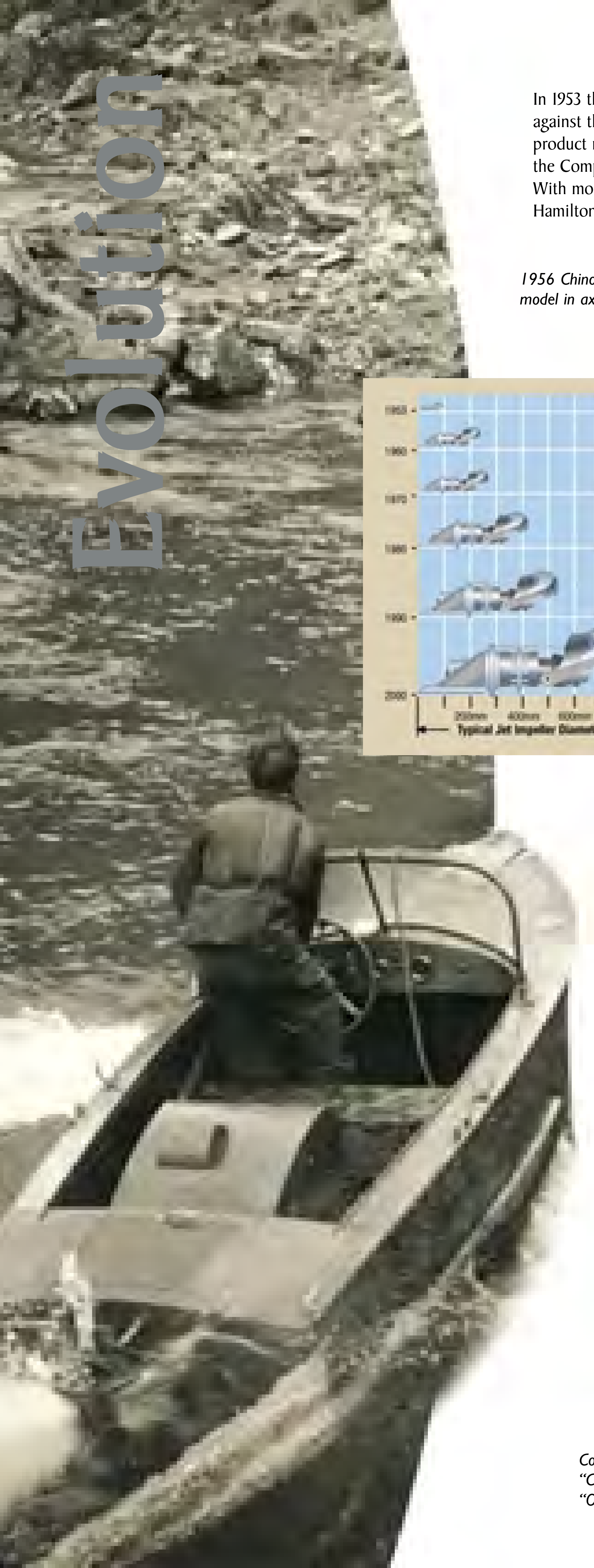
HM SERIES

WATERJET PROPULSION SYSTEMS

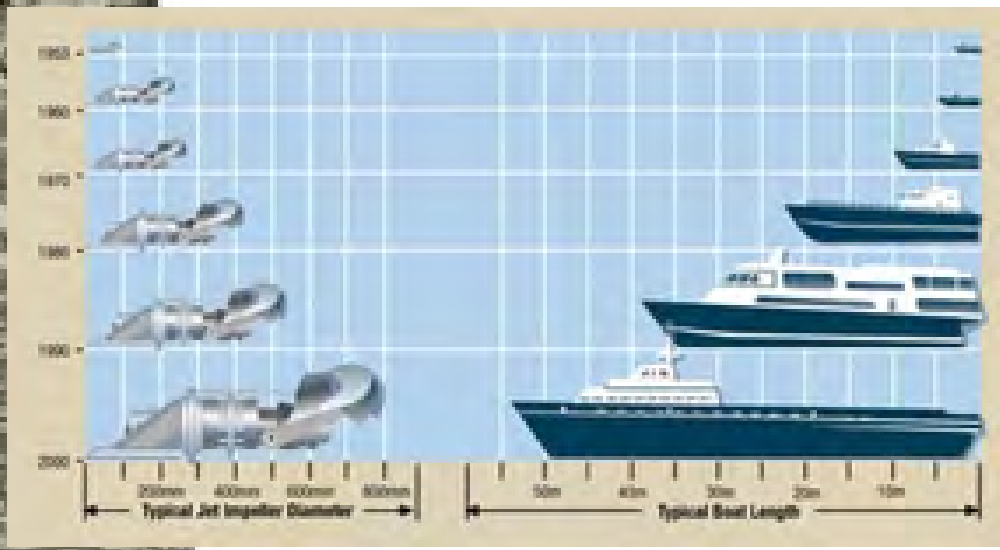
HamiltonJet



Evolution

In 1953 the first Hamilton Waterjet successfully propelled a small boat against the current of a swift-flowing river. Since then Hamilton Jet's product range has been refined and expanded, firmly establishing the Company as a leader in the marine propulsion industry. With more than 30,000 installations over 46 years, Hamilton Jet has a world of experience.

