



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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Areas of Initiative

- Hull Form
- Propulsors



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Areas of Initiative

- Hull Form
- Propulsors
- Power Plant



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Areas of Initiative

- Hull Form
- Propulsors
- Power Plant
- Auxiliaries



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Areas of Initiative

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



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Areas of Initiative

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



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Hull Form



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Hull Form

- Optimized by extensive computerized flow modeling



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Hull Form

- Optimized by extensive computerized flow modeling
 - 30,000 model runs



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Hull Form

- Optimized by extensive computerized flow modeling
 - 30,000 model runs
 - Overall 10% efficiency increase from initial design



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Hull Form

- Optimized by extensive computerized flow modeling
 - 30,000 model runs
 - Overall 10% efficiency increase from initial design
- Modified bulbous bow



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Hull Form

- Optimized by extensive computerized flow modeling
 - 30,000 model runs
 - Overall 10% efficiency increase from initial design
- Modified bulbous bow
 - Up to 6% increase in fuel efficiency at cruising speed



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Hull Form

- Optimized by extensive computerized flow modeling
 - 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



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Hull Form

- Optimized by extensive computerized flow modeling
 - 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



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Propulsors



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Propulsors



Propulsors



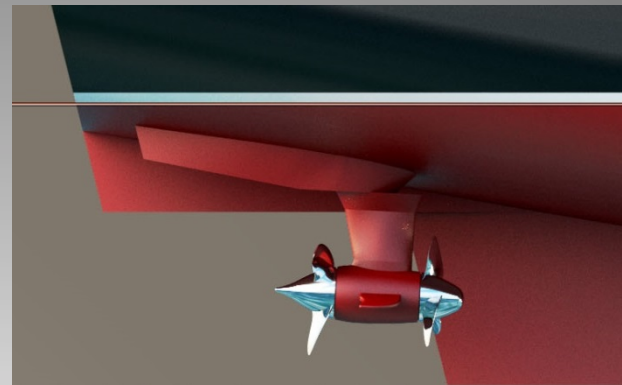
Propulsors



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

Propulsors

- Twin 360° azimuthing primary drives

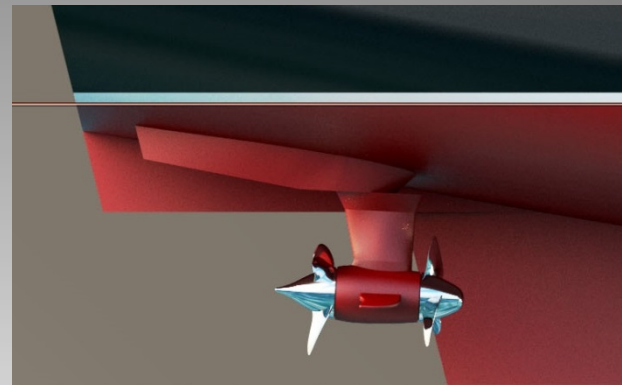


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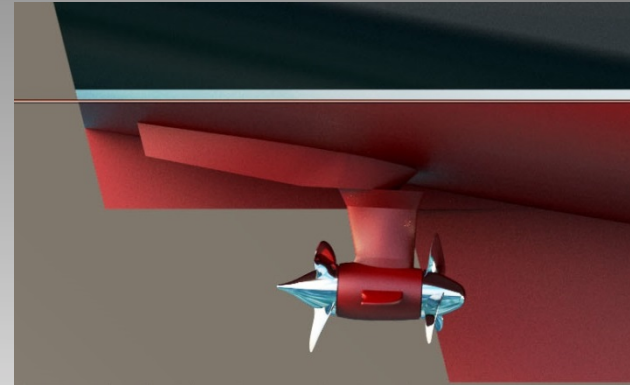
Propulsors

