



# Building on a **Marine Power Legacy**

Product specifications • Applications • Experience



U.S. Navy FFG 62 Frigate

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GE has been providing aeroderivative marine gas turbines since the 1950s and has amassed extensive experience serving military and commercial ship applications. GE offers a wide range of engine sizes backed by continual infusion of new technologies to meet ever-changing customer needs. GE's design-for-maintenance approach is supported by global service experts, ensuring these engines remain the market's most reliable gas turbines with the lowest lifecycle costs.

Our LM marine gas turbines provide superior availability for diverse military applications including United States Navy shock-tested designs and lower shock requirements. These reliable engines are ideal for military ships ranging from 200 to more than 65,000 tons displacement with applications on patrol boats, corvettes, frigates, destroyers, cruisers, aircraft carriers, amphibious warfare ships, and supply and sealift ships.

GE marine gas turbines also have been used on commercial ships since the 1990s. These compact, lightweight engines have the capability to burn a wide variety of fuels, as well as the ability to meet existing and proposed environmental regulations. These features make GE marine gas turbines ideal for LNG tankers, container ships, power barges, cruise ships and ferries.

The marine gas turbine family shares extensive pedigree with GE's reliable industrial aeroderivative turbines. There are over 5,400 aeroderivative gas turbines operating worldwide, logging more than 150 million hours in marine, power generation, and oil and gas settings. Enjoy this 2021 updated reference book describing GE marine gas turbine products and services.

For more information contact George Awiszus at [George.Awiszus@ge.com](mailto:George.Awiszus@ge.com), +1-513-212-8424 or visit [www.ge.com/marine](http://www.ge.com/marine).

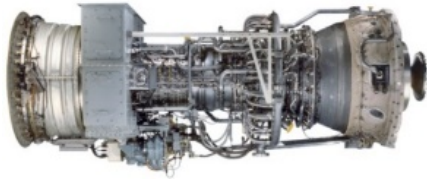
## The world's most experienced marine gas turbines

- 39 world navies
  - 633 naval ships
  - 115 naval ship programs
  - 1,500 engines delivered or on order
  - >16 million operating hours
  - 86 engines on 47 commercial vessels
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- Large fleet of engines on every continent providing interoperability and supportability either onshore or afloat
  - Supported by GE's nine worldwide depot/service locations

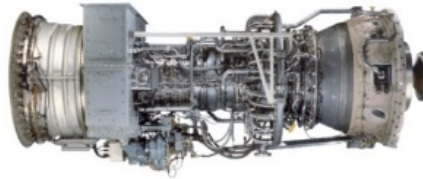
# GE family of marine engines

Engine performance characteristics – liquid fuel

**LM6000PG**



**LM6000PC**



**LM2500+G4**



Weight (lb/kg)	16,180/7,337	16,340/7,411	11,545/5,237
Length (ft/m)	24/7.3	24/7.3	22/6.7
Height (ft/m)	8.3/2.5	8.3/2.5	6.7/2.04

## Output

(shp)	70,656	61,851	49,587
(kW)	52,689	46,123	36,977

## SFC

(lb/shp-hr)	0.335	0.333	0.350
(g/kW-hr)	203.6	202.7	213

## Heat rate

(Btu/shp-hr)	6,168	6,128	6,432
(Btu/kW-hr)	8,279	8,224	8,626
(kJ/kW-hr)	8,773	8,675	9,098

## Exhaust gas flow

(lb/sec)/(kg/sec)	306/139	286/130	209/93
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## Exhaust gas temperature

(°F)/(°C)	921/494	853/456	1,042/549
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## Power turbine speed

(rpm)	3,850	3,600	3,600
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Average performance, ISO (60 Hz, 59°F, sea level, 60% relative humidity, no inlet/exhaust losses), SFC based on Lower Fuel Heating Value of 18,400 Btu/lb

# GE family of marine engines

Engine performance characteristics – liquid fuel



**LM2500+**



**LM2500**



**LM500**



Weight (lb/kg)	11,545/5,237	10,300/4,672	1,500/680
Length (ft/m)	22/6.7	21.4/6.52	9.7/2.96
Height (ft/m)	6.7/2.04	6.7/2.04	3.0/9.1

**Output**

(shp)	40,500	33,600	6,130
(kW)	30,200	25,060	4,570

**SFC**

(lb/shp-hr)	0.354	0.373	0.443
(g/kW-hr)	215.3	226.9	269.5

**Heat rate**

(Btu/shp-hr)	6,522	6,863	8,140
(Btu/kW-hr)	8,746	9,204	10,916
(kJ/kW-hr)	9,227	9,705	11,520

**Exhaust gas flow**

(lb/sec)/(kg/sec)	189/85.9	152.9/69.4	36/16.4
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**Exhaust gas temperature**

(°F)/(°C)	965/518	1,051/566	1,049/565
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**Power turbine speed**

