

## IHS 50<sup>th</sup> Anniversary Conference and Celebration

### Update for Week of 15 November 2020

1. No changes in program or schedule
2. Sessions for this final week of the conference:

#### Tuesday 17 November

7 p.m. Washington, 4 p.m. Seattle/LA, 11 a.m. Sydney (18 Nov.)

Speaker: Mark Bebar — US Navy Hydrofoil Development

Speaker: Mark Bebar — The PHM Program – Retrospective

Speaker: Mark Rice — HYSWAS Research Vessel *Quest* – Retrospective

#### Thursday 19 November

5 p.m. Delft, 11 a.m. Washington, 8 a.m. Seattle/LA, 3 a.m. Sydney (20 Nov.)

Speaker: Mark Bebar — Overview of Mandles Prize

Speakers: Casey Brown, Cody Stansky (Webb Institute)  
Mandles Prize Paper, First Prize 2016, "A Fluid Structure Interaction Analysis of Vertical-Lift-Producing Daggerboards"

Speakers: Johan Schonebaum, Gijsbert van Marrewijk (Delft University of Technology)  
Mandles Prize Paper, First Prize 2017, "An Experimentally Validated Dynamical Model of a Single-Track Hydrofoil Boat"

Speaker: Ray Vellinga, IHS President — Closing remarks

These sessions will be conducted on Zoom. Use this link for all sessions:

<https://us02web.zoom.us/j/3157231248?pwd=TExBMnIrVE9MRG5PU29KVHkrYIRnZz09>

If it does not open automatically, use

Meeting ID: 315 723 1248

Password: r09YST

## Abstracts and Speaker Bios

**Speaker:** Mark Bebar

**Job Title:** Vice President, International Hydrofoil Society

**Affiliation:** CACI, Inc. (part-time)

Mark Bebar is currently employed part-time as a Systems Engineer at CACI, Inc. Mr. Bebar has an M.S. in Ocean Engineering from Massachusetts Institute of Technology (1973) and a B.S. in Naval Architecture and Marine Engineering from Webb Institute (1970).



Mark began his association with hydrofoils at the Naval Ship Engineering Center (NAVSEC) in Hyattsville, Maryland in 1970. He was involved in the Navy's early concept designs and feasibility studies of what would become a new Navy Fleet Capability, the PHM. he was Project Naval Architect and Design Integration Manager on the Patrol Hydrofoil – Missile (PHM) ship acquisition program (1971 – 1973 and 1975 – 1978). He was assigned as Deputy Ship Design Manager (DSDM) during PHM follow ship construction and participated in Producibility Studies and Production Readiness Review. This included a series of studies conducted jointly by Boeing and the Navy to correct PHM-1 deficiencies identified during OPEVAL (Operational Evaluation). Mr. Bebar was elected a SNAME Fellow in January 2002.

### **Presentation 1:** USN Hydrofoil Development

This presentation by Mark Bebar summarizes significant US Navy hydrofoil development leading to fleet introduction and operation of the Patrol Hydrofoil – Missile (PHM-1) Class. Mark will highlight key hydrofoil system and sub-system technologies, with the objectives of fostering interest in learning more about hydrofoils and encouraging students to consider ship design as a career field. The presentation will include experimental Hydrofoils as well as R&D and Operational Hydrofoils

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### **Presentation 2:** The PHM Program - Retrospective

In this presentation Vice President Mark Bebar will describe the program beginnings of the PHM. He will cover the design, the program evolution, the ships construction, the squadron operations, and finally the decommissioning of the PHM Squadron in July 1993. He will also touch briefly on the USS Aries PHM-5 Museum in Gasconade, Missouri.

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### **Presentation 3:** Overview - International Hydrofoil Society Mandles Prize for Hydrofoil Excellence

Commencing in 2014, IHS member Martinn Mandles and his wife Connie have funded up to \$4,500 a year to support annual awards in recognition of hydrofoil engineering, design or construction achievement by college and university students (undergraduate and graduate

level) worldwide. The award of the Prize is based on submissions from individual students or groups of up to six students. The submissions must be specific to hydrofoils. The awards consist of a \$2,500 First Prize with a commemorative plaque, and as many as two optional Honorable Mention prizes of \$1,000, with a commemorative plaque. As IHS Vice President, Mark Bebar has coordinated the conduct of the Mandles Prize since its inauguration and will review the prize as part of this presentation, which will be followed by presentations from two of the previous First Prize winning teams from 2016 and 2017.

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**Speaker:** Mark Rice, P.E.

**Job Title:** President, Maritime Applied Physics Corporation (MAPC)

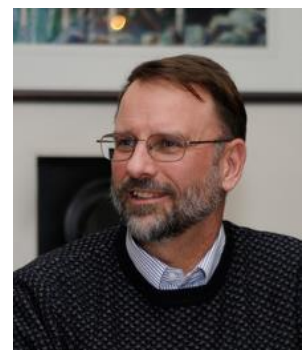
**Presentation Title:** HYSWAS Research Vessel *QUEST* Retrospective

**Abstract:**

Mark will host a video that recounts the exploration of hybrid hull forms at the Naval Ship R&D Center during the 1980s. The emphasis will be on hybrids that employed a combination of buoyant and dynamic lift to extend the range of hydrofoil vessels. The late John Meyer, President of the International Hydrofoil Society for many years, was the champion of a concept known as the Hydrofoil Small Waterplane Area Ship, or HYSWAS. The presentation recounts the construction of a 12-ton demonstration vessel, *Quest*, followed by the design of two larger vessels. The performance attributes of the HYSWAS hull form are discussed including its performance in high sea states as investigated through tank testing. Following the video presentation, Mark will host a discussion of hybrid hull-forms and their relative merits.

