FLIGHT MANUAL

UL airplane

SHARK.AERO s.r.o
SHARK.AERO CZ s.r.o.

Version: AFM Shark-EN 60_2017-05-17_final
created from Czech original version :
AFM_Shark-CZ_60_2017-04-22_certifikat.doc

Flight manual *UL aircraft*

Airplane Type / version: **SHARK UL**

Serial number:

Registration:

Date of issue:

LAA - Approval number and date:

ULL - 05 / 2013	1.3. 2013 / 20.12. 2016

Manufacturer – stamp and signature :

The airplane must be operated according to informations and limitations presented in this handbook.

This handbook must be available to pilot at any time of the flight.

LIST OF THE REVISIONS AND THE EPAIRS

Ordinal No.	Number of document - bulletin	It concerns to pages No.	Date of issue	Signature
1/13		2-1,2-2,2-6,2-9, 3-1 to 3-3, 3-6 to 3-8 4-1 to 4-11 5-1 to 5-5 6-2 7-8 to 7-10 appendix 3-3 format editing	5.3.2013	V.Pekár
2/13		2-6,2-7,6-1 to 6-7	15.3.2013	V.Pekár
3/13		2-6, 5-1,5-2,6-4,6-5,6-6	4.4.2013	V.Pekár
4/15		2-4, 2-6, 7-10, 7-18, 8-6	28.4.2015	J. Skočej
5/16	57-00	1-2,2-3,2-4,2-6, 3-6, 4-3, 4-7, 4-11,4-12, 5-2 to 5-6, 6-6, 7-1, 7-10, 7-11, 7-12, 7-14, 7-15, 7-18 to 7-27, 8-6	19.5.2016	V.Pekár
6/16	57-02	4-13	17.7.2016	V.Pekár
7/16	57-03	3-6 to 3-9, 5-2, 5-3, 7-1, 7-7, 7-14,7-19 to 7-29	22.8.2016	V.Pekár
8/16	57-04	4-15, 6-7 to 6-9	22.12.2016	V.Pekár
9/17	57-05	1-2, 2-1, 2-8, 2-9, 4-15, 6-2, 6-4, 6-5	1.2.2017	V.Pekár
10/17	57-06	Rewritten as a part of the LAA type certification requirements	1.4.2017	J.Dostál

Content

1. General 1-1
   1.1. Introduction 1-1
   1.2. Certification bases 1-1
   1.3. Warnings, cautions and notes 1-1
   1.4. Airplane basic description 1-2
   1.5. Three view drawing 1-3
2. Limitations 2-1
   2.1. Airspeed 2-1
   2.2. Airspeed indicator markings 2-1
   2.3. analog airspeed indicator markings 2-2
   2.4. Engine 2-3
   2.5. Engine instrument marking 2-4
   2.6. Weight limits 2-5
   2.7. Center of gravity (CG) 2-6
   2.8. Approved maneuvers 2-6
   2.9. Maneuvering load factor G 2-6
   2.10. Flight crew 2-6
   2.11. Kind of operation 2-7
   2.12. Fuel 2-7
      2.12.1. Approved fuel types 2-7
      2.12.2. Fuel tanks capacity 2-7
   2.13. Other limitations 2-8
   2.14. Placards 2-9
3. Emergency procedures 3-1
   3.1. Engine failure and emergency landing 3-1
      3.1.1. Engine failure during take-off run 3-1
      3.1.2. Engine failure during take-off 3-1
      3.1.3. In-flight engine failure 3-2
      3.1.4. Carburettor icing 3-2
   3.2. In-flight engine restart 3-2
   3.3. Fire 3-3
      3.3.1. Engine fire on the ground 3-3
      3.3.2. Engine fire during take-off 3-3
      3.3.3. Engine fire in flight 3-3
      3.3.4. Cockpit / electrical fire 3-4
   3.4. Gliding 3-4
   3.5. Precautionary Landing 3-4
   3.6. Blown-Out Tire Landing 3-4
   3.7. Landing with Damaged Landing Gear 3-5
   3.8. Landing gear retraction malfunction 3-5
   3.9. Landing gear opening malfunction 3-5
   3.10. Vibrations from engine or other engine problem 3-6

3.11. Inadvertent icing encounter 3-6
3.12. Extreme turbulence encounter 3-6
3.13. Electrical system malfunctions 3-7
3.14. Inadvertent Stall and spin recovery 3-8
3.14.1. Stall recovery 3-8
3.14.2. Spin recovery 3-8
3.15. USe of Rescue system 3-9
4. Normal procedures 4-1
4.1. Pre-flight inspection 4-1
4.1.1. Cockpit 4-1
4.1.2. Wing 4-2
4.1.3. Landing gear 4-2
4.1.4. Powerplant 4-2
4.1.5. Control cables 4-3
4.1.6. Tail unit and fuselage 4-3
4.1.7. Turning on of electric devices 4-3
4.2. Engine starting 4-3
4.2.1. Engine warm-up and test 4-4
4.3. Before taxiing 4-4
4.4. Taxiing 4-6
4.5. Check on holding line 4-6
4.6. normal take off 4-7
4.7. Climb 4-7
4.8. Cruise 4-8
4.9. Approach 4-8
4.9.1. Descent 4-8
4.10. Downwind 4-9
4.11. Normal landing 4-9
4.11.1. On Base Leg 4-9
4.11.2. On Final 4-9
4.11.3. Landing 4-9
4.11.4. After landing 4-10
4.11.5. Engine shut down 4-10
4.11.6. Post-Flight Check 4-10
4.12. Short field take-off and landing procedures 4-10
4.13. Balked landing procedures 4-10
4.14. Fuel SYSTEM use 4-11
4.15. REPEATED TAKE OFF 4-11
4.16. High speed flights 4-12
4.16.1. Turbulences 4-12
4.16.2. Maneuvering 4-12
4.16.3. Landing gear opening 4-12
4.16.4. Propeller, engine RPM 4-13

4.16.5. Flaps ... 4-13
4.16.6. Landing gear retraction ... 4-13
4.16.7. Flutter, high altitude flights ... 4-13
5. Performance ... 5-1
5.1. Airspeed indicator system calibration ... 5-1
5.2. Stall speed ... 5-2
5.3. TAKE-OFF Distance ... 5-2
5.3.1. In flight adjustable prop. NEUFORM TXR2-V-70 ... 5-2
5.3.2. In flight adjustable prop. Woodcomp SR3000/2WN ... 5-3
5.3.3. On ground adjustable prop. DUC SWIRL 1680 ... 5-3
5.4. Landing distance ... 5-4
5.5. Rate of climb ... 5-4
5.6. Cruise, endurance, range ... 5-5
6. Airplane empty weight and COG determination ... 6-1
6.1. Weight and center of gravity determination for flight ... 6-3
7. Technical Description of the airplane ... 7-1
7.1. AIRFRAME ... 7-2
7.1.1. Fuselage ... 7-2
7.1.2. Cockpit canopy ... 7-2
7.1.3. Engine cowlings ... 7-2
7.1.4. Wing ... 7-3
7.1.5. Ailerons ... 7-3
7.1.6. Flaps ... 7-3
7.1.7. Horizontal stabilizer ... 7-3
7.1.8. Elevator ... 7-3
7.1.9. Rudder ... 7-3
7.1.10. Airplane exterior surface painting ... 7-4
7.2. Landing gear ... 7-4
7.2.1. Front undercarriage ... 7-4
7.2.2. Main undercarriage ... 7-5
7.2.3. Undercarriage retraction and extension ... 7-6
7.3. CONTROL SYSTEMS ... 7-8
7.3.1. Elevator control ... 7-8
7.3.2. Aileron control ... 7-8
7.3.3. Rudder control ... 7-9
7.3.4. Flaps ... 7-9
7.3.5. Elevator trim tab control ... 7-9
7.4. ELECTRIC SYSTEM ... 7-10
7.5. Fuel system ... 7-10
7.6. COCKPIT - interior and instruments ... 7-12
7.7. POWER UNIT ... 7-16
7.7.1. Technical data ... 7-17
7.8. PROPELLER ... 7-18

7.8.1. DUC SWIRL 3 blade, on the ground adjustable propeller, diameter 1680 mm 7-18
7.8.2. Woodcomp SR 3000 2W two blade in flight electrically adjustable propeller 7-19
7.8.3. Woodcomp KW 20W - two blade hydraulically in flight adjustable 7-20
7.8.4. Neuform TXR2-V-70 7-21
7.9. Rescue system 7-22
7.9.1. Description of rescue system Stratos/Junkers Magnum 501 7-22
7.9.2. The activation mechanism 7-23
7.9.3. Rescue system installation 7-24
7.10. Towing system 7-25
7.11. Position lights 7-26
7.12. Landing Light 7-26
7.13. ELT Unit 7-27
7.14. Autopilot 7-28
8. Airplane handling, care and maintenance 8-1
8.1 Wing Dismounting 8-1
8.1.1. Remove flaps 8-1
8.1.2. Disconnect aileron controls 8-2
8.1.3. Disconnect rear wing spar pin 8-2
8.1.4. Disassemble the main wing spar pins 8-2
8.1.5. Disconnect fuel hoses and fuel sensors sockets 8-3
8.1.6. Remove wing spars out of center-wing 8-3
8.1.7. Disconnect pitostatic system hoses 8-3
8.1.8. Secure wings by hangaring (transport) jigs 8-3
8.2. Stabilizer disassembly 8-3
8.3. Parking and mooring 8-4
8.3.1. General 8-4
8.3.2. Cover of pitot tube 8-4
8.3.3. Mooring 8-4
8.4. Hangaring, Ground Handling 8-5
8.5. Towing 8-6
8.6. Tire pressure 8-6
9. Supplements 9-1

1. GENERAL

1.1. INTRODUCTION

This handbook is provided with your airplane to allow you obtain as much knowledge as possible for the airplane operation. Read this manual before your first flight and make sure you understand all the information summarized here.

1.2. CERTIFICATION BASES

This aircraft was manufactured in accordance ultralight airworthiness standards and does not conform to standard category airworthiness requirements.

The following standards were used for approval and testing:

UL-2	Czech Republic requirements of LAA
LTF-UL	German requirements for ultralight airplanes
ASTM standard	Requirements for Light Sport Aircraft (LSA) valid in USA and used as a background for European light airplane standards.

1.3. WARNINGS, CAUTIONS AND NOTES

The following definitions applied to WARNINGS, CAUTIONS and NOTES are used in this manual:

WARNING: INFORMATION which could prevent personnel injury or loss of life

CAUTION: INFORMATION which could prevent damage of equipment

NOTE: INFORMATION of special importance to pilot

1.4. AIRPLANE BASIC DESCRIPTION

SHARK is an all-composite low-wing ultralight airplane with retractable undercarriage, tandem seats configuration, designed for fast cross-country flights.

Airplane is equipped with **100HP Rotax 912 ULS engine** and one of propellers acc. paragraph 7.8.

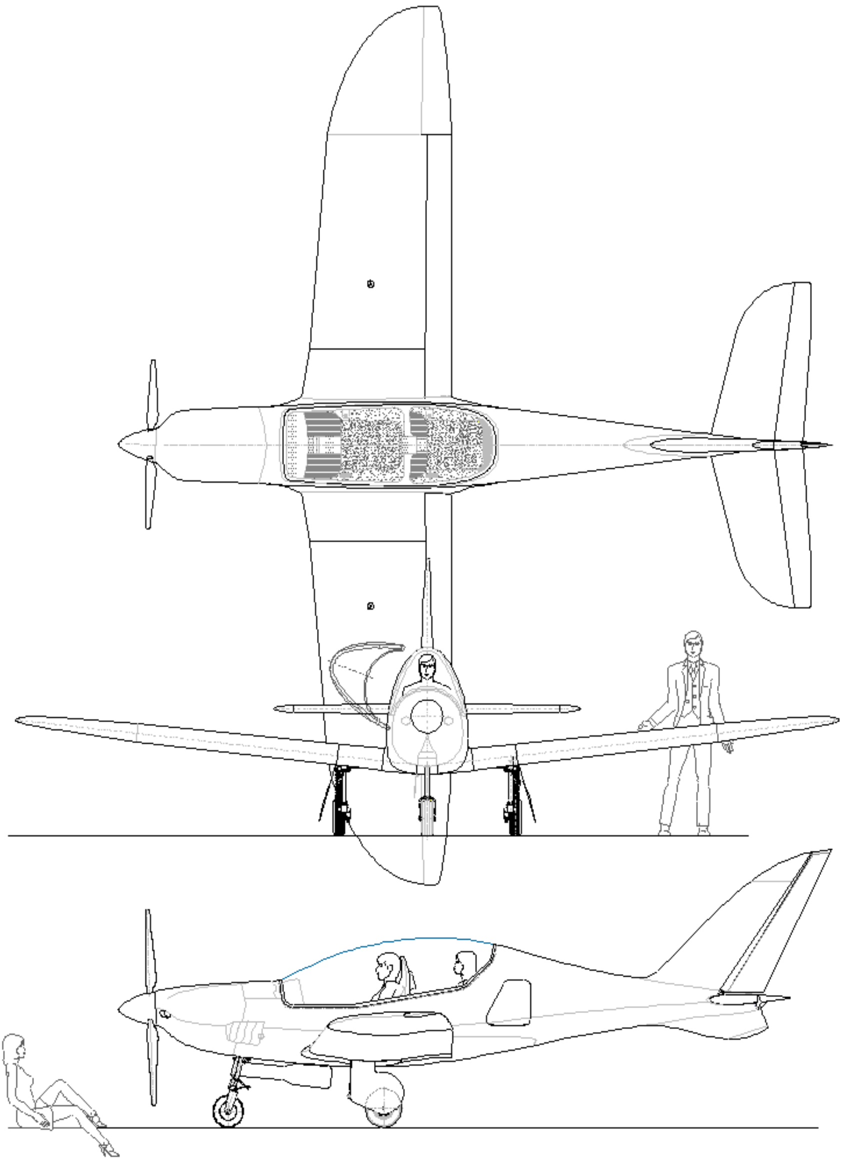
Wing span	**7,9** m
Length	**6,85** m
Height	**2,3** m
Wing area	**9,5** m^2
MAC length	**1,237** m
Swept wing angles	**3,53°** / 13,8° / 39,8°

Existing version of the airplane, approved by calculations and tests, cover installation of engines Rotax 912ULS with optional equipment.

All versions are calculated and tested for MTOW 600kg, but this specific Flight manual has defined limits, valid for UL category in Czech Republic under LAA CZ.

Marking of a specific airplane version is defined in introduction of this flight manual. Deviations from the basic version are described in the following box:

1.5. THREE VIEW DRAWING



2. LIMITATIONS

All speeds shown in this manual are indicated speeds. The conversion table in chapter 5.1. can be used to get the real speeds.

