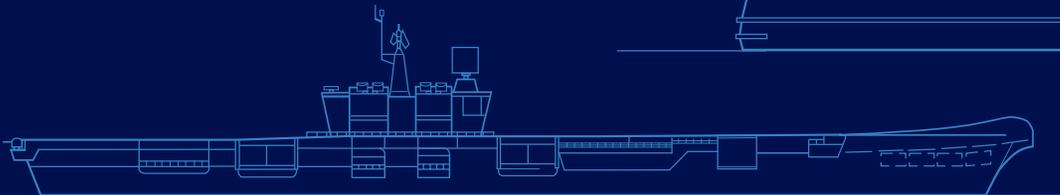
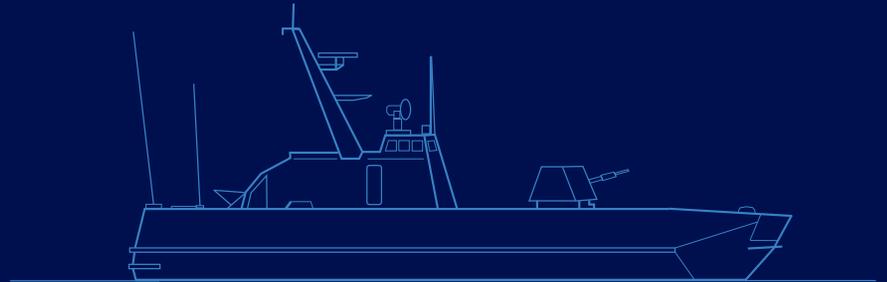
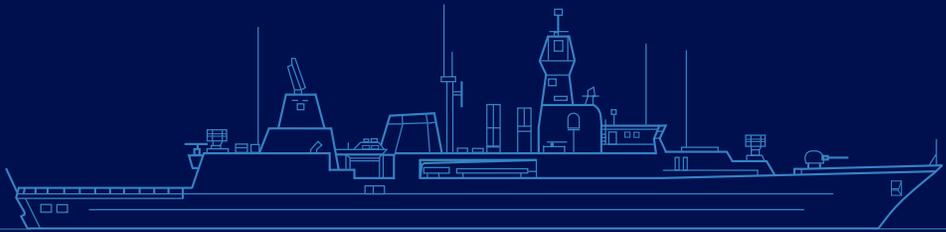


Innovative Power Transmission



Naval Applications

General Information

Innovative Gear Solutions in Naval Propulsion Systems

RENK on 400 vessels of 30 Navies

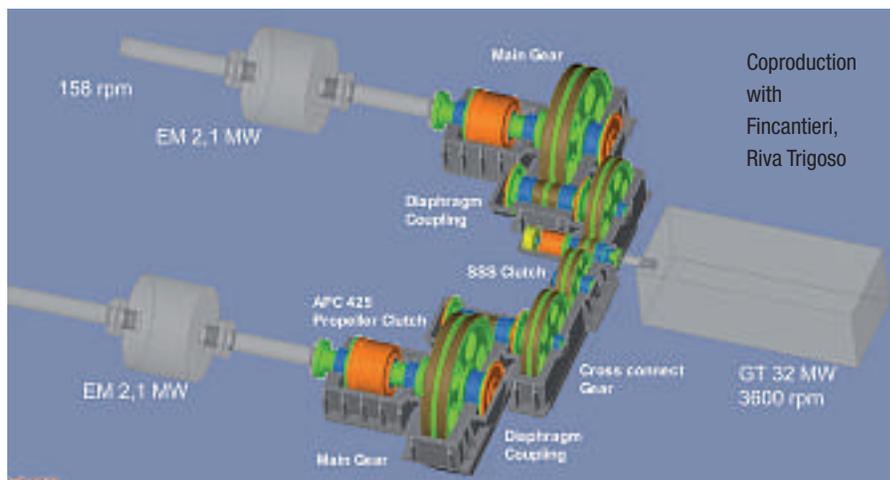
Developments in gear technology continue to orientate at increasingly sophisticated propulsion systems. Starting from classic CODOG arrangements initiated in the early eighties, enhanced systems are available. In today's cost and efficiency sensitive times, alternative naval propulsion concepts have been developed, such as CODAG, supported by high speed controls, leading to the CODELAG, the "hybrid" in naval propulsion. RENK main propulsion gears follow the technical needs, based on renowned experience with more than 400 installations aboard fleets of 30 Navies. Extremely compact gears such as high speed COGAG systems are required for specialised vessel designs. The trend with all applications are highly efficient compact solutions at low weights, including low noise signatures, even extinguishing tooth mesh frequencies in audible and structure borne noise. To combine all these factors to a reliable gear system is the challenge in the yet again enlarged market place for surface combatant propulsion gears.

CODAD Gear with fluid couplings for 16 MW shaftline power



- 100 CODOG / CODAG and 300 CODAD / Single DE gears up to 40 MW aboard destroyers, corvettes and frigates in Europe, Mid-/Far-east are equipped with RENK gears
- 32 NATO vessels with RENK propulsion gears
- Continuous logistic and maintenance support since 1960 according to Navy standards
- German Navy F 124 as first CODAG system worldwide, continued with US Coast Guard NSC
- No major failure experienced for 40 years
- World record in low noise with SAN CODAG system

CODELAG System for FREMM



OPV, Netherlands



German Navy Sachsen Class Frigate



Amatola Class Corvette for SAN



Demonstrator US-Navy "Seafighter"



Sigma Corvette Indonesian Navy



Flexible Support Ship Danish Navy



FREMM Italian Navy



USCG Deepwater National Security Cutter
"Bertholf"

National Security Cutter (NSC)

