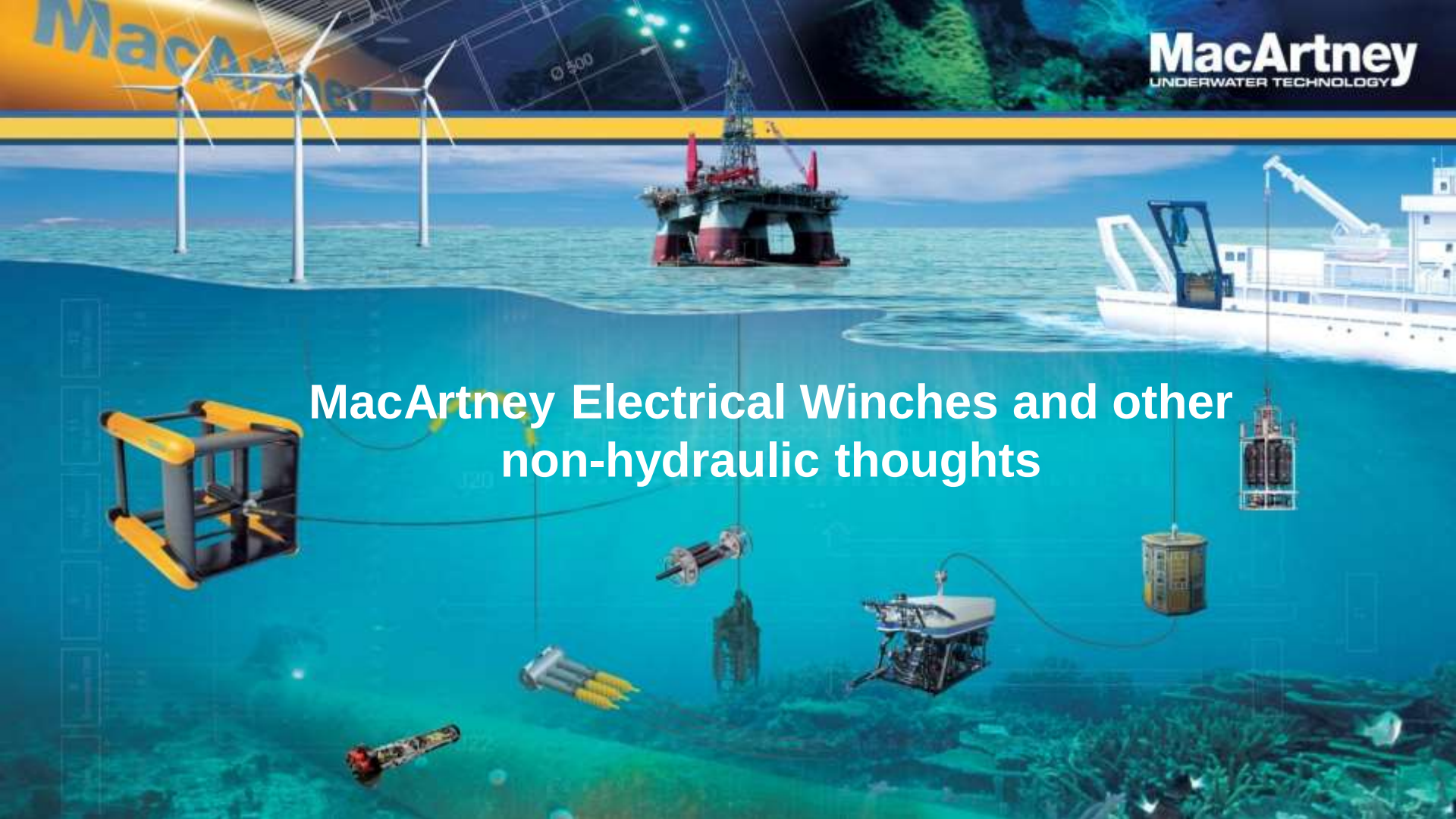

MacArtney Electrical Winches and other non-hydraulic thoughts

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MacArtney Manufacturing


MacArtney Hydraulics


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Green demands

From ERVO 2012 (and elsewhere):

- General desire for greener operations and vessels
- Not just ocean science, but also hybrid vessels and electrical vessels.
    - First all-electric ferry in NO (2015, Ampére)
    - Noticed poster and talk about Zero emission R/V
- No oil above water
    - from O&G industry
    - ROV operators and manufacturers

MacArtney brands

SubConn

OptoLink

TrustLink

TrustLink API

GreenLink

CORMAC

MERMAC

MERMAC A

MERMAC D

CEMAC

EMO

NEXUS

LOTUS

FOCUS

TRIAXUS

FLEXUS

LUXUS

Hydrostatic Pressure Vessels

CORMAC stainless steel winches

CORMAC B winches

CORMAC M winches

CORMAC Q winches

MERMAC

MERMAC R series

MERMAC S series

MERMAC A series

MERMAC D series

MERMAC winches – active heave compensation (AHC)