1956 Chinook, the first Hamilton model in axial flow configuration.



HAMILTON JET HM SERIES

The larger Hamilton Jet HM Series of waterjets are an extension of the Company's range of smaller jet units which have evolved in the ensuing years to represent the latest technological advances in marine propulsion. As boat speeds rise above 25 knots, Hamilton Jet waterjets return higher propulsive coefficients than conventional propellers. They are therefore an ideal choice for high-speed workboats, patrol craft, fast ferries and recreational pleasure cruisers.

Hamilton Jet innovation is the result of on-going research and development utilising its on-site hydrodynamic test rig facility and test boat programmes. Close co-operation is maintained with the local university throughout these programmes.

The Hamilton Jet factory is dedicated solely to the production of waterjets. All components are manufactured using the latest CNC machinery, and are produced to the world's most stringent marine quality standards, including ABS, Lloyds and Det Norske Veritas.

HamiltonJet

Cover photos:
"CNM Evolution" 43m Ferry, Quebec, Canada. Twin HM811 Waterjets.
"Ocean Flyte" 31m Passenger Ferry, Singapore. Triple HM521 Waterjets.

Model Range

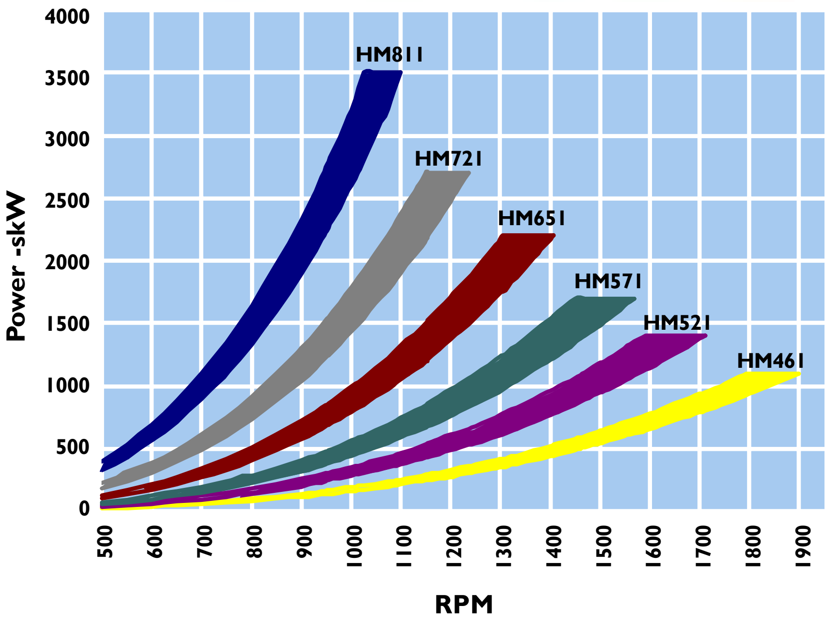
HM Series Power/RPM Inputs

Jet Model	HM461	HM521	HM571	HM651	HM721	HM811
Max Sprint Power (skW)	1100	1400	1700	2200	2700	3500
Input rpm range	1795-1900	1587-1710	1448-1569	1305-1407	1149-1236	1030-1104
Max Continuous Power (skW)	900	1200	1400	1800	2200	2800
Input rpm range	1680-1800	1508-1624	1357-1470	1220-1316	1073-1154	955-1025

NOTE: Input rpm are subject to suitable cavitation limits. The lower rpm figure is always preferred. Higher power inputs will restrict the input rpm range.

Model HM811s under construction at the Hamilton Jet factory.

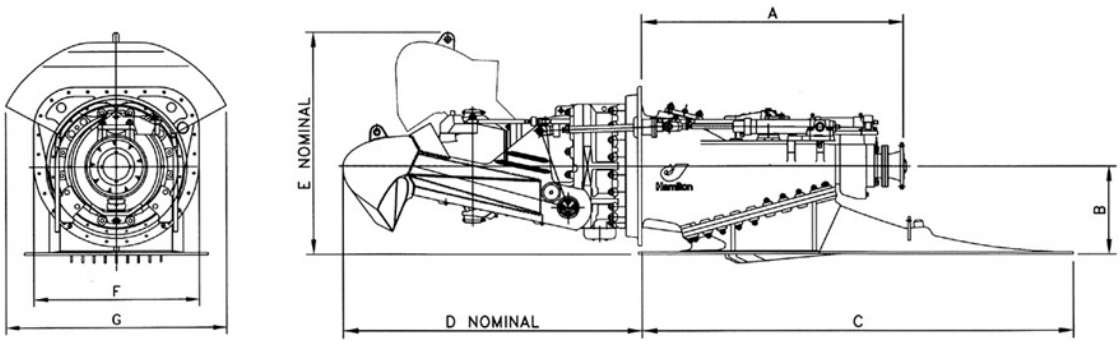
HM Series Power / RPM Envelopes



Note: The rpm ranges shown are for the impeller options which will give best cavitation performance. Please consult Hamilton Jet if this range is not suitable.

