **Operations over congested areas.** No person may operate an ultralight vehicle over any congested area of a city, town, or settlement, or over any open air assembly of persons.

(c) **Over other than congested areas.** An altitude of 500 feet above the surface, except over open water or sparsely populated areas. In that case, the aircraft may not be operated closer than 500 feet to any person, vessel, vehicle, or structure.

Resist the temptation to buzz or show off in front of groups of people. Stay away from residential or other noise sensitive areas such as state parks, public beaches, etc. Let's keep our sport from becoming over regulated and a nuisance in the eyes of the public.

Be sensible and enjoy flying.