# **Venetian Sails**

Petro-Freedom Fully-Programmable Aero-Electric Sail Design for Millennial Cargo Ships *William C. Patterson, Ph.D.* 



Solar Slats Rotate 180° on Mast Solar Slats Rotate 180° in Frame Sail Frame Can Be Wider Than Ship Ship Can Have More Masts than Conventional Sailing Ships *Wind Flows through Sail, Does Not Blank Downwind Sail Frames* Solar Slats and Frames are Individually Programmable *Fine Speed Control has Slats x Masts Gradations Slats Can Zig-Zag Airflow Running With the Wind* Venetian Sails Can Use 83% of Wind Compass Venetian Sails Multiply Conventional Sail Area for More Speed & Power Venetian Sailing Ships Are Supplemented by Electric Propulsion Solar Sail Electricity Propels Ship in Still Air, Meets Electrical Needs of Vessel, Mobilizes Docking

# Millennium Venetian Sailor Cargo Ship

**Cross Section** 



Ship Fills & Empties Container Cargo Automatically From Both Sides Deep-Knife Stone-Filled Aluminum Cylinder Keel for Max Stability & Min Drag Rectangular U-Hull Ideal for Container Cargo Form Factor All Cargo Inside Hull: Sealed From Sea & Weather Metal-Reinforced Thick-Glass Greenhouse Command Center Extreme Front & Rear *Maximal Hemispherical Visibility Proximate Vision for Piloting & Docking Glass Window Wall Tinted for Visual Comfort Two-Level with Draperies for Family Privacy* Reversing Electro-Thrusters L-R-F-R (Batteries below Load Deck)

# Venetian Sailor Longitudinal View

Two-Story Naturally-Lit Forward & Aft Command Centers Accommodate Crew & Their Families *Outdoor Jogging & Cycling Track Food Garden & Fruit Tree Arboretum Exercise Micro-Gym Home Schooling Aquarium in Each Room Kitchen & Dining Room Worship & Counseling Center w/ Pulpit & Organ* Deck Composed of Walk-Over Solar Panels All Light, Sound, GPS, Radar, Sonar, Solar, Cams, Pumps *Flush-Mount* 

Four-Corner Electro-Thrusters Operate Forward & Reverse for Total Maneuverability Automated Rudders Left & Right, Front & Rear for Integrated Control & Redundant Fault Tolerance Solar-Galvanic-Protected Unpainted Aluminum Hull is Lighter, More Affordable & Durable than Steel Raised & Polished Surface-Mount Permanent Metal Insignia Monolithic Water-Tight Access Door is Full-Length for Unimpeded Cargo Loading & Unloading

Stone-Filled Al Keel Raised & Lowered on Self-Cleaning Structural Tube Telescoping into Masts Keel Structural Tube Interspaces Filled by Accordion Metal or Fabric for Monolithic Keel Function Conical Keel Ends Equipped with Sonar for Collision-Free Navigation at Any Water or Keel Depth Ship Cruising, Harboring, and Mooring Automated & GPS Justified for Safety & Efficiency

Perfect Self-Parking & Self-Departure Perfect Harbor Navigation & Collision Avoidance Perfect Tacking & Storm Avoidance Navigation Hemispheric Cam Coverage Above & Below Waterline All Ship Lighting Energy-Efficient LEDs

Ship Employs All-Electric Utilities Furnished by Solar Power

Century Ship Lifetime Meets Hydro-Force Global Environmental Service Permanence Standard Ship Operates on Stream Energy

No Draw-Down on Vital Consumable Energy No Climate Overheating or Pollution

### **Aqua-Culture Preservation**



Each Voyage Will Replenish Ocean Habitat as a Thank Offering for Free & Easy Living at Sea Ships at Sea Collaboratively Relay Sonar & Underwater Video for Real-Time Oceanographic Stewardship GES Will Confer Hydro-Force Education Degrees for Scholarship at Sea Cargo Sailing Oceanography Aqua World Nutrition Aqua World Physical Fitness

## Precursors of Venetian Sail Linear Array Principle from Rotary Aerodynamics



Windmill Vanes



Jet Turbine Vanes

# Traditional Venetian Blind & Vertical Blind Form Precursors for Venetian Sail



Aluminum Venetian Window Blind Courtesy: Blind Technique



Vertical Window Blind Courtesy: Blind Technique

Sailing ForcesGray: ShipDark Blue: Solar Sail (Slat)Light Blue: Wind ForcePattern Blue: Resolved Wind ForcesRed: Forward Force



Running with the Wind Traditional Tall Ship Sail Configuration



Reaching Against 60-Degree Wind Close Reach Sail Oblique 30 Degrees





Running with the Wind Convergent Sail Array Improves Forward Speed Tail Wind Progresses Through Oblique Sail Array Oblique Array Draws More Peripheral Wind

Reaching Against 90-Degree Wind Beam Reach Sail Oblique 60 Degrees Beam Reach Sailing Delivers Better Speed

### Deep & Heavy Keels Resist Heeling



Lateral Wind & Hydro Force Dynamics Sail Close to Wind Catches Less of It Keel "Digs" Into Water Resists Lateral Displacement of Ship Couple Promotes Heeling



Lateral Wind & Hydro Force Dynamics Sails Further From Wind Catch More of It Ship Heels Weight of Displacing Water & Keel Resists Rotation Emergent Enlarging Lateral Force Limits Heeling

