Pilot Operating Handbook

KOLB MARK- III
N 553RL

CONTENTS:

1. Description:

General Description: The Kolb "Twinstar" Mark-III C is a kit-built light sport aircraft of conventional design and construction. Powered by a single engine in a pusher configuration, the aircraft employs a strut-braced high-wing with conventional (tailwheel-type) landing gear. The cockpit "pod" accommodates two pilots in side-by-side seating, with a single, centrally-mounted control stick accessible by either occupant. Both occupants have rudder pedals; only the pilot (left) position has throttle control and brakes. Three-position flaps are included. The Mark III utilizes all metal construction. The fuselage cage structure is made from welded 4130 chrome-moly steel; plus 4130 steel is used in all high stress areas. All remaining aircraft structure is aluminum. The pod, wings and tail surfaces are fabric covered. The aircraft employs traditional control systems, utilizing cables and push-pull tubes. A 6-inch diameter fuselage tailboom extends aft from the cockpit pod, connecting to the tail surfaces. The Mark-III design incorporates a unique wing-folding feature, allowing the aircraft to be easily transported on a trailer.

Aircraft Dimensions:

Overall Length –22.5 feet
Wingspan – 30 feet
Height – 76 inches (not including prop)
Wing Area – 160 sq feet
Cabin Width – 45 inches
Width (folded) – 82 inches

Aircraft Weights:

Empty Weight – 560 lbs
Gross Weight – 1000 lbs
Useful Load – 440 lbs
Max Fuel Wgt – 65 lbs (10 gallons)
Max Cargo Wt – 30 lbs

Aircraft Speeds:

Typical Cruise – 75 mph
VNE – 90 mph
Stall – 36 mph (solo); 40 mph (at gross wt.)

Engine: The Rotax-912ULS engine is a four cylinder, air- and water-cooled, normally-aspirated 4-stroke powerplant. Displacing 1211cc (74 c.i.d), the engine is rated at 81 horsepower. Maximum engine speed is 5800 rpm, limited to 5 minutes. Maximum continuous rpm is 5500, yielding 79 hp. Normal cruising range is 4500-5500 rpm. The engine employs a 2.27-to-1propeller speed reduction gearbox. The engine uses a dry-sump (i.e., separate oil tank) oil system, and circulates oil through an external radiator (oil cooler). Cylinder heads are water-cooled (50/50 water/glycol mix), utilizing a coolant radiator. Oil capacity is 3.2 quarts. Dual, altitude-compensating constant depression carburetors are effective up to 18,000 feet MSL without need for adjustment or mixture control. Recommended fuel is 87 octane (or higher) automotive gasoline, or 100LL aviation gas.

Ignition System: The Rotax 912ULS engine utilizes a breakerless, capacitive-discharge type ignition system. Dual and independent solid-state ignition modules provide spark energy to each of the two spark plugs per cylinder (8 spark plugs total). This magneto-type ignition allows the engine to operate independently of the aircraft electrical system (i.e., engine will still run with the master switch “off”). Two ignition kill switches are located on the instrument panel, allowing for test and shutoff (“kill”) of each ignition circuit.

Throttle: Engine power is controlled through a conventional, single-lever throttle setup. No mixture control is necessary. Moving the throttle lever forward increases engine power; aft lever movement decreases engine power. The throttle is accessible on the pilot’s side only.

Instruments: [Diagram - See Appendix]

Propeller: The aircraft is equipped with a Powerfin ground-adjustable propeller (model F-R372P). The 3-blade prop is 70 inches in diameter. The blades are of composite construction. Torque value for all twelve 8mm bolts is 175 inch-pounds.

Oil System: The Rotax 912ULS engine utilizes a dry-sump, forced lubrication oil system. The oil is stored in an external oil reservoir, and an engine-driven oil pump circulates the oil

through the engine during operation. An external radiator (oil cooler) is included, to keep oil temperatures down. Oil capacity is 3.2 quarts.