- Twin 360° azimuthing primary drives
 - “Push/pull” design



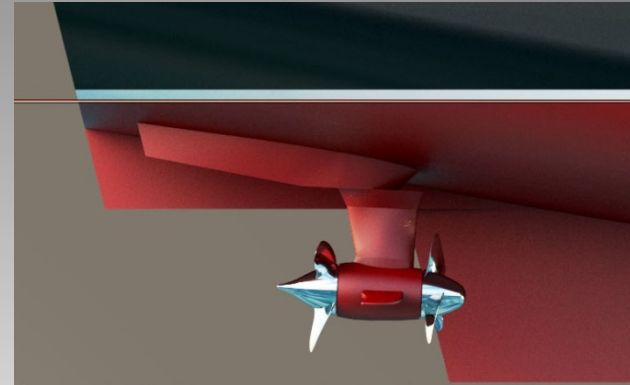
Propulsors

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



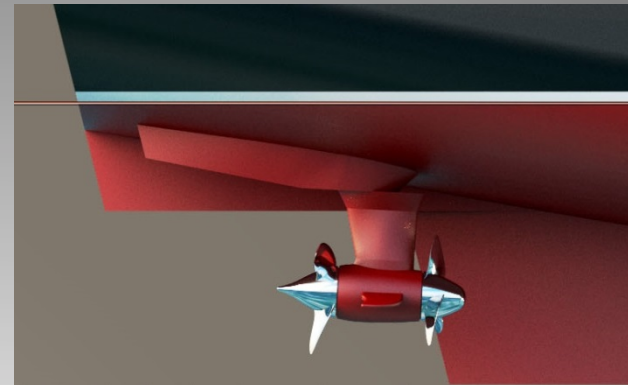
Propulsors

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



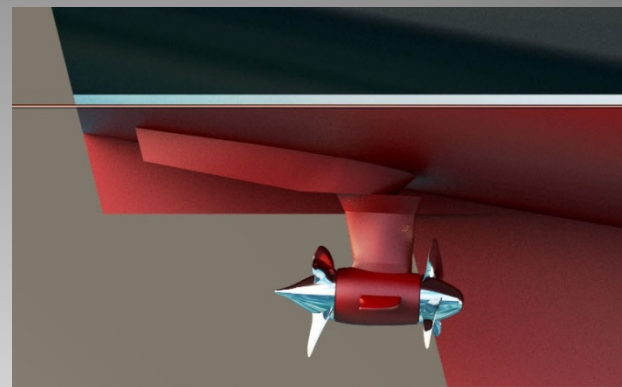
Propulsors

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



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Propulsors

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



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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



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Power Plant

- Variable speed/frequency power generation
 - Integrated DC bus



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Power Plant

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



Power Plant

- Variable speed/frequency power generation
 - 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