(rpm)	3,600	3,600	7,000
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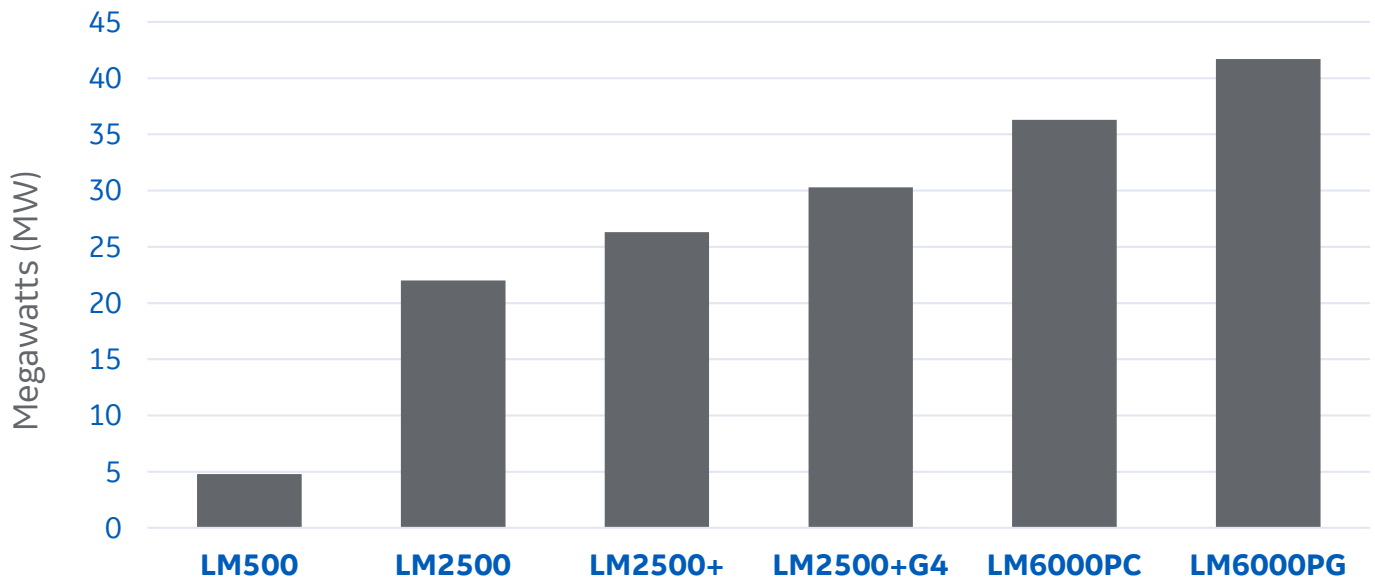
Average performance, ISO (60 Hz, 59°F, sea level, 60% relative humidity, no inlet/exhaust losses), SFC based on Lower Fuel Heating Value of 18,400 Btu/lb

# Power options

## Dimensions and weight

GE's family of six highly efficient gas turbines have a wide range of power and enable architects to design ships according to specific mission profiles.

### GE gas turbine power options (USN ratings)



U.S. Navy standard day rating MW

4.64

22.07

26.63

30.46

37.61

41.71

*100°F ambient air, sea level pressure, 60% relative humidity, 4.0 in H<sub>2</sub>O inlet loss/6.0 in H<sub>2</sub>O exhaust loss.*

## Best-in-class power density

### Solution for weight- and volume-constrained ships

All LM2500 models, with composite enclosures, have the same overall package dimensions to provide the greatest flexibility in engine arrangement and future power need.

Model (USN 901D Shock Design)	LM2500	LM2500+	LM2500+G4
Dry weight - lbs (mt)	40,500 (18.4)	43,900 (19.9)	
Baseplate length – in (m)	315 (8.0)		
Baseplate width – in (m)	104 (2.6)		
Height (bottom of baseplate to top of enclosure) – in (m)	96 (2.4)		

Packages with steel enclosures weigh an additional 5,500 lb and the length of the LM2500+ and LM2500+G4 are 14 in longer.

# LM2500 demonstrated naval reliability and availability



## Worldwide fleet of GE marine gas turbines boast >99% reliability and >98% availability

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### Proven engine

- Marinized to meet naval life requirements
- Only gas turbine shock-tested for superior survivability
- Proven, reliable two-spool engine with no restrictions for cold start-up or operation in harsh environments
- Relevant industrial operating experience: 90% commonality to >2,500 active industrial aeroderivative gas turbines
- Demonstrated mechanical drive and generator set experience

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### Performance

- Fuel efficient
- Best-in-class power density
- Lightweight, state-of-the-art composite enclosure
- Every United States Navy production engine and module full load-tested with noise and vibration acceptance criteria

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### Features

- Full enclosure for optimal noise and thermal performance and crew protection
- Full complement of auxiliary systems, including electric start

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### Maintenance and service

- Designed for in-place maintenance versus expensive, long turnaround turbine removals
- Modular construction enables sections to be separated inside the module for in-situ repairs or removal
- Global field service experts
- Nine worldwide depot/service locations

# LM2500 gas turbine enclosure

Lightweight, state-of-the-art composite

- One piece composite carbon fiber
- 5,500 lb wall weight reduction
- Improved access
- Improved sound attenuation
- Reduced wall temperature and heat rejection
- Fully qualified
- Updated sensors and components
- ✓ Eliminates corrosion
- ✓ 50% reduction over steel
- ✓ 6 in taller and 60% lighter doors, more panels
- ✓ 60% (4 dBA) quieter than steel
- ✓ 25°F to 50°F cooler
- ✓ Completed all analyses and tests including full load test on steel versus composite module
- ✓ Transducers, heater, flame and ice detectors



