One Ocean at a Time: Green Initiatives in the Regional Class Research Vessels

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5 – 6 April 2016
Areas of Initiative

- Hull Form
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- Hull Form
- Propulsors
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- Power Plant
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- Power Plant
- Auxiliaries
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- Auxiliaries
- Coatings and Lubricants

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- Hull Form
- Propulsors
- Power Plant
- Auxiliaries
- Coatings and Lubricants
- Certification
Hull Form

- Optimized by extensive computerized flow modeling

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Hull Form

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  - 30,000 model runs

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  - Overall 10% efficiency increase from initial design
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- Modified bulbous bow

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  - Up to 6% increase in fuel efficiency at cruising speed

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  - Up to 6% increase in fuel efficiency at cruising speed
- Tapered stern
Hull Form

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  - 30,000 model runs
  - Overall 10% efficiency increase from initial design
- Modified bulbous bow
  - Up to 6% increase in fuel efficiency at cruising speed
- Tapered stern
- Streamlined headboxes for propulsors
Propulsors

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Propulsors

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Propulsors

DPS-1 with “loiter” mode for increased fuel efficiency

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Propulsors

- Twin 360° azimuthing primary drives
Propulsors

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- “Push/pull” design
Propulsors

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  - “Push/pull” design
  - Greater surface area
Propulsors

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  - Lower RPM

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- Twin 360° azimuthing primary drives
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- Wake-adapted blades
Propulsors

- Twin 360° azimuthing primary drives
  - “Push/pull” design
  - Greater surface area
  - Lower RPM

- Wake-adapted blades
  - Physical model test showed zero cavitation at 11 knots
Propulsors

- Retractable 360° azimuthing bow thruster
Propulsors

- Retractable 360° azimuthing bow thruster
  - Better efficiency for field maneuvering
Propulsors

- Retractable 360° azimuthing bow thruster
  - Better efficiency for field maneuvering
  - Primary bow thruster for science operations
Propulsors

- Flush 360° azimuthing bow thruster
Propulsors

- Flush 360° azimuthing bow thruster
  - Minimal clearance for shallow-water and docking maneuvers
Propulsors

- Flush 360° azimuthing bow thruster
  - Minimal clearance for shallow-water and docking maneuvers
  - May be used for science ops in heavy seas or where URN is not a concern
Power Plant

- Variable speed/frequency power generation
Power Plant

- Variable speed/frequency power generation
- Integrated DC bus
Power Plant

- Variable speed/frequency power generation
  - Integrated DC bus
  - Reduced conversion loss
Power Plant

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  - Integrated DC bus
  - Reduced conversion loss
  - Reduced generation loss
Power Plant

- Variable speed/frequency power generation
  - Integrated DC bus
  - Reduced conversion loss
  - Reduced generation loss
- Real-time fuel monitoring
Power Plant

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  - Integrated DC bus
  - Reduced conversion loss
  - Reduced generation loss
- Real-time fuel monitoring
  - Engine-specific efficiency
Power Plant

- Variable speed/frequency power generation
  - Integrated DC bus
  - Reduced conversion loss
  - Reduced generation loss
- Real-time fuel monitoring
  - Engine-specific efficiency
  - Vessel efficiency
Power Plant

![Graph showing fuel consumption vs. engine loading for different speeds.](image)

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Auxiliary Systems

- Waste Heat Recovery as heating source for
  - Distillation
Auxiliary Systems

- Waste Heat Recovery as heating source for
  - Distillation
  - Potable water heating
Auxiliary Systems

- Waste Heat Recovery as heating source for
  - Distillation
  - Potable water heating
  - HVAC heating
Auxiliary Systems

- Variable Speed fan and pump motors
Auxiliary Systems

- Variable Speed fan and pump motors
- LED lighting throughout, dimmable where appropriate (labs and accommodation areas)
Auxiliary Systems

- Variable Speed fan and pump motors
- LED lighting throughout, dimmable where appropriate (labs and accommodation spaces)
- Oil/water separation to <5ppm

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Auxiliary Systems

- Variable Speed fan and pump motors
- LED lighting throughout, dimmable where appropriate (labs and accommodation areas)
- Oil/water separation to <5ppm
- Biologic, non-chlorinating MSD
Auxiliary Systems

- Variable Speed fan and pump motors
- LED lighting throughout, dimmable where appropriate (labs and accommodation areas)
- Oil/water separation to <5ppm
- Biologic, non-chlorinating MSD
- Shore power sized for all expected loads
Coatings and Lubricants

- Advanced fluoropolymer foul-release for underwater hull
Coatings and Lubricants

- Advanced fluoropolymer foul-release for underwater hull
- Non-biocidal
Coatings and Lubricants

- Advanced fluoropolymer foul-release for underwater hull
  - Non-biocidal
  - Non-ablative
Coatings and Lubricants

- Advanced fluoropolymer foul-release for underwater hull
  - Non-biocidal
  - Non-ablative
  - Low friction adds 1-3% efficiency
Coatings and Lubricants

- Advanced fluoropolymer foul-release for underwater hull
  - Non-biocidal
  - Non-ablative
  - Low friction adds 1-3% efficiency
  - Growth sloughs at <4 knots
Coatings and Lubricants

- Impressed-Current hull protection
Coatings and Lubricants

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- Aluminum anodes for tank and appendage protection
Coatings and Lubricants

- Impressed-Current hull protection

- Aluminum anodes for tank and appendage protection
  - Lower toxicity than zinc with the same or better performance
Coatings and Lubricants

- Environmentally Acceptable Lubricants
Coatings and Lubricants

- Environmentally Acceptable Lubricants
- All propulsion (oil-to-sea interfaces)
Coatings and Lubricants

- Environmentally Acceptable Lubricants
  - All propulsion (oil-to-sea interfaces)
  - All deck machinery
Coatings and Lubricants

- Environmentally Acceptable Lubricants
  - All propulsion (oil-to-sea interfaces)
  - All deck machinery
- Meets or exceeds present EPA VGP requirements
Certifications

- Green Marine/Alliance Verte consortium
Certifications

- Green Marine/Alliance Verte consortium
- Non-profit
Certifications

- Green Marine/Alliance Verte consortium
  - Non-profit
  - Publicly available results
Certifications

- Green Marine/Alliance Verte consortium
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  - Publicly available results

- International Association of Ports and Harbours
Certifications

- Green Marine/Alliance Verte consortium
  - Non-profit
  - Publicly available results

- International Association of Ports and Harbours
  - Potential savings in commercial ports
http://ceoas.oregonstate.edu/ships/rcrv/

All items presented are contingent on Federal funding for FY 2017 and beyond. Any equipment pictured is for illustration purposes only and may not reflect final installations.

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