Hybrid Hype & The Realities of Building Green

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• We need change
  – Past the pinnacle of diesel engine innovation
  – Foreign dependence

• Hybrid Hype and Greenwashing
  – 10 Knots or less (low horsepower or low RPM)
  – Complex & Expensive (being green takes green)
  – Cinderella Principle: individual fit

• Makes more than a “Marketable” Difference
  – Success is demonstrated through repetition
Driving Regulations

Ignorance

Practical and Feasible

Innovation
Why is Green Important?

- Environmental Impact
- Political Issues
- Social Responsibility
- Positive Publicity

GREEN Benefits

(BOTTOM LINE)
Being Green

- REGULATIONS
- Infrastructure
- Mission Requirements
- Green Tech
- Fuel & Emissions
- Space & Weight

Environmental Impact
Energy Efficiency

BOAT BUILDER

Not that easy is it?
• Regulations & Safety
  – USCG Subchapter T (recommended, not required)
  – Not encompassing of Hybrid Technology
    • Case by case
      – Lithium Ion Batteries
      – LNG
      – Hydrogen
Green Research Vessels

- Research Mission - critical
  - Hybrid Technology must be complementary
    - Solve one problem, create another
    - Speed
    - Range
    - Deck Gear / Systems
Green Research Vessels

• Reminder: These are BOATS!
  – Subject to laws of physics
    • Weight
    • Balance
    • Footprint

• Infrastructure Requirements
  – Homeport vs. Away or At Sea
    • Electrical: shore power connection
    • Fuel: LNG, Hydrogen
Green Research Vessels

- Environmental Impact
  - Set a Specific Goal - Arguable
    - Emissions
    - Fuel Burn
    - Fuel Type
  - Too Many Trade-offs & Variables

- Available Green/Hybrid Technology
What is Possible?
The Voyage of Eco-Pioneers
Foss Hybrid

- Diesel Electric
• Size and Weight
• Availability of Motors
• Battery Requirements: quantity, charge rate, voltage
• Speed
Takes a Tug Boat
Port of Los Angeles

• Heck with Hybrid
Suitable Candidates:
- Short Sea / Shipping Vessels
- Tugs
  - Frequent refueling
Nothing but reluctance
Policy is being developed
- LGC NCOE
LNG – Passenger Vessel Application

- Tank Size
- Tank Location
- Bunkering
- WSF – 4 years+
  - RFP
- Research Vessels – Working Deck Issues
Hornblower Hybrid

- Hydrogen Fuel Cell
About This Boat

The Hydrogen Hybrid is a revolutionary vessel that marks the first major technological achievement since the introduction of the diesel engine in 1920. In addition to demonstrating the capabilities of new clean technology on the water, this vessel will be a platform from which millions of people will see first hand what American innovation can create. This safe and reliable form of transportation is a key step in the maritime industry’s dependency on fossil fuels.

The Hydrogen Hybrid connects power sourced from the wind, the sun, the electrical grid, traditional fuels and hydrogen. There is nothing else like it on the ocean.
Solar Sailor

- Solar & Wind
Sky Sails
- Kite Assist
Spirit of the Sound
• Hybrid - Generator
What is Realistic?
Many Shades of Green
Hybrid Drive: Gear Box Driven

Source: Transfluid
## Reintjes Hybrid Gear Box

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- **WAF-RHS 344 – 374**
- **WAF-RHS 444 – 474**
- **WAF-RHS 543 – 573**

Source: Reintjes
The Hybrid System offers various Application Possibilities

- **Booster operation** - diesel engine and electric motor drive propeller
- **Power Take In (PTI) operation** - electric motor drives propeller
- **Power Take Off (PTO) operation** - RHS supplies power to the grids and for consumption

**Scope of Supply**
- REINTJES gearbox with combined electric motor/generator and frequency converter
- Compatible with various electric grids and configurable for different applications
- Worldwide Service
• Motor Generator
  – In Line
  – Decouples from Main Engine
  – Power Accelerator
Hydrofoil-Assist Technology

Fuel Consumption

More speed, no extra cost!
17 to 27 knots
Effective at 17 knots

- Displaces 1/3rd of the vessel’s weight
- Uses 1/3rd less horsepower
- Burns 1/3rd less fuel

NOTE: This drawing shows the hull and hydrofoil conceptually. Both the hullshape and the foil arrangement may change to suit a particular application.
Unconventional Conventional Drive
• Tier IV and SCR Systems
• Particulate Filters
• Noise Silencers
• Fuel Flow Meters
• Fuel Treatments
• Elements of a Tier IV System:
  – Engines
  – DEF / Urea Tanks
  – DEF / Urea Dosing System
  – SCR Catalyst
  – Compressor (maybe)
  – Heating Chamber (maybe)
  – Dry Exhaust
• **SCR Systems**
  
  — **Pros**
  
  • Removing harmful emissions: NOx & SOx
  • By-products – water and ammonia
  
  — **Cons**
  
  • Marinization of industrial and highway technology
  • Build boat around system
  • Weight, Burn more fuel
  • Cost of Urea
  • Better off building lighter, smaller engines, burning less fuel emitting fewer emissions?
• Representative SCR System – MTU
After-Treatment Filters

Pros

- 99% of Carbon monoxide
- 99% of Hydrocarbons
- 85% Particulate Material
- Provides additional sound attenuation

Cons

- No provisions for NOx and SOx treatment
- Back pressure
• Fuel Flow Meter
  – Flow Scan
  – Kral

• Fuel Treatment
  – Eco Emissions Platinum Catalyst
THANK YOU

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