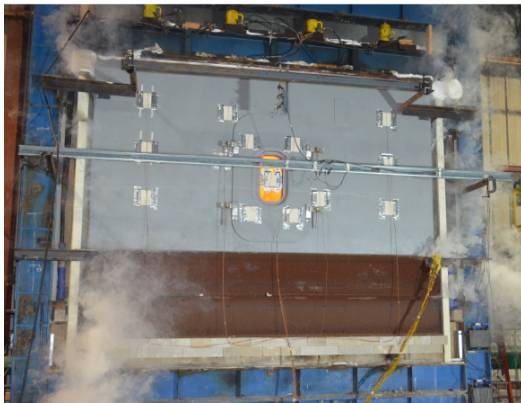


# Qualified LM2500 composite module

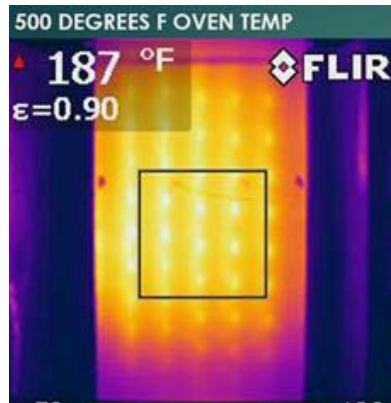


First applications: LCS 32 and DDG 128

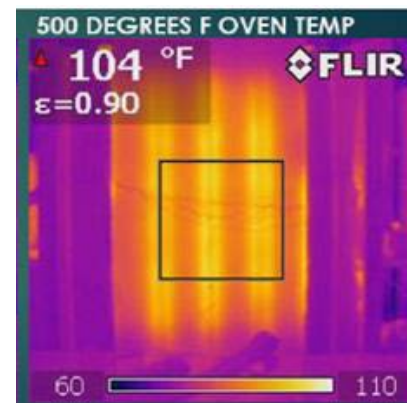
## Oven thermal panel tests



Fire resistance and toxicity testing



Steel



Composite



MIL-S-901D shock tested, X-ray and pressurization integrity testing



Engine removal and maintenance verification

# LM2500 in-situ maintenance

No need to remove gas turbines; saves millions in repair costs; more engine availability per year

## Modular design



- Gas generator and power turbine can be separated inside the module
  - Facilitates in-situ repair: high and low pressure turbine, turbine mid-frame, bearings and seals
  - Allows easy removal of only affected section, yielding lower cost and expedient repairs whether on ship, dockside or at a local facility

## Horizontal split casing design



- Facilitates in-situ maintenance, repair and trim balance in days versus turbine removal that could take weeks or months
- Standard feature on LM2500 and LM6000 gas turbines
- Prevents countless turbine removals and eliminates need for costly spare turbines or gas generators

## Access, proven tooling and procedures



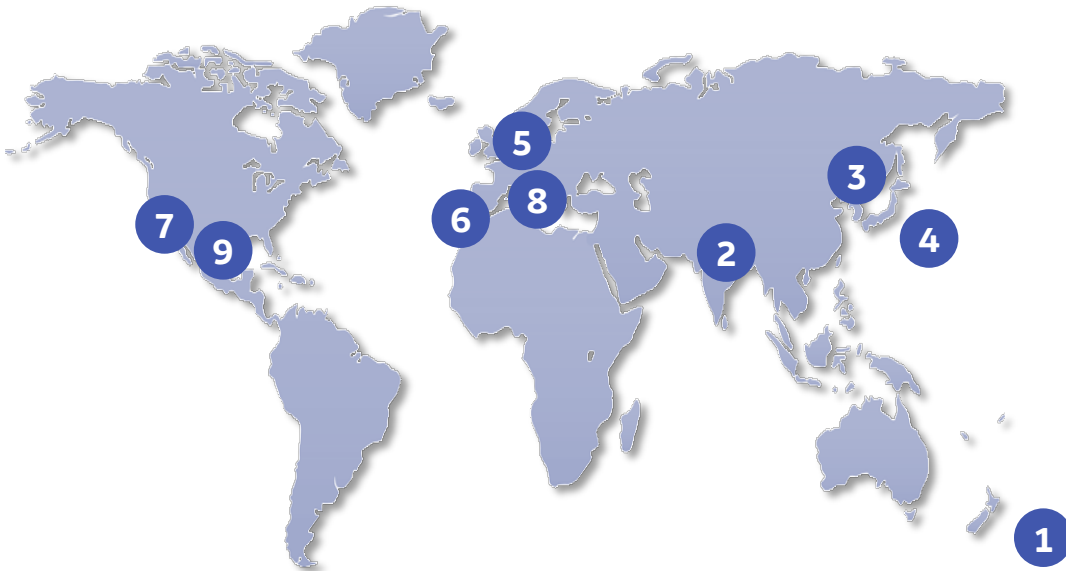
- Modular design provides crew with ample room for repairs
- Tooling offers flexibility for either in-module or dockside work
- Technical manual detailing in-situ, dockside or local facility work with or without OEM support

## Global service experts



- Field service experts keep gas turbines operating the world over
- Full range of customized service and support solutions
- GE OEM replacement parts ensure outstanding gas turbine performance and reliability

# Global service depots and customized service agreements



## Licensed depots

1. Air New Zealand Gas Turbines
2. HAL – India
3. Hanwha Aerospace – Republic of Korea
4. IHI – Japan
5. MTU Aero – Germany
6. Navantia – Spain

## Navy depot

7. Fleet Readiness Center Southwest (FRCSW), North Island, California

## GE depots

8. GE Avio – Italy
9. GE Energy – Houston, Texas

## Customized Service Agreements

### Partners for success

#### Proven performance

Navies have seen significant performance and operational excellence results – increased reliability and availability with lower administrative costs

- Delivering 99.9% reliability to the Royal Canadian Navy's fleet of 12 Halifax class frigates under a CSA since 2001
- Since 2014, the Royal Australian Navy benefits from a CSA for its LM2500 fleet