**Bio:**

Mark is President of the employee-owned Maritime Applied Physics Corporation (MAPC), located in the Fairfield area of Baltimore City. He has a BA in Physics from the University of Maine (1975) and is a licensed Professional Engineer. Mark formed MAPC in 1986 after working for the Navy as a civilian engineer and has overseen the company's growth from a 1-person company to its current 60-person staff. MAPC has both R&D and manufacturing production work in Baltimore where the employee owners design and manufacture both Defense and commercial products. Mark is a past Chair of the National Advisory Board of the NIST Manufacturing Extension Partnership, is a past Chair of the Business Network for Offshore Wind, and is a member of the JARC Manufacturing Advisory Board and the CARVER High School CTE Advisory Board, both in Baltimore.



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**Speakers:** Johan Schonebaum & Gijsbert van Marrewijk

Job titles: Co-founder / systems engineer

**Affiliation:** Flying Fish Maritime Innovations, The Netherlands

**Presentation title:** "An Experimentally Validated Dynamical Model of a Single-Track Hydrofoil Boat"

### **Abstract**

A single-track hydrofoil boat has two inverted T-shape wings placed on the centre line of the hull. In 2013 the TU Delft Solar Boat Team designed a solar-powered single-track hydrofoil boat with the goal of winning the DONG Energy Solar Challenge 2014 (now Solar Sport One). The authors were members of that team.

The yaw, roll and sideslip motions of the flying boat depend on the front strut steering input of the pilot. We modelled the dynamic behaviour of the boat to find the optimum strut length, flight height and distance between the two hydrofoils. This model was based on conventional aircraft flight dynamics.

Application of the model resulted in a single-track hydrofoil boat design with shorter struts and a larger distance between the two hydrofoils than originally expected. With enthusiastic support from Dr. Ir. Arend Schwab, we set out to experimentally validate the dynamical model. For this, motion sensor data from the TU Delft Solar Boat 2016 was compared to the mathematically predicted motions under a given sinusoidal steering input. We found that our mathematical model very accurately predicts the dynamic behaviour of the single-track hydrofoil boat at typical steering frequencies of 1 Hz and below.

The validated model can be used in computer simulators for pilot training and boat design. A video was produced showing how the boat flies and how its dynamics have been modelled.

### **Author bios:**

Gijsbert Van Marrewijk, Msc graduated cum laude in Space Systems Engineering at Delft University of Technology. In 2013 he worked at the TU Delft Solar Boat Team as Chief of Hydrofoil Dynamics and Stability, responsible for the dynamics of the solar-powered single-track hydrofoil boat they developed. He now works for Flying Fish to bring the future of sustainable waterway mobility closer step by step.

Johan Schonebaum, Msc graduated in high tech engineering at Delft University of Technology. In 2013 he worked at the TU Delft Solar Boat Team as hydrofoil engineer in the department of Dynamics and Stability, responsible for the structural design of the hydrofoils and the assembly and maintenance of the entire boat. Now he is one of the four co-founders of Flying Fish and working there to realise the Flying Fish vision.

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**Speakers:**

Casey Brown, Wyspa Technologies & Inde Foil, USA

Cody Stansky, Inde Foil & Darkmatter Engineering, USA

**Job Title:** Naval Architect

**Presentation Title:** A Fluid Structure Interaction Analysis of Vertical-Lift-Producing Daggerboards

**Abstract:**

This presentation describes an analysis of the steady-state fluid-structure interactions, FSI, of high-performance sailing hydrofoils. This was performed by evaluating an isotropic CV-style sailing hydrofoil similar to the AC-50's which competed in the 2017 America's Cup and are currently being sailed in the SailGP circuit. The FSI analysis was completed using the multi-physics simulation software StarCCM+. The results from the FSI study are compared to a CFD analysis of the un-deformed foil, to determine the value of the FSI study. The deformed foil performance varied significantly enough at speeds of 30 knots and above to warrant a FSI study.

**Bios:**

Casey Brown grew up sailing and racing in Narragansett Bay at the epicenter of the racing culture that Newport is known for. He developed an early understanding of composites while attending the IYRS Composite Technician Program before graduating from Webb Institute with a degree in Naval Architecture and Marine Engineering. Casey spent two years working on a variety of naval architecture projects for Sparkman and Stephens before stepping away to focus on developing Wyspa Technologies. Currently he leads all design and engineering projects and continues to race and kite foil in his spare time.

Cody Stansky began sailing and racing in South Florida with a focus on the 29er skiff. He also graduated from Webb Institute with a degree in Naval Architecture and Marine Engineering partnering with Casey on their senior thesis, the paper being presented here. Design engineer specializing in composite design and computational fluid dynamics (CFD) analysis. Cody spent three years working for the multihull focused firm Morelli and Melvin before stepping away to focus on consulting projects and spearheading the development of Inde Foil. His work on the Fliteboard eFoil hydrodynamics has been critical to Fliteboard's product success. Cody has had the opportunity to lecture professionals and academics on hydrofoil design and analysis at SNAME as well as UC Berkeley. He is actively competing in the kite foil racing circuit and passionate about kiteboarding in general!