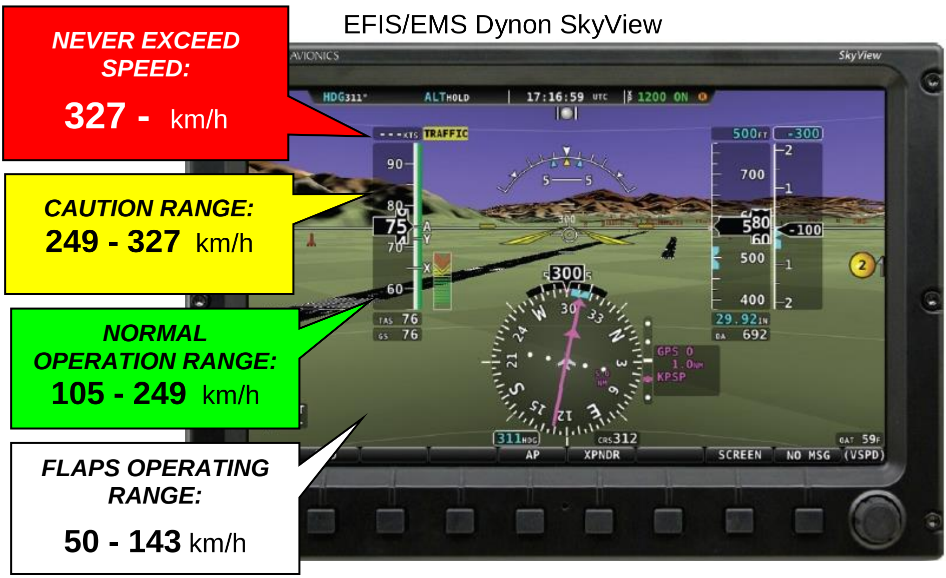
2.1. AIRSPEED

	Speed	IAS km/h	CAS km/h
V_{NE}	Never exceed speed	**327**	333
V_{RA}	Maximal speed in hard turbulence	**249**	250
V_A	Maneuvering speed	**175**	170
V_{FE}	Maximum speed with open flaps	**143**	140

WARNING: Above Maneuvering speed use only small deflections of control surfaces - the airplane may be easily overloaded!

2.2. AIRSPEED INDICATOR MARKINGS

EFIS/EMS Dynon SkyView



2.3. ANALOG AIRSPEED INDICATOR MARKINGS

NEVER EXCEED SPEED:
327m/h

CAUTION RANGE:
249 - 327
km/h

FLAPS OPERATING RANGE:
50 - 143
km/h

NORMAL OPERATION RANGE:
105 - 249
km/h

CAUTION:
All speeds in this manual are determined by primary airspeed indicator displayed on EFIS (Dynon SkyView, FLYMAP). Analog airspeed indicator, used as emergency one, may indicate slightly different speeds – see item 5.1.

2.4. ENGINE

SHARK is powered by **100HP ROTAX 912 ULS** engine.

Airplane **Engine type**	**SHARK** **ROTAX 912 ULS**
Max. take-off power (kW)	73,5
Max. continuous power (kW)	69
Max. engine speed (5 min)	5 800 ot/min
Max. engine speed (continuous)	5 500 ot/min
Max. cylinder head temperature (°C)	150
Max. oil temperature (°C)	140
Oil pressure - minimum (bar)	0,8 below 3500 rpm
	2,0 above 3500 rpm
Oil pressure: maximum, cold start only (bar)	7
Oil pressure: normal operation (bar)	2,0 – 5,0
Fuel pressure: min-max (bar)	0,15 – 0,4
Operation range of outside temperature	-25°C
	+ 50°C

For more details see Operator’s Manual for all versions of Rotax 912 supplied with the engine.

WARNING:
Flying this aircraft must always be done with the possibility of a safe landing due to loss of engine power.
The pilot is fully responsible for consequences of such failure

2.5. ENGINE INSTRUMENT MARKING

The airplane is equipped with the integrated engine display.
Values can be displayed in the integrated EFIS/EMS (Dynon SkyView, FLYMAP, GARMIN ...), on separate EMS unit (MiniEIS, EMSIS, VIGILUS ...) or on conventional imaging devices.

An example of FLYMAP engine operating variables:

Warning limits of Indicator Unit:

			912 ULS
TACH	- Max. RPM	[1/min]	5800
EGT	- Exhaust gas temperature	[ºC]	860
CHT	- Cylinder head temperature	[ºC]	150
OIL	- Oil temperature	[ºC]	140
	- Oil pressure, max	[bar]	7
	- Oil pressure, min	[bar]	0,8
	- Oil pressure, normal	[bar]	2 – 5
ERT	- Engine room temperature	[ºC]	**70**
TFUEL	- Fuel temperature	[ºC]	**70**

- normal values are displayed in **green** color
- values with higher attention are displayed in **yellow**
- critical values are displayed in **red**

2.6. WEIGHT LIMITS

Empty weight: standard version	(kg)	290 kg
Empty weight: fully equiped	(kg)	320 kg (max 325 kg)
Max. take-off weight: NO Ballistic Recovery System installed	(kg)	450 kg
Max. take-off weight: Ballistic Recovery System installed	(kg)	**472,5 kg**
Max. crew weight: *calculated for max take-off weight*	(kg)	177 kg
Min. crew weight:	(kg)	55 kg
Max. crew weight: rear seat	(kg)	**95 kg**
Max. one pilot weight:	(kg)	**110 kg**
Max. weight in baggage compartment ***- for solo flight from front seat***	(kg)	25 kg
Max. weight in baggage compartment	(kg)	**10 kg**

MAXIMAL CREW WEIGHT (kg) depends on fuel and baggage quantity						
Fuel tank filling →	**Fuel gauge indication** →	full	3/4	1/2	1/4	30 min of flight
	Fuel quantity in liters →	100	75	50	25	5
	kg	72	54	36	18	3,6
Baggage weight →	Max: 10 kg					
	½ : 5 kg					
	Without baggage					

Max. crew weight ***has to be written indelibly*** *for specific measured weight of airplane.*

WARNING:
Do not exceed these weight limits. Pay attention to fuel quantity, especially when 2 persons are on board.
DO NOT EXCEED maximum take-off weight.

2.7. CENTER OF GRAVITY (CG)

The values for ready to fly airplane (including fuel, crew, baggage).

Front center of gravity limit	16 % MAC
Rear center of gravity limit	34 % MAC

See Section 6 for center of gravity calculation.

Retraction of landing gear moves CG 0,5-1% backwards.

2.8. APPROVED MANEUVERS

The Shark Airplane may perform:

- turns required for normal flying
- practicing falls
- steep turn (max. bank 60°)

WARNING:
All maneuvers must be performed with a positive overload because the fuel and lubrication system is designed for positive overloads. All maneuvers must be performed in a maneuver envelope with maximum positive + 4g and negative -2g overload.

WARNING: Aerobatics, intentional stalls and spins are prohibited. Maximum angle of bank: 60°

2.9. MANEUVERING LOAD FACTOR G

Flap up 0°	Maximum positive center of gravity load factor	**+ 4**
	Maximum negative center of gravity load factor	**- 2**
Flaps down	Maximum positive center of gravity load factor	**+ 2**
	Maximum negative center of gravity load factor	**0**

2.10. FLIGHT CREW

Minimum crew on board	1 pilot
Maximum crew on board	2 persons

2.11. KIND OF OPERATION

WARNING:	**Only VFR day flights are permitted.**

WARNING:
IFR flights and flying in clouds is prohibited.
Flights in icing conditions are prohibited.

2.12. FUEL

2.12.1. Approved fuel types

Premium unleaded automtive fuel (**Natural 95** in Czech - Standard spec. for Automotive Spark-Ignition Engine Fuel, ASTM D 4814) or AVGAS 100 LL.

NOTE: Due to the higher lead content in AVGAS, the wear of the valve seats, the deposits in combustion chamber and lead sediments in the lubrication system will increase. Therefore, use AVGAS only if other fuel types are not available.

For more details see Operator's Manual for all versions of Rotax 912 supplied with the engine.

2.12.2. Fuel tanks capacity

Fuel tank types	**Standard**	**L**ong **R**ange
Fuel tank capacity (each wing tank)	**50** liters	**75** liters
Total fuel capacity	**100** liters	150 liters
Unusable fuel	**1** liter	

2.13. OTHER LIMITATIONS

Max. crosswind component	**16 knots** (**8** m/s)
Max. wind in runway direction	**30 knots** (**15** m/s)
Maximum outside temperature	**50° C**
Minimum outside temperature	**-25° C**

Heavy rain or excessive moisture can cause mild decrease of airplane performance. During these poor conditions we recommend to increase take-off and landing speed approximately about 10 km/hour.

WARNING: No smoking on board!

2.14. PLACARDS

Production label:

SHARK.AERO

SHARK UL 034/2017

… The serial number of the particular airplane (total serial number / year of manufacture)

Registration label:

Matriculation:		
Producer:	**SHARK Aero spol. s r.o.**	
Type/Name :	**SHARK**	
Production number/year:		
Empty weight:		**kg**
Max. take-off weight:	**472,5**	**kg**

Front and rear seat / luggage weight limit label:

	Front seat limit	Rear seat limit	Luggages limit
solo	**110** kg	**0** kg	**25** kg
2+lugg.	**110** kg	kg	**10** kg
2 max	**110** kg	kg	**0** kg

Basic information placards:

This product is not subject of the Czech Civil Aviation Authority approval and is operated at the user's own risk.

AEROBATICS MANEUVERS AND INTENTIONAL SPINS ARE PROHIBITED

Basic **LAA CZ label:**

OPERATION INFORMATIONS AND LIMITS - speeds IAS			
Matriculation			
Empty weight			kg
Max. take-off weight			kg
Max. payload			kg
Max. baggage weight for 1 pers. / 2. pers.		**25 / 10**	kg
Min / Max. pilot weight		**55 / 110**	kg
Max. passanger weigh (rear seat)		**95**	kg
Stalling speed with flaps	V_{SO}	**50**	km/hour
Max. speed with not-retracted undercarriage	V_{LO}	**150**	km/hour
Maximum flap extended speed	V_{FE}	**143**	km/hour
Max maneuvering speed	V_A	**175**	km/hour
Max speed in hard turbulency	V_{RA}	**249**	km/hour
Never exceed speed	V_{NE}	**327**	km/hour

MAXIMAL CREW WEIGHT (kg) DEPEND ON FUEL AND BAGGAGE QUANTITY						
Fuel tank filling →	**Fuel gauge indication** →	full	**3/4**	**1/2**	**1/4**	30min of flight
	Fuel quantity in liters →	100	75	50	25	5
Baggage weight →	Max: **10** kg					
	½ : **5** kg					
	Without baggage					

Engine limit information:

ENGINE SPEED

Max. take-off (max 5min)	**5 800** rpm
Max. continuous	**5 500** rpm
Idling	**1 400** rpm

50 liters Natural 95 min. MON 85 RON 95	75 liters Natural 95 min. MON 85 RON 95
FUEL TANK VOLUME. LIMIT - standard	FUEL TANK VOLUME LIMIT - **L**ong**R**ange

Baggage
max. / solo flight
10 / 25 kg

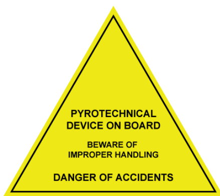
BAGGAGE WEIGHT LIMIT

tyre 300 kPa

TYRES PRESSURE

- on the wing, walk-around area for access to cockpit

- on the aerodynamic control surfaces



Rescue system info - on the tail / small on the Rescue System cover

3. EMERGENCY PROCEDURES

This section provides checklist of emergency situations which may occur. Emergency situations caused by airplane or engine malfunction are extremely rare with proper preflight inspections and maintenance. However, an emergency situation may occur. The guidelines, described in this section, should be applied to solve the problems. All air speed values in this chapter are presented in km/h - Indicated Airspeed.

3.1. ENGINE FAILURE AND EMERGENCY LANDING

3.1.1. Engine failure during take-off run

- throttle	reduce to idle
- ignition	off
- master switch	off
- brakes	as required

3.1.2. Engine failure during take-off

- airspeed	- **120** km/h
- landing site	- below 150 ft - land **straight ahead** - above 150 ft - choose suitable landing area in the runway direction or nearest suitable site clear of obstacles.
- master switch	off
- ignition	off
- fuel tank valve	shut
- fuel pump	off
- flaps	extend as needed
- undercarriage	extended / check
- safety belts	tighten

after touchdown:

- brakes	as required

3.1.3. In-flight engine failure

- airspeed	**120** km/h
- trim	trim
- landing site selection	select

Check situation, if master switch and ignition are on and fuel valve is open, continue according to procedure 3.2. (in-flight engine start) or by emergency landing according to procedure 3.1.2 (if the engine cannot be started up).

3.1.4. Carburettor icing

- airspeed	**140** km/h (optimal)
- throttle	try to find RPM with smallest loss of power

- leave the icing area (if possible)
- after 1-2 minutes increase slowly engine power to cruise speed
- when engine power is not recovered, land on the nearest airfield or off-airfield following the procedure described in **Chyba! Nenašiel sa žiaden zdroj odkazov.**

3.2. IN-FLIGHT ENGINE RESTART

- airspeed	**120** km/h
- master switch	on
- fuel tank valve	open tank with more fuel (check)
- choke	closed (as the engine is warm)
- fuel pump	on
- throttle	idle (when choke is activated), 1/3 of travel otherwise.
- ignition	on
- starter	start up

- if the engine cannot be started up (not enough power from battery), increase the airspeed to 150-170 km/h to rotate the propeller to support the engine starting.

WARNING: Loss of height needed for in-flight engine starting is approximately 600 ft.

3.3. FIRE

3.3.1. Engine fire on the ground

- fuel tank valve	off
- throttle	full
- ignition	off
- master switch	off
- leave the airplane and extinguish fire (if possible)	
- fire damage	inspect

WARNING:
DO NOT TAKE ANY FURTHER FLIGHT BEFORE THE FIRE CAUSE HAS BEEN DETERMINED AND REPAIRED.

3.3.2. Engine fire during take-off

- throttle	idle
- fuel tank valve	off
- if already airborne	keep airspeed **120** km/h and land
- brakes	as necessary to stop the airplane

after the airplane stops:

- throttle	full
- ignition	off
- leave the airplane and extinguish fire (if possible)	

3.3.3. Engine fire in flight

- fuel tank valve	off
- throttle	full
- airspeed	increase – try to extinguish the flames. **Do not exceed V_{NE}**
- landing site selection	use nearest airfield or a suitable landing site for emergency landing
- ignition	off
- master switch	off
- airspeed	120 km/h
- wings flaps	extend as needed
- undercarriage	extend/check
- safety belts	tighten
- perform emergency landing	
- leave the airplane and extinguish fire (if possible)	

WARNING: DO NOT ATTEMPT TO RESTART THE ENGINE

WARNING:
DO NOT TAKE ANY FURTHER FLIGHT BEFORE THE FIRE CAUSE HAS BEEN DETERMINED AND REPAIRED REPAIRED.

3.3.4. Cockpit / electrical fire

- cockpit vents and windows	open all vents and windows to remove smoke from the cockpit
- electric equipment switches	switch off all electric equipment not needed for safe landing

Land as soon as possible. Extinguish fire as soon as possible.

3.4. GLIDING

Optimal gliding speed	**125** km/h
Gliding ratio (at 125 -135 km/h), no flaps	1 : 12

3.5. PRECAUTIONARY LANDING

- choose suitable landing site, evaluate wind (direction and speed), surface, slope and obstacles
- perform a fly-over at a speed of 125 km/h, above the selected landing site at suitable height (150 ft recommended), observe the landing site
- follow normal landing checklist and land

after touchdown perform following:

- ignition off
- master switch off
- fuel tank valve off
- brakes as required

3.6. BLOWN-OUT TIRE LANDING

Use normal approach and landing procedure, keep damaged wheel above the ground during the flare as long as possible using ailerons (or elevator for the nose wheel).