Model Range

Dimensions



Model	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	F (mm)	G (mm)
HM461	1280	420	2048	1440	1016	900	1040
HM521	1424	475	2350	1630	1200	1000	1200
HM571	1561	530	2585	1800	1300	1000	1285
HM651	2105	593	3360	1650	1470	1100	1500
HM721	2381	667	3779	1860	1612	1250	1660
HM811	2672	750	4252	2100	1800	1400	2000

IMPORTANT NOTE: Dimensions shown above are indicative only for initial design purposes. All specifications are subject to change without notice or obligation. For detailed installation data and instructions consult Hamilton Jet.

Material Specifications

Component	Material	Standard
Transition Duct	To match hull material	
Impeller	CF8M Stainless Steel	ASTM A743 - 80a
Wear Ring	AISI 316 Stainless Steel	ASTM276 - 80a
Mainshaft	SAF2205 Stainless Steel	ASTM A789 - 81
Stator	LM6 Marine Grade Aluminium	BS1490 - 1970
Nozzle	LM6 Marine Grade Aluminium	BS1490 - 1970
Steering Deflector	LM6 Marine Grade Aluminium	BS1490 - 1970
Astern Deflector	LM6 Marine Grade Aluminium	BS1490 - 1970
Thrust Bearing	Spherical roller type	
Rear Bearing	Water lubricated Marine Bearing	
Shaft Seal	Face type mechanical seal	
Anodes	Zinc	MIL - 18001H

Follia 75 "Eufemo" 23m
Pleasure Yacht, Italy.
Twin HM521 Waterjets.

Features

COMPLETELY INTEGRATED PACKAGES

Pump

The stainless steel impeller is a highly refined mixed flow design, which exhibits high resistance to cavitation while providing exceptional efficiency. Rated to absorb the maximum engine power, in the 'normal' operating zone the jet absorbs the same full power regardless of boat speed, eliminating any possibility of engine overload.

- **Inboard thrust bearing, conventional marine bearing aft**
- **High cavitation resistance**
- **No engine overload regardless of vessel speed or load**

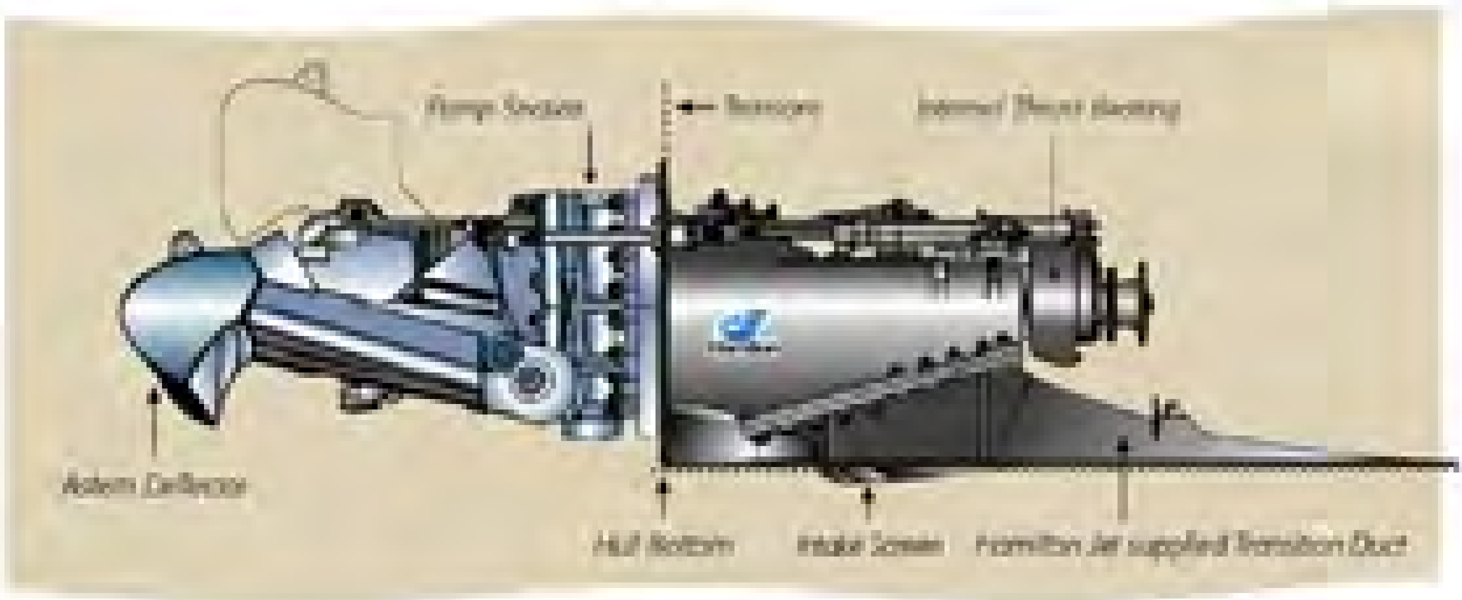
Intake Transition

Configured to mount inboard at the stern, the unit draws water through a Hamilton Jet supplied intake transition duct which is flush-mounted to eliminate appendage drag.

A highly developed intake screen prevents damage to internal components due to ingress of debris. The screen engineering is such that the effect on thrust and cavitation is negligible, and is fully accounted for in our performance data.

Thrust and control reaction loads are transmitted directly to the hull stringers and frames via the inboard mounted thrust bearing and transition duct. This eliminates fore and aft propulsion forces on the craft's transom and engine, thereby allowing lighter hull construction.

