

# Vortex

## SERVICES

Design & Construction in Composites  
Hovercraft Manufacture  
Mould and pattern work  
Bespoke engineering services

### Vortex Mistral

This 4 / 5 seat all purpose craft is the replacement for the successful Vortex 3 & 4 range. The engines from Toyota Engine Developments are specifically tailored to our hovercraft needs. This craft is manufactured using the same high tech composite construction used in our UK, European and World Championship winning race craft, and the same attention to detail during construction as our racing craft.



(Mistral under going trials)

Reasons to consider buying the new Vortex Mistral:-

- Choice of engine output 80hp as standard, 120hp can be an option if needed for very adverse conditions
- High quality composite construction, light but extremely strong and durable
- 400kg payload (425kg depending on final specification), much more than other craft in its class, (this is due to our use of light weight composites) More than enough capacity for 4 adults or 5 medium sized passengers. The craft is equipped with 5 padded fold up seats
- High pressure loop / segment skirt, giving the stability of a high pressure loop skirt with the obstacle clearance and low drag of a segmented skirt.

- 35lt fuel tank, enough for 3 hours of very hard driving or 4+ hours on a leisurely cruise. Larger capacity fuel tank option available.
- Fly by wire variable lift system **fitted as standard**
- Fly by wire elevators for precise trim control **fitted as standard**
- Full instrumentation inc, tachometer, battery condition, fuel gauge, water temperature, oil pressure warning and, so you know when to service the craft, an hour meter is fitted
- Waterproof 12v power sockets are provided at the front and rear of the craft
- Heavy duty battery, so that accessories can be run without the need to have the engine running. Dual battery option available.
- Full safety equipment including operational lanyard and fire extinguisher
- Having a variable lift system does mean that cruising at 20mph with 4 people in the craft is easily achieved with the engine just doing 4000rpm. Open the throttle and take the engine to its maximum of 6800rpm will see you travelling at over 50 mph ..... without brakes!!
- All craft are supplied with a limited warranty

Manufactured to customer' chosen colour and specification

<b>Number of crew</b>	1 (pilot)
<b>Number of passengers</b>	3/4 (depending on size / weight)
<b>Hull Details</b>	
Length	4.8m
Width for trailing / loading	2.15m
Height (off hover)	1.7m
Weight (depends on final spec)	Approx 300-325kg
Length (on hover)	5.3m
Width (on hover)	2.45m
Height (on hover)	2.00m
Max Design Payload (depends on final spec)	400-425kg

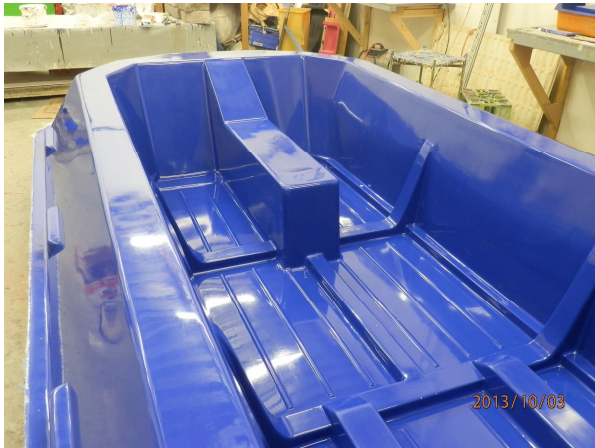
<b>Buoyancy</b>	
Polystyrene and polyurethane	1.3 m <sup>3</sup> (1200kg)
<b>Integrated System</b>	
Fan dia	1100mm
Toyota 3 cylinder 1000cc petrol	80hp@6800rpm
or	
Toyota 3 cylinder 1000cc petrol	120hp@6600rpm
Hascon BS series (5Z)	8 / 12 @ 45deg
Other engine options could be available	
<b>Control Surfaces</b>	
Rudders	2
Trim control	5
<b>Skirt</b>	
Loop	650gr/ m <sup>2</sup>
Fingers / segments	275gr/ m <sup>2</sup>
<b>Nominal cruising speed</b>	70kph
<b>Maximum operating speed</b>	> 90kph
<b>Standard equipment</b>	
Safety Lanyard	
Navigation beacon	
Engine temperature gauge	
Engine tachometer	

Oil warning light	
Battery Meter	
Hour Meters	
Mooring ropes	
Fuel Tank	35lt
Operation time under normal cruising conditions	4+ hours
12v power outlets (front and rear)	

**Detailed specification:-**

**Hull construction**

- Full composite construction, most areas are made up of a 3 layer system, 300grm CSM (chopped strand matt), 265grm Diolen (hybrid woven cloth) 300grm CSM. Polyester resin is used making repairs in the field easy.
- Addition layers of Kevlar (255grm) are sandwiched to provide additional support in high stress areas, ie engine mounting points and load mount fixings
- Foam cores also increase panel stiffness in non stress areas.
- Underneath, the floor has an additional layer of 12mm end grain balsa wood (as used in power boat construction) this produces a very hard wearing, puncture resistant floor surface
- 6 off HDPE (high density polyethylene) landing pads are bolted to the floor, these are sacrificial items and are easily replaced at major service intervals. These landing pads enable the craft to operate on strong abrasion surfaces such as airport runways.
- Unlike many other hovercraft, any part of our craft can be walked on, even the rear duct. The only part that is not a stress item is the windscreen!!
- The inside floor of the craft has built in load stress integral mouldings, meaning that heavy items like pumps and engines are directly mounted to these mouldings and not just attached to the floor of the craft.