3.7. LANDING WITH DAMAGED LANDING GEAR

Use normal approach and landing procedure, keep the damaged wheel, or unopened wheel, or wheel with unlocked leg, above ground during the flare as long as possible using ailerons (or elevator for the nose wheel).

3.8. LANDING GEAR RETRACTION MALFUNCTION

- switch off landing gear circuit switch/breaker
- climb to safe altitude where you can continue flight without stress
- switch on landing gear circuit/breaker and activate landing gear opening procedure – speed bellow 130 km/h
- check visually locked landing gear struts
- do not use airplane if landing gear system is not checked, repaired and adjusted by authorised person.

Note: Electric system of landing gear has safety switch installed, activated by air pressure from pitostatic tube. This system block retracting below speed 115 km/h, and activates warning sound and blinking alarm if all 3 legs are not opened and locked below this speed.

3.9. LANDING GEAR OPENING MALFUNCTION

If any malfunction occurs during opening procedure of landing gear

- switch off landing gear circuit switch/breaker
- climb to safe altitude where you can continue flight without stress
- reduce and keep speed on 120 km/h
- switch on landing gear circuit switch/breaker and activate landing gear opening procedure
- if landing gear is not fully opened and locked, activate retracting of LG, and then try to open it again. Combination of plus and minus G load can help release the system if there is a mechanical failure
- if some leg of landing gear is not fully open or locked, use landing gear emergency release. Open small flaps, reduce speed to 120 km/h, switch off landing gear circuit, pull off red emergency release handle of dysfunctional leg
- check visually locked landing gear struts

EMERGENCY LANDING GEAR EXTRACTING

- if you have any doubts the landing gear is properly open and locked, check visually yellow-black flag-arrow via check windows
- this visual check is superior to electronic information
- in case of one leg stays locked, safe procedure is to retract other legs as well, and perform belly landing. When landing on grass, close flaps, stop engine with 2 blades proppeler in horizontal position to reduce demage to minimum

CAUTION:
When landing gear emergency release is used, landing gear stays open without possibility to retract it without re-assembling by authorised technician!

3.10. VIBRATIONS FROM ENGINE OR OTHER ENGINE PROBLEM

Vibrations:

- use engine power with minimal vibrations
- in case the airplane has in flight adjustable propeller try to find in manual control regime angle with minimal vibrations
- land as soon as possible, consider off-airfield landing if vibrations increase

Oil pressure drop - probability of engine failure. In this case reduce engine power and land as soon as possible (before the failure occurs), consider off-airfield landing.

3.11. INADVERTENT ICING ENCOUNTER

- throttle	increase above normal cruise settings
- course	reverse or alter as required to avoid icing
- altitude	climb (if possible)

3.12. EXTREME TURBULENCE ENCOUNTER

- airspeed	recommend **200** km/h **(V_{RA}=249 km/h)**
- safety belts	tighten
- loose objects	fixed

3.13. ELECTRICAL SYSTEM MALFUNCTIONS

In case of electric system malfunction we have 3 indicators providing informations about system status.

Charging indicator - red LED on left top edge of instrument panel. Providing primary information about electric regulator status.

- **normal function:** with the ENGINE START switch on, and engine turned off, the LED is blinking, because generator doesnt provide energy. With running engine, generator provides energy, regulator provides volts and ampers to appliances and for battery charging, and LED stops blinking.

- **failure:** is signalised by blinking of red LED, while the engine is running, it signalizes the regulator doesn´t provide energy. Appliances take energy from main battery or backup batteries, which have limited cappacity. The flight may continue for several minutes. Carburator engine will run even in full failure of electric system, energy for spark plugs is generated by magnetos, independent on the rest of the electric system.
  Engine with injection fuel system is limited by battery capacity, as it needs power for high pressure fuel pump and electronic control unit.
  Appliances requiring electric power will run until the batteries run out. With both batteries discharged, electric control of landing gear will be inoperative. Emergency opening of landing gear manually will be necessary. Flaps will be inoperative, landing will be possible with closed flaps only. Radio and transponder will be inoperative too.

Voltmeter: when the engine is off, voltmeter shows battery voltage. Normal value is between 12 to 13,5 V. Below 11 V the battery is empty and engine start will probably not be possible. With a running engine, voltmeter shows voltage provided by regulator. Normal level is 13,5 - 14,4 V. If failure of regulator occurs, followed by blinking indicator, it is necessary to check volts, if they gradually decrease with time, it signalise loss of battery voltage, battery is discharged. If battery voltage drops under 10,5 V, some instruments stop working. Damage of battery can occur in the same time.

Ammeter: shows current flowing from or to the battery. With engine off, ammeter indicates possitive values, battery is providing current, is discharging. Normal level is 1 to 6 Amps, depends on the number of devices turned on. With running engine, batteries are charged,

ammeter shows negative values. When the battery is low, ampers can reach -15 Amps. When battery is charged, current slowly decreases. After few minutes of flight, battery is charged, and ammeter starts showing zero values. This indicates fully charged battery.
In case of regulator failure, when current is provided by battery, the ammeter shows plus Amps.

Procedure: if charging indicator is blinking - switch off all instruments unnecessary for the flight. Make safety landing at the closest airport and fix the problem.

3.14. INADVERTENT STALL AND SPIN RECOVERY

Stall or spin should not occur during normal flight and both **are prohibited.**

3.14.1. Stall recovery

- push down the nose of airplane by pushing the control stick – to increase speed
- gradually increase power

Loss of altitude in straight direction after stall is:

450 - 500 ft = 137 - 150 m

3.14.2. Spin recovery

WARNING:
Spin characteristics of the airplane have not been tested.
A procedure bellow is for information purposes only.

- throttle	idle
- aileron	neutral
- rudder	opposite to rotation
- control stick	pushed

Once the rotation is stopped, get rudder back to neutral position and establish a level flight.

3.15. USE OF RESCUE SYSTEM

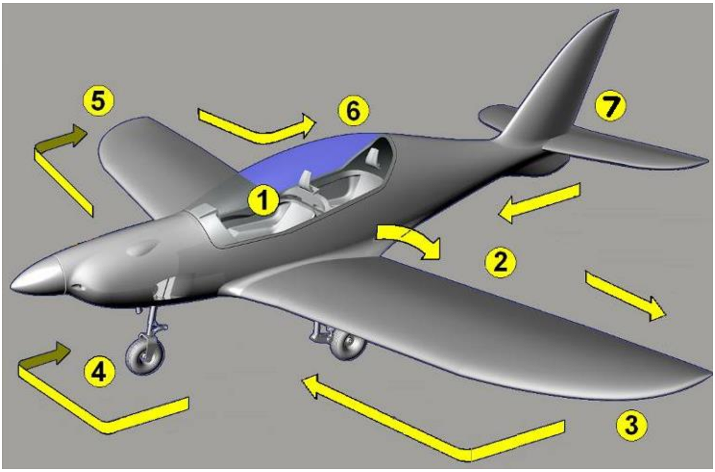
- engine off
- pull red handle of ballistic recovery system placed between legs of both pilots
- protect your body

WARNING: Rescue system is secured by pin with red flag „REMOVE BEFORE FLIGHT“, which needs to be removed before every flight. In case you forget to pull the pin out, remove it before use.

CAUTION: When the rescue system is used, damage of airplane always occures.

4. NORMAL PROCEDURES

4.1. PRE-FLIGHT INSPECTION



4.1.1. Cockpit

- Master switch and ignition	off
- Attachment and position of seats	check, adjust
- Safety belts	inspect
- Instruments and equipment	inspect
- Control stick	inspect, freedom of movement
- Rudder pedals	inspect, freedom of movement *(consider nose wheel control)*
- Rudder and aileron cable control	inspect
- Engine control	inspect, freedom of movement
- Brakes	function
- Fuel	check (level)
- Condition of the composite shell and transparent canopy	check
- Oil quantity	between MIN and MAX marks

4.1.2. Wing

- Wing	inspect surface and damages
- Hinges, saving	inspect
- Ailerons	inspect, freedom of movement and deflections
- Flaps, hinges, control tube, bolts, nuts, securing	inspect
- Fuel tank tightness and caps	inspect
- Pitot tube	inspect
- Fuel tank ventilation holes in flap hinges	inspect

4.1.3. Landing gear

- Landing gear and brake system	inspect
- Landing gear leg and attachment	inspect
- Shock absorber of the nose landing gear	inspect
- Rubber shock absorber of the main landing gear	inspect
- Retracting system of undercarriage (locking strut, gas springs, steel springs, cables for retracting, emergency locks + bowdens, servo for front leg, sensors for opened and retracted position)	inspect
- Doors of retractable undercarriage	inspect
- Tire pressure	check
- Main and rear wing pins securing	inspect
- Fuel filters	inspect
- Connection and condition of fuel hoses	inspect
- Connectors and wiring to sensors in fuel tank	inspect

4.1.4. Powerplant

- Engine, propeller general condition	inspect
- Safety pins and wires	inspect
- Engine mount and engine bed	inspect
- Exhaust silencer	inspect
- Ignition system	inspect
- Fuel system - hoses and pump	inspect, drain the system
- Cooling fluid	inspect
- Propeller	turn (until you hear burp sound)
- Oil level check	inspect, refill if needed

4.1.5. Control cables

- Rudder control cables — inspect condition and tension
- Turnbuckles, bowdens, safety wire — inspect

4.1.6. Tail unit and fuselage

- Tail unit surface and damages — inspect
- Control surfaces — freedom of movement, deflection
- Trim tab — inspect
- Nut + securing on stabilizer rear pin — inspect
- Bolts + nuts + controls — inspect
- Fuselage — inspect surface

4.1.7. Turning on of electric devices

- the audio sequence is played when the EFIS SkyView unit is turned on. It tests the sound. Radio must be turned on.
- when the landing gear circuit is turned ON, the signal diodes start blinking and acoustic signal is played. This checks functionality of these devices.
- when flaps circuit is turned ON, top green LED starts blinking, and it is necessary to press related button. If flaps are not in zero position, they will retract to zero position.

4.2. ENGINE STARTING

- pre-flight inspection — completed
- safety belts — adjust and fasten
- instruments — values check, settings
- canopy — closed, locked
- master switch — switch on
- fuel tank valve *(left / full tank)* — open
- choke — activate (cold engine only)
- throttle — Idle for cold engine, 1/3 of travel for warm engine
- cowl flaps — open
- pre-heating of carburettors — as required
- fuel pump — on *(if left tank is used)*
- control stick — pulled
- brakes — on
- propeller area — “clear”
- ignition — switch on
- starter — turn on for max **10 sec**, then 2 min. cooling
- after engine start up — set the idle speed

- instruments — check out indication *(oil pressure must rise within 10 seconds)*
- choke — switch off slowly *(cold engine only)*
- avionics and other switches — switch on as required

4.2.1. Engine warm-up and test

- Warm up to operating temperature - first at idle or 2000 RPM for 2 minutes, then at 2500 RPM to reach oil temperature of 50 °C.
- Check out temperature and pressure values - must be within operating limits all the time.
- Check out the maximum power - speed around 5000 RPM depends on used propeller
- Check out ignition (magnetos) - set **4 000 RPM**
  - drop should not exceed 300 RPM on either magneto
  - difference between magnetos shouldn´t exceed 120 RPM
- Check idle - **1600 RPM** ±100

CAUTION: Perform the engine check on suitable terrain heading upwind. Consider also safety of other persons. Do not operate the engine for longer time than necessary and allow sufficient cooling before switching off.

4.3. BEFORE TAXIING

Check from left to right:

- seat — adjust
- headset — connected
- seatbelts — locked, tightened

Left side of cabin:

- items below armrests — secured, fixed
- check copilot if ready — headset, seatbelts
- cabin — closed, locked, front + rear
- cabin windows — closed, front + rear
- kneeboard + pen — write down data, time
- fuel tank valve — left
- throttle — 2500 rpm
- choke — closed
- cooling (cowl flaps) — opened
- ventilations - airstream — opened
- items below knees — secured, fixed

Left side of instrument panel:

- items in drawer — secured, fixed
- flaps lever visual — check 0,1,2,3, adjust 1 - take-off position
- landing gear breaker — ON
- position of landing switch — DOWN (neutral)
- landing lights — 3 green
- landing gear struts arrows — visual check of locked position
- charging control light — off –>check
- adjustable propeller — auto, take-off or manual, set min. angle

Middle of instrument panel:

- GPS — ON, adjust
- EFIS — ON, adjust
- QNH — adjust
- AOA/stall warning — ON, check function
- EMS — ON, check pressure and temperature – in green
- fuel amount — quantity check, minimum 10 litres in left fuel tank
- radio — ON, adjust frequency, check function
- intercom — ON if passenger is on board, check function
- transponder — ON, adjust (7000)
- magneto 1+2 — ON
- master switch — ON

Right side of instrument panel:

- EFIS alarm LED — no warning
- backup altitude — adjust QNH
- switches/breakers — ON
- fuel pump — ON
- lights — ON
- optional instruments — check + adjust

(ELT, CO detect, FLARM, IPHONE..)

Right side of cabin:

- ventilation - airstream — open
- heating — according to need
- ventilation — open
- control stick — free movement elevator + ailerons
- trim — neutral
- items below armrest — fixed, secured
- items below knees — fixed, secured

Middle of the cabin:

- pedals	adjust, free movement
- brakes	press, check function
- parking brake	open
- handle of rescue system	remove pin (at front seat)
- runway and take-off area	check of availability
- radio	report line-up

4.4. TAXIING

The maximum taxiing speed is 10 km/h (walking speed). Always check brakes functionality as soon as the airplane start taxiing. Do not use too much brake in snowy conditions, melting ice can freeze on brake discs.

Check the temperatures in summer to avoid overheating of the engine. In case of high temperatures and VAPOR LOCK risk, open the oil check cap.

In temperatures above 70 ^{o}C there is a risk of VAPOR LOCK in the engine compartment, let the engine cool down.

4.5. CHECK ON HOLDING LINE

- Cabin	closed
- Control	check, free
- Fuel selector	left
- Mouth	opened
- Flaps	position 1
- Propeller	take-off
- Circuit breakers	set (as needed)
- Engine pressure and temperature	check
- Fuel pump	ON
- Trim	neutral
- Handle of rescue system	release
- Radio	report

4.6. NORMAL TAKE OFF

- Pedal brakes — release
- Throttle — full power

Drive straight ahead. Lift slightly nose wheel at about 50 km/h IAS.
Take off at speed around 90 km/h, accelerate and climb.
Do not climb until speed **115 km/h** is reached.

WARNING: Do not take-off when engine is not running smoothly or runway is occupied.