[Diagram - See Appendix]

Fuel System: Maximum fuel capacity is ten gallons, carried in two 5-gallon individual polyethylene tanks, located behind the seats. During operation, fuel is drawn from one tank at a time, as dictated by a fuel select valve. As the engine is located significantly above the level of the fuel tanks, two fuel pumps (in series) are used to transfer fuel to the engine. An engine-driven mechanical fuel pump operates continually during engine operation; an auxiliary electrical fuel pump is used for the takeoff and landing phases of flight. A quick-disconnect fitting on the starboard tank fuel line allows for easy removal of the starboard fuel jug. Gas tanks are vented to overboard. A gascolator and fuel drain are installed at the fuel system's lowest point. A fine-mesh fuel filter is also installed.

[Diagram - See Appendix]

Electrical System: The aircraft is equipped with a 12-volt DC electrical system, including an engine-driven 250-watt alternator and an on-board battery. DC-powered equipment include: Starter, electric fuel pump, strobe light, and 3 power jacks in the cockpit (for DC service to handheld electronic equipment, such as radio, intercom and GPS unit). The following instruments require 12 volt power to operate: oil temperature and oil pressure gauges, tachometer, CHT gauge, and Hobbs meter. A DC voltmeter on the instrument panel indicates the charge status of the battery. A master switch brings battery power on line, energizing the entire electrical system. An annunciator light on the instrument panel illuminates when the master switch is turned "on." An auxiliary electrical panel is located on the cockpit floor, just forward of the passenger seat. The auxiliary panel contains the master switch, starter button, switches for electric fuel pump and strobe light, the three DC power jacks, and the fuse box. [Diagram - See Appendix]

Landing Gear: The maingear legs of the conventional (tailwheel-type) landing gear are made from solid 7075 aluminum rods, tapered at the ends for added flexibility. Maingear tires are pneumatic, size 6.00x6.

Tailwheel Steering: The Mark-3 is equipped with a steerable, full-swiveling tailwheel. Rudder cables link the rudder pedals directly to the rudder control horn. Short chains link the tailwheel control horn to the rudder control horn, providing positive ground steering.

Brakes: Hydraulic disc brakes are installed, one for each main wheel. Brakes are actuated via heel pedals on the pilot's side only. Each brake pedal activates its own master cylinder, located directly beneath the pedal, below the floor pan. The two brake cylinders are supplied by a common fluid reservoir. The independent brakes allow for differential braking. The hydraulic fluid used for the brake system is Dextron automatic transmission fluid.

Flaps: The Mark-3 is equipped with three-position flaps. Flaps are actuated by mechanical linkage to a flap control handle, located approximately head level and centered between the two occupants. Detents in the flap handle guide provide positive stops for each of the 3 positions: Retracted, half-deployed, and fully-deployed. The push-pull tubes that move the flaps are disconnected when the wings are folded. CAUTION – Use of full flaps is recommended only after considerable experience is gained using half-flaps for landing!

Flight Controls: The aircraft is maneuvered in flight using standard, three-axis flight controls. A control stick moves the elevator and ailerons; dual and interconnected sets of rudder pedals control the rudder. Because the control stick is centrally-mounted, either occupant can control the aircraft. Rudder and elevator are actuated by cables, and the ailerons are mounted on torque tubes, which rotate by the action of push-pull tubes. The push-pull tubes that actuate the flaps and ailerons are disconnected when the wings are folded.

Trim System: Adjustable pitch trim is incorporated into the elevator system. Pitch trim is set with the black-handled lever on the port side of the cockpit interior, immediately outboard of the pilot's left knee. Various trim positions are obtained by moving the trim lever forward or aft, locking into any of 12 notch positions in the lever guide. Moving the trim lever forward yields nose-down trim; lever aft provides nose-up trim.

Pitot-Static System: Three instruments are tied into the pitot-static system: Airspeed Indicator, Altimeter, and Vertical Speed Indicator. The pitot tube is located at the forward-most point of the nosecone. Ram air entering the pitot tube is routed to the Airspeed Indicator. The static port is flush-mounted on the port side of the nosecone. Static pressure is provided to the Airspeed Indicator, Altimeter, and Vertical Speed Indicator.
[Diagram - See Appendix]

Doors/Full enclosure: The convertible feature of the Mark-3 allows flying with doors installed or removed. Each door is hinged at the top edge and has a latch handle at the bottom. Doors can be easily removed by removing the hinge pin. The rear window, a sewn vinyl flap installed behind the occupants' seats, is also removable. CAUTION – If the doors are removed for flight, the rear window must also be removed. Do not fly the aircraft with the rear window installed if the doors are removed.

