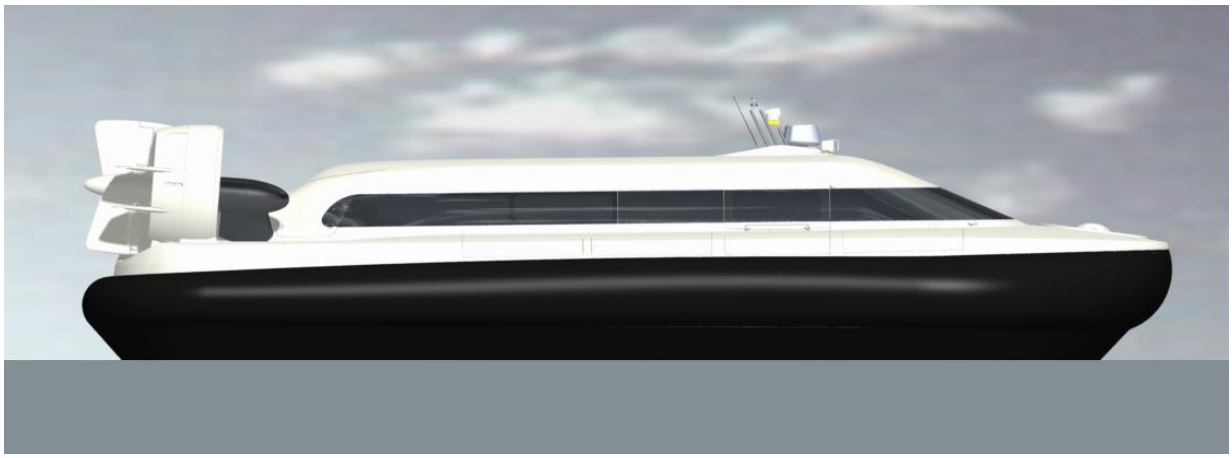

General Description

The Pioneer Mk3.2 hovercraft is an amphibious hovercraft designed to carry up to 33 passengers or 3.2 tonnes payload + 1 crew. The air-conditioned cabin provides comfortable seating and good visibility for the passengers and crew. The Pioneer Mk3 is powered by a Walter M601-B Gas Turbine and will cruise comfortably at 30 to 35 knots with higher speed on demand.

The Pioneer Mk3.2 is based upon the Pioneer Mk3 with the addition of a gas turbine engine and with increased hull length and width providing considerable increases of payload and performance over the standard version Pioneer Mk3 diesel powered version.

Construction is in accordance with Australian NSCV Rules, British Hovercraft Safety Requirements (BHSR), Transport Canada Hovercraft Requirements (TP5579), Lloyds SSC rules, Korean Register of Shipping, IMO HSC Code and other class requirements.

Technical Details Table

Dimensions	When Hovering	Hull Survey Measure	For Transporting
Length	13,750mm	13,100 mm	13,100 mm
Width	6,300 mm	5,100 mm	5,100 mm
Height	2,910 mm	910 mm (bottom to skirt top)	3,600 mm
Cockpit length		7,700 mm	
Cockpit width		3,100 mm (inside @ bottom of windows)	
Cabin Internal Height (centre)		2,000 mm (floor to ceiling on craft centre-line)	
Cushion height		670 mm	
Isolated obstacle clearance		580mm	
Wave height clearance		1.5 meters @ a pitch of 18m or greater	
Maximum recommend speed (for safety)		100 km/hr (54 kts) on smooth ice 70 km/hr (37 kts) on smooth water 30 km/hr (15 kts) on land	
Economical cruising speed		55 to 65 km/hr (30 to 35 kts) on smooth water	
Max wind speed (heavy)		37 km/hr gusting to 46 km/hr (20 kts gusting to 25 kts)	
Max wind speed (light)		46km/hr gusting to 55 km/hr (25 kts gusting to 30 kts)	