- **Factory supplied intake and transition duct**
- **No thrust load on transom**
- **Stainless steel impeller**



Stator and Nozzle

Water flow leaving the impeller passes through stator vanes where rotational flow components are removed. Nozzle size is the key variable in achieving maximum propulsive coefficients. For each application Hamilton Jet will select the optimum jet size, taking into account factors such as vessel speed, fuel load and lifetime propulsive costs.

- **Optimised propulsor for maximum propulsive coefficients**

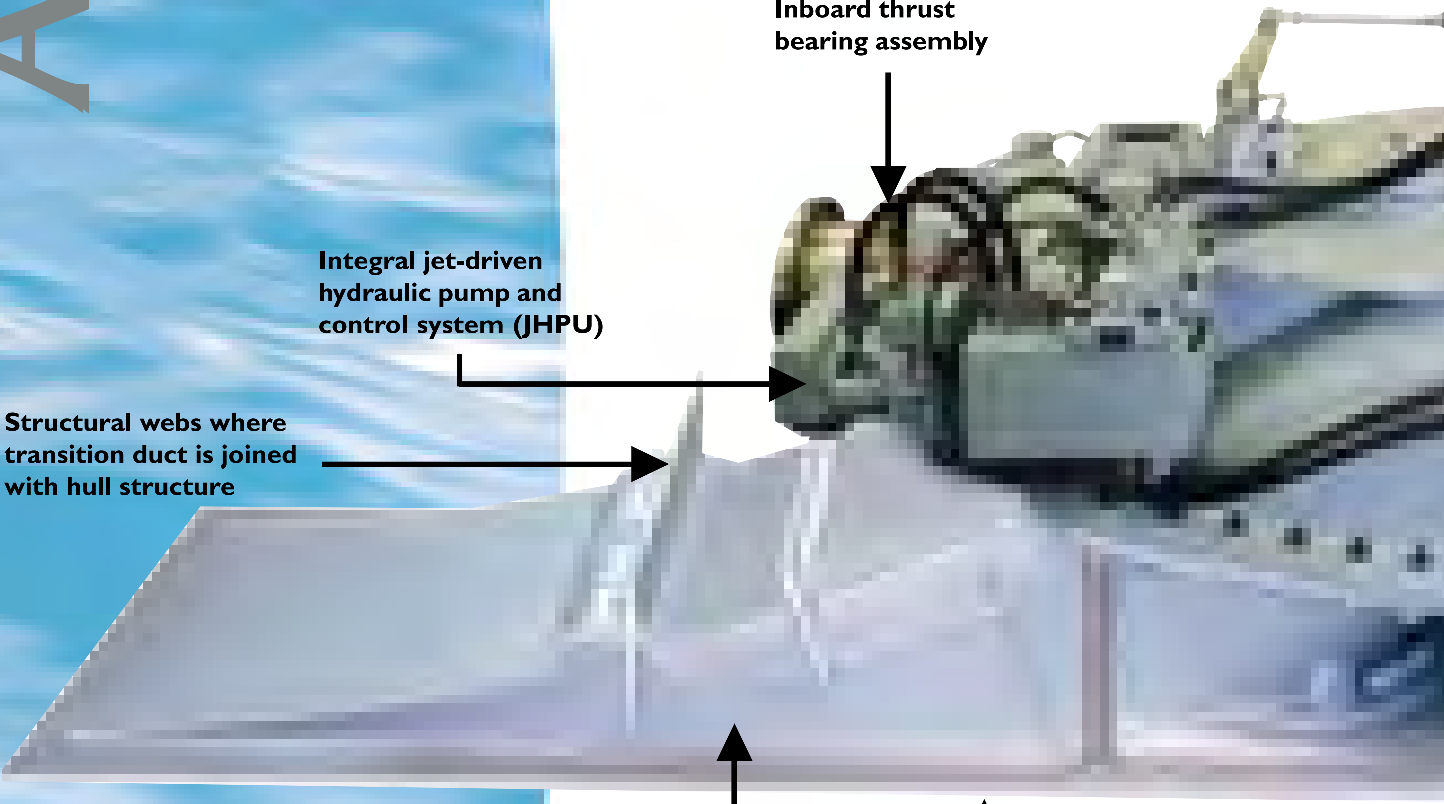
Intake

An important characteristic of a Hamilton Jet is that the intake remains highly efficient across the full craft speed range, rather than be optimised for one power/speed.

The main thrust bearing is housed in this rigid structure where it is outside the water flow and can be serviced from inside the craft.

Advantage

Columbia Bar Pilot Tender, Oregon USA. Twin HM651 Waterjets.