Electrical winch advantages

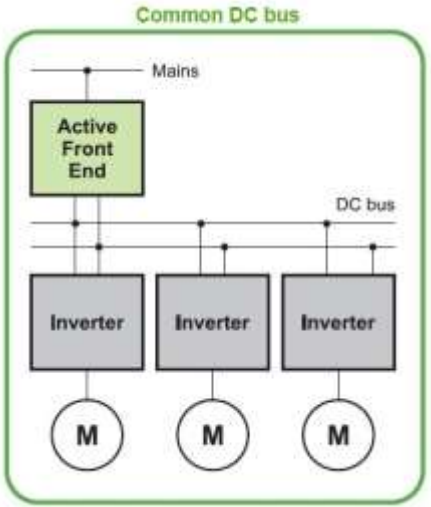
- No oil pollution.
- Lower noise.
- Better efficiency – typical values:
  - hydraulic 0,65-0,7
  - electrical 0,85-0,92.
- Fast reaction time, relevant in Active Heave Compensation mode.
  - AHC using multiple smaller motors
  - Accelerations up to 2,0 m/s^2 @ 2,7m/s @ 343kN
- Takes up less space.
- Potentially allows for remote diagnostics
- Potentially easier to swap umbilical
- Option to regenerate energy.

Regenerating energy

- Using any electrical winch system generates electrical energy.
- When the winch is paying out, the electrical motor will act as a generator and create electrical power.
- The system needs to get rid of this generated power.
- Two options
    - Option 1: Burn off the energy in a Brake Resistor – very suitable for portable systems.

Regenerating energy

- Option 2: Return the generated power back into the ships power management system using an Active Front End.
  - AFE placed in front of the frequency inverter
  - Allows bi-directional power flow
  - Energy generated by the winch can then be forwarded to the vessel power management system…
  - …provided the vessel is designed to receive the generated power!
  - Up to 70% of the total generated power will be available as regenerated power
  - i.e. a 400kW winch can regenerate 280kW



Source: http://blog.999automation.com/2016/02/01/schneider-active-front-end-for-atv61-and-atv71/

Source: http://www.pwmconverter.com

Regenerating energy

- Green advantages of electrical winches w/ AFE
  - No / very little risk of oil spill
  - Feeding regenerated power back to the vessel (instead of heating up brake resistors), thereby saving fuel.
  - Not more expensive than a hydraulic system
  - But only worth it for larger winches (>~50-100kW)

Non-hydraulic vs hydraulic actuators

- Hydraulic actuators (hydraulic cylinders) have been used for centuries.
- Hydraulic cylinders are able to generate huge amounts of force, while requiring minimum of space.
- However there will always be a minimum of oil spill
    - As the market requires cleaner environment, we see more requests for ways to replace the hydraulic cylinder with a more environmental suitable actuator.
    - Especially for applications above water

In principle, everything is possible – but maybe not wise / feasible

- Replacing A-frame cylinders?
- Potentially possible using bascule bridge designs.
- Simple, but not exactly space saving…
- So the old mechanical designs are out!

Source: https://en.wikipedia.org/wiki/Bascule_bridge

Source: http://www.realclearlife.com/design/building-bridges-and-community-online/#1

Electrical actuators?

- Electrical actuators have roughly the same form factor as cylinders
  - Potential for swap
  - Known in industrial application for decades
- Consists of a spindle, moved by an electrical motor through a gearbox.
  - Requires a motor for each actuator
  - Requires motor control, using the same principles used to control the electrical winch motors.

http://www.actuators-electric.co.uk/wp-content/uploads/idcu-10000kg-electric-actuator-e1469456144330.jpg

Electrical actuators?

- Industrial grade ≠ marine/offshore grade!
- Availability of electrical actuators for offshore use extremely limited
    - Existing designs all would have to be enclosed in an offshore housing

http://www.actuators-electric.co.uk/wp-content/uploads/idcu-10000kg-electric-actuator-e1469456144330.jpg

Electrical actuators?

- MacArtney investigating the requirements for electrical actuators to be used on A-frames and docking heads:
  - The main electrical actuator running the A-frame in and out need to be designed with respect to high load and low speed.
  - Four minutes from A to B.

A

B

Electrical actuators?

- MacArtney investigating the requirements for electrical actuators to be used on A-frames and docking heads:
  - The main electrical actuator running the A-frame in and out need to be designed with respect to high load low speed.
  - Four minutes from A to B.
  - Electrical actuators used on docking heads need to be able to react very fast with low load.
  - 34 seconds from A to B and B to C

A

B

C

Electrical actuators?

- MacArtney investigating the requirements for electrical actuators to be used on A-frames and docking heads:
  - The physical requirements for these two different actuators is very different.
- MacArtney's cylinder factory currently developing the initial designs.

World-wide sales and service support

Thank you for your attention

For further information

please visit**:**

www.macartney.com

or contact us at**:**

info@macartney.com