### **Engine and Transmission.**

- The power unit is an 80hp Toyota engine. This K1 series engine 1000cc, 3 cylinder unit is supplied to our specification by Toyota Engine Developments. This includes an ECU system programmed to match our fan installation.
- The engine is rubber mounted on a composite and aluminium engine cradle
- The fan is produced by Hascon in Italy, we are their UK distributors for their products.
- The power transmission coupling system is provided by Centa Transmissions of Germany
- Drive reduction system is designed by Vortex Services and produced by Megadyne of Italy
- The fan frame is fabricated from mild steel, heat treated welded tube, not stainless steel. As a company we have found that a welded stainless frame does not stand up to the loads that the frame is subjected to over a long period of use; age hardened stress cracks form in welded steel structures.
- The fan frame is plated and powder coated to resist corrosion for long life.
- The fan guard is also plated and powder coated.



## Controls and Instrumentation

- The main controls are focused around the handle bar steering system.
- The engine throttle is a handle bar mounted lever; we have found that a lever gives much better ease of use, especially when hands are wet etc.
- Hovercraft trim control is provided by 2 sealed push button on the left of the handle bars.
- The variable lift control is operated by a 5 position rotary control knob.
- All instrumentation and other controls are grouped around the driving position.



## Seating and Operation

- The Mistral is designed for single crew operation, the trim and balance is such that with the pilot sitting in the driving position the craft is in perfect balance.
- The triple seat across the centre of the craft is placed at the C of G and so the addition of 1, 2 or 3 passengers in this seating position have no impact on the trim of the craft.
- When you have an addition crew member / passenger sitting behind the pilot on the tandem seat, their weight will affect the trim slightly but this is easily balanced out using the fly by wire trim control.



## Skirt system

- The skirt system that we use on this craft is of the industry standard loop and segment skirt.
- This type of skirt uses a loop (or bag) that is fitted to the top of the hull and to the underneath lower edge of the planing surface.
- To this loop is attached individual skirt segments (sometimes called fingers). There are 80+ of these small segments, and it is the lower tip of these that supports the craft when on lift.
- These segments are bolted to the loop using 3 nylon bolts, and are fastened to the lower part of the loop using plastic cable ties.



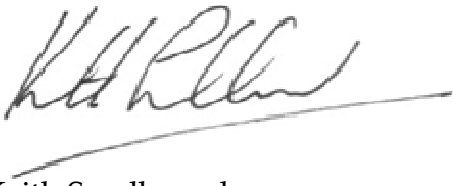
- The skirt system is so efficient that the craft will continue to operate even with 5% of these segments missing.
- On craft that use full depth segments ie no loop, the loss of even one segment reduces the ability of the craft to operate safely.
- The loop is made from a very heavy duty 650grm PVC coated nylon, a similar material that is found on inflatable rib boats.
- The segments are made from a high quality 6oz nylon base cloth coated with 2oz of Hyperlon. This material is made especially for us.

## Service and maintenance

- The craft is designed to enable easy servicing and maintenance by personnel that have no previous experience of hovercraft.
- The engine being a standard small car engine is very cost effective to maintain
- The drive and transmission uses standard bearings and belts that are readily available almost anywhere in the world.

- Whilst Vortex Services maintain a stock of replacement skirt segments these could easily be made locally with material supplied by Vortex.
- The only specialised components are the fan and pulley assemblies which have been designed for long life and these are always available off the shelf from Vortex.





Keith Smallwood

Vortex Services (Hovercraft) Ltd

**Please note:-**

The above specification is based on good, engineering and design practice. The design philosophy is based on more than 40 years designing hovercraft of all types, there are design restraints involved with hovercraft design, the key points are detailed below.

*The foot print area of a hovercraft defines its load carrying capabilities, this 'load' not only refers to what it can carry but also the craft's structural weight (all up weight). Lift fan systems used on small and medium hovercraft (< 10m long) are limited to producing pressure equivalent to 22lbs sq foot, so a craft of 18' \* 8' would only be able to lift a craft weighing 1.29tons all up weight. The Vortex Mistral has a theoretical maximum weight limit of 1.05tons. However running fans producing 22lbs of force is not efficient or reliable so at Vortex we limit our design figures to 15lb so giving a much truer all up weight of 750kg. Hull weight is around 325kg leaving 425kg of load.*

*It is also worth noting that for stability in operation the width to length ratio should be 0.5 / 0.6 to 1.*