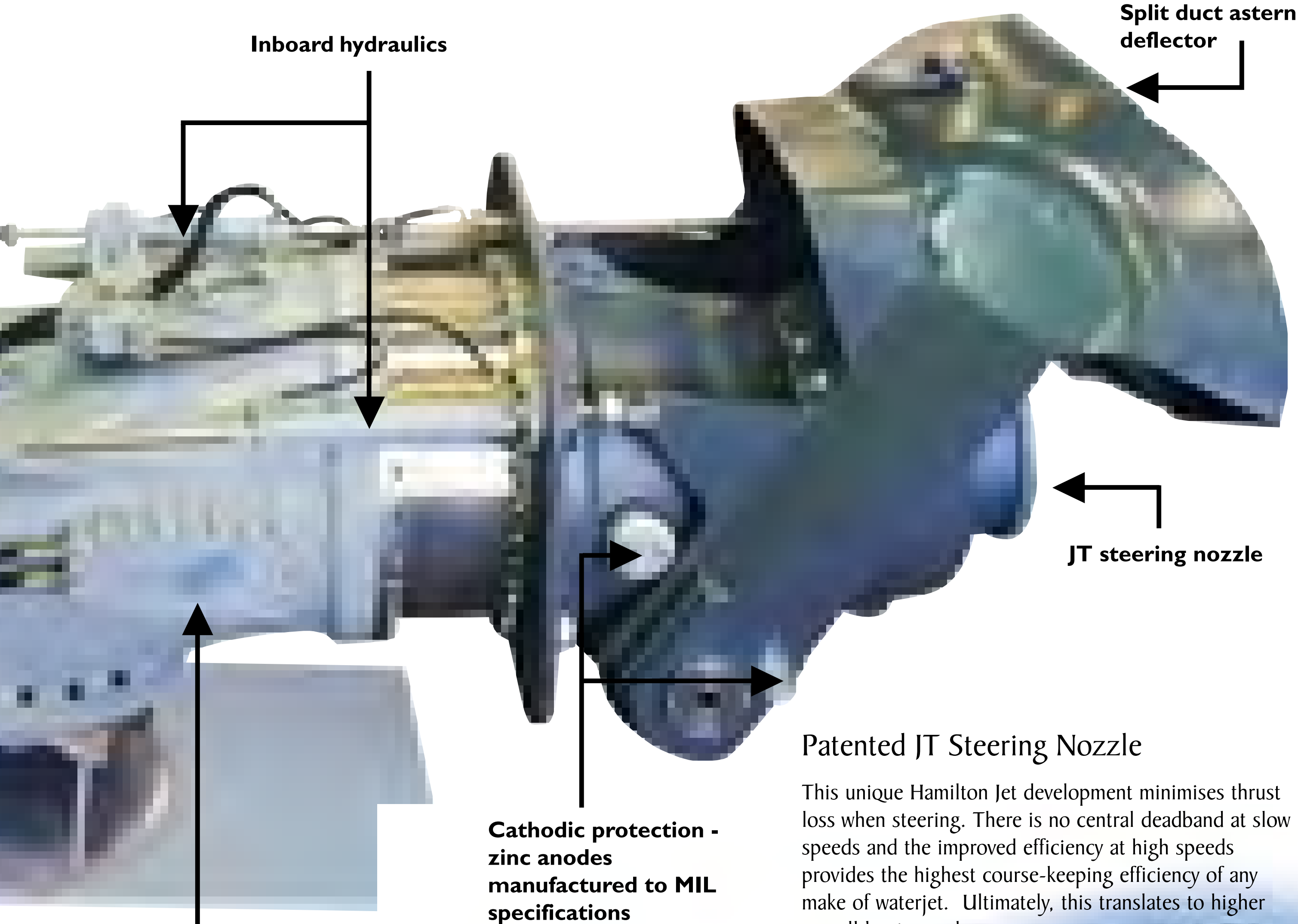
Unrivaled Cavitation Performance

Hamilton Jet's mixed flow pump design offers up to 25% more thrust than other waterjets between 0 and 20 knots. Manoeuvrability at low speeds and acceleration to higher speeds are superior to any other waterjet on the market.

"Voyager III" 34m Catamaran, New England Aquarium, Boston USA. Quad HM461 Waterjets.

Competitive High Speed/Superior Low Speed Performance

HM Series intake and impeller designs are the culmination of 46 years of research and development. Their hydrodynamic design is a further evolution from that of the HJ Series and provides excellent high and low speed performance.



Patented JT Steering Nozzle

This unique Hamilton Jet development minimises thrust loss when steering. There is no central deadband at slow speeds and the improved efficiency at high speeds provides the highest course-keeping efficiency of any make of waterjet. Ultimately, this translates to higher overall boat speeds.

"MV Lisa Ann" 44m Oil Rig Crew Boat, Morgan City LA USA. Quad HM571 Waterjets.

Operation

Puget Sound Pilot Tender, Seattle USA. Twin HM571 Waterjets.

Control Functions

Since the steering and ahead/astern functions are separate and have independent effects, they may be used in conjunction with each other to enable complex vessel manoeuvres without complex combinations of control inputs by the operator.

With the astern deflector fully raised, full forward thrust is available. With the deflector in the lower position, full astern thrust is generated. In both positions full independent steering is available for rotating the craft. By setting the deflector in the intermediate "zero-speed" position, ahead and astern thrusts are equalised for holding the craft on station, but with independent steering effect still available for rotational control. Infinitely variable adjustment either side of "zero-speed" enables the craft to be crept ahead or astern, and in multiple jet installations, appropriate thrust vectoring alone can be used to induce true sideways movement.

