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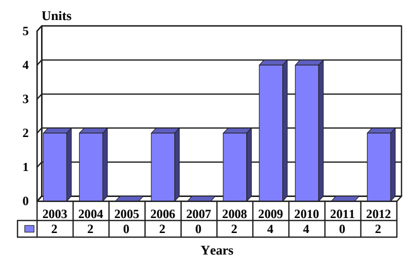
Rolls-Royce MT30 - Archived 5/2003

Outlook

- Main thrust is the marine market, both military and commercial
- Ease of machine production due to 80 percent commonality with Trent 800 aviation turbofan engine
- First marine application garnered in September 2002

10 Year Unit Production Forecast
2003 - 2012



Orientation

Description. The MT30 is a twin-spool, aeroderivative marine gas turbine machine in the 35-40-MW class.

Sponsor. The MT30 was privately developed by Rolls-Royce plc.

Contractors. The prime manufacturer is Rolls-Royce plc, Rolls-Royce Marine & Industrial Gas Turbines Limited; Ansty, Coventry, UK. The MT30 will be manufactured and assembled in Bristol, UK.

Licensees. At of the start of 2003, no firms were known to be affiliated with Rolls-Royce plc on the MT30 gas turbine program.

Power Class. The approximate power outputs of the currently announced machine are as follows:

Power Output	Machine Use
36.0 MW @26°C	–
34.1 MW @32°C	Mechanical Drive
30.7 MW @45°C	Mechanical Drive

Status. In development.

Total Produced. At the start of 2003, at least one development and test engine had been fabricated.

Application. The MT30 machine is currently targeted for service in either mechanical or electrical genset applications for both commercial and military marine propulsion/power markets. Depending on market conditions, the machine may be later be adapted for utility and industrial power generation (including base-load and peaking power) and for various mechanical load drives (including gas compression).

Price Range. The MT30 is priced as follows (prices estimated in 2003 US dollars): $12-$13 million for a basic gas turbine-equipped generating set; $9.7-$10.2 million for a gas turbine-equipped mechanical drive generating set; and $8-$9.5 million for marine engines unpackaged.

Competition. At 36.0 MW (48,275 shp), the MT30 has no direct competition. It is about 20 percent more powerful than the GEAE M&I LM2500.

Technical Data

The MT30 and the aero Trent 800 share an 80 percent commonality. Rolls-Royce has made use of 3-D blades and vanes in the engine's compressor section, and uses modular design for simplified maintenance. Key parts are protectively coated for service in a marine environment.

Design Features. The Rolls-Royce MT30 gas turbine machine has the following design features:

Compressor. An eight-stage variable-geometry IP compressor and a six-stage HP compressor are standard.

Combustor. The machine's annular combustor is similar to that of the aero Trent 800; it was designed to burn a wide variety of fuels. The machine is capable of meeting both the current and anticipated legislated standards for emissions and smoke.

Turbine. A single-stage HP turbine and a single-stage IP turbine are standard. A four-stage power turbine, derived from the aero Trent 800, is supported on a new robust bearing structure. Power turbine nominal speeds are 3,600 rpm for alternator drive and 3,300 rpm for mechanical drive.

Dimensions. The approximate dimensions and weights of a Rolls-Royce MT30 gas turbine machine are as follows:

Mechanical Drive Package	**Metric Units**	**English Units**
Length:	9.147 meters (9,174 mm)	30.1 feet
Width:	3.837 meters (3,837 mm)	12.6 feet
Height:	5.028 meters (5,028 mm)	16.5 feet
Alternator Package		
Length:	16.151 meters (16,515 mm)	53.0 feet
Width:	2.91 meters (2,910 mm)	9.54 feet
Height:	5.2 meters (5,200 mm)	17.06 feet
Weights		
Gas Turbine Change Unit (GTCU) (incl. power turbine): [a]	6.2 metric tons (6,200 kg)	13,668 pounds
Packaged Module (direct drive):	22.0 metric tons (22,000 kg) [b]	48,501 pounds
Packaged Module (incl. baseplate & alternator):	77.0 metric tons (77,000 kg) [b]	169,754 pounds

[a] Dry Weight.
[b] Depending on options.

Performance. The following are the performance parameters of the Rolls-Royce MT30 gas turbine:

	Metric Units	**English Units**
Power Output:	36.0 MW @ 26°C (36,000 kW @ 26°C)	48,276 hp @ 78.8°F
	34.1 MW @ 32°C (34,100 kW @ 32°C) [a]	45,728 hp @ 89.6°F
	30.7 MW @ 45°C (30,700 kW @ 45°C) [a]	41,168 hp @ 113.0°F
Thermal Efficiency:	> 40%	> 40%
SFC:	207 g/kWh	0.340 lb/hr-hr
Exhaust Mass Flow:	113 kg/sec (113 kg/s)	249.1 lb/sec
Exhaust Temperature:	466°C	870°F

[a] Mechanical drive.