- initial climb speed — 120 km/h
- engine speed — reduce to max 5 500 RPM
- engine instruments — check
- landing gear — retract above **150 ft**, when speed is over 120 km/h, check 3 red marks
- wing flaps — flaps up above 150 ft, at speed 120 km/h
- trim — trim
- fuel pump — off, when level flight

Note: In landing gear electric circuit is installed the pressure switch, connected to pitotstatic sytem, and adjusted to speed 115 km/h. This should prevent unintentional retraction of landing gear on the ground. Control unit does not retract landing gear, until the speed is reached. Opening of landing gear is not blocked by this switch. It works at any speed.
If all 3 wheels of landing gear are not opened and locked below this speed, pressure switch activates sound and light warning system.

Inspection of opened and properly locked landing gear is realized visually via small check windows.

4.7. CLIMB

- throttle — 5 500 RPM max
- airspeed — 120 to 180 km/h as required (130 km/h best angle, 180 km/h best climbing)
- temperature — check maximum, if needed reduce power to avoid overheating

4.8. CRUISE

- bring the airplane into horizontal flight
- in-flight adjustable propeller 4 000 – 5 500 RPM
- throttle 24 inHg – full (as required)
- airspeed as required
- engine instruments check
- fuel tank valves switch between tanks when necessary

WARNING:
Do not forget to switch the wing tanks supplying the engine on regular basis to prevent fuel starvation.
When both fuel tanks are full or almost full, always select the left tank.

Followed values are recommended for ideal airplane use:

Standard SHARK version **Engine Rotax 912 ULS**	Engine speed (1/min)	Power (kW)	Torque (Nm)	Intake pressure (in Hg)
Take-off power	5800	73,5	121,0	27,5
Max. continuous power	**5500**	**69,0**	**119,8**	**27**
75 %	5000	51,0	97,4	26
65 %	4800	44,6	88,7	26
55 %	4300	38,0	84,3	24

4.9. APPROACH

4.9.1. Descent

- throttle as required
- engine instruments check

WARNING:
Avoid prolonged operation with IDLE during the flight as the engine may become overcooled and lose the power.

If higher descent is needed, there is possbility to extend flaps under 140 km/h, and extend the undercarriage. Side slip is not efficient, steep descend is reached with flaps III.

4.10. DOWNWIND

- power	4 000 – 5 000 rpm
- airspeed	reduce to **120-130** km/h
- engine instruments	check
- fuel tank valve	left, if there is enough fuel
- fuel pump	ON, if left tank is selected
- safety belts	tighten
- approach area and landing site	situation check
- undercarriage	open (3 green lights on) visual check
- TWR	report (3 green)

4.11. NORMAL LANDING

4.11.1. On Base Leg

- power	3 000 rpm, or according to need
- airspeed	**120** km/h
- engine instruments	check
- wing flaps	take-off position *(position I)*
- adjustable propeller	take off position
- trim	trim
- final leg airspace	situation check

4.11.2. On Final

- airspeed	**90 - 110** km/h
- power	adjust as needed
- engine instruments	check
- wing flaps	**landing position** *(II or III)*
- trim	trim
- check of landing site	situation check

4.11.3. Landing

At a height 30 ft set the engine at idle speed.. Maintain speed of **90-100** km/h till the flare. When flaring at a height of 1-2 ft above the ground, decelerate gradually by pulling the control stick backward till the airplane lands. Keep pulling control stick to avoid immediate contact of the front wheel with the ground.

4.11.4. After landing

- brakes	use as needed
- wing flaps	retract
- trim	neutral
- flaps	0 or 1
- fuel pump	off

4.11.5. Engine shut down

- power	cool down the engine at 2 000 rpm *(if necessary)*
- avionics and other switches	off
- ignition	off
- master switch	off
- fuel tank valve	off - closed
- secure the airplane	use parking brake, anchor an airplane, or otherwise secure the airplane against free movement.

4.11.6. Post-Flight Check

Check the airplane overall condition.

4.12. SHORT FIELD TAKE-OFF AND LANDING PROCEDURES

Normal procedures can be followed for short take off. Use second landing flaps setting together with approach speed **90 - 100** km/h.

4.13. BALKED LANDING PROCEDURES

- power	max. 5 500 r.p.m
- airspeed	**120** km/h
- engine instruments	check
- wing flaps	take-off (position 1)
- trim	trim
- landing gear	retract, check 3 red
- wing flaps	retract in 150 ft
- trimming	trim
- power	max. 5 500 rpm
- climb	**120** km/h

4.14. FUEL SYSTEM USE

Fuel system consists of two integral fuel tanks connected by fuel valve. It is necessary to check fuel level and switch between tanks if needed.

According to requirements of engine manufacturer, the fuel system possess of return line back to left fuel tank.
Electric fuel pump is installed behind fuel valve, it works for both tanks.

NORMAL USE of FUEL SYSTEM:

1. START **FROM LEFT FUEL TANK**
2. Switch between tanks as needed.
3. **Fuel return system draws fuel back into left fuel tank,** pilot should check it continuously and switch back to left tank when right one is nearly empty.

Do not start from right fuel tank, when left tank is full !!!
Excess fuel is returned to the full left tank and continues through air vent out of the airplane.

4.15. REPEATED TAKE OFF

During the hot days problem with engine re-startup can occur, caused by overheated fuel in the engine space,. Fuel starts boiling at 70-80°C. Formed bubbles cause irregular fuel supply and engine can fails during take off. This effect is called Vapour Lock.
To reduce risk of Vapour Lock, T connection of return line is placed in highest position of fuel hoses.
Most of the airplanes has one or two temperature sensors inside engine space and at fuel hose installed, so pilot has information about these temperatures. Temperatures over 60 ^{o}C has yellow indication, attention is needed, over 70 ^{o}C has red indication, risk of Vapour Lock. Recommendation is to cool engine down, turn airplane against the wind and run engine at idle, or stop it and let it cool down.
During hot days, we recommend to keep oil doors on upper motorcowling open, to reduce this problem.
There is no risk of Vapour Lock during the flight. After take off engine compartment cools down to temperature about 20 ^{o}C above the air temperature. Engine producer recommend to use AVGAZ fuel in case of Vapor Lock issues.

WARNING:
Before repeated take-off, during the hot days, is necessary to let the engine run for a longer time and test full throttle to be sure the engine fuel supply is without any problems.

4.16. HIGH SPEED FLIGHTS

Because Shark cruising speed is higher comparing to average ultralights, there are certain risks the pilot should know about.

4.16.1. Turbulences

Shark economy cruise speed is 230 km/h. Normal cruise speed is 250 km/h and during faster flights 270 km/h. Max speed at full continuous power is 280-300 km/h. Max speed depends on installed systems as landing gear doors, airbox, injection, exhaust, weight, temperature, altitude. Speed 250 km/h is possible to use for planning long trips, it is acceptable even in turbulences.
Speed 270 km/h is comfortable for passangers when used in conditions of lower turbulences.
Speeds over 280 km/h is comfortable only in very low turbulences.
In extremely high turbulences is good to reduce speed to 180-200 km/h.

4.16.2. Maneuvering

Maneuvering speed, when pilot can use full deflections of control system, is 170 km/h, and airplane can reach load factor 4. Normal cruising speed is significantly higher, so is is necessary to use smooth movements of control system. Fast maneuvers can easily exceed strength limits.

4.16.3. Landing gear opening

Approach and entering the traffic pattern is realized at speeds around 250 km/h. At downwind position is needed to decrease speed to 130 km/h, throttle at idle speed, and decrease speed in horizontal flight without descending. Keep in mind it takes some time. Often mistake is late power reducing, higher power than idle, descending. When airplane is descending, speed doesnt decrease, and pilot can get into the stress with next procedures. Unskilled pilots has problems with higher speed range. They tend to fly at higher speeds, because of fear of stall.

4.16.4. Propeller, engine RPM

Shark easily increase speed when maneuvering. Careful power control is required to avoid engine overrun. This is important for fixed proppeler, but keep it in mind with electrically adjustable propeller as well, because it takes about 12 seconds to change blade angles from minimum to maximum. Therefore even in constant speed mode is recommended to reduce RPM when maneuvering and work smoothly with throttle. Best propeller is hydraulically controlled, as it react very fast, and risk of engine overrun is minimal.

4.16.5. Flaps

At traffic pattern, after opening landing gear, at speed 130 km/h, is recommended to reduce speed to 120 km/h and open flaps 1. Often mistake is higher speed, or speed fluctuation caused by turbulence, or incorrectly pressed button on control panel. Pressure switch, incorporated to flaps control system, is adjusted to 130 km/h. Over this speed flaps will not open, and in case they are already opened, warning will be activated. Therefore is needed to prove if flaps are really open.
Another risk associated with flaps is balked landing. Pilot often in stress applies full power, and instead of climb transforms power to speed. Flaps are designed for max. speed 140 km/h. Higher speeds can cause structure overload.

4.16.6. Landing gear retraction

Pressure switch is incorporated to control system of landing gear. It prevents retration below speed 115 km/h. It is recommended to keep airplane in light climb, after take-off, and wait till speed increase enough. Pilot can hold the switch for landing gear on, and wait till the airplane reaches required speed. Then the landing gear retraction sequence automaticly starts. It is recommended to check visually, if retracting procedure started – lights blink, or if underarriage is really retracted – 3 red lights on. Flight with opened landing gear is possible, landing gear doors was tested up to 230 km/h.

4.16.7. Flutter, high altitude flights

Fast airplanes can have flutter issues. Problems can occur specially during higher speeds in high altitudes, because critical flutter speed decreases with higher altitude.

Never exceed speed VNE = 327 km/h (calibrated speed CSA = 333 km/h).

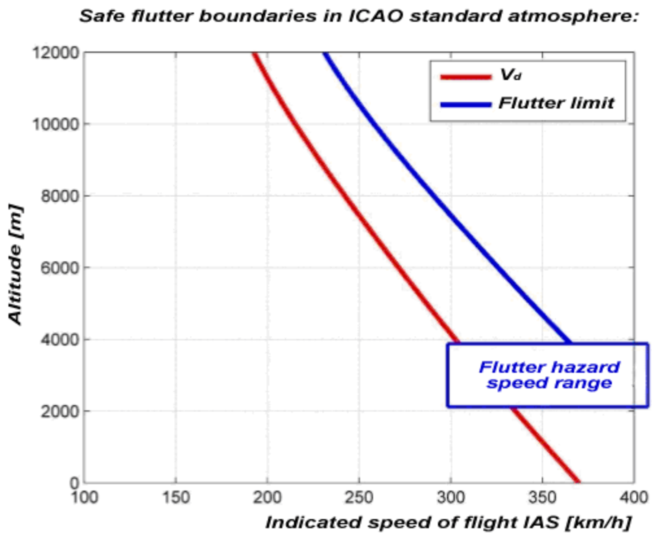


Table of VNE changes with increasing altitude:

Height	m	0	1000	2000	3000	4000	5000	6000	7000	8000
TAS	km/h	327	327	327	327	327	327	327	327	327
IAS	km/h	327	310	298	285	271	263	248	238	224

For higher altitude flights, keep maximum allowed speeds indicated in the previous table, or check TAS displayed by modern EFIS devices.

5. PERFORMANCE

These flight performances are valid for the standard version of airplane at maximum take-off weight 472,5 kg, normal flying technique and ISA conditions (seal level, 15°C, 1013 hPa). Actual performance might be different due to pilot skills, weather and airplane conditions.

WARNING: Variations in pilot technique as well as weather conditions and airplane setting (e.g. propeller pitch) can cause significant differences in flight performance.

5.1. AIRSPEED INDICATOR SYSTEM CALIBRATION

Primary airspeed indicator – EFIS (SkyView, Flymap ...)

IAS km/h	50	60	70	80	90	100	120	140	160	180	200	220	240	260	280	300	320	327
CAS km/h	65	76	81	88	93	104	122	137	156	174	202	218	240	263	284	305	326	333

Changing from cruise to take-off or landing configuration does not affect an error of air speed indicator.

	IAS km/h	CAS km/h	
VS0	50	65	Stall speed in landing configuration
VS1	75	85	Stall speed in clean configuration
VFO3	100	104	Maximum speed for flap extending III
VFO2	110	113	Maximum speed for flap extending II
VFO1	120	122	Maximum speed for flap extending I
VLO	130	130	Maximum speed for extending and retracting landing gear
VFE	143	140	Maximum flap extended speed
VA	175	170	Design maneuvering speed
VC	267	270	Design cruise speed- gust intensity loading
VRA	249	250	Maximum turbulence penetration speed
VH	280	284	Maximum speed in level flight at maximum continuous power.
VNE	327	333	Never exceed speed

All speeds described in this manual are written as IAS speed, displayed by primary airspeed indicator!!!

IAS - indicated speed of flight, *indication of* airspeed indicator *in your airplane*
CAS - calibrated speed, *real speed of flight*
(in zero flight level ISA) = compensated for indicator and aerodynamic error

5.2. STALL SPEED

Stall speed valid for airplane weight 472,5 kg and wing level flight.

	Deflection	indicated	Stall speed	
			km/hour IAS	km/hour CAS
Flaps up	0°		75	85
Flap take-off position	20°	I	68	80
Flaps	30°	II	53	68
Flaps	40°	III	50	65

5.3. TAKE-OFF DISTANCE

5.3.1. In flight adjustable prop. NEUFORM TXR2-V-70

Flaps position 20°	Take-off run	Total take-off distance to 50 ft
Grass surface	125 m	225 m
Paved surface (concrete / asphalt)	105 m	205 m

Flaps position 30°	Take-off run	Total take-off distance to 50 ft
Grass surface	110 m	210 m
Paved surface (concrete / asphalt)	100 m	200 m

Flaps position 0°	Take-off run	Total take-off distance to 50 ft
Grass surface	270 m	300 m
Paved surface (concrete / asphalt)	240 m	270 m

5.3.2. In flight adjustable prop. Woodcomp SR3000/2WN

Flaps position 20°	Take-off run	Total take-off distance to 50 ft
Grass surface	**130 m**	**225 m**
Paved surface (concrete/asphalt)	**110 m**	**210 m**

5.3.3. On ground adjustable prop. DUC SWIRL 1680

Flaps position 20°	Take-off run	Total take-off distance to 50 ft
Grass surface	**185 m**	**290 m**
Paved surface (concrete/asphalt)	**160 m**	**270 m**

5.4. LANDING DISTANCE

Flaps position 40°	Landing ground roll	Total landing distance from 50 ft
Grass surface	120 m	245 m
Paved surface (concrete / asphalt)	120 m	240 m

Flaps position 30°	Landing ground roll	Total landing distance from 50 ft
Grass surface	150 m	290 m
Paved surface (concrete / asphalt)	150 m	290 m