TOTAL CONTROL

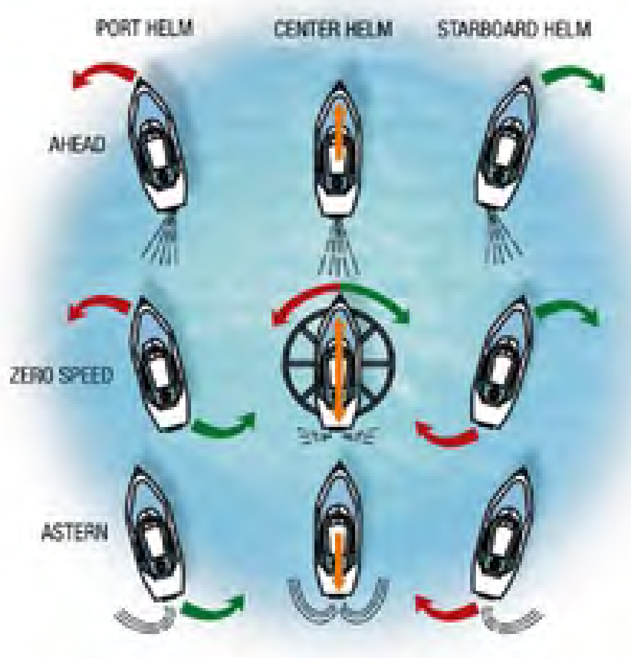
JT Steering

All HM Series waterjets incorporate Hamilton Jet JT steering, a patented steerable nozzle to optimise both steering efficiency and delivery of propulsive thrust. Compared with other waterjet steering systems, the JT nozzle provides outstanding steering responsiveness at all boat speeds. This is particularly noticeable at low speeds due to the absence of a central deadband (no steering reaction immediately either side of the central or dead ahead position). The design reduces nozzle flow disturbance, resulting in lower energy losses and minimal loss of forward thrust when steering. These factors mean higher overall efficiency through improved course-keeping and, coupled with low steering loads and noise level, make the JT system highly effective and reliable under all conditions.

Ahead / Astern

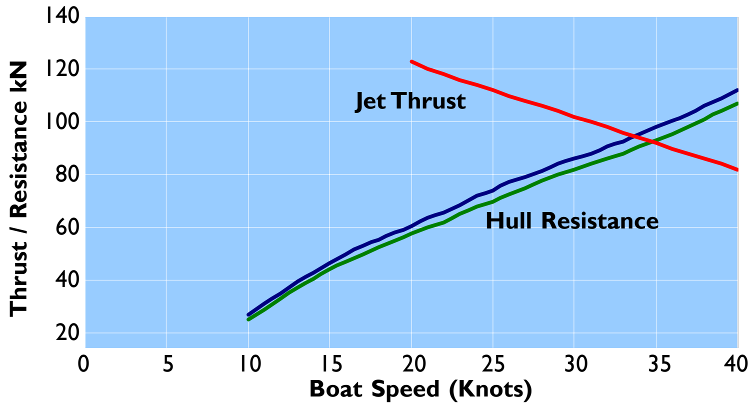
As with steering, the ahead/astern function is an integral part of the HM Series jet. The split duct astern deflector is designed to provide maximum astern thrust under all conditions of boat speed, water depth and throttle opening. The splitter incorporated in the deflector divides the flow to two outlet ducts. These ducts angle the astern jetstream down to clear the transom and to the sides to retain the steering thrust component. Vectoring the astern thrust away from the jet intake avoids recycling and the resulting astern thrust generation is equivalent to up to 60% of ahead thrust – maintainable up to high throttle settings.

The shift from full ahead to full astern is a smooth transition as the deflector is lowered through the jetstream, eliminating any delay or shock loading normally associated with propeller/gearbox drives. Designed to withstand the loads imposed when the deflector is lowered at full speed ahead, the arrangement provides a powerful braking function for emergencies. The separation of the steering and ahead/astern functions offer the opportunity for unlimited combinations of transitional and rotational movements for outstanding vessel control.



Application Engineering

Hamilton Jet's extensive track record means a wealth of experience is available to designers, builders and operators. From conceptual design stages to final commissioning, computer speed predictions and nozzle optimisation studies, service life costs, detailed installation advice, commissioning assistance and training programmes are available to support each project.

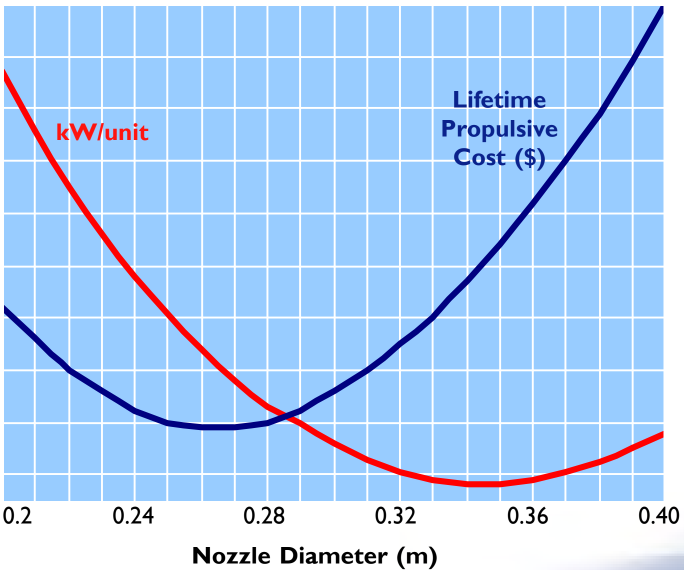


Typical Speed Estimate

Hull resistance is provided by the designer or can be estimated by Hamilton Jet (for most monohull forms). Minimum data required includes waterline length, chine beam, deadrise angle at transom and at mid-LWL, LCG (if known), fully laden displacement and light displacement, and proposed engine power/rpm data.