Cabin	The cabin incorporates laminated glass windscreen and side windows. The cabin doors are top hinged.
Climate Control	Two air-conditioners of approximately 50,000 BTU/h plus heaters to provide ample cooling or heating in ambient temperatures from minus 10°C to plus 40°C.
Seating (According to Survey)	Total = 1-2 crew plus 32-37 passengers. Individual forward facing seats for each passenger.
Minimum Operating Weight	4,750 kg as equipped for passenger transit with safety equipment.
Payload (Normal) (for a water-start)	4,200 kg (includes full fuel, normal ballast, safety equipment and passengers).
Overload Payload	Up to 5,000 kg (reduced performance).
Engine	Walter M601-B Gas Turbine 558kW max, 489kW continuous @ sea level.
Fuel capacity	60 litres in the central run tank plus 2 x 800 litres (max) in the ballast tanks (normal is 860 litres but max of 1660 litres can be carried). All fuel including ballast fuel is useable.
Fuel Burn Rate	284 l/hr @ max short time (558kW) 246 l/hr @ max continuous (489kW) 136 l/hr @ cruise of 35 knots in good conditions (260kW)
Endurance	For 95% use of fuel load @ cruise speed of 35 knots with full load and in good conditions. Endurance is approx. 6 hours on normal fuel load and 11.5 hours if using ballast fuel load.
Hull construction	Infusion moulded using Vinyl-ester resin, non-woven E-glass fabrics and Corecell® foam core. Under-hull Urethane landing pads for abrasion protection.
Skirt type	Pressurised bag tapered from front to back with larger sections at the front for improved wave clearance. All fingers are separate and detachable.
Thrust system	2 x pitch controllable (and reversing) propellers of 1400mm diameter x 5 blades. Blades made from Carbon fibre and Epoxy resin. Hubs CNC machined from high tensile aluminium.
Thrust transmission	Industrial rated components of toothed belts, shafts and self-aligning bearings.
Lift System	Co-axial fans direct coupled to hydraulic motors.
Lift Transmission	Hydrostatic transmission. The lift fan speed is automatically controlled to a constant pre-set speed.
Steering	By 4 - power assisted rudders fitted behind thrust ducts. Assistance at low speed by changing the propeller pitch to give differential or reverse thrust from the propellers.
Pitch control	Dynamic control by 8 - power assisted elevators fitted behind thrust ducts assisted by static weight shift by transferring fuel between the front and rear ballast tanks.
Roll control	By differential action of the elevators.
Controls Interface	• Engine speed: - 1 lever to left of driver. • Propeller pitch: - 2 levers to the left of the driver. • Pitch & Roll: - A 2-axis joystick to the right of the driver. • Steering is controlled by a helm wheel.
Electrical System	Nominal 24-volt system. Battery charging by 1 x 28-volt, 150-amp alternator. There are two banks of batteries for starting and one additional radio battery.

	All circuits wired and protected in compliance with codes utilizing a CANBus networked power control and monitoring system fully compliant with NMEA 2000® and J1939 protocols enabling integrated craft monitoring and navigation.
Pumping	Two double acting manual bilge pumps with manifold to each compartment, strum boxes and non-return valves. One electric pump 7570 l/h (2000 gph) in the Cabin Port Side. One electric pump 7570 l/h (2000 gph) in the Rear Space. One electric pump 7570 l/h (2000 gph) in the Port Locker. One electric pump 7570 l/h (2000 gph) in the Stb'd Locker. One electric pump 1893 l/h (500 gph) in the Port Stairwell. One electric pump 1893 l/h (500 gph) in the Stb'd Stairwell.
Fire Protection	Engine room lined with refractory fibre fire barrier faced with aluminised foil. 30 minute fire rating with low temperature rise to the bulkheads and a facing surface which is attractive and easily cleaned.
Fire Fighting	Fixed HFC-227ea type fire extinguisher to the engine room with temperature sensor and monitoring at the dashboard. Control of extinguisher and engine room vents is from inside the cabin space.
Navigation & Communications Options (Standard)	Standard equipment includes… • Magnetic Compass, 70 mm • VHF transceiver and matching antenna (NMEA2000 compliant) • SIMRAD GPS with co-ordinate display to radio and navigation system. • SIMRAD Digital Radar. • SIMRAD Chart Plotter (Including World maps) • Man Overboard System distress signal broadcasting position. • AIRMAR PB200 weather station.
Other Electronic Equipment (Available at extra cost)	Optionally Fitted and fully Integrated optionally available extra electronic equipment includes… • FLIR night vision camera with integrated display. • Separate display for FLIR camera. • Rear View Camera • Cabin security camera. • Security system with or without mobile phone link.

Technical Details, Descriptions

Classification

Classification may be carried out according to Australian NSCV, "Class 1D or class 1C". The build construction does not change but a charge will be made if the Class Certificate is required. Advice prior to construction starting is necessary to complete the certification process properly due to hull construction inspection requirement of the attending surveyors.