Seat Belts: A four-point restraint harness is installed for each occupant.

Fabric Covering: The wings, cockpit pod, and all control surfaces are fabric covered, using the Stits covering process. A conventional and widely-used method of aircraft covering, the Stits process offers durability and ease of repair.

Road-Transportability Features: The Mark-3 utilizes a unique folding wing and tail design which allows for easy set-up and take-down. The horizontal tail surfaces fold vertically and the wings fold back to lie flat against the sides of the fuselage, leading edge down. In the folded position, the tailboom and wings rest on a support dolly, allowing for ease of ground handling. In this configuration, the aircraft can be conveniently transported on a trailer. The process can be done in minutes, requiring no tools or brackets.

2. Normal Operating Procedures

Aircraft Assembly Steps:

WINGS:
Set pad on ground, under wingtip and 2 ft inboard.
Lift wing up out of saddle; walk forward while rotating leading edge upward to horizontal.
Set wingtip down onto pad.
Attach main spar at root; pin & safety.
Attach lift strut, lower end first; pin & safety.
Position self under wing, beneath strut attach point.
Grasp outboard end of lift strut with one hand.
Lift wing to horizontal, while guiding strut end into fitting.
Insert upper lift strut; pin & safety.
Connect aileron push-pull tube
Connect flap push-pull tube
Repeat for other wing

EMPENNAGE:
Remove tail-stow pads.
Fold down horizontal stabilizers.
Attach cables at bottom, using bolt & wing nut; safety pin.

Preflight Check:

Cockpit:
Master Switch – *"**on**"*
Verify Battery Charge
Strobe Light – **Test**
Master Switch – *"**off**"*
Aircraft Documentation – Current, **Stowed** in aircraft
Fire Extinguisher – **Secure**
Flight Com Equip – Ready, **Secure**
Verify adequate **Fuel Quantity** for Flight
Fuel Caps – Verify air vents are **Unobstructed**
Fuel Valve – "***on***" (lever horizontal)

Left Wing:
Wing General Structure & Fabric – **Undamaged**
Wing spar attach pin – **Secure**, safety clip'd
Landing Gear – Tire OK, strut **Secure**

Brake & Fluid line – **Secure**, no fluid leaks,
Leading Edge – Uniform, **Undamaged**
Lift Strut – **Pins & safety clips**, both ends
Inspection Covers – **Secure**
Wing Tip – Rock up & down, verify **Secure**
Aileron – **Free** movement
Flap – **Free** movement
Hinges – **Secure**, hinge pins safetied
Aileron Push-Pull Tube – **Pins & safety clips**, both ends
Flap Push-Pull Tube – **Pins & safety clips**, both ends
U-Joint Attachment – **Secure**

Engine:
All Wires, Hoses – In place, **Secure**
Oil Level – **Check**, verify adequate level
Spark Plugs – Check wire caps **Secure** (8 plugs)
Air Filters (2) – Check **Secure**
Carb Cables (4) – Check **Secure**
Coolant Radiator - Check **Secure**
Oil Cooler – Check **Secure**

Engine (cont.):
Oil & Coolant Hoses – Check **Secure**, no leaks
Coolant Overflow Bottle – At least **half full**, Check **Secure**
Oil Tank – Check **Secure**
Muffler Attachment – Check **Secure**, incl. springs
Prop – Check **Secure**, free movement

Empennage:
Boom Tube – **No damage**
Data Plate – **Secure**
Tail Panels (6) General Structure & Fabric - **Undamaged**
Stab Leading Edge Attachments – **Secure**
Strobe Light – Securely **Attached**
Flying Wires – Secure, **Tight**
Elevators – **Free** movement
Rudder – **Free** movement
Hinges – **Secure**, hinge pins safetied
Flying Wires Wing Nut – Check **secure**, safety clip
Bellcrank – **Secure**, free movement
Elevator Cable Attachments – **Secure**