Variants/Upgrades

At the start of 2003, no information was available with which to determine if Rolls-Royce was planning to produce variants or upgrades of the MT30. Rolls-Royce is, however, believed to be working on another marine engine, the MT50, at a much higher output.

Program Review

Background. The Rolls-Royce MT30 gas turbine machine development program began in June 1999, utilizing the Rolls-Royce strategy of developing its core gas turbine technology expertise across a range of markets. The aim was to design an efficient, cost-effective and reliable marine prime mover that can be configured for both mechanical and electrical drive.

The Trent 800 aviation turbofan engine was selected as the preferred parent since it offered the best combination of power, efficiency, life, and proven reliability, and could be developed within a reasonable cost and time scale. The marine variant was designated the MT30, and would be the first marine engine based on the state-of-the-art Trent technology. The design of an aero-derivative marine engine retains the aero-engine power density and reliability to ensure trouble-free operation. The design change from aero-parent engine is strictly limited to what is necessary to adapt the engine to a new environment, resulting in an 80 percent commonality with the Trent 800.

The MT30 gas turbine has been developed to meet the growing demand for higher power and efficiency while driving down the cost of ownership of propulsion systems within the military and commercial marine markets.

The Rolls-Royce MT30 harnesses the latest aero Trent engine materials and technology to reliably deliver a broad band of powers for commercial marine and naval applications in an exceptionally lightweight package. Designed with 50-60 percent fewer parts than other aero-derivative gas turbines in its class, the MT30 maintains its competitive efficiency down to 25 MW. Derived from the reliable Trent 800, the MT30 is also designed to burn commercially available distillate fuels, giving a high degree of operational flexibility and associated through-life cost benefits.

Advanced Design. The MT30 benefits from advanced technology features common to the Trent aero engine family such as the 3-D blades and vanes in the compression system, incorporated for increased efficiency. It is a twin-spool, high-pressure-ratio gas generator with an eight-stage variable geometry Intermediate Pressure Compressor (IPC) and a six-stage High Pressure Compressor (HPC). The four-stage free-power turbine is derived from the Trent 800, and is supported on a new robust bearing structure for optimum reliability. Proven components, incorporating the latest blade cooling technologies, are used throughout. Key parts are protectively coated for service in the marine environment to reduce maintenance and deliver long service life. The annular combustor is similar to the aero parent and ensures the MT30 meets all current and anticipated legislated standards for emissions and smoke.

Packaged Module. A self-contained, fully packaged module, the MT30 can be supplied for direct drive or power generation – complete with alternator, and its own acoustic enclosure. The design incorporates all engine auxiliaries onto the package, leaving the shipbuilder to provide the starter energy (hydraulic or electric), a location for a control console, and an alternator lube oil module (if specified), plus the usual fuel, water and electrical interconnections. The package is modular, permitting a single lift or an ultra-low-weight, multiple-lift option, as well as a variety of intake and exhaust configurations to suit ship design requirements. The enclosure is also the fire boundary and is fitted with an automated fire suppression system.

Lightweight. The gas turbine change unit (GTCU), which includes the power turbine, weighs 6,200 kilograms (dry). The total package weight is 22,000 kilograms, depending on options. The MT30 offers the best power-to-weight ratio in its class. When packaged as a skid-mounted generator set (includes two-pole AC generator) with common baseplate suitable for multi-point mounting, the complete unit weighs 77,000 kilograms.

Reduced Maintenance. The MT30 is designed for unmanned engine rooms. Condition Based Maintenance (CBM) is a feature of the engine design, and routine maintenance is limited to checking fluid levels and visual examinations. Internal condition sensors enable the unit to be serviced on an “on condition” basis. Modular construction speeds major maintenance when it becomes necessary, and customers benefit from quicker turnaround times for repair with reduced maintenance costs.

Modular Design. The modules of the MT30 can be removed and often replaced, avoiding the cost of a complete engine overhaul. The engine is broken down into the following modules: tail bearing housing, power turbine, IP turbine, core, internal gearbox and intercase, and IP compressor and front bearing housing. An external gearbox can be added.

The MT30 can be replaced within 12 hours of engine cool down, and is easily transportable by land, sea or air for module separation on the dockside or at a repair and overhaul facility.

Power Density. The MT30 is designed to provide the marine market with significant improvements in power density. The MT30 delivers a continuous rating of 36 MW at 25°C net of installation losses. It has an overall package size and weight comparable to that of a 25 MW industry-standard engine. Thanks to its twin-spool design and state-of-the-art aero-based technology, the MT30 offers a 25 percent improvement in power density.

Fuel Consumption. The fuel consumption of the engine is comparable to that of high-speed diesels at maximum power, and even with the MT30 engine running at a power as low as 25 MW, the fuel burn was designed to match competing gas turbines. The unit burns DMA fuel and is designed to meet all current and anticipated emission requirements.

Simple Installation. The MT30 follows the traditional Rolls-Royce approach of a single-lift package, with all auxiliary equipment mounted on a baseplate.