#### Maintenance experts

Access to GE experts providing planned and unplanned operations and maintenance support with OEM quality gas turbine parts, repairs, and services

# Ship classes

GE marine gas turbines have powered ships of all sizes

## Sealift

50,000-60,000 tons



## Support ship

40,000-50,000 tons



## Cargo ship

20,000-26,000 tons



## Aircraft carrier

25,000-65,000 tons



## Amphibious ship

20,000-45,000 tons



## Cruiser

9,500-11,000 tons



## Destroyer

5,000-10,000 tons



## Frigate

2,500-7,400 tons



## Corvette

1,000-3,900 tons



## Fast patrol boat

200-500 tons



100 200 300 400 500 600 700 800 900 1000

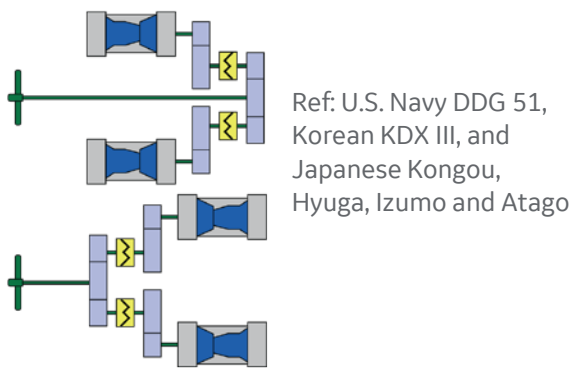
Length of ship in feet

# Gas turbine based marine cycles

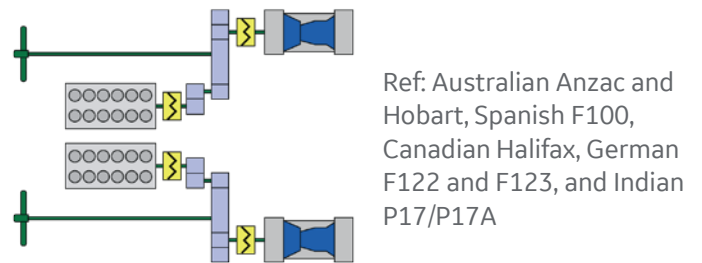


Propulsion plant architecture and prime mover selection is largely based upon the ship's mission, operating profile (i.e., time spent at various power levels), and the maximum speed. Other important design considerations include cost, reliability, maintainability, shock, and noise signature. To those ends, GE has successfully integrated its marine gas turbines across a wide array of architectures such as the cycle diagrams depicted below.

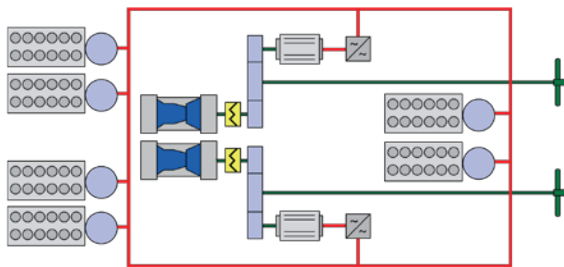
## COmbed Gas turbine And Gas turbine (COGAG) system



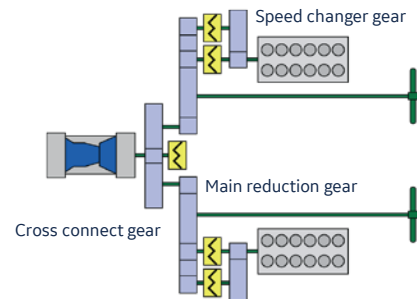
## COmbed Diesel Or Gas turbine (CODOG) system



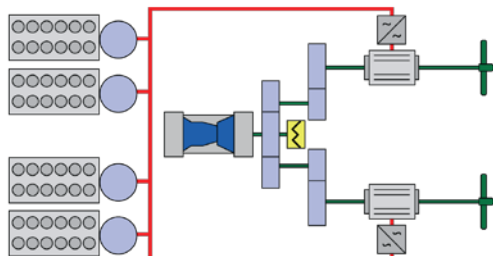
## COmbed Diesel eLectric Or Gas turbine (CODLOG) system



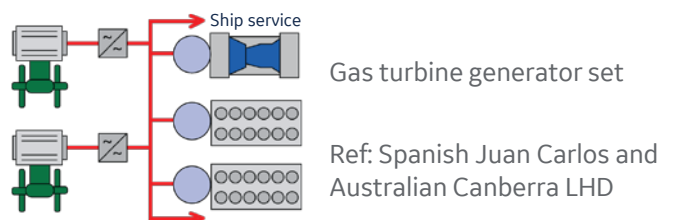
## COmbed Diesel And Gas turbine (CODAG) system