Tailwheel – **Secure**
Tailwheel Cables & Springs – **Secure**, safety wired

Right Wing:
Wing General Structure & Fabric – **Undamaged**
U-Joint Attachment - **Secure**
Flap Push-Pull Tube – **Pins & safety clips**, both ends
Aileron Push-Pull Tube – **Pins & safety clips**, both ends
Hinges – **Secure**, hinge pins safetied
Flap – **Free** movement
Aileron – **Free** movement
Wing Tip – Rock up & down, verify **secure**
Inspection Covers – **Secure**
Lift Strut – **Pins & safety clips**, both ends
Leading Edge – Uniform, **undamaged**
Landing Gear – Tire OK, strut secure
Brake & Fluid line – **Secure**, no fluid leaks,
Wing spar attach pin – **Secure**, safety clip'd

Nose:
Windshield – **Secure**
Gap Seal – Installed, **secure** at 2 attachments
Pitot Tube – Safety cover removed; **Flying tube inserted**
Static Port - **Unobstructed**

– Preflight Complete –

Normal Operation:

Engine Start:
Fuel Valve – "***on***" (lever horizontal)
Choke – "***on***" (lever fwd)
Master Switch – "***on***"
Ignition Switches (2) – "***on***"
Elec Fuel Pump – "***on***" for 15 sec, then off
Throttle – Closed
Brakes - Set
Area – "Clear Prop!"
Starter – Hit it ! (10 seconds, max)
Warmup RPM – 2000 for 2 minutes, then 2500
Oil Pressure – In green within 10 sec

Choke – Slowly, pull "***closed***" (lever aft)
Oil Temp – 120 deg. before higher RPM
Idle RPM – 1400

Before Takeoff:
BRS Parachute – Remove & Stow Safety Pin
Controls – Free & Correct
Mag Check – 4000 RPM
- Check L & R Switches
- 300 RPM Max Drop

Brakes – Check
Altimeter – Set for Field Elev
Oil Temp – Min 120 deg. for Takeoff
Fuel Pump – "***on***"

Takeoff / Climb:
Throttle – Smoothly advance to Full
RPM – Verify Static: 5200
Rotate – 40 mph
Climb -
- Best Rate (**V**y) – 55 mph
- Best Angle (**V**x) – 50 mph

Fuel Pump – "***off***" after 1000 agl

Cruise:
Normal Cruise: 4500-5400 RPM
Max continuous output: 5500 RPM
CHT Normal Range: 167 - 230 °F
Max CHT: 240 °F
Oil Temp Normal Range: 190 – 230 °F
Max Oil Temp: 285 °F
Oil Pressure Normal Range: 30 – 73 PSI
Min Oil Pres: 22 PSI
Normal Speed Range: 50 – 80 mph
Vmax: 90 mph
Intentional spins are not permitted.

Descent:
Best glide (idle) – 60 mph (no flaps)
Deadstick glide – 65 mph (1 notch flaps)
Min CHT in descent - 158°F

Approach / Landing:
Max flaps speed, 1 notch – 65 mph
Max flaps speed, 2 notch – 55 mph
Note: flaps not normally needed for landing
Fuel pump – "***on***"
Final – 65 mph
Short Final – 55 mph
Fly it all the way down!
Stall – 35-40 mph
After Landing – Fuel pump "***off***"

Shut Down:
Required Cooldown Time – 2 to 3 minutes at idle
RPM – Below 2000, until CHT drops to 167 °F
Elec Switches – "***off***"
Mag #1 - "***kill***"
Throttle - Closed
Mag #2 – "***kill***"
Master Switch – "***off***"
Fuel Valve – "***off***" (lever vertical)

Fold-Up:
Attach boom tube support
Fold & secure tail surfaces
Disconnect aileron push-pull tubes (2)
Disconnect flap push-pull tubes (2)
Set pad on ground, under wingtip and 2 ft inboard.
Position self under wing, under strut attach point.
Remove pin at upper end of strut; detach strut.
Lower strut and wing together; lay strut on ground.
Lower wing tip onto pad on ground.
Remove pin at inboard end of strut; detach strut.
Remove pin at spar attach point at root.
Grasp wingtip; lift, walk toward tail, rotating leading edge downward.
Set wing leading edge into saddle; secure wingtip with bungee cord.
Repeat for other wing.
Secure wings in place.