Typical Nozzle Optimisation

Nozzle optimisation, based on boat data and operating profile, is used to provide the most efficient waterjet selection.



"Famille Dufour II" 40m Passenger Ferry, Quebec, Canada. Twin HM811 Waterjets.

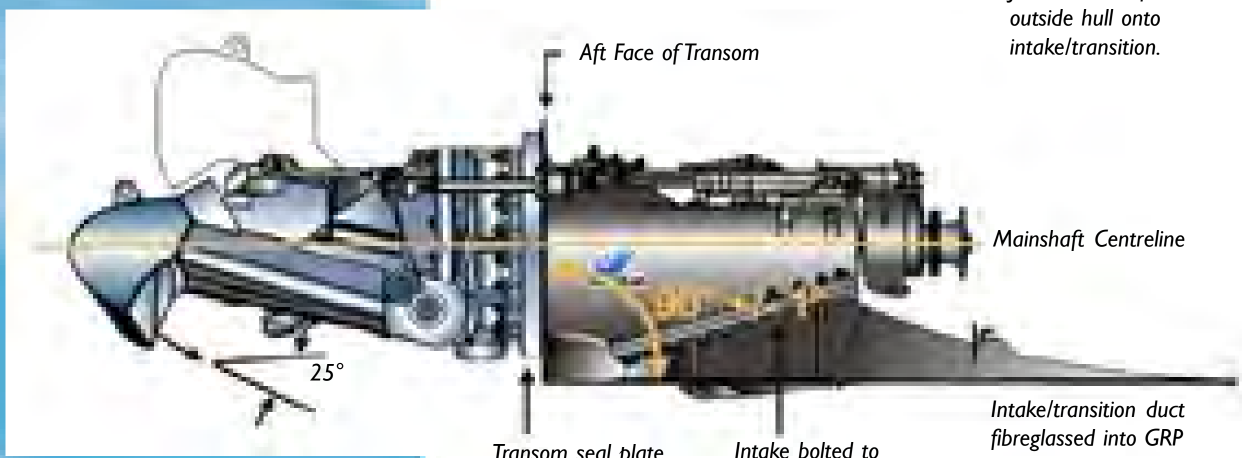
Installation

Triple HM521 Waterjets in a 20m Patrol Craft.

TOTAL PACKAGE

HM Series jets are supplied as a completely packaged propulsion module - a design philosophy that simplifies installation procedures for the boat builder. The jet is simply bolted to the Hamilton Jet supplied matching intake/transition duct, which has been welded or moulded into the hull. The builder is not required to fabricate any complex intake ducts. It is then only a matter of installing the driveline and completing the control system interface. The integral JHPU hydraulic pump and circuits are set up and tested in the factory prior to dispatch.

No special strengthening of the hull or transom is required as HM jets are of robust cast construction capable of transmitting the full force of generated thrust to the hull bottom via the intake/transition. The jet's main thrust bearing is incorporated in the cast body and is unaffected by hull movement. Jets and matching control systems can be configured for up to quadruple main propulsion installations. Alternatively, for loiter and boost applications, HM jets can be employed with other jets or propulsor types for independent or combined operation.



HM series jets are installed as an assembly, being manoeuvred forward through the transom hole and bolted down on the transition duct.

At the helm of an 18m Police Coast Guard Patrol Craft powered by Twin HM521 Waterjets.

Control Systems

A number of Hamilton Jet packaged control systems are available to maximise the jet's inherent manoeuvring capabilities.

HYRC Servo-Hydraulic Control
(HM461 to HM571 only)

Where simplicity and low cost are primary factors, the Hamilton Hydraulic Reverse Control (HYRC), a mechanical-hydraulic servo system, can be employed for ahead/astern control. The Jet mounted and driven Hydraulic Power Unit (JHPU), reverse cylinder(s), HYRC control valve with feedback linkage, hydraulic circuit and position feedback units are all inboard and mounted on the jet. A Morse "Hynautic" hydraulic remote system is used for control from the Wheelhouse and other control stations. Steering control may be achieved by a simple manual hydraulic system, directly actuating the jet-mounted steering cylinders, or by a power-assisted steering system. The requirement for the latter is dependent on jet unit input power and the number of jets.

Hynautic engine throttle controls are also available with this control system option, together with multi-station controls.

MECS Electronic Control

The Hamilton Jet Modular Electronic Control System (MECS) is a software configurable control system for waterjet steering and reverse, engine throttle and gearbox control. It comprises a number of standard modules that may be connected together in varying combinations to build a vessel control system. The system architecture is based around the CAN Bus network protocol.

A key feature of MECS is that each module is standard and, with the exception of engine/gearbox interface wiring, the configuration of a complete system for a particular vessel is achieved solely through menu driven software configuration carried out during vessel commissioning.

