Seaeye Jaguar

The Revolutionary Electric Work Class ROV

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The Seaeye Jaguar represents a new era in ROV design and continues the long tradition of innovation and excellence that Saab Seaeye is world renown for.

The largest vehicle in Saab Seaeye's range the Jaguar introduces a new concept in control and power distribution that ensures reliability and complete redundancy throughout the vehicle. Easy self diagnostics and the ability to fix problems while the vehicle is working are a key part of the new control software.

It gives precise control and is designed with an easy to use interface so that the system can be easily reconfigured.

The modular design of the new control software means that future platforms will benefit from commonality of parts and therefore lower maintenance and spares requirements.

With a standard operational depth of 3000msw and options of up to 6000msw most subsea applications are within its range and capabilities.

Jaguar System Architecture
The core Jaguar vehicle is split into two identical halves, each half is completely independent and can be isolated from the other. Essentially two ROVs in one providing total system redundancy throughout.

Control System
Jaguar operates on Saab Seaeye's latest distributed intelligence control system known as RASPUTIN. Each half of the Jaguar runs a dedicated multidrop RS485 network to which the various system devices are connected. These devices, thrusters, lights, camera actuators, etc are known as "nodes".

Each node communicates to the surface processor on three levels: fundamental mode, diagnostic mode and update mode.

Using a thruster as an example; fundamental mode controls the thruster to output thrust - start, stop, speed and direction. Diagnostics mode is, as the name suggests, a mode within which the thruster can be health checked and interrogated for parameters such as power, temperature, hours run and vibration. Update mode allows new internal control software to be downloaded to the thruster, these updates are made available as and when new features are introduced.

Power Distribution
Propulsion and instrumentation on each half of the ROV is powered by two separate circuits. Each circuit comprises a surface power supply that outputs a 3kV 800Hz single phase supply. This supply is transmitted via dedicated cores in the mainlift umbilical and tether. At the ROV each circuit terminates in a transformer, the outputs of which supply a series of power converters which create 500VDC, 24VDC and 110VAC - 50Hz buses.

All devices, thrusters, lights, cameras, sensors, etc are connected to these buses through a power manager which allows all devices to be individually switched and electrically isolated remotely. Each power manager output can be configured with a software fuse that can be set and reset by the user. The power manager continually monitors the current drawn by each device, this information is fed into the system's diagnostics.

The surface power supplies continually monitor earth leakage within the system. Should an isolation fault be detected the pilot is alerted, the system power managers can then be instructed to open the electrical connections to all devices connected to the system and reconnect them in sequence allowing the faulty component to be identified - once identified the faulty component is isolated allowing the remaining system components to be operated as required. This process is completely automated and completed within seconds.

Should a fault occur at a higher level within the power distribution system, in a transformer or power converter for example, the power managers can share power between the two halves of the system. This allows all essential systems to remain operable with vehicle performance reduced to 50%. The two surface power supplies are each fitted with a dual output, under normal operating conditions only one output is used; in the event of the failure of one surface power supply or conductors in the mainlift and tether of one half of the system then all or half of the system can be powered from one surface power supply to a maximum of 50% power.

A total of 26kVA is available at the ROV for tooling. The tooling power system comprises a dedicated surface power supply that outputs a 3kV 50/60Hz supply.

Man Machine Interface (MMI)
The Jaguar's surface control equipment is console mounted. The pilot interface is a combination of physical switches and touchscreens. The primary vehicle controls are ergonomically designed on a pad which can either be mounted within the console desk or, if preferred, removed and operated on a 5m flying lead. Pilot and co-pilot stations are provided.

Graphical information is available on three levels - real time pilot aids and flight information, diagnostics and configuration. Diagnostics are tailored to decrease repair time. The use of pictorial representations and different language options make this MMI truly universal and intuitive.

Fibre Optic System
Two combined video data multiplexers are supplied as standard providing a total of:

- 8 x composite video channels
- 4 x RS485 channels
- 8 x RS232 channels

All channels are provided as client interfaces. The two core system telemetry channels utilise their own dedicated Gb Ethernet channels.

The four supplied fibre adapters are connected to an 8 channel Course Wave Division Multiplexer (CWDM). The output of the CWDM is passed through an optical splitter allowing data to be transmitted via two of the six single mode fibres available in the tether. The remaining four are provided for redundancy and future expansion.

Additional adapters are available to support additional data formats including but not limited to: Gb Ethernet, HDSDI, ECL/PECL & ArcNET.

Ancillary Equipment & Video Interfaces
The Jaguar vehicle is fitted with two interface hubs. Each hub is supplied with 24VDC and 110VAC - 50Hz and is fitted with a video/data MUX. All video/data channels and power are routed through an interface PCB arranged into 12 channels; each channel can be individually switched and pre-programmed with a “software fuse”. Voltage selection for each individual outlet is switch selectable between 24VDC or 110VAC.

