The NEWSLETTER

International Hydrofoil Society
P. O. Box 51, Cabin John MD 20818 USA

Editor: John R. Meyer | Spring 2003 | Sailing Editor: Martin Grimm

Hybrid Trimaran Hydrofoil Spreads Its New Wings

By William McFann

The Island Group

Tests and trials of the 46' hybrid foil-assisted trimaran developed by TechMan a/s, Norway, and built by Island Engineering, Inc (IEI), Maryland, USA, were successfully completed in May 2002. [Ref previous IHS Newsletters]. After demonstrations of the vessel for representatives of Navatek, Ltd, Hawaii, a program was started to use the trimaran as a test bed to evaluate a new variant of Navatek's proprietary lifting body technology.

Navatek has been developing and testing various configurations of lifting bodies and foil systems, separately and in combination, since

Hybrid Trimaran Flying at 32 Knots

Continued: See Hybrid Trimaran, Page 3

WHERE ARE YOU IN CYBERSPACE?!

IHS relies on electronic communication with the membership to improve timeliness and reduce mailing costs. If you change your email address, **let us know about the change!** Thank you.

2003 DUES ARE DUE

IHS Membership is still only US$20 per calendar year (US$2.50 for students). Your renewal or new membership is critical. IHS accepts dues payment by personal check, bank check, money order or cash (all in US dollars only). We have also recently arranged for payment of regular membership dues by credit card using PAYPAL. To pay by credit card please go to the IHS membership page at <http://www.foils.org/member.htm> and follow the instructions.

INSIDE THIS ISSUE

PRESIDENT'S COLUMN

As I reported in the Winter Newsletter, the Society continues to grow with new members joining every week. During the first three months of 2003 we already had 14 new members. Many thanks to all those who are spreading the word and encouraging their colleagues to join the hydrofoil community.

Total AMV CDs delivered to date is now up to well over 200. Again many thanks to Steve Chorney who has labored to copy these many CDs and send them all over the world. At the same time "Optimized Office Solutions for the 21st Century" has completed scanning thousands of pages from a host of technical reports and documents for the IHS. The subject matter in these reports covers a broad range of advanced Marine Vehicles. So later this year the IHS will be coming out with a new CD: AMV-II. So stay tuned for the announcement and ordering instructions. However, due to the relatively higher scanning costs, AMV-II will be more expensive. Predicated on a sale of 200, a review of projected costs have resulted in a price of $12 for IHS Members and $15 for non-members.

I regretfully report that one of our long standing Charter Member and Life Member of the IHS, Dr Edward Sedgwick passed away in December of last year (see page 9). Also we were saddened to receive word from IHS Member Charlie Pieroth that a hydrofoil colleague, Ray Wright, died in February (see page 12).

At an earlier IHS Board of Directors meeting Jim King and Dennis Clark had taken an action item to propose an approach to developing an IHS long-range plan. At the meeting in March, Dennis presented an approach, which had proved most effective for him in planning activities for several organizations. This "bottom up" approach involves discussing, and prioritizing certain IHS activities, subsequently working through to desired outcomes and goals in a two-phased approach. Clearly, as resources are very limited for the IHS, it makes sense to assess our "activities" and establish priorities consistent with perceived goals for the Society. Dennis will continue to develop this approach with Jim King for implementation and discussion at the next Board meeting in May.

At the IHS Board meeting in March, Ken Spaulding briefly discussed past efforts to promote a traveling hydrofoil exhibit with the Smithsonian Institution in Washington, D.C. Martin Grimm has provided information on a European hydrofoil exhibit containing many models, in Rostock, Germany in 1997. Ken proposed that a letter to the museum believed to have at least some of the models might be worthwhile. However, it was decided to defer this action at this time subject to prioritizing the exhibit option in the planning effort mentioned above.

John R. Meyer
President

WELCOME NEW MEMBERS

Michael Bosworth – Mike is currently the Ship & Force Architecture Concepts (S&FAC) Program Manager in NAVSEA 05D1. He is a retired naval officer/engineer (CDR USN (ret), retired in 1996). Prior to naval service, in the late sixties/early seventies, Mike experimented with hovercraft, surface effect ships and hydrofoils with a series of small experimental craft out of Santa Barbara, CA. After a bachelor's in Naval Architecture from Naval Academy (1976), he served in many capacities as a Naval Officer. After naval retirement, Mike worked for half a decade at Syntek Technologies. In 2002, Mike rejoined the government as program manager of the multi-sponsor program (S&FAC).