3. Emergency Procedures

Maintain aircraft control
Analyze the situation – take proper action
Land as soon as conditions permit

4. Flight Characteristics

Takeoff Data: (collect data for 300 msl field elevation)
- Weight : 858 lbs.
- I A S : 44 mph
- Takeoff Roll : approx. 400 feet

Climb Performance: 800-1100 fpm
Cruise Performance:
airspeed : 75mph
fuel burn : 5 gal/hr
Spins – Intentional spins are not permitted.
Stall Performance:

5. Operating Limitations

EIS settings as of 6/11/2007:

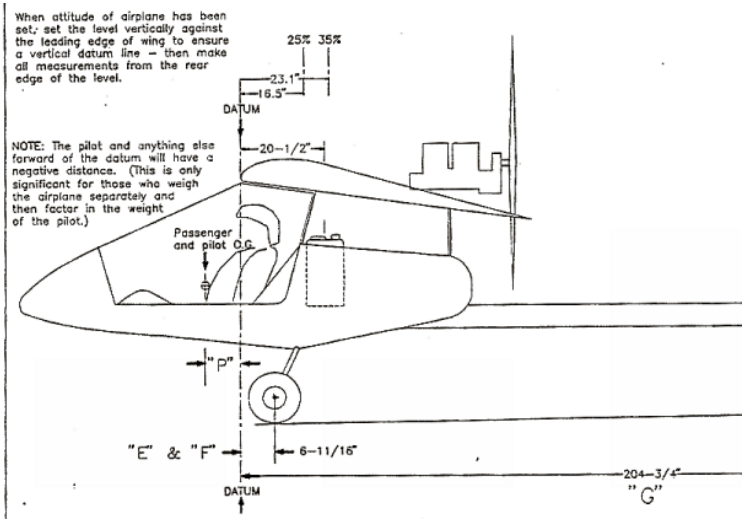
Max timer: 104
Max oil pressure: 72
Min oil pressure 22
Max oil temp: 270
Min oil temp:
Max rpm: 5790
Max voltage: 15.4
Min voltage: 11.6
Max CHT: 290
Max EGT: 1600

Weight & Balance:

Empty Weight & CG	Weighing Point	Weight (lbs)	Arm (in)	Moment (in-lbs)	Center of Gravity (in)
Left main wheel	Scale reading:	254			
	Tare:				
	Net weight:	254	4.5	1143	
Right main wheel	Scale reading:	258			
	Tare:				
	Net weight:	258	4.5	1161	
Tailwheel or	Scale reading:	76	204.625	15551.5	

Nosewheel	Tare:					
	Net weight:	76				
	Empty weight/CG:	**588**		**17855.5**	**30.37**	empty
Most Aft Loading	**Item**	**Weight (lbs)**	**Arm (in)**	**Moment (in-lbs)**	**Center of Gravity (in)**	
	Aircraft empty:	588	30.37	17855.5		
	Pilot:	170	-4	-680		
	Passenger:		-4	0		
	Baggage:	0		0		
	Fuel:	0	16.125	0		
	Weight/CG	**758**		**17175.5**	**22.66**	must be <= 23.1
Most Fwd Loading	**Item**	**Weight (lbs)**	**Arm (in)**	**Moment (in-lbs)**	**Center of Gravity (in)**	
	Aircraft empty:	588	30.37	17855.5		
	Pilot:	170	-4	-680		
	Passenger:	170	-4	-680		
	Baggage:			0		
	Fuel:	60	16.125	967.5		
	Weight/CG	**988**		**17463**	**17.68**	must be >= 16.5
Flight Test Loading	**Item**	**Weight (lbs)**	**Arm (in)**	**Moment (in-lbs)**	**Center of Gravity (in)**	
	Aircraft empty:	588	30.37	17855.5		
	Pilot:	210	-4	-840		
	Passenger:			0		
	Baggage:			0		
	Fuel:	60	16.125	967.5		
	Weight/CG	**858**		**17983**	**20.96**	

CG Envelope:



Instrument Markings:
- Airspeed

- CHT
- Oil Temp
- Tach

Appendix – Diagrams

1- Instrument Panel
2- Oil System
3- Fuel System
4- Electrical System
5- Pitot-static System
6- CG Envelope
7- Top view of engine