## COmbed Diesel eLectric and gas turbine system (CODLAG)



## Integred Electric Propulsion (IPS)



# LM2500/LM2500+/LM2500+G4

## Naval applications by country

Country	Class	Type	# Ships	# GT's per ship	# GT's in Class	GT Model	Propulsion Cycle
<b>Algeria</b>	Erradii	Frigate (MEKO A200)	2	1	2	LM2500	CODOG
<b>Australia</b>	Anzac	Frigate	8	1	8	LM2500	CODOG
	Adelaide	Frigate	6	2	12	LM2500	COGAG
	Canberra AHLD (***)	Amphibious Helicopter	2	1	2	LM2500	IPS
	Hobart AWD	Destroyer	3	2	6	LM2500	CODOG
<b>Bahrain</b>	Sabha	Frigate	1*	2		LM2500	COGAG
<b>Brazil</b>	Inhauma	Corvette	5	1	5	LM2500	CODOG
<b>Canada</b>	Halifax	Frigate	12	2	24	LM2500	CODOG
<b>Chile</b>	Adelaide (Australia)	Frigate	2*	2		LM2500	COGAG
<b>China (PRC)</b>	Luhu	Destroyer	2	2	4	LM2500	CODOG
<b>Colombia</b>	Narino	Corvette (Donghae)	1*	1		LM2500	CODOG
	Pohang Class (S. Korean)	Corvette	1*	1		LM2500	CODOG
<b>Denmark</b>	Niels Juel	Corvette	3	1	3	LM2500	CODOG
<b>Egypt</b>	Sharm El Sheikh	Frigate (FFG-7)	4*	2		LM2500	CODOG
	Pohang Class (S. Korean)	Corvette	1*	1		LM2500	CODOG
	Tahya Misr	Frigate (DCNS FREMM)	1	1	1	LM2500+G4	CODLOG
<b>Finland</b>	MEKO	Frigate	4	1	4	LM2500	CODAG WARP
	Pohjanmaa (SQ2020)	Corvette	4	1	4	LM2500	CODLAG
<b>France</b>	Forbin	Frigate (Horizon)	2	2	4	LM2500	CODOG
	Aquitaine	Frigate (DCNS FREMM)	8	1	8	LM2500+G4	CODLOG
<b>Germany</b>	Bremen	Frigate (122)	8	2	16	LM2500	CODOG
	Brandenburg	Frigate (123)	4	2	8	LM2500	CODOG
	Sachsen	Frigate (124)	3	1	3	LM2500	CODAG
	Baden-Wuerttemberg	Frigate (125)	4	1	4	LM2500	CODLAG
<b>Greece</b>	Hydra	Frigate	4	2	8	LM2500	CODOG
<b>India</b>	Shivalik	Frigate (P-17)	3	2	6	LM2500	CODOG
	Unnamed	Frigate (P-17A)	7	2	14	LM2500	CODOG
	Vikrant	Aircraft Carrier (P-71)	1	4	4	LM2500	COGAG
<b>Indonesia</b>	Mandau	Fast Attack	4	1	4	LM2500	CODOG
<b>Israel</b>	Eilat	Corvette (Sa'ar 5)	3	1	3	LM2500	CODOG
<b>Italy</b>	Artigliere	Frigate	4	2	8	LM2500	CODOG
	Maestrale	Frigate	8	2	16	LM2500	CODOG
	Durand de la Penne	Destroyer	2	2	4	LM2500	CODOG
	Garibaldi	Aircraft Carrier	1	4	4	LM2500	COGAG
	Andrea Doria	Destroyer (Horizon)	2	2	4	LM2500	CODOG
	Cavour	Aircraft Carrier	1	4	4	LM2500	COGAG
	Bergamini	Frigate (FNC FREMM)	10	1	10	LM2500+G4	CODLAG
	PPA	Offshore Multi-purpose Patrol	7	1	7	LM2500+G4	CODLAG
<b>Japan</b>	Asuka (***)	Experimental	1	2	2	LM2500	COGLAG
	Murasame	Destroyer	9	2	18	LM2500	COGAG
	Takanami	Destroyer	5	2	10	LM2500	COGAG
	Kongou	Destroyer	4	4	16	LM2500	COGAG
	Hyuga	Helio Destroyer (DDH)	2	4	8	LM2500	COGAG
	Izumo	Helio Destroyer (DDH)	2	4	8	LM2500	COGAG
	Atago	Destroyer (DDGHM)	2	4	8	LM2500	COGAG
	Asahi	Destroyer	2	2	4	LM2500	COGLAG
<b>Morocco</b>	Maya (27DD)	Destroyer	2	2	4	LM2500	COGLAG
<b>Morocco</b>	Mohammed VI	Frigate (DCNS FREMM)	1	1	1	LM2500+G4	CODLOG
<b>New Zealand</b>	Te Kaha	Frigate (Anzac)	2	1	2	LM2500	CODOG
<b>Norway</b>	Fridtjof Nansen	Frigate	5	1	5	LM2500	CODAG
<b>Pakistan</b>	PNS Alamgir	Frigate	1*	2		LM2500	COGAG
	MILGEM	Corvette	4	1	4	LM2500	CODAG