Hull and Superstructure

The hull is infusion moulded from Vinyl ester resin and non-woven E-glass fibreglass reinforcements and Corecell® cores for increased panel stiffness. This method of construction is lightweight while retaining excellent strength and stiffness. Thermal and sound isolation properties are excellent for this construction system. All laminating is conducted within a controlled environment with active quality control procedures to ensure the highest quality. The hull construction complies with or exceeds…

- Australian U.S.L.
- British Hovercraft Safety Requirements'
- Transport Canada (TP5579)
- Lloyds SSC rules
- Korean Register of Shipping
- IMO High Speed Craft Code and other international survey society requirements.

Seat fixing strong points are moulded directly into the floor. Under-hull moulded Urethane landing pads are fitted for hull protection.

Four lifting 'Chain Plates' are mounted through the deck and internally strengthened. A towing eye is fitted to the stern. There are 8x cleats mounted to the deck (separate to lifting eyes) plus 4x recessed 'hooks' providing more than ample attachment points for mooring, towing and lifting.

Cabin

The cabin sides and ceiling are finished in fabric to owner choice. The floor is in gelcoat finish or optionally covered with heavy duty vinyl or cork laminate to customer choice.

The two large 'gull-wing' style doors are top hinged and pneumatically counterbalanced. Fold out steps may be optionally fitted to each gangway. The steps and the doors may optionally be fitted with pneumatic openers enabling open and shut operation from the driver position.

Glazing:

All windows are custom manufactured from laminated safety glass. The front screen and front quarter windows have wipers and washers fitted (total of 5). All glazing is bonded with polyurethane adhesive sealant.

Seating:

The seats are lightweight marine style bucket seating and are collision tested and certified for high speed marine craft. Optionally available are rear mounted brochure holders, under-mounted life jacket containers and additional arm rests. The covers are normally hard wearing fire retardant fabric. Covers may be selected from a wide range of colours and patterns. Total seating capacity is variable but normally 1-crew plus 32-passengers. Seating may be provided for a maximum of 2-crew plus 37 passengers within the constraints of total allowable payload.

Engine

Power is provided by one Walter M-601B engine which is a dual-shaft reverse-flow free turbine engine. The gas generator section consists of two axial and one centrifugal compressor stages, an annular combustion chamber, and a single stage axial compressor turbine. The power section consists of a single stage axial power turbine, exhaust system, and a two stage planetary reduction gearbox (15:1) with torquemeter. Engine starting is accomplished using a combination starter-generator and electronic ignition (dual low voltage torch igniters). An accessory gearbox is mounted on the rear of the engine.

The Walter M601 range of turboprop power plants have been manufactured since 1977 and designed for use in remote parts of Russia, Siberia, Africa, America and Eastern Europe, where rugged durability and minimal field maintenance requirements were top priorities. Unlike some turboprop engines, 'hot section inspections' between overhauls are not required with the M601 range. Maintenance between overhauls consists primarily of filter and screen cleaning, compressor wash, oil change, bore-scope inspection, igniter replacement, testing and calibration.

Turbine engine reliability and performance has long been desired by, but rarely available in modern commercial hovercrafts. The Walter M-601B is an outstanding engine.

Engine Specifications

Max Rating	566kW (760hp)
Max Continuous Rating	490kW (657hp)
Rated altitude	Sea Level
Rated Ambient Temperature	25C
Max Output Shaft Speed	2080 rpm
Max N1 (Gas Generator) RPM (100%)	36,293 rpm
Max Inter-Turbine Temperature	690C
Max Fuel Consumption @ 490kW	246 litres/hour
Fuel Consumption @ 260kW (cruise)	132 litres/hour
Fuel Consumption @ Idle	94 litres/hour
Weight	193kg
Time between Service	300 hours
Time between Overhauls	3,000 hours or 6,000 cycles or 8 years.

Exhaust Systems
The engines exhausts are ducted to the rear providing additional jet thrust. All exhaust pipe work is manufactured from Stainless Steel and thermally lagged for safety.

Propellers
There are two in-flight pitch adjustable ducted propellers of 1400mm diameter X 5 blades. The propeller blades are precision moulded from Carbon-Fibre and Epoxy resin and are post-cured at high temperature to obtain consistent high tensile strength. The propellers provide full in-flight pitch control and reversing capability. The pitching mechanism is controlled by the operator for optimum angle relationship to the engine speed and for the best performance and economy.