The hubs are oil filled with connections made through stuffing glands into the enclosure and onto the PCB through push terminals for rapid and easy reconfiguration. Each hub is fitted with a series of relays, these are typically assigned to tri-state camera control functions but can be allocated to other equipment as required.

Ancillary Equipment Surface Interface
All multiplexed communication channels are available at the surface for third party equipment; data from the core ROV sensors and actuators can be exported via telemetry and over a network. Third party data can be imported to enhance the ROV’s performance even further.

Chassis
The extremely rugged polypropylene and stainless steel chassis has been designed to maximise free water flow through the ROV.

Materials and design are balanced to create an incredibly lightweight chassis, maximising strength and stiffness in support of a 1Te through frame lift capability and rigid mountings for manipulators, TDUs, tools and sensors.

Buoyancy
Buoyancy is derived from syntactic foam blocks finished with a tough polyurethane skin. The buoyancy modules contain apertures for vertical thrusters and the main system lift point.

Electronics Pods
The vehicle has two watertight electronics pods manufactured from machined 6082 marine grade aluminium. All pods are fitted with Leak and Vacuum alarms.

Navigation
As standard the Jaguar is fitted with a combined compass and inertial measurement unit which will provide 6 degree of freedom motion measurement for enhanced azimuth stability, autos and DP. This core equipment can be augmented by additional high performance sensors which will feed directly into the control algorithms running in the surface control unit.

Propulsion
Four horizontal SM8 and four vertical SM7 500V brushless DC thrusters provide full three dimensional control including pitch and roll. All Seaeye ROVs feature brushless DC thrusters which, apart from having the greatest power density, have integrated drive electronics with velocity feedback for precise and rapid thrust control.

Each thruster has an on board control system to give precise and predictable thrust with the maximum acceleration and braking and minimal reversal time possible without placing a damaging load on the mechanics.

The control system is tuned to give the maximum thrust vector from the over actuated thrusters and it achieves this whilst minimising inputted power. The thrust vectoring algorithm can accommodate multiple damaged thrusters whilst retaining normal flying characteristics.

Auto Pilots
Jaguars advanced auto pilots include heading, depth, pitch/roll and stabilisation as standard. Auto altitude and full DP capabilities are available with additional sensors.

Pan & Tilt
A high torque, oil filled, Pan & Tilt platform is supplied. The unit is manufactured from anodised aluminium with the pan and tilt positional information being displayed graphically on the video overlay and/or pilots dashboard.

Tilt Platform
Using the same internal components as the Pan & Tilt a tilt actuator is provided behind the chassis bull bar for the mounting of cameras, lights and imaging sonars. Tilt position is displayed graphically on the video overlay and/or pilots dashboard.

Lighting
Three individually controlled lighting channels are provided as standard, each channel comprising two LED lamp units. Each channel has its own brilliance control on the pilot's Hand Control Unit. Each LED lamp produces the equivalent light output of a 150W tungsten halogen bulb.

Additional lighting can be readily added to the system network.

Connectors
Seaeye’s range of DR metal shelled connectors are used throughout, these are pin and shell compatible with Seaeye’s standard connectors but with the added benefit of having an open face pressure rating of 10,000 psi.

Skids
Job specific tooling skids are available up to a maximum in air weight of 1Te. These skids are fitted with a system of guides that allow the vehicle to be easily positioned onto the skids even in rough seas.

TMS Type 10
This winch style TMS has an innovative shuttle drum that moves side to side of a fixed power sheave which greatly improves tether life. The 500m capacity drum is fitted with a sealed, oil compensated electro-optic slip ring. The stainless steel main frame of this garage TMS is fully adjustable allowing for easy adjustment to accommodate varying sizes of ROV mounted tool skids. The TMS has its own dedicated surface power supply.

LARS
A single, road transportable skid based Launch and Recovery System complete with ‘A’ frame, hydraulic power unit and high speed winch is offered. A LARS can be ordered for use ‘in safe areas of operation’ or to meet the ‘Zone 2 area’ explosion proof standard often required in the offshore oil and gas industry.
A snubber and rotator can be fitted to the A frame head to improve safety during launch and recovery as an option.

SPECIFICATIONS	JAGUAR
Depth rating	3000 msw
Length	2200 mm
Height	1500 mm
Width	1325 mm
Launch weight	1300 kg
Forward speed	> 3 knots
Thrust forward	325 kgf
Thrust lateral	290 kgf
Thrust vertical	225 kgf
Payload	240 kg
Through frame lift	1 Te
Tooling power	26 kVA
Instrumentation power - 24 VDC	2.5 kW
Instrumentation power - 110 VAC - 50 Hz	2.0 kVA
Depth accuracy & resolution	0.01% / 1 x 10^{-8}
Heading accuracy & resolution	±1° / 0.351°

SYSTEM POWER REQUIREMENTS:	
Input	3-Phase 380 to 480V - 50/60 Hz
ROV & tooling	75 kVA
TMS	15 kVA
TMS propulsion (option)	28 kVA
LARS (typical)	150 kVA

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