# LM2500/LM2500+/LM2500+G4



## Naval applications by country

Country	Class	Type	# Ships	# GT's per ship	# GT's in Class	GT Model	Propulsion Cycle
Peru	Caravajal	Frigate - Mod Lupo	4	2	8	LM2500	CODOG
	Aguirre	Frigate - Lupo	4	2	8	LM2500	CODOG
	Pohang Class (S. Korean)	Corvette	1*	2		LM2500	CODOG
Philippines	Pohang Class (S. Korean)	Corvette	1*	2		LM2500	CODOG
Poland	ORP Slazak	Offshore Patrol Vessel	1	1	1	LM2500	CODOG
	Gen. K. Pulaski	Frigate (FFG-7)	2*	2		LM2500	COGAG
Portugal	Vasco Da Gama	Frigate (MEKO 200)	3	2	6	LM2500	CODOG
Saudi Arabia	Al Siddiq	Patrol Combatant	9	1	9	LM2500	CODOG
	Badr	Corvette	4	1	4	LM2500	CODOG
S. Africa	Amatola	Frigate (MEKO A200)	4	1	4	LM2500	CODAG WARP
S. Korea	Donghae	Corvette	4	1	4	LM2500	CODOG
	Pohang	Corvette	24	1	24	LM2500	CODOG
	Ulsan	Frigate	9	2	18	LM2500	CODOG
	KDX-1	Destroyer	3	2	6	LM2500	CODOG
	KDX-2	Destroyer	6	2	12	LM2500	CODOG
	KDX-3 B1	Destroyer	3	4	12	LM2500	COGAG
	KDX-3 B2	Destroyer	1	4	4	LM2500	COGLAG
	FFX I (**)	Frigate	6	2	6	LM2500	CODOG
Spain	Hansando (ATX)	Aux Training Ship	1	1	1	LM2500	CODOG
	Santa Maria	Frigate	6	2	12	LM2500	COGAG
	Alvaro de Bazan	Frigate (F100)	5	2	10	LM2500	CODOG
	Principe De Asturias	Aircraft Carrier	1	2	2	LM2500	CODOG
	Juan Carlos (***)	Amphibious Assault (LHD)	1	1	1	LM2500	IPS
	Bonifaz (F110)	Frigate	5	1	5	LM2500	CODLAG
Taiwan	Cheng Kung	Frigate	8	2	16	LM2500	COGAG
	Ming Chuan	Frigate (FFG-7)	4*	2		LM2500	COGAG
	Kee Lung	Destroyer (Kidd)	4*	4		LM2500	COGAG
Thailand	Naresuan	Frigate	2	2	4	LM2500	CODOG
	Chakri Naruebet	Helo Carrier	1	2	2	LM2500	CODOG
	HTMS Bhumibol Adulyadej	Frigate	1	1	1	LM2500	CODOG
Turkey	Barbaros	Frigate	4	2	8	LM2500	CODOG
	Gabya	Frigate (FFG 7)	8*	2		LM2500	COGAG
	Ada	Corvette (MILGEM)	4	1	4	LM2500	CODAG
	ISTIF	Frigate (MILGEM)	1	1	1	LM2500	CODAG
	DIMDEG	Fleet Replenishment	1	2	2	LM2500	CODAG
USA	Adm. Wm. M. Callaghan	Roll-on, Roll-off	1	2	2	LM2500	COGAG
	Pegasus	Patrol Hydrofoil	6	1	6	LM2500	CODOG
	Oliver Hazard Perry	Frigate	51	2	102	LM2500	COGAG
	Spruance	Destroyer	31	4	124	LM2500	COGAG
	Arleigh Burke	Destroyer	85	4	340	LM2500	COGAG
	Kidd	Destroyer	4	4	16	LM2500	COGAG
	Ticonderoga	Cruiser	27	4	108	LM2500	COGAG
	Supply (AOE-6)	Fast Combat Support	4	4	16	LM2500	COGAG
	Watson	Fast Sealift	8	2	16	LM2500	COGAG
	Sea Fighter	Fast Sea Frame	1	2	2	LM2500	CODOG
	Makin Island	Amphibious Assault (LHD8)	1	2	2	LM2500+	CODLOG
	Legend	USCG National Security Cutter	11	1	11	LM2500	CODAG
	America	Amphibious Assault (LHA6&7)	2	2	4	LM2500+	CODLOG
	America	Amphibious Assault (LHA8&9)	2	2	4	LM2500	CODLOG
	Independence	LCS2 (Littoral Combat Ship)	19	2	38	LM2500	CODAG
	Venezuela	FFG 62 - Constellation	Frigate	10	1	10	LM2500+G4
Mariscal Sucre		Frigate	6	2	12	LM2500	CODOG
Vietnam	Pohang Class (S. Korean)	Corvette	2*	1		LM2500	CODOG

**Totals 574 1,312**

\* Ships not included in total (Transferred from other navies)

