Providing power & propulsion

for the demands of today and tomorrow

ROLLS ROYCE

HYBRID PROPULSION SYSTEMS

The UK Royal Navy was the world's first to operate naval surface ships with hybrid propulsion systems. First introduced into the Type 23 frigates in 1990, these ships quickly became the backbone of the Royal Navy ASW capability. The hybrid propulsion system had overcome the noise issues inherent in a mechanical propulsion system design by eliminating gearbox noise at critical operational speeds. Designed to enhance the Royal Navy's Anti-Submarine Warfare (ASW) capabilities, the Type 23 has certainly achieved its aim.

ANTI-SUBMARINE WARFARE

The move to hybrid propulsion in the Royal Navy's Type 23's has proven so successful, they are referred to as "the Ghost Ship" and still widely recognised as the benchmark for ASW capability and low Underwater-Radiated Noise (URN) signature

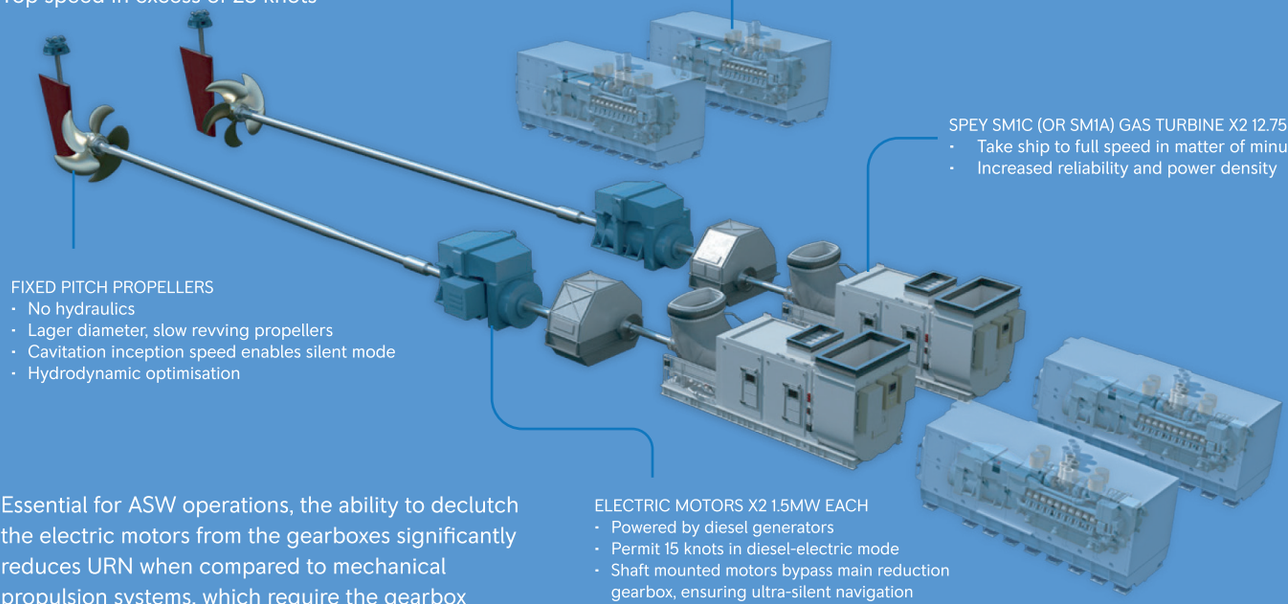
KEY ADVANTAGES OF A HYBRID PROPULSION SYSTEM

Type 23 Hybrid Propulsion System

Range of 7,500 nautical miles (14,000km)

28.5MW of power

Top speed in excess of 28 knots



Essential for ASW operations, the ability to declutch the electric motors from the gearboxes significantly reduces URN when compared to mechanical propulsion systems, which require the gearbox clutched in all propulsion modes.

