WASHINGTON STATE FERRIES’ HYBRID EVOLUTION.
NICE TO MEET YOU.

SEAN CAUGHLAN, PE
Senior Marine Engineer, Glosten
WHAT WE DO BEST.

• Naval architecture
• Marine engineering
• Ocean engineering/analysis
• Electrical engineering
• Production engineering
• Marine civil construction
• Noise control engineering
WSF PROJECT
TEAM & ROLES.

SIEMENS ENERGY
Prime Consultant; Propulsion SSV

GLOSTEN
Sub Consultant; Vessel Design Integration

STEMMANN-TECHNIK
Sub Consultant; Medium Voltage Charging
WSF
SYSTEM-WIDE ELECTRIFICATION.

20-YEAR PLANNING HORIZON

• Technology Assessment
• Vessel Requirements & Feasibility Analysis
• Terminal Requirements & Feasibility Analysis

• Construction Project Schedule
• Workforce Assessment
• Financial Model
• Emissions Impact Estimate
MEETING EMISSION REDUCTION REGULATIONS.

With Shore Charging
CO₂e reductions:
53% by 2030
76% by 2040
Meets requirements of RCW 70A.45.050.
GOALS

MEETING EMISSION REDUCTION REGULATIONS.

Without Shore Charging
CO₂e reductions:
20% by 2040
Not compliant with RCW 70A.45.050.
EMISSIONS & CAPITAL INVESTMENT.
DESIGNS IN PROGRESS.

JUMBO MKII CONVERSION
- 460 ft long, 202 vehicle capacity
- 3 vessels, 2 routes
- 2 of 4 diesel engines removed
- 5.7 MW-Hr of energy storage
- 5 million gallons/yr fuel savings

RAPID CHARGING SYSTEM
- 12.47 KV
- 15 MW maximum charging power
- 20 minutes available charging time
- 20 ft tidal range
- Minimal over-water construction

HYBRID-ELECTRIC OLYMPIC
- 5 vessels, 2 routes
- New propulsion design
- 9.9 MW-Hr of energy storage
- 5 Million gallons/yr fuel savings
JUMBO MKII
PROJECT REQUIREMENTS.

Two routes
• Seattle-Bainbridge Island (2200 kWh crossing energy)
• Edmonds-Kingston

Shore charging stations: Seattle, Bainbridge, Kingston

Charging system (10MW)
• Recover full trip energy with 90% availability (~8,800 kW)
• Power for pushing the dock (~800 kW)
• Hotel power (~400 kW)

• 8.1 NM
• 35 min crossing
• 20 min Load/unload time
JUMBO MKII CONVERSION.

- Siemens Design complete pending US Coast Guard approval
- Vessel #1 funded by VW Mitigation Fund, CMAQ, and MARAD
- Construction for vessel #1 scheduled for Oct 2022 - March 2023
- Two remaining vessels and terminal construction yet to be funded
Siemens Marine Solutions provided the original Propulsion, Drives, and Control Systems on the Jumbo Mark IIs.
BATTERY ROOM ARRANGEMENTS.
RULES AND REGULATIONS.

USCG Regulations
- 46 CFR § Part 70-80 Subchapter H Passenger Vessels
- USCG Policy Letter 02-19, Design Guidance for Lithium-Ion Battery Installation onboard Commercial Vessels;
  - Standard Guide for Shipboard Use of Lithium-Ion (Li-ion) Batteries, ASTM International, F3353-19

Design Guidance (WSF)
- Marine Vessel Rules, American Bureau of Shipping (ABS), 2020
- Use of Lithium-Ion Batteries in the Marine and Offshore Industries, ABS, February 2020

Battery Certification
- DNV-GL and ABS Type Approval
BATTERY ROOM VENTILATION DESIGN.

Battery Room Supply
• Supply from fresh air source
• Slight over-pressurization of Battery Room, per DNV recommendations for internal off-gas system

Off-Gas
• Supply from fresh air source

Battery Room Exhaust
• 3m from access/crew/passenger area
• Operating Capacity: 3 AC/hr
• Max Capacity: 6 AC/hr
• Increase capacity based on gas detection
• Non-sparking fan

Battery Off-Gas System
• 3m from access/crew/passenger area
• Operating Capacity: 100 CFM
• Ex motor, non-sparking
• Continuously operating
• Location opposite to passenger loading ramp
RAPID CHARGING SYSTEM.

- Developed under Jumbo MKII contract
- Intent for WSF fleet standard
- Integrated into Hybrid Electric Olympic design

Arm extending during charging operations (cabling and covering not shown)

- Automated connection
- Accommodates vessel motions and tides
- Minimizes over-water construction
- Adaptation of successful European designs
CALL TO ACTION & STRATEGIC ROADMAP.

- Governor’s Executive Order 18-001
- State GHG Reduction Goals (RCW 70A.45.050)
- Long Range Plan submitted to legislature in January 2019
  - Reliable service
  - Customer experience
  - Manage growth
  - Sustainability and resilience
THANK YOU.

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