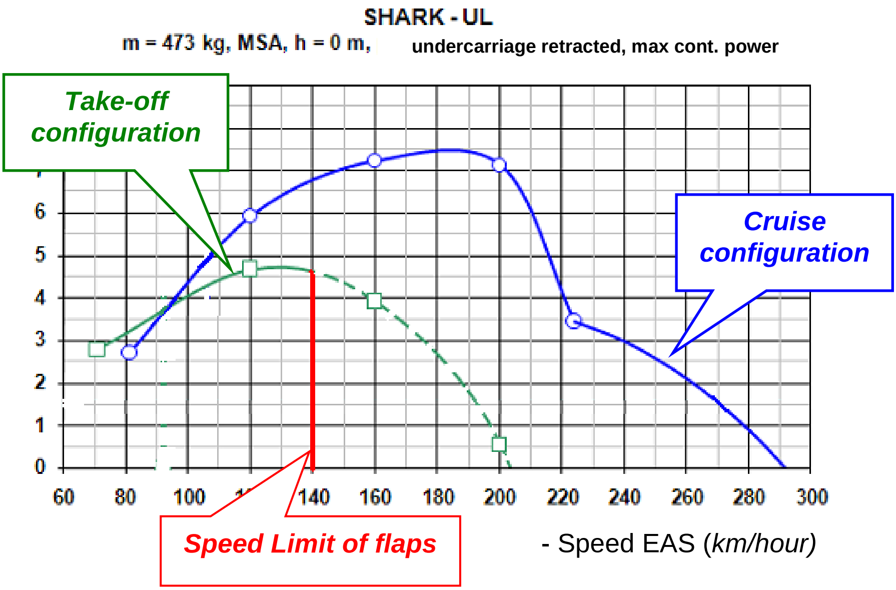
Flaps position 20°	Landing ground roll	Total landing distance from 50 ft
Grass surface	175 m	355 m
Paved surface (concrete / asphalt)	175 m	355 m

Without flaps (flaps 0°)	Landing ground roll	Total landing distance from 50 ft
Grass surface	210 m	530 m
Paved surface (concrete / asphalt)	210 m	530 m

5.5. RATE OF CLIMB

Altitude	Neuform TXR2-V-70	Woodcomp SR3000/2WN, KW 20N	DUC SWIRL 1680	Max. rate of climb speed (km/hour IAS)
0 ft	7,5 m/s	6,5 m/s	5,1 m/s	185 km/h
	1470 ft/min	1270 ft/min	1000 ft/min	
3000 ft	6,2 m/s	5,2 m/s	3,8 m/s	185 km/h
	1220 ft/min	1020 ft/min	745 ft/min	
With flaps – take off configuration				
0 ft	4,7 m/s	3,8 m/s	2,9 m/s	130 km/h
	920 ft/min	745 ft/min	570 ft/min	

Rate of climb diagram *m/s* (*shows the best speeds for climbing with and without flaps).*



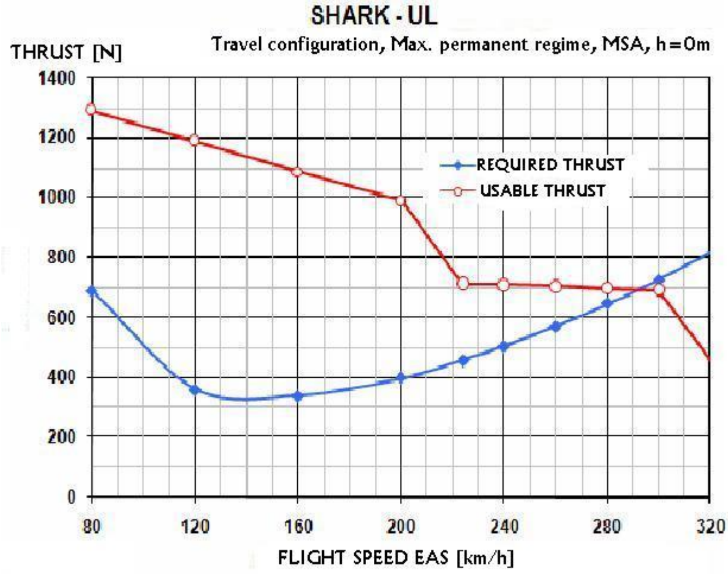
5.6. CRUISE, ENDURANCE, RANGE

SHARK Rotax 912 ULS - 100 HP

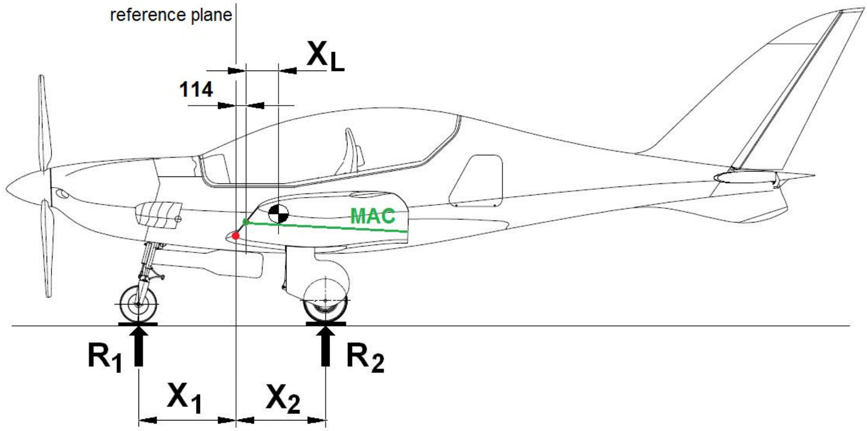
Measured 2010-07-22 Pekár

	Regime	Long range cruise	Economic cruise	Medium cruise	Fast cruise	Max. cruise
			55%	65%	75%	Max. continuous
	RPM	4000	4300	4800	5000	5500
IAS	km/h	198	235	249	267	290
CAS	km/h	200	235	250	270	295
	Mph	124	146	155	168	183
	knots	108	127	135	146	159
Fuel consumption	litres / h	12	16	18	21	25
Endurance	hour	8,3	6,3	5,6	4,8	4,0
Range	km	1660	1470	1390	1280	1180
	miles	1030	910	860	790	730

Graph of required and usable THRUST suggests the best cruise speeds for Shark.



6. AIRPLANE EMPTY WEIGHT AND CENTRE OF GRAVITY DETERMINATION



The airplane is weighted standing on main wheels – all tyres must have the correct size and pressure. The airplane has to be levelled for the purpose of c.g. determination. The reference plane is defined on leading edge of wing, where wing and fuselage connect.
All operating fluids must be filled to the normal volume and also unusable amount of fuel must be in the fuel tanks.

The following values have to be measured:

Front wheel reaction	R_1 =		kg
Main left wheel reaction	R_{2L} =		kg
Main right wheel reaction	R_{2P} =		kg
Distance between front landing gear and reference lane.	X_1 =		mm
Distance between main landing gear and reference line	X_2 =		mm

Empty plane weight M_L is calculated as follows:

$$M_L = R_{2L} + R_{2P} + R_1$$

Permitted range for empty weight: **290 – 325 kg**

Note: different weight limit might apply due to national regulations.

Center of gravity for empty plane calculation:

Centre of gravity position to MAC:

$$X_L = \frac{(R_{2L} + R_{2P}) \cdot X_2 - R_1 \cdot X_1}{M_L} - 114 = \qquad [\text{ mm }]$$

Centre of gravity position XT to MAC in %:

$$X_T = \frac{X_L \times 100\ \%}{b_{MAC}} = \frac{\quad \times 100\ \%}{1\ 237} = \qquad [\ \%\text{MAC}\ ]$$

Permitted centre of gravity range for empty airplane: **15 – 20 %**

Empty plane weight is calculated and recorded in weighing record, which is integral part of plane documentation: „RECORD about the weighing and location of gravity *for UL and LSA airplane Shark“.*

Weighting must be performed and recorded when any change on the airplane configuration is made:

Date	Empty weight M [kg]	Center of gravity		Performed by
		X_L , [mm]	X_T [%]	

6.1. *WEIGHT AND CENTER OF GRAVITY DETERMINATION FOR FLIGHT*

Weight limits are described in section 2 of this manual.

Permitted centre of gravity range for airplane ready to fly (including fuel, crew and baggage) is: **16 - 34%**

When the airplane is occupied according to the following table, the limits can be met for airplane with an empty weight of 290 325 kg and center of gravity between 15 to 20%.

	Front seat max	Rear seat max	Bggage max
solo	**110** kg	**0**	**25** kg
2 + baggage	**110** kg	**69** kg	**10** kg
2 max	**110** kg	**88** kg	**0**

These weights are limited by the rear center of gravity and lower weight of empty airplane, so it is possible to increase these limits for a particular airplane according to the specific weighting data of the individual airplane.

Airplane seriál number:	

Empty plane weight		**kg**
CG of empty plane		**%** BSAT

	Front seat max	Rear seat max	Bggage max
solo	**110** kg	**0**	**25** kg
2 + baggage	**110** kg	**kg**	**10** kg
2 max	**110** kg	**kg**	**0**

Airplane with 150 liter tanks should be operated from the front seat, during the solo flight, if there is more than 100 l of fuel in the tanks.

ATTENTION:
Heavier pilot ALWAYS sits on the front seat!

Note:
The table of CG limits shown on the following pages is based on an analysis of all permitted occupancy of the airplane in both versions = UL and ELSA, including items that can change during the flight.

Emptying a full 100 liter tank shifts the center of gravity 1% forward.
Emptying a full 150 liter tank shifts the center of gravity 1.5% forward.

By retracting of landing gear, the center of gravity shifts between 0.5 - 1% backward, but it does not affect the given limits.

ATTENTION:
If the airplane is fully occupied, the maximum take-off weight and CG limit must be checked and maintained, depending on the weight of the pilot, passenger, fuel and luggage.

If special equipment is installed, the current CG needs to be determined by a separate calculation or by weighing the take-off weight, including crew, fuel and special equipment. It must be within the permitted range of 16 - 34%.

Examples of CG limits (appendix to the table on page 6-3):

Empty weight of airplane **290 - 300 kg**

CG LIMITS for empty airplane **15 - 20 %**

19 -**20%**	Front seat max	Rear seat max	Luggage max
solo	110 kg	0	25 kg
2+baggage	110 kg	69 kg	10 kg
2 max	110 kg	88 kg	0

18 -**19%**	Front seat max	Rear seat max	Luggage max
solo	110 kg	0	25 kg
2+baggage	110 kg	74 kg	10 kg
2 max	110 kg	93 kg	0

17 -**18%**	Front seat max	Rear seat max	Luggage max
solo	110 kg	0	25 kg
2+baggage	110 kg	80 kg	10 kg
2 max	110 kg	95 kg	0

16 -**17%**	Front seat max	Rear seat max	Luggage max
solo	110 kg	0	25 kg
2+baggage	110 kg	85 kg	10 kg
2 max	110 kg	95 kg	0

15-**16%**	Front seat max	Rear seat max	Luggage max
solo	110 kg	0	25 kg
2+baggage	110 kg	90 kg	10 kg
2 max	110 kg	95 kg	0

Empty weight of airplane **300 - 310 kg**

CG LIMITS for empty airplane **15 - 20%**

19 -**20%**	Front seat max	Rear seat max	Luggage max
solo	110 kg	0	25 kg
2+baggage	110 kg	72 kg	10 kg
2 max	110 kg	90 kg	0

18 -**19%**	Front seat max	Rear seat max	Luggage max
solo	110 kg	0	25 kg
2+baggage	110 kg	77 kg	10 kg
2 max	110 kg	95 kg	0

17 -**18%**	Front seat max	Rear seat max	Luggage max
solo	110 kg	0	25 kg
2+baggage	110 kg	83 kg	10 kg
2 max	110 kg	95 kg	0

16 -**17%**	Front seat max	Rear seat max	Luggage max
solo	110 kg	0	25 kg
2+baggage	110 kg	88 kg	10 kg
2 max	110 kg	95 kg	0

15-**16%**	Front seat max	Rear seat max	Luggage max
solo	110 kg	0	25 kg
2+baggage	110 kg	95 kg	10 kg
2 max	110 kg	95 kg	0

Empty weight of airplane **310 - 320 kg**

CG LIMITS for empty airplane **15 - 20%**

19 - **20%**	Front seat max	Rear seat max	Luggage max
solo	110 kg	0	25 kg
2+baggage	110 kg	74 kg	10 kg
2 max	110 kg	93 kg	0

18 -**19%**	Front seat max	Rear seat max	Luggage max
solo	110 kg	0	25 kg
2+baggage	110 kg	80 kg	10 kg
2 max	110 kg	95 kg	0

17 -**18%**	Front seat max	Rear seat max	Luggage max
solo	110 kg	0	25 kg
2+baggage	110 kg	85 kg	10 kg
2 max	110 kg	95 kg	0

16 -**17%**	Front seat max	Rear seat max	Luggage max
solo	110 kg	0	25 kg
2+baggage	110 kg	90 kg	10 kg
2 max	110 kg	95 kg	0

15 -**16%**	Front seat max	Rear seat max	Luggage max
solo	110 kg	0	25 kg
2+baggage	110 kg	95 kg	10 kg
2 max	110 kg	95 kg	0

Empty weight of airplane **320- 325 kg**
CG LIMITS for empty airplane **15 - 20%**

19 -**20%**	Front seat max	Rear seat max	Luggage max
solo	110 kg	0	25 kg
2+baggage	110 kg	78 kg	10 kg
2 max	110 kg	95 kg	0

18 -**19%**	Front seat max	Rear seat max	Luggage max
solo	110 kg	0	25 kg
2+baggage	110 kg	84 kg	10 kg
2 max	110 kg	95 kg	0

17 -**18%**	Front seat max	Rear seat max	Luggage max
solo	110 kg	0	25 kg
2+baggage	110 kg	89 kg	10 kg
2 max	110 kg	95 kg	0

16 -**17%**	Front seat max	Rear seat max	Luggage max
solo	110 kg	0	25 kg
2+baggage	110 kg	94 kg	10 kg
2 max	110 kg	95 kg	0

15 -**16%**	Front seat max	Rear seat max	Luggage max
solo	110 kg	0	25 kg
2+baggage	110 kg	95 kg	10 kg
2 max	110 kg	95 kg	0

7. TECHNICAL DESCRIPTION OF THE AIRPLANE

SHARK is a composite high-performance low-wing airplane with tandem seats and retractable tricycle type undercarriage, designed according to European UL and US Light Sport Airplane criteria.
Airplane is powered by 100HP Rotax 912ULS with variable-pitch composite propeller and 100/150 litres integral fuel tanks in the wings.

EQUIPMENT: Shark is equipped by upholstered two-seat tandem cockpit with adjustable seats, full dual control (with sidesticks on the right) and throttle levers on the left panels.
Elevator trim tab, radio and autopilot OFF button are placed on sidesticks.

Instrument panel: equipped by standard EFIS/EMS displays for both pilots has control panel for landing gears, flaps, propeller, transceiver, transponder and optionally GPS, ELT and backup flight indicators.

The single-piece cockpit canopy: supported by gas struts, opens to starboard.

Baggage compartment: is located behind the rear seat, accessible from the rear pilot seat or through lockable baggage door on the left side of the plane.

7.1. AIRFRAME

Carbon-fibre/epoxy airframe consist of glass and aramid fibres, with PVC foam and aramid honeycomb core in sandwich panels. Self-supporting fuselage with integral fin is made as one piece with integral monocoque interior, armrests and floors. Composite wing with carbon main beam and an auxiliary beam carrying hinges of ailerons and flaps have a 60% of trailing edge used for Fowler flap. Wings and stabilizer are dismountable.

7.1.1. Fuselage

Monocoque fuselage is made of carbon-glass fibre / epoxy composites with integral fin. The inner monocoque fuselage shell complemented by ribs is glued into the middle part of the fuselage. It creates integral ergonomic structure of cabin for two crew members sitting in tandem configuration, with the luggage space behind the rear seat, accessible from inside, or outher left side of the fuselage. Part of central fuselage creates 1,73m long center-wing, used for main undercarriage retracting.

