Agenda

1. ZF 400 Family – Intelligent Transmission Technology
2. ZF Full Electric Propulsion – Proof of concept
01
ZF 400 Family
Intelligent Transmission Technology
ZF 400 – First “Intelligent” Transmission

- Integrated Intelligent Technology to plan maintenance dates in advance
- Power factor up to 0.3195 kW/rpm (typical engine 1.000HP@2300rpm)
- Gear ratios from 1.4 to 2.5
- Configurable to various application in the appropriate power range, for both yachts and commercial vessels
- Supershift2 technology inside
- Optional embedded electronic unit to better control the proportional valves, thus granting smoother shifting/trolling
- Possibility to integrate further smart alert functionalities for scheduled maintenance (CAN BUS ready)
- Available soon also in IV, parallel and W configuration
Generic Overview

Proportional Block

ECU - ESGI

ZF 400
POC - New Features Description

POC (Proportional Oil Control)
Innovative hydraulic control block including new proportional solenoid valves (replaces traditional ON/OFF solenoid valves)

In combination with ITT electronics, it allows:

- Further improvement of shifting performances (better than latest Supershift2 technology)
- Improved clutch responsiveness and precision
- Integrated trolling feature (no need of additional valves)
- Less complexity: two proportional valves instead traditional three valves
- Compact design and reduced overall dimensions
- Integration with the new ZF controls
IIT - New Features Description

IIT (Integrated Intelligent Technology)

It is based on a ZF ESGI processor that allows to elaborate different sensors data (temperature, pressure and output speed). Embedded software and algorithms allow to optimize:

- control of the proportional valves
- improve clutch discs slippage behavior
- provide a more accurate propeller shaft speed control
- improve the transition between trolling and lock-up operating modes

Following information ad alerts could be provided to the vessel:

- clutch oil temperature
- clutch oil pressure
- output shaft rotation direction
- service maintenance calendar*
- adaptive trolling control based on oil temperature*
- oil leakage alert*
- clutch wearing monitoring*
- crash stop optimization*
- high temperature alert*

* second step introduction
ESGI processor

Main processor

- tested according IEC 60068-1, ISO 16750, ISO 7637, EN 60945
- **+10,000 units** already in the field (agricultural and off-road applications)
- Safety Integrity Level **SiL2** (IEC61508)
- Analog (Voltage, PWM, 4-20mA) and CANBUS engine interface
- **SAE 1939 & NMEA 2000 interfaces**
- UDS (ISO 14229) for Service and Diagnostic
- IP69K & IP67 waterproof
- -40°C / +120°C operating temperature
- 9 - 32V operating voltage range
- **Bulkhead mounted and/or on transmission mounted**

- IP69K
- IP67
- -40°C / +120°C
- SIL2
FULL integration with ZF new controls

ESGI processor is also the core component for the new ZF controls. The launch of the new ZF controls is planned in 2021. Completely new hardware, software and functionalities. Further information to come...
ZF 400 option: Standard Package

ZF 400
- Standard Gearbox & Accessories

MB/EB 30/31
- Standard mechanical/electrical oil control

ZF Controls Standard
- 9000 Series / CruiseCommand / MiniCommand / SmartCommand / JMS
ZF 400 option: Intelligent Transmission Package

**ZF 400**
- Standard gearbox & accessories

**POC**
- Proportional oil control

**ECU**
- New Control Platform (wall & on transmission mounted)

**ZF Controls**
- Wire harness and HMI (joystick and control head)
02
ZF Full Electric Propulsion – Proof of concept
Steerable eSail Drive on Oceanis 46
Prototype Vessel

See more: https://www.youtube.com/watch?v=cMeuNB8Q3M4
Steerable eSail Drive on Oceanis 46
Prototype Vessel
Steerable eSail Drive on Oceanis 46
Prototype Vessel

Mechanical specs

- Smooth torque transmission
- Vibration free operations
- Low noise operations
- Reduction of:
  - Cooling water temperature
  - Heat generation
  - Lubricant oil
  - CO₂ emissions
  - Life cycle costs
Steerable eSail Drive on Oceanis 46
System Architecture

- Ctrl head
- Electronic Control Unit
- Electric Motor
- Steerable Saildrive
- DC/DC
- Inverter
- HV Battery Charger
- PDU
- HV Lithium Battery
- BMS
- Bow thruster
- On-board 12-24V system

Zf CAN EV
Zf CAN 1
Zf CAN 2

Out of ZF scope of supply
ZF scope of supply
Optional ZF scope of supply

Charge Inlet

2020-10-08 | Marine Online Seminar 2020 | Pleasure Craft New Technologies
ZF Friedrichshafen AG
Steerable eSail Drive on Oceanis 46
Cooling System

- Pump
- Cooler
- Sea water inlet
- DC/DC
- Inverter
- HV Battery Charger
- HV Lithium Battery

- Out of ZF scope of supply
- ZF scope of supply
- Optional ZF scope of supply
## Steerable eSail Drive on Oceanis 46

### System Components

<table>
<thead>
<tr>
<th>Electric motor</th>
<th>Battery</th>
<th>Inverter</th>
<th>On-board charger</th>
<th>DC-DC converter</th>
<th>Charge inlet</th>
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<tbody>
<tr>
<td>Model</td>
<td>Technology</td>
<td>Nominal voltage</td>
<td>Rated current</td>
<td>Rated output</td>
<td>Interface</td>
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<td>Rated output</td>
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</table>

* rated output in the application: 30 kW
Electric Sail Boat | Pleasure Craft Product Line

Lake Scenario

Range: 47 nautical miles
Speed: 5 knots
Duration: +9 hours

Motor power: 30kW
Battery capacity: 60kWh
Thank you