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

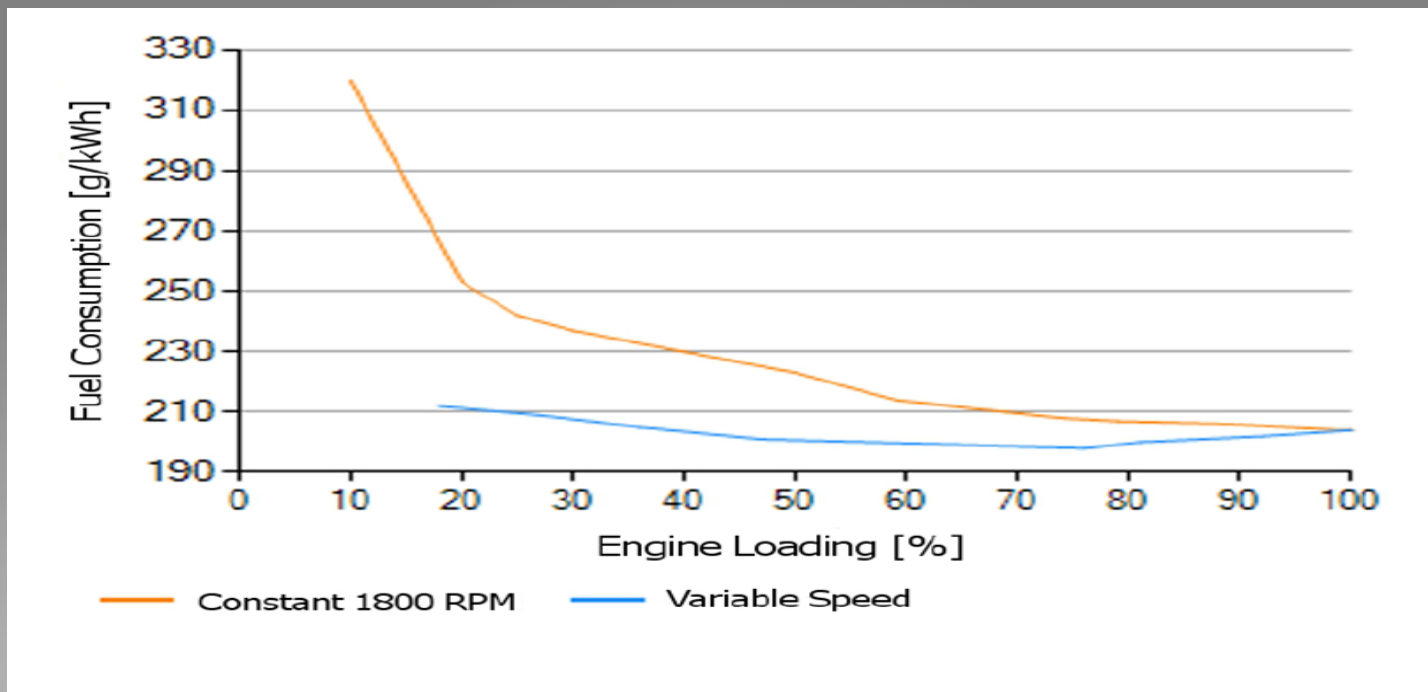


Power Plant

- 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





Auxiliary Systems

- Waste Heat Recovery as heating source for
 - Distillation



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Auxiliary Systems

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



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Auxiliary Systems

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



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Auxiliary Systems

- Variable Speed fan and pump motors



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Auxiliary Systems

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



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Auxiliary Systems

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



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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 <math><5\text{ppm}</math>
- Biologic, non-chlorinating MSD



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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 <math><5\text{ppm}</math>
- Biologic, non-chlorinating MSD
- Shore power sized for all expected loads



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Coatings and Lubricants

- Advanced fluoropolymer foul-release for underwater hull



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Coatings and Lubricants

- Advanced fluoropolymer foul-release for underwater hull
 - Non-biocidal



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Coatings and Lubricants

- Advanced fluoropolymer foul-release for underwater hull
 - Non-biocidal
 - Non-ablative



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Coatings and Lubricants

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



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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



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Coatings and Lubricants

- Impressed-Current hull protection



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Coatings and Lubricants

- Impressed-Current hull protection
- Aluminum anodes for tank and appendage protection



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Coatings and Lubricants

- Impressed-Current hull protection
- Aluminum anodes for tank and appendage protection
 - Lower toxicity than zinc with the same or better performance



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Coatings and Lubricants

- Environmentally Acceptable Lubricants



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Coatings and Lubricants

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



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Coatings and Lubricants

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



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Coatings and Lubricants

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



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Certifications

- Green Marine/Alliance Verte consortium



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Certifications

- Green Marine/Alliance Verte consortium
 - Non-profit



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Certifications

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



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Certifications

- Green Marine/Alliance Verte consortium
 - Non-profit
 - Publicly available results
- International Association of Ports and Harbours



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Certifications

- Green Marine/Alliance Verte consortium
 - Non-profit
 - Publicly available results
- International Association of Ports and Harbours
 - Potential savings in commercial ports



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<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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