Propulsion Transmission System
Toothed belts provide positive power transmission from the engine shaft to the propeller shaft. The propeller shaft is firmly supported by self-aligning bearing units within the transmission housing. All transmission components are power rated well above the maximum engine output.

Lift Fans
The Lift Fans are coaxially mounted, counter-rotating and driven directly by hydraulic motors. This arrangement provides good operating efficiency and low noise along with a robust construction and long life.

Lift Fan Transmission
The lift fans are supported on an elastomerically mounted bearing system to reduce noise and are directly driven by the hydraulic motors. The hydraulic motors are provided by oil from the pump mounted on the engine output shaft. The pump is of the variable displacement type and is controlled automatically to keep the lift fan running at a constant speed independently of the engine speed. The pre-set speed may be varied at any time by the pilot for different operating modes. This is a unique system which is easily controlled and allows efficient use of available power by applying only what is necessary to meet lifting requirements and leaving all other available power for thrust.

All hydraulic filtration is to 3 µm and cooling is suitable for tropical (+40^{o}C) operation in salt water and dusty conditions.

Skirt

The skirt is a fully pressurised tapered bag and finger system. The bag pressure is higher than the cushion pressure and is regulated by control orifices in the bag inner membrane. This system is well proven to be the most stable and dynamically efficient skirt system available for amphibious hovercraft today.

The skirt bag is manufactured from PVC coated Nylon fabric. All joints are R.F. welded for exceptional strength. Colour is normally black but other colours may be optionally available. Hypalon fabric is optionally available for extreme cold weather operation. The skirt fingers are manufactured from rubber coated nylon and have high abrasion resistant properties.

Controls

The controls are simple and easily managed.

- Turning is controlled by a 'steering wheel' type helm, similar to boats.
- Pitch (fore and aft trim) and Roll (sideways trim) easily accomplished by a small joystick mounted to the right of the operator.
- The speed of each engine is controlled by a pair of levers to the left of the operator, in similar fashion to the typical boat engine speed lever.
- The Pitch angle of each propeller is controlled by a pair of levers to the left of the operator.
- The fuel ballast system is logically controlled by switches on the dashboard.

Instrumentation and Indicators

Monitoring Systems

The monitoring of all engine and other hovercraft operating parameters is accomplished by an NMEA2000 CANBus which is the newest industry standard communication backbone for all navigation and on-board marine controls. The engines control units are J1939 CANBus according to automotive and marine engine manufacturer's standard systems. A J1939 to NMEA2000 gateway is fitted to allow all engine related data to be available on the NMEA2000 compliant flat screen display units. The data shown can be programmed to suit the end user requirements with quick select (up to 4) screen views pre-configured.

A variety of NMEA2000 compliant flat panel displays are available which can give anything from the most basic information display all the way up to the most beautiful combined displays of navigation and machinery reporting all integrated according to the client wishes.

The NMEA2000 system also has power output modules linked in to provide control of lighting, bilge pumps, fuel ballast transfer pumps and ventilating fans.

System Displayable Information…
Hydraulic System

Item	Range	Operating
Main Loop Pressure	0 – 300 Bar (0 – 4300 PSI)	230 Bar
Charge Pressure	0 – 5 Bar (0 - 44 PSI)	1.5 Bar
Main Loop Temperature	0 °C to 120 °C (32F to 250F)	60°C
Critical Warnings	Low Charge Pressure. Low Oil Level. High Oil temperature.	

Engine

N2 (Power Turbine) RPM
N1 (Gas Generator) RPM
Inter-Turbine Temperature
Oil Pressure
Oil Temperature
Output Shaft Torque
Fuel Pressure
Fuel Flow