MT30 in Marine Propulsion. The MT30 turbine is suitable for the following applications:

Fast Ferries. Where power density, reliability and operational flexibility are paramount, the MT30 is well-suited to mono- and multi-hull large fast craft.

Cruise. In electric drive configuration, the provision of 36 MW from a GTA package can allow the shipbuilder significantly more flexibility during the design process.

LNG. The MT30 has enabled Rolls-Royce to develop a gas carrier propulsion system that delivers significant through-life cost savings.

Frigates. At 36 MW installed output, the MT30 offers 30 percent more power without the volume or weight penalty of typical naval boost gas turbines.

Carriers. Regarding propulsion systems for larger warships, particularly in electrical configuration, the MT30 offers significantly more flexibility in ship design.

European High-Speed Cargo Vessel. In late September 2002, Spanish shipbuilder and designer IZAR and Rolls-Royce announced plans for a new European High-Speed Cargo Vessel (EHSCV) as a cost-effective short-sea shipping alternative to road transport in Europe. The mono-hull EHSCV will be powered by two Rolls-Royce MT30 gas turbines and Rolls-Royce KaMeWa waterjets.

The baseline design enables 124 trailers to be carried at a service speed of 37 knots. The vessel is considered economically competitive with road transport on routes longer than 300 nautical miles.

The design meets the needs of ship owners wishing to develop fleet plans in line with the European Union's Marco Polo program, which is designed to give financial support to projects that improve the environmental performance of Europe's freight transport system.

Preliminary technical details of the EHSCV are: length, 212 meters; breadth (max), 22 meters; draught, 4.7 meters; deadweight, 3,400 dwt; fuel, marine diesel oil; range, up to 800 nautical miles; and cargo capacity, 1,700 lane meters.

Funding

It is unknown if any funding has been allotted to Rolls-Royce for the MT30 engine effort via the European Union's Marco Polo program, which is designed to give financial support to projects that improve the environmental performance of Europe's freight transport system.

Recent Contracts

No military contracts involving the Rolls-Royce MT30 gas turbine machine have been issued or received.

Timetable

Month	Year	Major Development
	1988	Development work on Trent aviation turbofan engine begun
Jan	1995	Trent 700 aviation turbofan engine enters service
	1996	Trent 800 aviation turbofan engine enters service
Jun	1999	Development work on MT30 marine engine begun
Early	2001	New marine test facility construction begun
Sep	2001	Rolls-Royce provides the first details of the MT30
Spring	2002	MT30 machine formally launched
Sep	2002	First developmental MT30 goes to test
		Construction of new marine test facility completed
		IZAR and R-R announce plans for European High-Speed Cargo Vessel
Early	2004	MT30 to become available for delivery
Thru	2012	Continued production/aftermarket support of MT30 marine turbine machine; continued search for additional applications for MT30 machine

Worldwide Distribution

At the start of 2003, at least one MT30 developmental engine had been fabricated; that machine is in the **UK**. A second developmental engine, when completed, will also be in the **UK**.

Forecast Rationale

The Rolls-Royce MT30 marine gas turbine was developed to meet a growing demand for higher marine power/propulsion outputs and even greater machine efficiencies – yet also with an eye on keeping down the cost of ownership for the military and commercial marine markets. Being an aero-derivative marine engine, it maintains the aero-engine power density and reliability to ensure virtually trouble-free operation.

We believe that the European High-Speed Cargo Vessel (EHSCV) program will be the first of several that generate engine production orders during our forecast period. The MT30's major selling points will be its low maintenance costs and the fact that Rolls-Royce already has a wide customer base for the aero Trent 800. It should be noted here that while no firms have been mentioned as partners with Rolls-Royce on the MT30, the aero Trent program has several manufacturing partners.

The cruise ship market is another arena in which the marine MT30 can well compete, and the engine does fit into an increasingly popular marine propulsion class.

Our forecast projects that one additional development and test engine will be built in 2003 (one in 2002), and one preproduction series engine in 2003, with production-standard machines becoming available in early 2004.

At this early stage in the machine's life-cycle, we are cautious of issuing too-rosy a forecast. We are forecasting the production of 18 machines in the forecast period. When large-production applications arise, we will reissue our report to include engine production for those applications.

Given the growing demand for electrical generation worldwide, Rolls-Royce may eventually consider adapting the MT30 for electrical generation duty, and perhaps even adapting the MT30 for various mechanical load drives outside the marine arena.

Ten-Year Outlook

ESTIMATED CALENDAR YEAR PRODUCTION

			High Confidence Level				Good Confidence Level			Speculative			
Engine/Machine	**Application**	**thru 2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**Total 2003-2012**
ROLLS-ROYCE (INDUST. & MARINE)													
MT30	DEV & TEST	1	1	0	0	0	0	0	0	0	0	0	1
MT30	MARINE POWER	0	1	2	0	2	0	2	4	4	0	2	17
TOTAL PRODUCTION		1	2	2	0	2	0	2	4	4	0	2	18