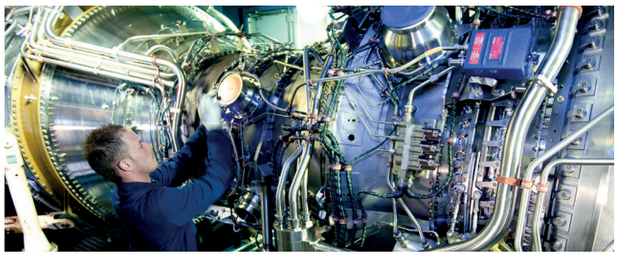
By acoustically enclosing the diesel generators and enabling their physical location above the waterline, the hybrid system further enhances stealth capability to produce ultra-quiet propulsion states.

Reversible electric motors enable an optimised design of fixed bladed propellers to be fitted; these propellers are inherently more efficient and better able to suppress cavitations than their controllable counterparts, further adding to the vessel's overall performance and stealth characteristics.

Increased platform efficiency is achieved, (particularly in the context of an operational profile dominated by low ship speeds), extending a vessel's range which yields many military benefits and reduces reliance on replenishment ships.

The number of running diesel generators are matched to power demand, which now includes electric motors, resulting in improved efficiency against ship cruise speed, optimising propulsion plant efficiency and reducing the

Twin Spey CODLAG
(Combined Diesel Electric and Gas)



KEY DEVELOPMENTS

The Type 23's hybrid power & propulsion system proved adaptable and able to accommodate successive upgrades, which included a change of role to become more General Purpose and a move to warmer operational climates. These factors placed greater demand on the ship's electrical system. These lessons learnt, amongst many others, drove new capability developments as seen in the Royal Navy's Type 26 Global Combat Ship (GCS) and enabled designers to effectively future proof the vessel in line with technology developments.

SINGLE GAS TURBINE HYBRID SYSTEMS

The Royal Navy's Type 26 GCS will replace the Type 23 moving to the single-gas turbine COmbined Diesel eLectric Or Gas (CODLOG) system and will join a growing number of single-gas turbine hybrid platforms. The hull form and propulsion system of the Royal Navy's Type 26 GCS will operate with an exceptionally low underwater radiated noise, improving on the Type 23's existing benchmark in detecting and avoiding detection in the theatre of submarine warfare.

Type 26 Hybrid Propulsion System

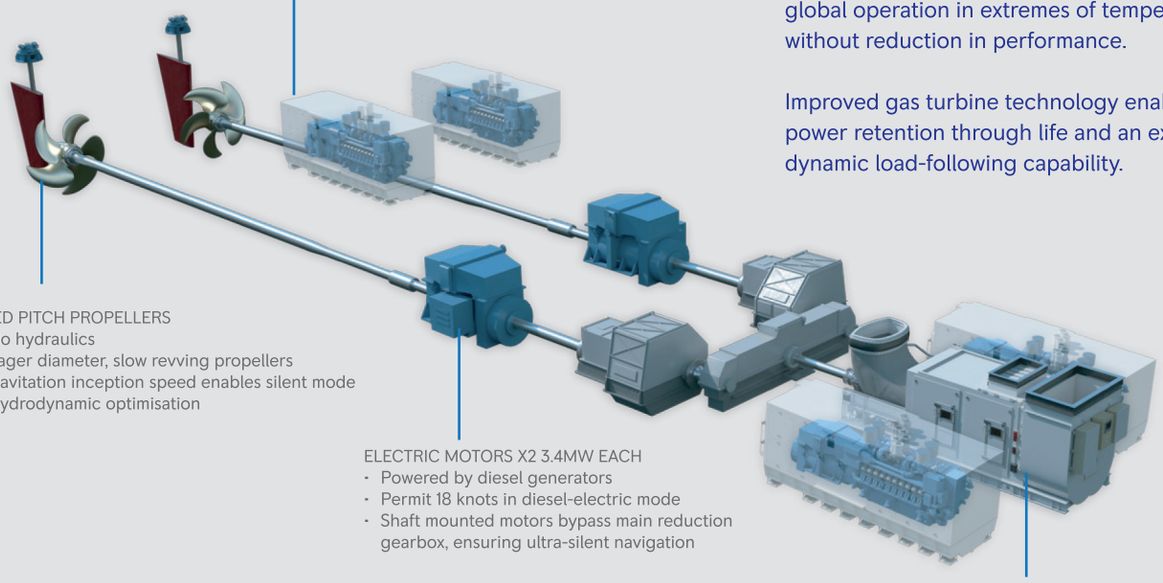
Range of 7,000 nautical miles (13,000km)
36MW of power
Top speed in excess of 26 knots

A simpler system – reduced complexity and cost in the design of the Integrated Platform Management System (IPMS), electric motor, power converter and gearbox.