Other Systems

Fuel Ballast Tank Port Front	Contents – 0% to 100%
Fuel Ballast Tank Stb'd Front	Contents – 0% to 100%
Fuel Ballast Tank Port Rear	Contents – 0% to 100%
Fuel Ballast Tank Stb'd Rear	Contents – 0% to 100%
Fuel Run Tank	Contents – 0% to 100% (with low warning at 20% full)
Power Management (indicated separately for each battery bank).	Battery Volts Port Starting Battery Volts Stb'd Starting Battery Volts – Radio Battery
Cabin Bilge Pump	On/Off (with fault warning)
Engine Room Bilge Pump	On/Off (with fault warning)
Rear Space Bilge Pump	On/Off (with fault warning)
Port Locker Bilge Pump	On/Off (with fault warning)
Stb'd Locker Bilge Pump	On/Off (with fault warning)
Port Stairwell Pump	On/Off (with fault warning)
Stb'd Stairwell Pump	On/Off (with fault warning)
Fuel Transfer Pump	Running (with fault warning)
Air-Con Compressor	On/Off (with fault warning)
Air-Con Condenser Fans	Off/Slow/Fast (with fault warning)
Air-Con Evaporator Fans	On/Off (with fault warning)
Critical Warnings	Engine Room High Air Temperature Engine Room Bilge Alarm Low Fuel Level Alarm
Normal Warnings	High Air Temperature Engine Room Unusual Low Current for any motor/pump running (indicates open circuit). Unusual High Current for any motor/pump running (indicates overload or seized) Screen Wash Tank Low Level
Other Information	Outside Air Temperature Cabin Air Temperature Engine Room Air Temperature

Electrical System

System voltage is nominally 24 volts DC. The normal voltage range is 21 volts to 27.8 volts.

Batteries

The engine has two 24 volt starting battery banks. All batteries are connected through remotely operated battery switches according to class rules. An additional remotely controlled and voltage sensitive isolator provides parallel connection of the port and stb'd battery banks for emergency starting if overall system voltage is low.

An additional 12 volt emergency radio battery is provided and charged from either starting battery bank via an electronic voltage converter and regulator.

Protection

Circuit breakers, PLC controls and fuses are installed according to class rules. All electrical cable is marine type tinned copper multi-strand cable with V90°C (or better) low halogen insulation. All terminations in exposed areas are crimped and covered with heat shrinking and hot-melt insulation for corrosion protection. Exposed cable runs are protected in conduits. Every wire in the loom is printed with circuit identification matching the electrical maintenance drawings.

Lighting

All navigation lights comply with IMO recommendations. In addition a flashing orange beacon is mounted atop the thrust cabin according to the British CAA requirements for hovercraft.

A red night vision map light is provided at the navigation station. Main cabin lighting is provided by dimmable LED strip lighting. Entrance and steps are illuminated by LED lights. Beside the cabin doors are 24V x 15A power outlets suitable for connecting a high-powered spotlight or other auxiliary devices.

A remotely controlled spot light is mounted to the roof.

Fuel System

The engine can burn diesel, kerosene or Jet fuel.

In addition to the fuel tanks utilised by the ballast system there is an 'engine run tank'. This tank is automatically topped when the ballast pump is operated. In the event of low fuel, a warning is given at 20% level.

The maximum fuel load is normally 860 litres but this can be 'pressed-up' to 1660 litres for exceptionally long duration in special circumstances. Independent load trimming may be required when the fuel load prohibits movement for trimming.

All fuel piping (apart from short flexible elements near the engine) is stainless steel metal pipe. A safety shut off valve is mounted near each tank. Comprehensive fuel/water separators and filters are fitted for reliable supply of the fuel to the engine.

Fuel Ballast System

There are two fuel tanks in the ballast system, each of approximately 800 litres and mounted in the front and the rear of the hull. The normal fuel ballast load is 860 litres which is moved fore and aft by a high-flow pump as required for weight transfer. This relieves the dynamic control surfaces of static trimming load and increases the overall craft efficiency.

Fire Safety

The engine room is lined with ceramic fibre refractory material to provide a 30 minute fire barrier with minimal heat rise at the bulkheads. This material is mechanically mounted and has an aluminised facing to provide an attractive and easily cleaned surface.

A fire detection heat sensor is mounted in the engine room and connected to an alarm at the control position. The engine room is fitted with a fixed HFC-227ea chemical smothering system that can be activated from the cabin. The engine room vents and fire extinguisher are operated from a control panel at the rear of the cabin area. Additional portable extinguishers are mounted inside the cabin. The exhaust system is lagged and shielded to reduce heat radiation and increase safety. The bulkhead to the cabin is insulated and fire rated.

Lifting

There are four lifting attachment points protruding from the deck upper surface enabling connection with cranes and other lifting tackle. A portable gantry is optionally available.

NB: The above specifications pertaining to performance are based on estimates extrapolated from performance measured on the Pioneer Mk3.1. These specifications will be changed as improvements are made and should only be used as a guide unless specifically annexed to a build contract and signed by all parties to that contract. Specifications may also be varied from time to time by agreement between the parties involved.