

The deep sea research vessel **Pourquoi pas?** built for Ifremer and the French Navy is the first ship to be fitted with the new medium voltage PWM\* MV7000 converters as part of a contract for an electric propulsion system awarded to Converteam.



**MV7000 converter + Low frequency induction motor**  
**Main advantages**

**Stringent noise & vibration level**

- Adjustable PWM pattern & frequency

- 3 level npc inverter topology

- Low noise induction motor

**Reliability and robustness**

- Press-pack IGBT technology

- Fuseless protection

- Reduced number of components for the converter

- Induction motor design

**Compactness**

- Powerful switches

- Front access

- No need for harmonic filter

- No need for sinusoidal filter

- No need for excitation

The Pourquoi pas ? is a multifunctional ship, mainly dedicated to deep sea oceanographic expeditions and hydrography missions, such as the study of marine life and update of maritime maps. The 105m vessel, built at STX France Lorient SAS shipyards in Lanester (France), operates at a service speed of 13.3 knots.

**The Pourquoi pas ? equipped with a Converteam electric propulsion system**

The Pourquoi pas ? features two shaftlines, driven by two 1,650kW at 148rpm induction motors, supplied and controlled by 3-level neutral point clamped (npc) medium voltage PWM press-pack IGBT MV7000 converters.

Converteam also supplied two 2,000kVA propulsion transformers as well as the

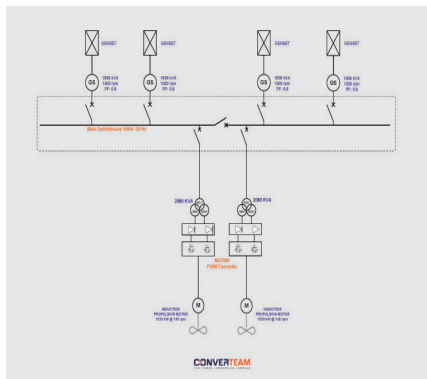
remote control system for the propulsion. This system is used as an interface with the operator during the normal operation of the ship. Levers and controls are fitted at each location to generate the speed references.

The module controls allow the starting, stopping and manoeuvring of the propulsion system.

**... and an A-Series dynamic positioning (DP) system**

The Pourquoi pas ? is fitted with an A-Series ADP21 DP system featuring advanced tracking facilities and deep water ROV follow capabilities which use the latest high res. operator displays. The DP system provides redundant control with interfaces to survey, ECDIS, four DGPS systems, acoustics, inertial navigation & high precision doppler logs. The DP control system is networked to the MV7000 propulsion system and power system over ethernet providing an integrated solution.

\*PWM: Pulse Width Modulation



| Electric propulsion single line diagram

## MV7000 innovative drives

Using the powerful press-pack IGBTs in conjunction with proven technologies from Converteam's extensive range of drives, the MV7000 converters offer reliability and compactness for all variable speed drive applications, including the more dynamic and high performance demands.

MV7000 drives cover the medium and high power range up to 33MW at two motor voltages 3.3 and 6.6kV. The drives are water cooled PWM voltage source inverters. They can feed both induction and synchronous motors. Different options are available, such as regenerative front ends, dynamic braking choppers, connection to a DC link so that the drive can best suit the applications and offer:

- **Quality of motor supply**
  - high grade torque
  - low noise signature
  - no motor derating
- **Minimum network interference**
  - low harmonics
  - high power factor
- **Compactness & robustness**
- **Low operational cost**
  - high efficiency
  - low reactive power
  - high reliability

- **Easy to operate**
  - advanced control features
  - functional block diagram (FBD)
  - remote PC
- **Easy to maintain**
  - monitoring system
  - low component count
  - all front access
  - modular construction

sinusoidal filter and a very low current THD (total harmonic distortion), below 2% at every operating point. Consequently, there is no thermal derating of the motor and the amplitude of the torque pulsation at the motor shaft is negligible and noise & vibration level is reduced.



| MV7000 converter

## Simple diode front end

MV7000 features as standard a 12-pulse diode front end (option for 24-pulse), fed by a 2 phase-displaced secondary windings transformer. The drive has an excellent power factor that is above 0.96 throughout the speed range. It complies with international standards for voltage and current harmonic distortion, without any harmonic filters nor var-compensation equipment.

## Dedicated DC link

The front end feeds DC link capacitors that are pre-charged by an auxiliary transformer. The latter also pre-magnetises the main transformer, thus avoiding in-rush currents and system transients.

## Top level PWM inverter

MV7000 features a PWM 3-level neutral point clamped inverter that provides excellent output wave-forms, without a

## PWM strategy

Adjustable PWM patterns and frequency at every operating point, provide a wide range of benefits: low commutation losses, low motor current THD, operation at very low frequency and low noise & vibration levels.

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