The system modules are interconnected using a set of preterminated (plug-in) cables supplied with each system. The cable plugs are polarized so that each plug and cable will only engage at its correct location. The only wiring that the ship builder is required to complete is the power supply and interlocks to a Power and Interlock Module, plus the engine and gearbox interfacing connections to the Engine Control Module. Within MECS there are two separate control subsystems. Normal control allows full proportional control of the steering, reverse and throttle, as well as control of the gearbox. Backup is provided as an independent set of controls intended for use if normal controls are not available.

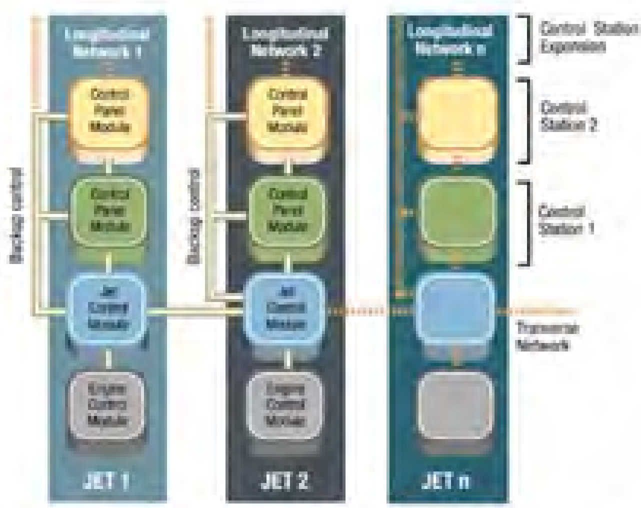
In addition to the electronic modules, a complete system includes a Jet mounted and driven Hydraulic Power Unit (JHPU) on each jet, inboard hydraulic steering and reverse actuators, including feedback units, engine and gearbox interfaces (or actuators). The system is also capable of interfacing with other proprietary Autopilot and vessel management systems.

▲ *Engine Control Module.*

▶ *Jet Control Module.*

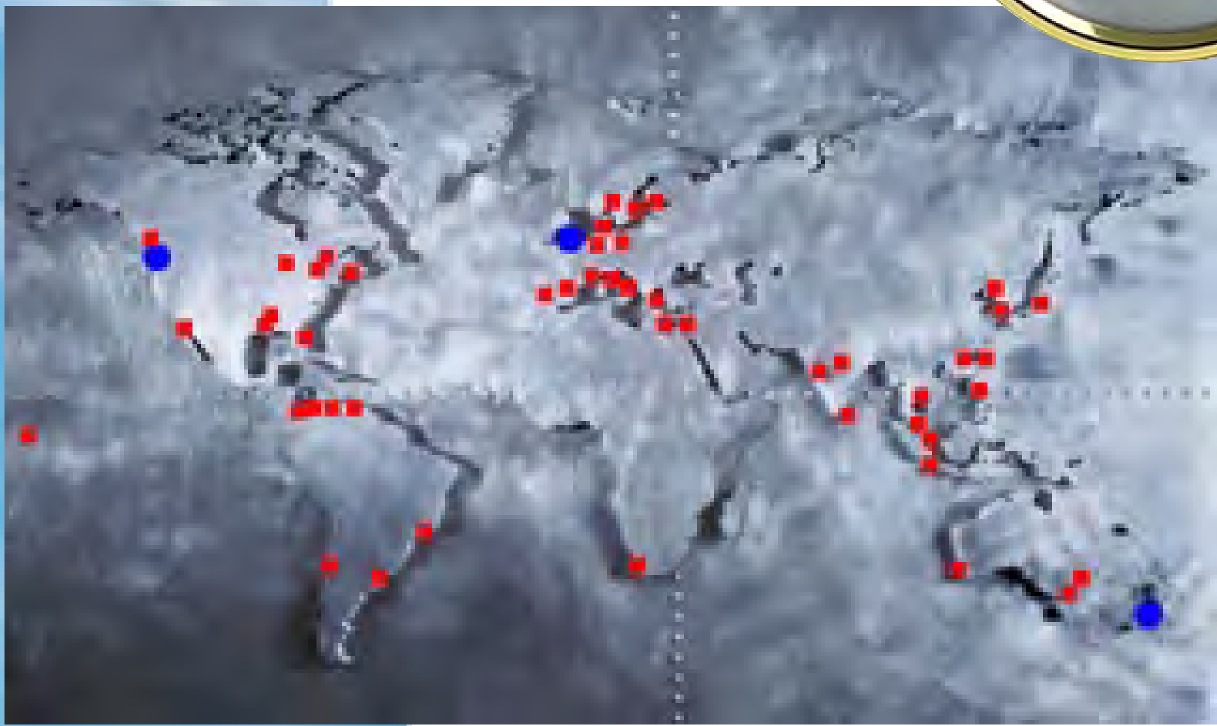
◀ *Control Panel Module.*

Modular Control System Architecture



Modules are plug-in for ease of exchange or maintenance.

Support



Worldwide Support

Access to Hamilton Jet is unrestricted with the factory in New Zealand complemented by company offices in both the United States of America and the United Kingdom. This network is further enhanced by authorised factory trained Distributors in over 50 locations worldwide to provide comprehensive logistic support in the form of commissioning assistance, operation and maintenance training programmes and spare parts supply. Additionally, factory-based field technicians are on permanent stand-by to travel anywhere in the world at short notice.

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