Fuselage airframe includes all necessary hinges of firewall with four engine mounting hinges, BRS and front undercarriage hinges, main undercarriage and cockpit hinges, 2+1 hinges of horizontal stabilizer, 2 hinges of rudder in the rear part, together with bottom fin with tailbump, prepared for optional towing system.

7.1.2. Cockpit canopy

One-piece cockpit canopy consist of carbon fibre frame with glued plexiglas windscreen. Canopy is opened by gas strut and hinged on the right side (starboard) by two hinges. Canopy is locked from inside by point lock system, reachable by both pilots, with separate outside key-lock.

7.1.3. Engine cowlings

Engine cowlings are fixed to the body by CAM-LOC screws. Bottom cowling has large NACA air intake, with adjustable flap, for cooling of water and oil radiator. Adjustable flap is used during low speeds and taxiing. Top cowling has small air intakes for direct cylinder cooling on both sides. Air from engine compartment is exhausted hrough gills placed on the sides. Top cowling has large door for oil check, which serve as air exhaust hole during hot days.

7.1.4. Wing

Shark has trapeze composite wing with speed airfoil and elliptic leading edge in aileron part of wing is optimized for fast cross-country flights.
Wing structure is carbon-fibre/epoxy monocoque, with PVC foam panels. Carbon-fibre main beam placed in 25% of airfoil and an auxiliary beam carrying flap levers and aileron hinges has got 60% of the trailing edge occupied by powerful single-slotted flaps. Integral fuel tanks (2x50/75 litres) are between main and rear beams of both wings, with connected fuel gauge, inputs and return line ending into root rib and drain valves. Fuel tank ventilation ends in the last hinge of flaps. Wing is optionally equipped by integral position lights at the leading edge of wing tips. The wings can be dismounted for transport or storage by removing two main pins and one rear wing pin, by dismounting flaps drive, ailerons control, fuel hoses and electrical connector.

7.1.5. Ailerons

40% differential ailerons with carbon monocoque structure are hinged on three carbon hinges attached on the top of monocoque wing. The drive is on the root rib. Aerodynamic forces are balanced by automatic trim tabs.

7.1.6. Flaps

Fowler flaps with monocoque sandwich design are hinged on three lever-hinges and driven by root-rib lever. System of electric flaps has deflections **20°** (take-off), **30°** (short take off/ landing), and **40°** (landing).

7.1.7. Horizontal stabilizer

Stabilizer has carbon monocoque sandwich design with continual rear beam and auxiliary front beam. Hinges for elevator are attached on the top surface of rear beam. Stabilizer is attached to fuselage by two hinges on the rear fin frame and by one to the rear fuselage bracket.

7.1.8. Elevator

Split carbon nonococque elevator is hinged to stabilizer by 3 hinges. Left part is equipped with electric trim-tab.

7.1.9. Rudder

Carbon monocoque rudder is hinged in two hinges and controlled by lever on root rib, through wires in bowdens.

7.1.10. Airplane exterior surface painting

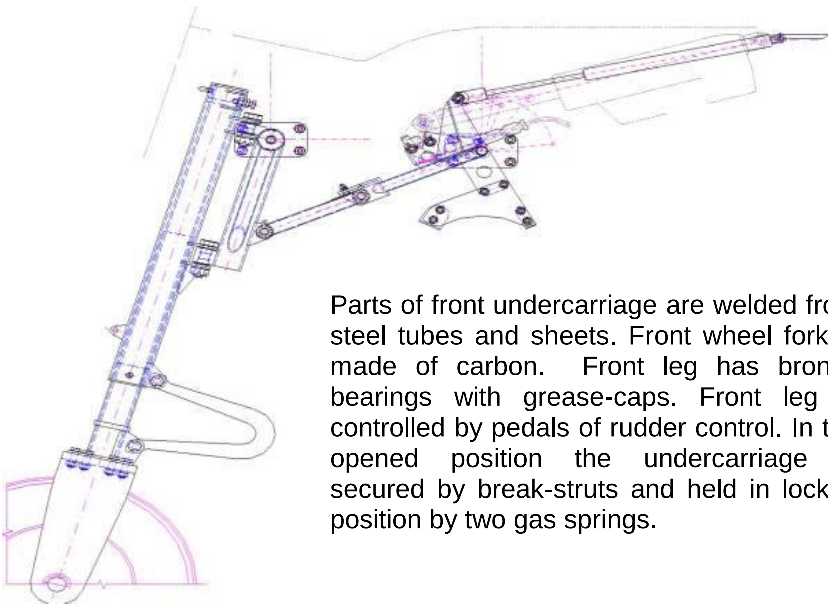
White two-component acrylic polyurethane topcoat is used.

7.2. LANDING GEAR

Retractable tricycle type landing gear is used, equiped by steerable 13x4" nose wheel and 14x4" main wheels **Beringer** with hydraulic disc brakes.

Front undercarriage is retracted backwards into a box behind the firewall. Main undercarriage is retracted to the central wing boxes.

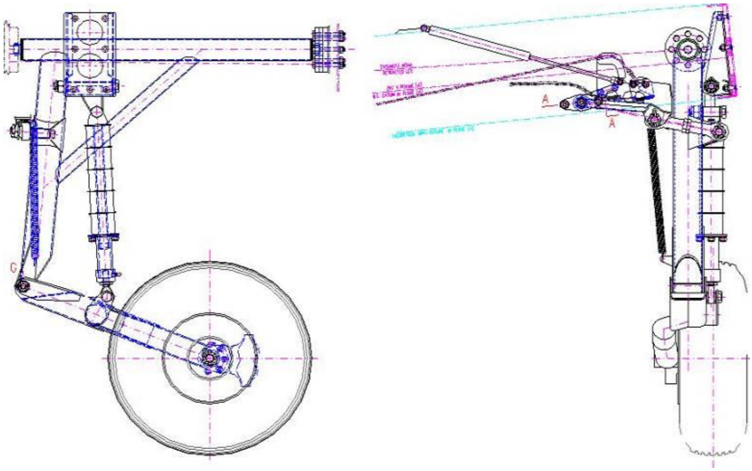
7.2.1. Front undercarriage



Parts of front undercarriage are welded from steel tubes and sheets. Front wheel fork is made of carbon. Front leg has bronze bearings with grease-caps. Front leg is controlled by pedals of rudder control. In the opened position the undercarriage is secured by break-struts and held in locked position by two gas springs.

Front undercarriage damping is provided by V-shaped composite spring.

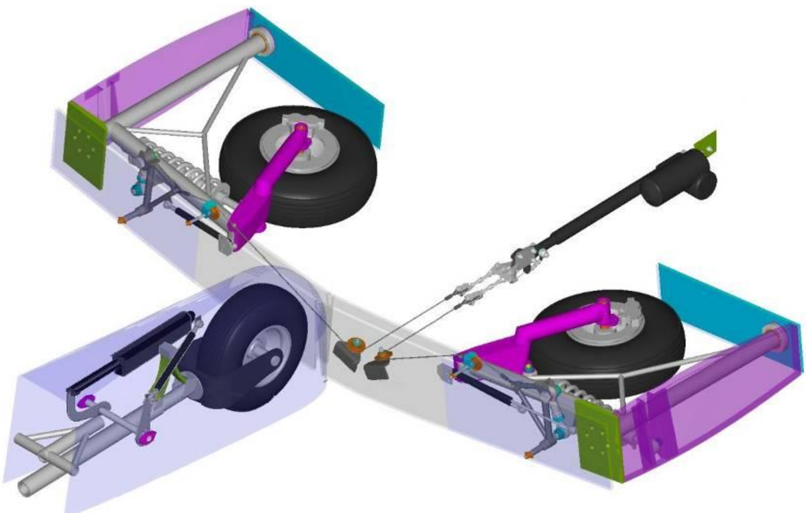
7.2.2. Main undercarriage



Legs of main undercarriage are welded from steel tubes and sheets, the main parts are hardened for better resistance required by 600kg MTOW. Legs are hinged in two brackets with mounted bearings SKF between centre-wing beams. Legs are retracted to fuselage bays.
Main joints are equipped by bronze bearings with grease-caps.

Shock absorbers are assembled from five absorber polyurethane blocks EFFBE, which are hinged between lever and root rib of centre-wing by gimbals.
Legs are secured in extended position by break-struts and held in locked position by two gas struts and steel springs.
Main wheels Beringer with tyres SAVA 14x4 use hydraulic disc brakes Beringer, controlled by toe-brakes on front pedals.

7.2.3. Undercarriage retraction and extension



Front undercarriage is retracted by independent electromechanical strut LINAK LA12.

Extension and retraction of the main undercarriage
- is done by system of ∅2,5 mm steel cables driven by pulleys and connected to electromechanical strut LINAK LA30. Time of retraction is approximately 15 seconds and extension approximately 10 seconds.
Electromechanical strut is placed in the rear cockpit floor, accessible from baggage compartment.

Locking
Undercarriage legs are secured in retracted position by self-locking electromechanical struts, in extended position by gas struts and springs.
Electric strut regulates speed of opening. Strut is stopped by proximity inductive sensors when required position it reached.

Emergency landing gear extension
- is released by mechanical locks controled by bowdens with rods from front seat, independent for every leg.
A pressure switch for landing gear, connected to pitotstatic system, is installed in the electrical circuit. Pressure switch is adjusted to speed 115 km/h. This should prevent unintentional retracting of landing gear while plane is standing on the ground. Control unit does not allow to retract landing gear, until speed 115 km/h is reached. Extension of landing gear is not blocked by any switch and works at any speed. Shortcut connector bypassing this pressure switch is installed on instrument panel for maintenance purposes. In case the speed drops below 115 km/h and any of undercarriage legs stay retracted or unlocked, sound warning signal and flashing of particular LED diode is applied. Opened and locked position of locking struts on all three legs can be checked through small information windows. Visual inspection is always superior to electrical signaling and pilot should use it routinely during undercarriage checkup or in case of any doubts of correct function of electronic system.

Extension, retraction and signalization of gear
Is controlled by the electronic module designed for this purpose, situated behind the instrument panel on the parachute partition together with other electronic modules. Other components of the system are:

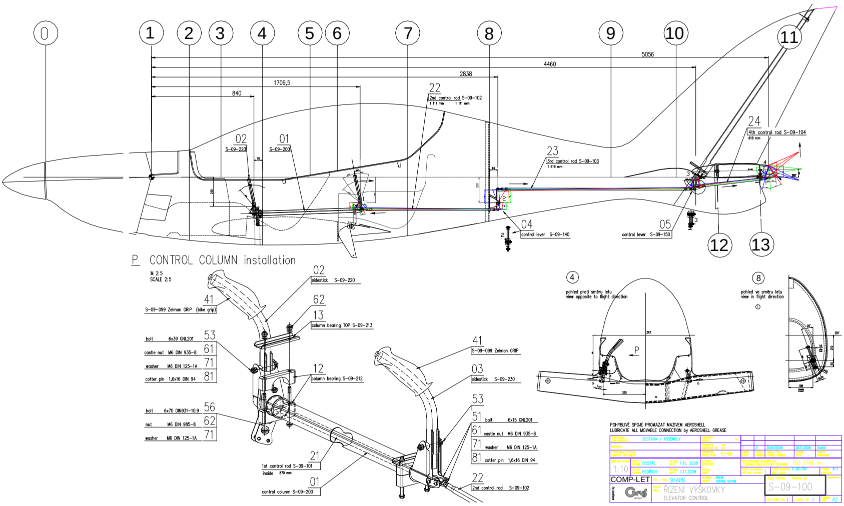
- relay switching voltage to the servo of main landing gear
- control and display panel, on the instrument panel, associated with flaps controll panel
- pressure switch set to 115 km/h, provides signal to control unit
- contactless inductive position sensors, placed in the landing gear bays, provide informations about landing gear.
- second control and display panel can be optionally placed on the rear instrument panel.

7.3. CONTROL SYSTEMS

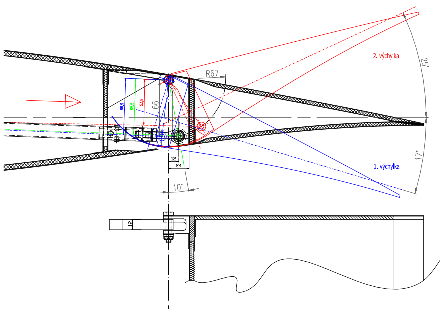
Full dual control, with right-side sidesticks and adjustable front pedals, equipped by toe-brakes.

Flap handle and undercarriage retracting control panel are located on the instrument panel. Throttle and choke levers are placed on the left cockpit panel. Trim control switches are placed on the sidesticks.

7.3.1. Elevator control



Elevator is controlled by sidesticks, hinged in control column through system of rods and levers and connected directly with levers of two-piece elevator.

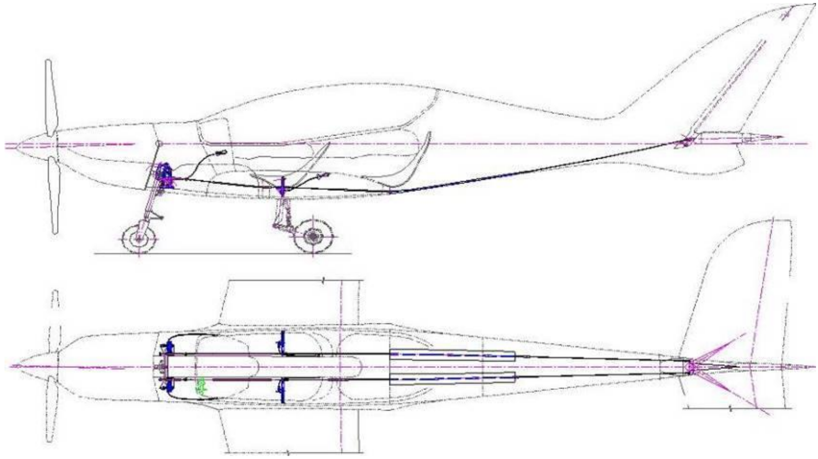


7.3.2. Aileron control

Ailerons are controlled by side movements of sidesticks, hinged in control column, through system of rods and levers, hinged in carbon brackets of wings.

Automatic tabs attached on root parts of ailerons deflect in opposite direction than ailerons. The servo of trim can be optionally installed on one tab.

7.3.3. Rudder control



Rudder is controlled by cables in plastic bowdens and connected at one end with ruddler lever and on the other end with peddals of front undercarriage. This connection allows to control airplane on the ground. System controlling front wheel is automatically disconnection by retraction of undercarriage. The tensioners located in the front and accessible from the cockpit are prestretched to 30 kg.

7.3.4. Flaps

Flaps are controlled by electro-mechanical actuator LINAK LA12 placed under the left armrest of rear seat. The short rod at the root rib controls the flaps through the torsion tube with the lever placed on the first flap hinge. System is controlled by electronic module witch has control and signalisation panel placed together with undercarriage panel on front instrument panel. Optionaly can be same panels placed on rear instrument panel. In the flaps electric circuit is pressure switch installed under the dashboard. It is connected to a pitotstatic system and set to block flaps opening and trigger allarm if the speed exceed 130-135km/h.