### **Cargo Sailing Strategy Innovations**

### Venetia Cargo Air-Linked Flotilla High-Tech Mobile Rafting

Interconnect Ships at Sea via Shock-Absorbing Pneumatic Cylinders & Coiled Electronic Umbilical Greater Stability United Expertise Enlarged Community Life Shared Resources No Lost Ship



**Scalable Venetia Cargo Flotilla Geometry** *Command Ship Navigates & Centrally Manages Sailing Efficiency* 



# **Venetia Outriggers**



Telescoping Outrigger Pontoons with Ship-Saver Storm Stability Heel Resistance Unsinkable Hull Deployed (Left) for Cruising Retracted (Right) for Harbor or Mooring Clearance Situate Between Masts Aluminum or Inflatable Rubber Pontoons

Individual Deployed Outrigger Longitudinal View Water Spider "Spider Legs" Catamaran "Catalize"

Outrigger With Air-Bag Ship-Saver Deployed Longitudinal View Ship Life-Saver





Water Spider Metaphor for Venetia Cargo Sailor Outrigger Pontoon Feature



Venetia Break-Away Survival Command Center If Ship Goes Down, Sealable Command Center Disengages & Stays Afloat Life Boat Life Preserver Life Bobber Life Float



Command Center Floats Like Bar of Ivory Soap HVAC Utility Layer Between Floors Completely Seals Off for Sea Worthiness Continuously Broadcasts Position While Awaiting Rescue All Crew & Passengers Safely Abandon Ship Without Getting Wet

### **1900 Class Hydro-Force Venetia Cargo Sailing Ship** Approximating Cargo Sailing Ships of the 1900s

Ship Length: 400' Ship Width: 50' Loaded Ship Weight: 9,300 tons Keel Extension: 10'- 50' Max Keel Area: 22,000 ft2 Keel Weight: 600 tons Sail Height: 100' Solar Slat Width: 13' Slats/Mast: 8 Masts: 5 Sail Area: 52,000 ft2 Sail/Keel Area Ratio: 2 Speed: 13 mph Heeling: <8° Solar Collector Area: 68,000 ft2

### 2000 Class Hydro-Force Venetia Cargo Sailing Ship Approximating Petro Cargo Ships of the Millennium

Ship Length: 1,000' Ship Width: 200' Loaded Ship Weight: 83,000 tons Keel Extension: 10'- 50' Max Keel Area: 50,000 ft2 Keel Weight: 1,600 tons Sail Height: 100' Solar Slat Width: 13' Slats/Mast: 31 Masts: 12 Sail Area: 480,000 ft2 Sail/Keel Area Ratio: 10 Speed: 13 mph Heeling: <8° Solar Collector Area: 650,000 ft2

### **Venetia Voyage Duration Generalities**

(12 mph average speed or 288 miles per day)

Global (24,000 miles): 83 Days Hemisphere (12,000 miles): 42 Days (E-W Pacific Span) Quarter-Sphere (6,000 miles): 21 Days Eighth Sphere (3,000 miles): 11 Days (E-W Atlantic Span)

### **Ocean Wave Generalities & Extremes**

Average Wave Height: 1 ft Average Crest-to-Crest Length of Swells: 28 ft Average Crest-to-Crest Period of Waves: 3 seconds

Average Significant Wave Height: 8.1 ft Associated Wind: 32 mph Average Crest-to-Crest Length of Significant Swells: 184 ft Average Crest-to-Crest Period of Significant Waves: 6 seconds Significant Wave (3<sup>rd</sup> Quartile): 17% higher Ship Lengths Near Significant Sea Wave Length Ill-Advised Due To Wave Break-Up Potential



### **Venetia Global Sailing Power Model**

"God's Bow" Revelation:6.1-2

World Ocean Winds & Currents Sympathetic to Intercontinental Trade

Gyres: Basins of Circulating Oceanic Water Between Continents Coriolis Effect: Gyre Directionality Induced by Sphere Rotation Gyres Span Ocean East & West and Traverse Many Ports-of-Call North & South Lesser Draw on Fuel-Limited Ground Logistics by Ship Serving Multiple N-S Ports via Free Wind & Sun

Currents in Ocean of Air Move 10X Faster Than Currents in Ocean of Water Average Ocean Wind 12 mph

Venetia 1900 Benefit: 440 MW or 600,000 HP Venetia 2000 Benefit: 4,460 MW or 6,000,000 HP Average Ocean Current 1.2 mph

Venetia 1900 Benefit: 44 MW or 60,000 HP Venetia 2000 Benefit: 446 MW or 600,000 HP



Potent Petro Power Allowed Ships to Navigate Shortest Distance & Time Ignoring Free Trade Winds & Currents Earlier Used by Tall Ships

Venetia Sailors Draw Solar & Wind Power Direct From Ocean Environment Sacrifice Great Circle Navigation Efficiency to Co-Opt Free Trade Wind & Currents Releases Ocean Trade from Dependency on Vanishing Petro Resources Longer Sea Travel Times Restrict Cargo Choices Durable Goods, Refrigerated Containers, Live Food Containers

Shadow-Free Oceanic Solar Power

Solar Constant W/Ft2: 127 Atmospheric Filtration: 50% Collector Efficiency: 15% Collector Potential: 10 W/Ft2 Clear Day Facing Sun 1900 Class Venetia Benefit: 680 KW or 900 HP 2000 Class Venetia Benefit: 6,800 KW or 9,000 HP Solar Sail Time-Cost Same as Canvas, But Generates an Electricity Surplus of \$5/Ft<sup>2</sup>/Yr