A single, more powerful gas turbine further reduces life-cycle costs and enhances operational capability over the ship's life.

The power density and performance envelope of the Royal Navy's Type 26 GCS single gas turbine helps to futureproof the platform and enables global operation in extremes of temperature without reduction in performance.

Improved gas turbine technology enables power retention through life and an exceptional dynamic load-following capability.



DIESEL GENERATORS X4 3MW EACH
- Noise and vibration attenuation on constant speed
- Double-resilient mounted
- Acoustic enclosures

FIXED PITCH PROPELLERS
- No hydraulics
- Lager diameter, slow revving propellers
- Cavitation inception speed enables silent mode
- Hydrodynamic optimisation

ELECTRIC MOTORS X2 3.4MW EACH
- Powered by diesel generators
- Permit 18 knots in diesel-electric mode
- Shaft mounted motors bypass main reduction gearbox, ensuring ultra-silent navigation

MT30 GAS TURBINE X1 36MW AT 38ºC AMBIENT TEMPERATURES
- Designed for the 21st century, MT30's power density and performance envelope helps to future proof this vessel
- Global operation in extremes of temperature without any degradation in performance
- Takes ship to full speed in matter of minutes
- MT30 enables power retention through life and an exceptional dynamic load-following capability
- Supports current and future demands to power the ship's electrical generation capacity to the weapon systems and ship's hotel

Single MT30 CODLOG
(Combined Diesel Electric or Gas (CODLOG) system)

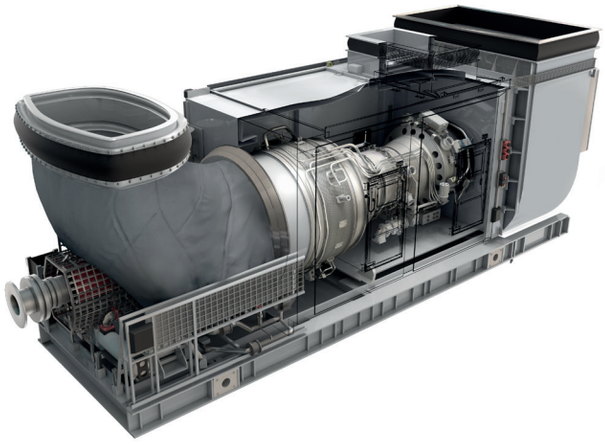
MT30 Powering the world's future fleets

2008 marked the entry into service for the MT30 powering the US Navy's first Littoral Combat Ship, USS Freedom. The propulsion system features twin MT30 engines and two diesel engines driving waterjets in a sophisticated combined diesel and gas turbine (CODAG) mechanical arrangement. MT30 has demonstrated excellent performance in service, powering the ship to speeds in excess of 40kts.

MT30 alternator packages provide the power for the US Navy's all-electric Zumwalt class destroyers and the Royal Navy's new aircraft carriers. The Italian Navy's future flagship, the Landing Helicopter Dock, will be powered by two MT30s.

Drawing on the high-power density attributes, single MT30-based hybrid propulsion systems have been chosen for the Republic of Korea Navy's new Daegu class frigates, the Royal Navy's innovative Type 26 City Class and the Royal Australian Navy's new Hunter class following the preferred selection of BAE System's Global Combat Ship Australia design. Japanese Maritime Self Defence Force's new 30FFM frigates will also be powered by MT30 in a single gas turbine CODAG configuration.

Now selected for over seven ship types, MT30 has become the gas turbine of choice for many of the World's advanced naval programmes.



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