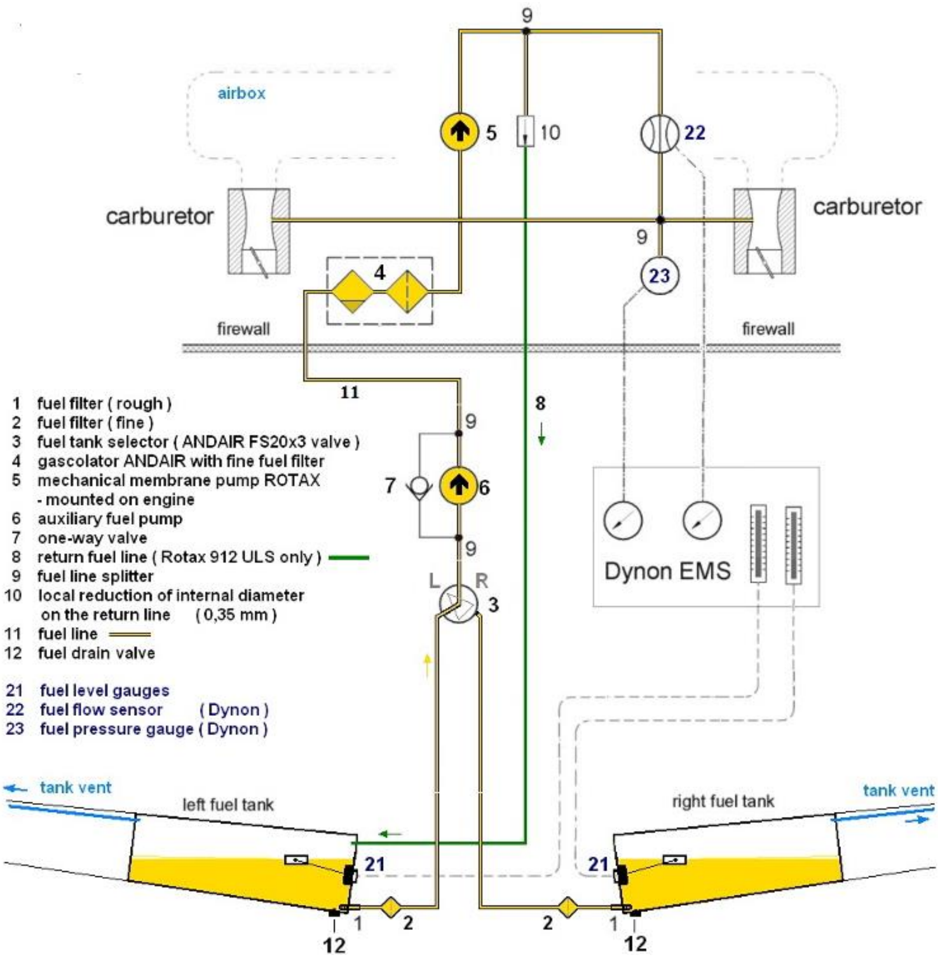
7.3.5. Elevator trim tab control

Carbon trim-tab of elevator is controlled by servo Ray Allen Z2-10A , placed on root part of left elevator. Servo is mounted in front of elevator beam working as a part of elevator weight ballancing.

7.4. ELECTRIC SYSTEM

Scheme of electric system in appendix.

7.5. FUEL SYSTEM



Air vent of fuel tanks through the external fuel tank flap hinges.

Attention:
Clogged fuel tank ventilation, caused for example by placing tape over air-vent hole, results in collaps of wing shells creating the fuel tank. This is caused by suction of fuel pump.

7.6. COCKPIT - INTERIOR AND INSTRUMENTS

Standard instruments, electronic engine monitoring device MiniEIS, EFIS OBLO

EFIS/EMS/GPS DYNON SKYVIEW + backup small EFIS OBLO


FUEL TANK
RIGHT
OFF


EMERGENCY
RELEASE

ARRANGEMENT

- ➔ Access to seats through right-side openable canopy
- ➔ Two composite height adjustable seats with adjustable headrests and pair of four-point safety belts.
- ➔ Dual control with two sidesticks on the right side**,** dual rudder control pedals connected with front wheel. Throttle lever and choke placed on left panel with engine cooling flap lever - usable in hot weather conditions.
- ➔ Main wheels are equiped by hydraulic brakes, controlled by the toe brakes placed on front pedals and parking brake. The front pedals are adjustable, ends of the unlocking cables are on the sides of the interior panel. Central brake lever for rear pilot is optional.
- ➔ Air vents are placed on the sides of instrument panel.
- ➔ Flaps control, undercarriage retracting control and propeller control panel are on left side of instrument panel. If propeller is hydraulic, controlling lever for both pilots is on side of throttle lever.
- ➔ Right side of instrument panel is used for backup instruments, GPS, 12V plug, starter, magnetos and master switches.
- ➔ Middle panel is used for EFIS (Dynon SKYVIEW, FLYMAP, Garmin), circuit breakers / switches.
- ➔ Radio and transponder are placed in the middle, or on side of EFIS screen, transponder is often controlled via EFIS screen.
- ➔ Trim switch, radio button and autopilot off button are placed on top of sidesticks.
- ➔ Fuel valve is placed on the left armrest behind the throttle. Indication of fuel amount is visible on EFIS/EMS display.
- ➔ In front of front sidestick is button controlling ventilation and heating.
- ➔ On middle panel and side panels of front seat there are red handles for emergency release of landing gear.
- ➔ Windows allowing to check properly locked gear struts are situated on the root of wings and on middle panel.
- ➔ Baggage compartment situated behind the rear seat is accessible from inside or from outside through lockable doors.
- ➔ Ballistic rescue system has 2 independent activation **RED grips** installed on the middle panel between pilot legs.
- ➔ Below armrests are small storage compartments.
- ➔ Optionally installed towing system with TOST lock has release handle on left panel. Small camera is installed in towing bracket. It displays rear view on the EFIS screen or on the aditional display.

REAR INSTRUMENT PANEL

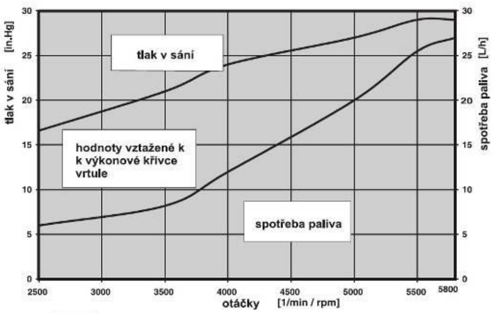
- ➔ Rear instrument panel is part of cabine frame, optionally is equipped with EFIS/EMS screen connected to main device.
- ➔ Instructor configuration has also panel controlling flaps and landing gear. On the central panel are switches for engine start, magnetos, master switch. On the left panel is central brake lever.
- ➔ Optionally the slave radio control panel is installed.

7.7. POWER UNIT

► **ROTAX 912 ULS** 100HP engine with electric starter, stainless steel exhaust with integral heating.

Engine ROTAX® type 912 ULS
uncertified - 100 hp at 2380 RPM

Fully equipped 912 ULS 3 DCDI - composite air distribution, alternator and airbox



obr. 13

DESCRIPTION:

4-cylinder
4-stroke
water / air cooled flat motor

pressure lubrication with a separate 3 liter oil tank

2 CD carburetors

mechanical diaphragm pump

electronic double ignition

electric starter

integrated reducer I = 2.273
(Optionally i = 2.43)

ATTENTION:
This engine does not meet ICAO aviation standards (FAA, CAA). Can be used in experimental and ultra-light airplane (Sport Flying Devices) only.

7.7.1. Technical data

Performances for standard conditions (MSA/ISA).

Engine Model	**912 ULS D.C.D.I.**	
Engine power	**69,0 kW (95,0 hp)**	**at 5500 RPM**
Max. 5 min.:	**73,5 kW (100,0 hp)**	**at 5800 RPM**
Torque	128 Nm	at 5100 RPM
Maximum speed	5800 RPM	
Bore:	84,0 mm	
Stroke:	61 mm	
Cilinder capacity:	1352,0 cm^3	
Compression ratio:	10,5:1	
Ignition:	DUCATI double CDI	
Ignition timing:	4° to 1000 RPM / above 26°	
Sparking plugs:	ROTAX part no. 297 940	
Generator output:	250 W DC	at 5 500 RPM
Voltage:	13,5 V	

OPERATING FILLING:

Fuel:	**Natural 95** or AVGAS 100 LL
Olej:	API SF or SG, 100LL, not synthetic oil
Coolant:	**50% BASF Glysantin-Antikorrosion / 50% water**

WEIGHT- engine

Standard engine with gearbox	**i=2,43**	**56,6 kg** (124,8 lb.)
Oil cooler 886 029		0,5 kg
Radiator 995 697		1,0 kg
Slip clutch		1,0 kg
Fuel pump incl. pipes		0,2 kg
Vacuum pump		0,8 kg
External alternator 40 A/ 12 V DC		3,0 kg
Rectifier		0,1 kg

7.8. PROPELLER

Shark can be equipped by different propellers:

DUC SWIRL	- 3 blade, on the ground adjustable
Woodcomp SR 3000 2WN	**-** 2 blade, in flight electrically adjustable
Woodcomp KW20W	- 2 blade, in flight hydraulically adjustable
Neuform TXR2-V-70	- 2 blade, in flight electrically adjustable

7.8.1. DUC SWIRL 3 blade, on the ground adjustable propeller, diameter 1680 mm

Weight of this 3 blade propeller is 4,5 kg. It has carbon core, same as DUC FC WINDSPOON propeller, resistant to heavy loads.

This propeller is simple, lightweight, robust, with a stainless steel leading edge. It achieves high cruising speeds, but it is less efficient during take-off. It is therefore not suitable for short grassland airports.
Sheet settings are more laborious. Recommended angle is 24º.

7.8.2. Woodcomp SR 3000 2W two blade in flight electrically adjustable propeller

Specification:

SR 3000/2 – electically in flight adjustable propeller with two wood-composite blades, designed for Rotax 912 UL, Rotax 912 ULS and Rotax 914. Diameter is 1600 or 1700 mm.

Blades angle is controlled electrically by servo mechanism and can be adjusted from minimum to maximum angle within approximately 8 second.

Constant Speed unit:

Control unit placed on instrument panel provides manual control of propeller constant speed mode.

PROPELLER BLADE DESIGN

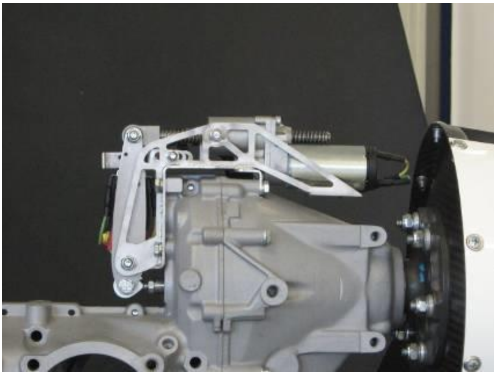
Propeller blade has wooden core, wrapped by several layers of carbon. Leading edge is made of durable plastic material providing mechanical protection.

7.8.3. Woodcomp KW 20W - two blade hydraulically in flight adjustable

KW 20W has wood-composite blades, designed for Rotax 912 UL, Rotax 912 ULS and Rotax 914. Diameter is 1,7m. Propeller has identical blades and same performance as electrically adjustable SR 3000 2W.
Blades adjustment is controlled by hydrulic regulator using oil from engine lubrication system. Oil goes through hollow shaft in gearbox to the piston inside propeller hub. Regulator is controlled by lever placed on side of throttle.

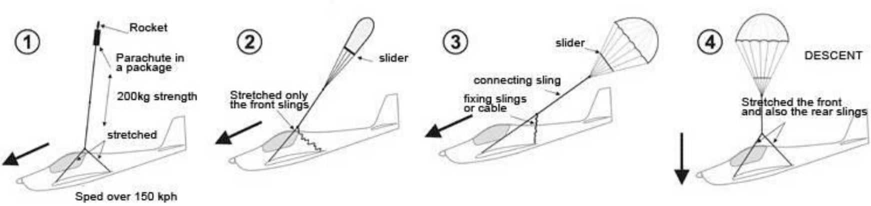
7.8.4. Neuform TXR2-V-70

Neuform TXR2-V-70 is electrically or hydraulically in flight adjustable propeller with two composite blades. The blades are made of glass-fiber and are hollow. Root of blade is duralumin. Outside part of blade leading edge is casted of plastic material with improved resistance to abrasion. Servo controling the angle of the blades is located on the engine gearbox.
Mechanical stops and micro switches of maximum and minimum angle of attack are situated on the servo brackets.
The minimum angle of attack is set as mechanical stop by spacer rings during propeller assembly.
Blade setup provides control unit FLYBOX.



7.9. RESCUE SYSTEM

Shark is standardly equipped with ballistic rescue system **Stratos/Junkers Magnum 501** with 2 independent release handles.



7.9.1. Description of rescue system Stratos/Junkers Magnum 501

Parachute canopy is pulled out by a specially designed rocket engine. The time required to launch is between 0.6 - 1.2 seconds, depends on the type of system and air temperature.
The rocket engine is placed in the rocket case. After the activation by activation handle the movement is mechanically transported by a bowden cable on a percussive device. It activates two percussion caps which ignit the rocket box. After ignition, the rocket escapes under high pressure from the rocket box, towing the rope which releases the cap of the parachute container, and the parachute is pulled out of the container. Then the bag of parachute is discarded and parachute canopy is filled with air.

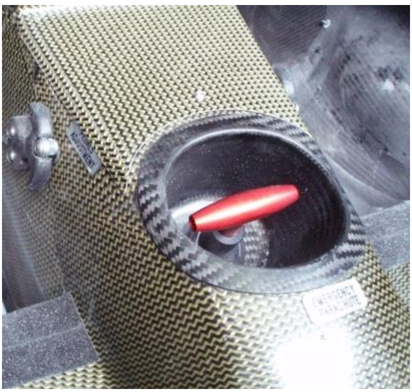
Technical data:

Weight	9,65 kg	21,3 lbs
Dimensions	360x245x200mm	14,2x9,7x7,9in
Rocket engine	Magnum 450	
Area of parachute canopy	86 m^2	926 sqft
The number of ropes	32	
Max. payload	475 kg	1050 lbs
Max. speed	300 km/h	187 mph
Repacking interval	6 years	
Burning time	0,6 sec.	
Total impulse at 20ºC	0,303 kNs	
Mechanical double ignition		

Minimum recommended flight level for system activation is 200 m. But there are known cases of successful application in less than 80 m. It also depends on the horizontal and vertical component of velocity. System lifetime is 18 years, if the revision and repackaging is performed every 6 years.