\*\* First three ships using engines from decommissioned ship

\*\*\*Gas turbine generator set

Includes units delivered and on order

# U.S. Navy and Coast Guard ships

95% of gas turbine-propelled ships powered by GE marine engines

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FFG 7 frigate



DD 963 destroyer



Ticonderoga CG 47 cruiser



AOE 6 fast combat support



Watson class sealift



Arleigh Burke DDG 51 destroyer



LHD 8 amphibious ship



LHA 6 amphibious ship



USCG National Security Cutter



LCS 2 Independence frigate



FFG 62 FREMM frigate



# International naval vessels

Powered by GE marine engines



Spanish and Australian LHD



French and Italian Horizon frigate



Republic of Korea KDX III destroyer



Republic of Korea PKX patrol ship



Indian P-17 frigate



French, Italian, Egyptian and Moroccan FREMM frigate



Japanese DDH helicopter destroyer



Algerian, Portuguese and South African MEKO frigate



Turkish/Pakistan MILGEM corvette



German F124 Sachsen frigate

# LM500 experience

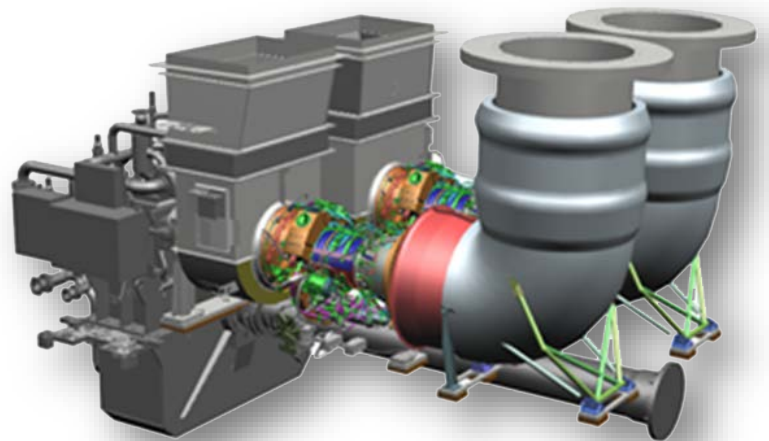
## Applications by country

Country	Class	# Ships	# Engines
Denmark	Flyvefisken patrol boat	14	14
Hong Kong	Foilcat	2	4
	Foilcat spares		6
Japan	Hayabusa patrol boat	6	18
	Sparvieo hydrofoil	3	5
	Izumo destroyer (22, 24 DDH)**	2	8
Republic of Korea	Gumdoksuri patrol boat (PKX-A)	18	36
	Gumdoksuri II patrol boat (PKX-B)	16	32
Lithuania	Flyverfisken from Denmark*	4	--
Portugal	Flyverfisken from Denmark*	5	--
USA	Test site***	0	1
		<u>61*</u>	<u>124*</u>

## GE LM500 engine powers Republic of Korea's Gumdoksuri II-class PKX-B patrol boat

The ROK Navy took delivery of the first 220 ton patrol boat in October 2017. The ship can attain speeds over 40 knots, and is powered by two, 4.6 MW GE LM500 engines. The engines and packages are provided by GE Marine in partnership with Hanwha Aerospace.

The PKX-B propulsion system realized a 45% reduction in size and weight from its PKX-A predecessor by optimizing the package and gas turbine auxiliary systems to include an electric start system.



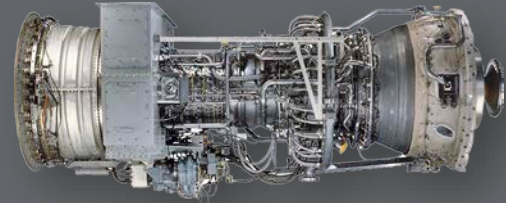
\*Ships not counted in total  
\*\*Gas turbine generator set

# LM6000 experience

Power for larger ships



- Marinized module designed for U.S. Navy shock requirements, built and tested with engine
- Naval “hot-day” certified to 41.6 MW by Lloyd’s and RINA; up to 52.4 MW
- Available in hot or cold end drive configuration
- 42% thermal efficiency, highest power and efficiency in marine market
- 1,388 industrial engines fielded in mechanical drive and generator set applications; includes 15 for offshore marine
- 99.7% reliability and 41 million operating hours



GE LM6000PG marine gas turbine



LM6000PG on test in Italy

**The LM6000 is ready to propel high powered naval ships**

## Gas turbine generator set applications

- 2,455 LM2500 and 1,318 LM6000 industrial generator sets
- Naval LM2500 gas turbine generator sets: first LHD commissioned in 2010



Spanish and Australian LHD LM2500



Cruise ship LM2500+



Oil and gas offshore



Japanese Izumo Helio destroyer LM500



Base load or peaking



Mobile trailers

# GE Marine commercial ship propulsion experience

Country	Engine	Class	# Ships	# Engines
Bahamas	LM2500+	Radiance of the Seas Cruise Ships *, **	4	8
Bermuda	LM2500+	Coral Princess Cruise Ships **	2	2
Denmark	LM1600	Seajet 250 Ferries	2	4
	LM2500	Auto Express 86 Ferry	1	2
France	LM2500+	SNCM Corsaire 13000 Ferry	1	2
Germany	LM1600	Enigma (Katana) Yacht	1	1
	LM2500+G4	AZZAM Mega-yacht	1	2
Greece	LM2500+	Nel Corsaire 14000 Ferry	1	2
Holland	LM2500	Ecstasea Yacht	1	1
Italy	LM1600	Destriero Yacht	1	3
	LM2500	Aquastrada Yacht	2	2
	LM2500	MDV3000 Ferries	4	8
Hong Kong	LM500	Foilcat Ferries	2	4
Liberia	LM2500+	Grand Princess Cruise Ships **	2	2
Netherlands	LM2500	Oosterdam Cruise Ships **	4	4
Sweden	LM2500	Stena Fast Ferries	3	6
	LM1600	On same Stena Ferries	3	6
United Kingdom	LM2500+	Queen Mary 2 Cruise Liner **	1	2
United States	LM2500+	Millennium Cruise Ships *, **	4	8
Uruguay	LM2500	Buquebus Francisco Ferry	1	2
Various	LM6000	Floating Oil Production Platforms and Barges	6	15
			47	86

To learn more about our COmbined Gas turbine Electric and Steam (COGES) system, which has the lowest annual operating cost of any propulsion system, visit [www.ge.com/commercial](http://www.ge.com/commercial).



Cruise ships



Ferries



Floating oil rigs

\*COGES  
\*\*Gas turbine generator set

# GE innovation and value-added solutions



## LM2500+G4

U.S. Navy certification at 30.5 MW (Navy standard day)



## Electric start

86% weight savings versus hydraulic; ideal for electric ships



## Engine auxiliaries/skids

GE provides integrated and certified solutions

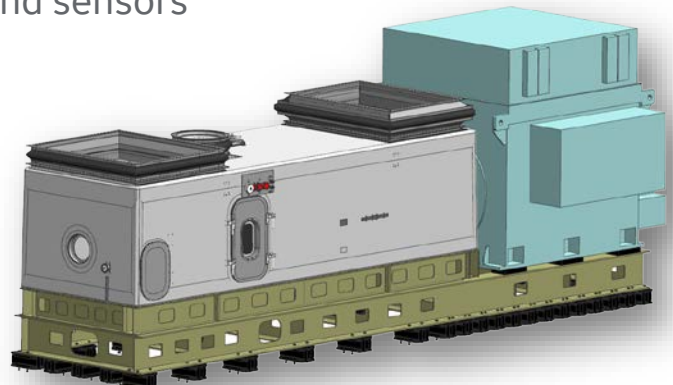
- ✓ Engine start
- ✓ Fuel forwarding
- ✓ Fire protection
- ✓ Engine control
- ✓ Water wash