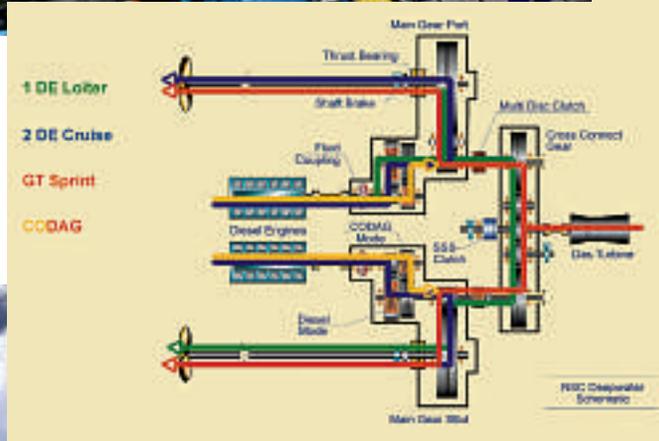
CODAG Propulsion
1 GT 23 MW + 2 DE 7.4 MW
126 m length
4 400 tons

Vessel Data

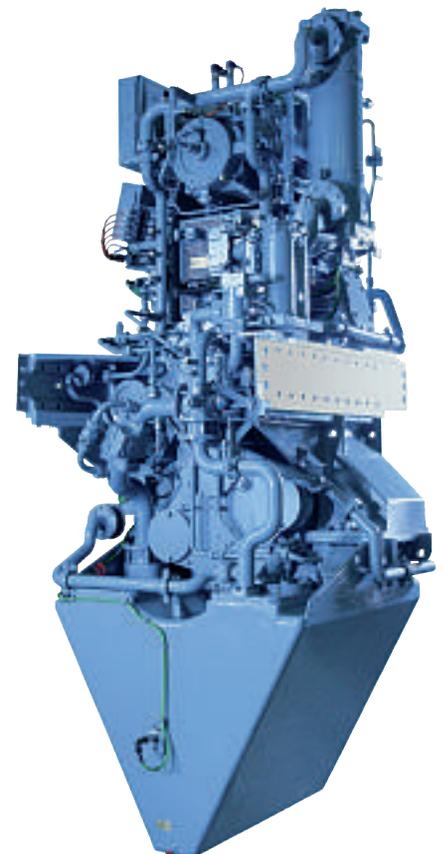
Overall Length	418 ft (127.5 m)
Max. Displacement	4,300 tons
Max. Speed	29+ kts
Shipyard	Northrop Grumman
Ship Owner	US Coast Guard



COGAG marine gears for Skjold – the ultimate record in compactness



Drive Modes

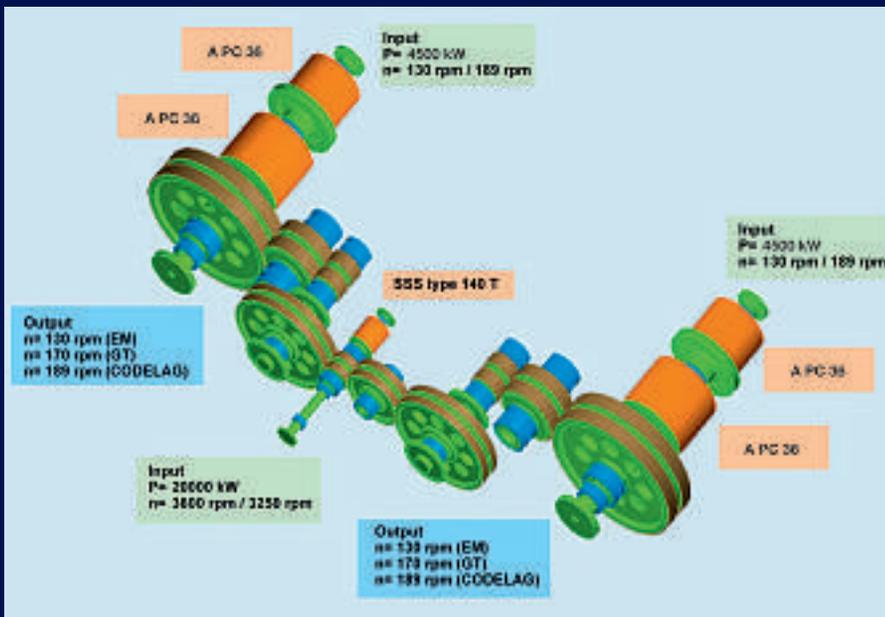


Gas turbines to water jet drives could develop fantastic speeds. With catamarans, this performance is being supported, in addition, with their low water resistance. In case of surface effect ships (SES), where the ship's superstructure is lifted relative to the water line at high speeds by vertically active air fans between the semi-hulls, the water resistance is brought to minimum. All these design features are combined with the Norwegian Navy Skjold program fast patrol craft, comprising two COGAG propulsion modules of 6 MW in each semi-hull, serving for a vessel's top speed close to 60 knots.

Main features:

- Reduce inputs speeds 20000 rpm and 16000 rpm, respectively, to 1000 rpm water jet output
- Single or twin gas turbine operation
- anti shock resistance up to 5 g above elastic supports
- optimized efficiency grade
- gas turbines cantilevered to gear
- fit into tight semi hull structures
- ultra light weight to meet 3700 kg limit

CODELAG Plant for German Frigate F125



The unique propulsion arrangement includes one gasturbine between the propeller shaft lines and two front end located electric motors. The RENK patented APC clutch module comprises two multidisc clutches for variable operational modes, with separate foundations for displacement absorption.

The entire configuration provides three separate gears:

- cross connect gear to split the GT power to both shafts
- two main gears port and starboard

plus two APC modules. Highest double helical tooth technology, sliding bearings and FEM advanced casing structure completes the outstanding design.

RENK as partner for innovative naval propulsion.



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