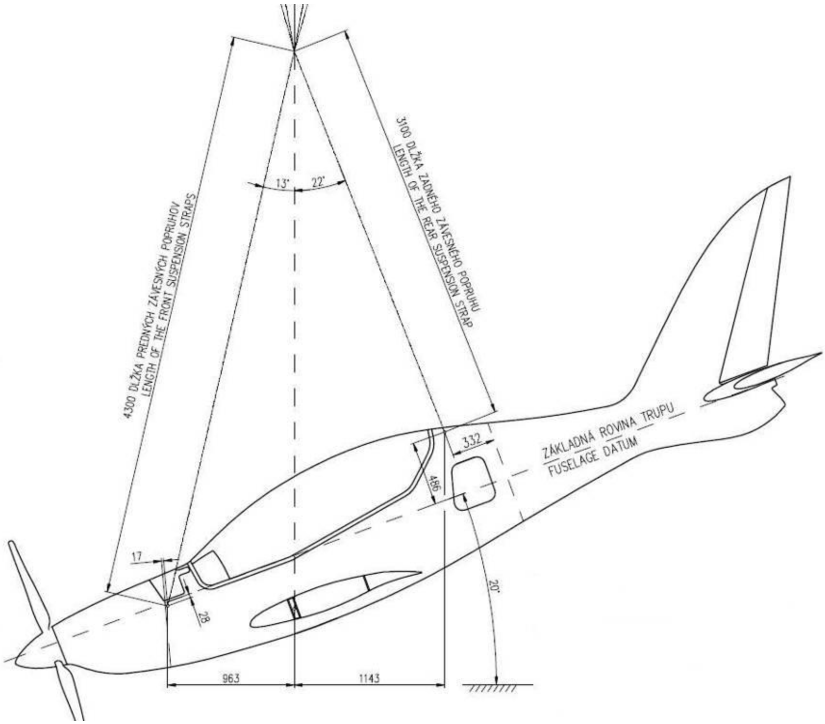
7.9.2. The activation mechanism

Activation mechanism is made of cable with teflon coating and metal bowden. Activation handle has double safety mechanism to prevent accidental launch and lock mechanism for storage and transport.
The mechanism is designed to have minimal activation forces under all circumstances. This minimal resistance remains throughout the life of the system.




7.9.3. Rescue system installation

Rescue system is installed between firewall and canopy/instrument panel. Two front rescue system belts are hinged on the top of engine mounting hinges and are folded inside of rescue system box. Third belt is going under left cockpit frame to rear hinge, mounted on the top of baggage space frame. If the system is activated, the parachute cover is broken in defined places and the rear strip is ripped off the surface of the fuselage under the left edge of the cab frame.



7.10. TOWING SYSTEM

Not installed.

7.11. POSITION LIGHTS

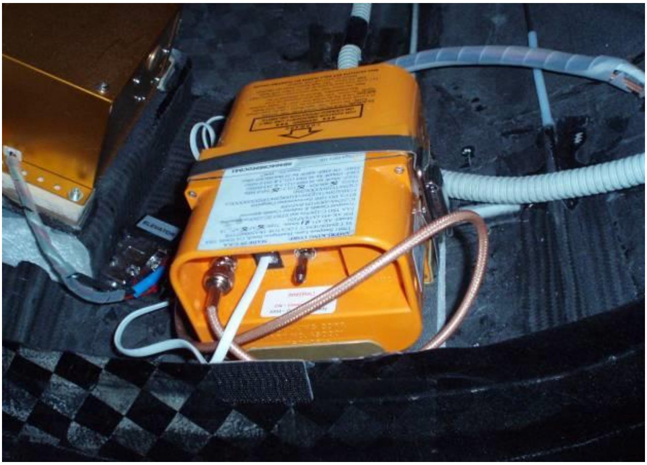
Airplane can be optionally equipped by position and strobe lights. Lights are made of transparent material with integrated LED lights.
Position lights (red, green and white LEDs) operate constantly. Lights are designed according to the regulations with defined angles and colours. Strobe lights blink. Left wing tip has red position light plus white strobe, right wing tip has green position light plus white strobe, on top of fin is white strobe, rudder has white position light plus white strobe.
Strobe flashes are synchronized, three in a row and then break.

7.12. LANDING LIGHT

Landing LEDs light can be optionally installed in NACA inlet.

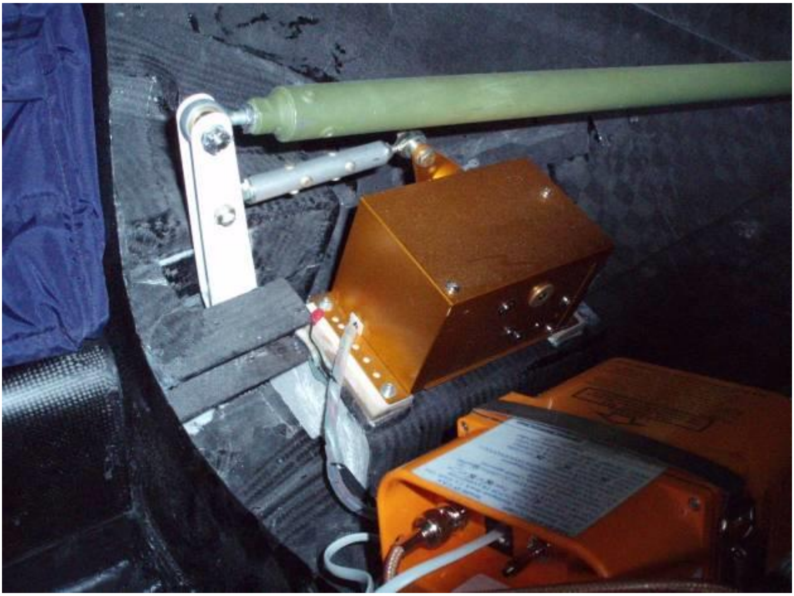
7.13. ELT UNIT

ELT unit is installed as **option**. The unit is attached on the bracket, behind the rear baggage frame. It is accessible through the cover of rear baggage frame. In cover is small window for easy ELT check. Antenna is placed on upper rear part of baggage frame and extended above the fuselage surface. Control panel of ELT is placed on instrument panel.



7.14. AUTOPILOT

Airplane can be optionally equipped with an autopilot, mostly dual-axis. Control system is integrated in EFIS system - Dynon SkyView, FLYMAP, Garmin, or Oblo. Elevator servo is located behind baggage compartment rib. Aileron servo is located on right side in front of spar channel of fuselage.
System is activated via separate ETA switch/fuse. The system is controlled and programmed through the EFIS display. Flight course can be inserted or planned route can be followed according to GPS coordinates. Autopilot deactivation buttons are located on both control levers.



Servo of elevator

8. AIRPLANE HANDLING, CARE AND MAINTENANCE

8.1 WING DISMOUNTING

Wing dismounting is an option for hangaring in a limited space or for transport.

Wing disassemble

The **disassembly procedure** consists of:

- Flaps on – position III (free access to pins on rear wing beam)
- Remove flaps
- Remove sealing tape from fuselage - root ribs gap
- Disconnect aileron controls below seat and flaps drive – left and right
- Unlock and dismount rear wing beam hinge pin
- Unlock and dismount two main wing spar pins
- Disconnect fuel hoses
- Disconnect electric socket from fuel sensors
- Disconnect pitotstatic hoses
- Remove wing spar brackets from fuselage spar channel
- Secure wings by using of hangar/transport jigs.

8.1.1. Remove flaps

Before wings disassembly there is needed to remove flaps : Remove 3 bolts from flap hinges and one from control tube end in flap root rib.

8.1.2. Disconnect aileron controls

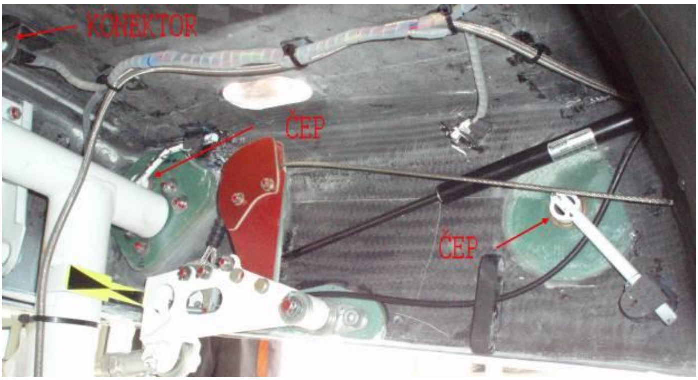
Disconnect aileron control rods below seats on left and right side.

8.1.3. Disconnect rear wing spar pin

Unlock and dismount pins of rear wing SPAR. *(accessible after flaps on)*

8.1.4. Disassemble the main wing spar pins

Unlock and dismount both pins of main wing beam hinges
(accessible from main undercarriage space)



8.1.5. Disconnect fuel hoses and fuel sensors sockets

8.1.6. Remove wing spars out of center-wing

With disconnected aileron and flaps control rods and free wing hinges, wing can be dismounted from centre wing box by pulling them out in the direction out of the airplane axis.

8.1.7. Disconnect pitostatic system hoses

Disconnect pitostatic hoses before completely removing wing spar from spar channel of centre wing.

8.1.8. Secure wings by hangaring (transport) jigs

Repeat the same procedure for second wing.

8.2. STABILIZER DISASSEMBLY

Similar to wing it is possible to remove stabilizer as well:

- Remove tape sealing gaps
- Disconnect pushrods from elevator
- Remove safety pin from rear bolt and remove castle nut
- Disconnect connector from elevator trim servo
- Move rudder on side
- Pull stabilizer backward from pins and bearings

8.3. PARKING AND MOORING

8.3.1. General

Always secure the airplane when parked. It is recommended to moor airplane in bad weather conditions or when it is left unattended (overnight etc.)

Ground equipment: - cover of the pitot tube
- securing set for mooring
- fabric covers of canopy, wings or aircraft

8.3.2. Cover of pitot tube

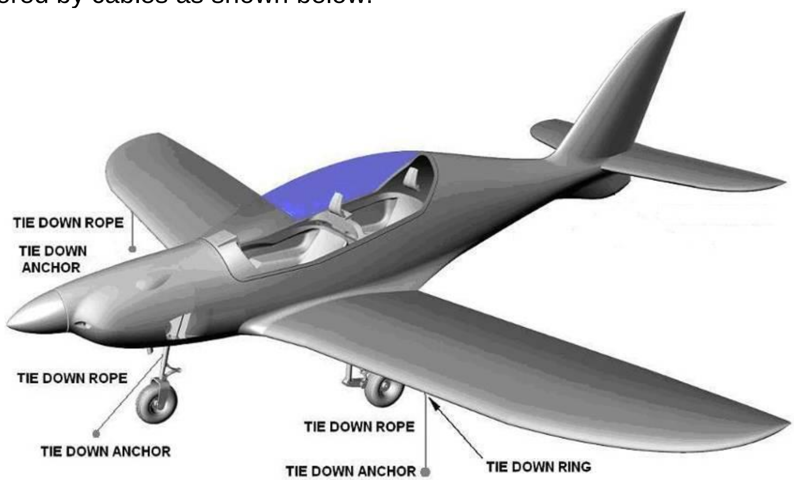
Use cover of pitot tube while parking, as system protection against blowing air. Cover is provided with a red flag.

8.3.3. Mooring

The airplane mooring set consists of the following:

- 3 mooring bolts
- 2 long and 1 short mooring cables
- 2 wing bolts with M8 eye

Mooring bolts should be screwed to the ground and the airplane should be moored by cables as shown below:



8.4. HANGARING, GROUND HANDLING

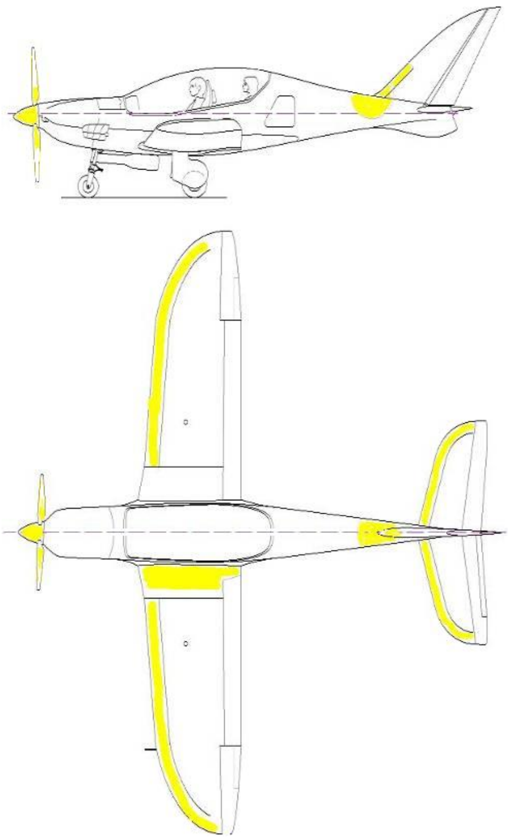
Moving the airplane during hangaring, parking, etc. is recommended with empty airplane.
Steering rod connected to front wheel axle is allowed.
The following list and sketch show surfaces reinforced by extra layers of carbon, to prevent surface dimples caused by ground handling.

Reinforced surfaces:

- Fuselage-fin connection, circle with radius 350 mm, where fuselage can be pushed down to lift the front wheel
- Leading edge of fin up to 500 mm height, 100 mm wide on each side.
- Top part of the wing leading edge, 200 mm wide area
- Top part of the stabilizer leading edge, 150 mm wide area
- Area around fuel caps
- Stepping surface on left wing root - fuselage part
- Whole upper surface of the wing is reinforced, but maximum load is still limited
- Spinner is reinforced
- Root part of propeller blades can be used for towing, dont use the tip parts !

CAUTION – airplane surface is created by thinnest allowed layer of carbon fabric, to keep the lowest possible weight. Under the carbon fibre layer is layer of PVC foam with relatively low firmness and stiffness. Common hand pressure can result in surface damage and complicated repair. Gentle ground handling is therefore highly recommended.

CAUTION – airframe has integrated lifting points for landing gear maintenance. Metal brackets with nuts are bolted on front wall of fuselage main spar.
If the plane is lifted by pulling the wings, it is necessary to follow basic rules. Supported area should be wide enough and below wing spar, close to checking window of aileron crank. Otherwise wing bottom shell can be broken or damaged.



Sketch of reinforced surfaces for ground handling

8.5. TOWING

Towing of the airplane by car is not allowed.

8.6. TIRE PRESSURE

Nose landing gear	**13x4**	**3,5 bar**	**51 psi**
Main landing gear	**14x4**	**3 bar +/- 0,3**	**44 psi**

9. SUPPLEMENTS

- List of equipment
- Weighing protocol
- Protocol of control surfaces deflections
- Nivelation protocol
- Protocol of first test flight

MANUALS - according to airplane equipment:

- Engine manual
- Propeller manual
- EFIS / EMS manual
- Rescue system manual
- Manual ELT
- Manual OBLO, backup EFIS
- Manual VHF radio
- Manual transponder

DASHBOARD DEFINITION airplane no.

FLIGHT INSTRUMENTS:

	INSTRUMENT	TYPE	PROD. NUMBER
1			
2			
3			
4			
5			
GPS			

COMMUNICATION:

	INSTRUMENT	TYPE	PROD. NUMBER
11			
12			
13			
14			
15			

ENGINE INSTRUMENTS

	INSTRUMENT	TYPE	PROD. NUMBER
21			
22			
23			
24			

SPECIAL EQUIPMENT:

31			
32			
33			
34			

Rescue system installation:

Type:		

Producer: Date of installation:

ELECTRIC SYSTEM