## Shortened/common length composite enclosure

Maximum flexibility with 22.0, 26.3 or 30.3 MW USN rating in the same footprint

## Gas turbine generators

Performance-matched gas turbines with generators for electric propulsion ships to provide power for advanced weapons and sensors



# Experience summary of GE marine and industrial LM2500 and LM6000 gas turbines

LM2500 fleet	Industrial	Marine	Industrial + Marine
Total engines	2,585	1,365	3,950
Operating hours	>94 million	> 16 million	>110 million
High time engine	>280,000	>45,000	>280,000

LM2500	Industrial	Marine	Industrial + Marine
Total engines	1,169	1,294	2,463
Operating hours	>73 million		
High time engine	>280,000		

LM2500+	Industrial	Marine	Industrial + Marine
Total engines	752	32	784
Operating hours	>18 million		
High time engine	>159,000		

LM2500+G4	Industrial	Marine	Industrial + Marine
Total engines	664	39	703
Operating hours	>3.7 million		
High time engine	>84,000		

LM6000 fleet	Industrial
Total engines	1,388
Operating hours	42
High time engine	>225,000

Industrial: Active units  
 Marine (naval and commercial): Delivered and ordered  
 Excludes LM500 and LM1600 gas turbines

LM2500 and LM6000 fleet	Industrial	Marine	Industrial + Marine
Total engines	3,973	1,365	5,338
Operating hours	>136 million	>16 million	>152 million
High time engine	>280,000	>45,000	>280,000



## **1959 LM1500**

1966 LM1500

## **1969 LM2500**

1974 LM2500

1975 LM2500

1977 LM2500

1977 LM2500

1978 LM2500

1980 LM2500

1980 LM2500

1982 LM2500

1984 LM2500

## **1987 LM500**

## **1988 LM1600**

## **1991 LM500**

1991 LM2500

1991 LM2500

1992 LM2500

1992 LM1600

1993 LM2500

## **1993 LM2500 & LM1600**

1995 LM2500

1997 LM2500

1997 LM2500

## **1998 LM2500+**

1998 LM2500+

2000 LM2500+

2002 LM2500+

2004 LM2500

2004 LM2500+

## **2006 LM2500**

## **2006 LM2500+G4**

2008 LM2500

2009 LM2500+

2011 LM500

## **2014 LM2500 Dual Fuel**

2015 LM2500+G4

## **2015 LM6000**

## **2017 All GE Gas Turbines**

## **2020 Composite Module**

2020 LM2500+G4

## **U.S. Navy H.S. Denison Hydrofoil**

U.S. Navy Patrol Gunboats

## **GTS Adm. Wm. M. Callaghan Roll-on, Roll-off**

Italian Navy High-Speed Frigate

U.S. Navy Spruance Class Destroyers

U.S. Navy Pegasus Class Hydrofoils

U.S. Navy Perry Class Frigates

Royal Danish Navy KV72 Corvettes

U.S. Navy Kidd Class Destroyers

South Korean Navy's Donghae Class Corvettes

U.S. Navy Ticonderoga Class Cruisers

Spanish Navy Aircraft Carrier

## **Royal Danish Navy Stanflex Fast Patrol Boats**

## **Katana High Speed Yacht**

## **Far East Hydrofoils, First Commercial Application**

U.S. Navy Arleigh Burke Destroyers

U.S. Navy AOE 6 Auxiliary Ships

Japanese Navy Murasame Destroyers

Destriero Sets Transatlantic Speed Record

U.S. Navy Watson Class Sealift Ships

## **HSS Stena, World's Largest High-Speed Ferry**

Thailand Navy Helicopter Carrier

Spanish Navy F100 Frigate

German Navy F124 Frigates

## **RCCL and Celebrity Cruise Ships (COGES)**

SNCM Corsaire 13000 Fast Ferry

Millennium Cruise Ship Enters Service

U.S. Navy LHD 8 Amphibious Assault Ship

French and Italian Navy Horizon Frigates

Queen Mary 2, Largest Cruise Liner in Service

## **Spanish Juan Carlos LHD gas turbine generator set**

## **French, Italian, Egyptian and Moroccan Navy FREMMs**

U.S. Navy Littoral Combat Ships

U.S. Navy LHA 6 Amphibious Assault Ship

Japanese Izumo Destroyer gas turbine generator set

## **Francisco, First LNG Powered Gas Turbine Ferry**

Italian PPA frigate

## **Naval engine and module tested and LR/RINA certified**

## **Electric start systems delivered and available**

## **Delivered on LCS 32 and DDG 128**

U.S. Navy FFG 62 frigate award; Fincantieri

Bold/blue indicates first application or introduction of engine model or feature

# Run fast, turn hard and leave a great wake



[ge.com/marine](http://ge.com/marine)

GE's marine gas turbines are the most reliable in the world, keeping 40 navies and more than 600 ships on mission. These engines offer up to 33% greater power density than the competition thanks to GE's innovative lightweight composite enclosure. **Get onboard!**



Building a world that works

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