Jacques Hadler - Professor Hadler has had 60 years of experience in the field of naval architecture and marine engineering of which about 24 years have been in academia, 31 years at the David Taylor Model Basin and the remainder in ship design and repair. Concurrently, during the last 46 years, he has served as a consulting naval architect to commercial shipbuilders, the United Nations and to foreign governments on hydrodynamic problems concerned with ship and propeller design. For the last 24 years, Professor Hadler has been on the faculty at Webb Institute of Naval Architecture where he has been successively Director of Research, Dean of the College and, currently, J.J. Henry Professor of Naval Architecture. He is recipient of the Society of Naval Architects and Marine Engineers, David Taylor Medal for notable achievements in Naval Architecture.

Dr. Daniel H. Harris – "Rick" is a senior engineer at Maritime Applied Physics Corporation. His work focuses on the dynamics and control of high performance marine vehicles for commercial and military applications.

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HYBRID TRIMARAN

(Continued From Page 1)

1996, with successful demonstrations of the technology on their Midfoil and Waverider test craft. Working with commercial Computational Fluid Dynamics (CFD) programs, and with assistance from California State University, Long Beach, Navatek has developed the next evolution of lifting body technology, the blended-wing-body (BWB). The main objective of the BWB is to enhance the seakeeping and high-speed payload capacity of a range of existing or planned vessel designs. The IEI test craft was determined to be the ideal test bed on which to evaluate the performance of the BWB concept at a reasonably large scale.

The BWB, an optimized combination of two lifting bodies with a cross-foil between them, replaces the original main lifting foil on the test craft entirely. Requiring only three supporting struts instead of the five used with the original foil configuration, it was designed by IEI to accurately reflect the geometry of the Navatek design yet bolt directly to the original main foil foundations. The BWB also uses the existing servomechanisms and controls for trailing-edge control flap actuation.

In order to remove or preclude the influence of the center hull on the BWB test results, the waterjet propulsion was removed and a pair of Yamaha outboards installed on the transom of the center hull. This modification allows the craft to achieve a fully flying condition with all hulls completely clear of the water surface. The existing inboard V-8 was retained to provide hydraulic and electrical power. The original waterjet steering servos were modified to steer the outboard motors instead.

Sixty-four high-response surface-mounted pressure sensors were installed in one of the BWB lifting bodies and a section of the cross-foil to measure the pressure distribution and boundary layer transition locations for correlation with the CFD predictions. Net thrust from the outboard motors and the lift and drag on the BWB assembly are also recorded on the on-board data acquisition systems.

The IEI Spectrum flight control system that was already proven in the original craft configuration was retained, although system gains were modified to accommodate the added mass and damping associated with the BWB. The Spectrum fly-by-wire digital control system maintains the trim, list, flying height and heading commanded by the operator and dampens transient pitch, roll, heave and yaw motions.

Results to Date

With the first phase of the test program completed, the following results have been noted:

- Controllability of the craft in trim, list, heading and height is excellent. The Miros bow-height sensor continues to prove an excellent package for providing real-time height data to the flight control system.
- Take-off drag (hump drag) characteristics were improved with the BWB foil as compared to the original main foil.
- The total drag at flight speeds has increased relative to the original main foil configuration but at the same time, the maximum take-off displacement, and hence the useful payload fraction, has been increased dramatically, by almost 30% as demonstrated to date.
- The previously excellent sea keeping performance was improved relative to the original foil configuration due primarily to the added damping provided by the lifting bodies.
- The remarkably low wake/wash exhibited by the original concept does not appear to have been changed by substitution of the BWB foil system for the original main foil.

The large quantity of data acquired to date is being reduced for correlation with the lift, drag and pressure distribution predictions.

[Editor's Note: An illustration of the Hybrid Trimaran showing the installation of the BWB is not available at this time. However, an earlier concept called Hybrid Small Waterplane Area Craft (HYSWAC) is based on separate lifting body, amidships, and conventional aft foil on a catamaran hull (the former SES200). The BWB represents the first integration of the two separate lifting elements and is being developed further for both catamaran and monohull/trimaran applications.]

HYSWAC Concept

EXTENDING THE CHOICE OF PROPELLER SOLUTIONS

(From Speed at Sea*, December 2002)*

by Doug Woodyard

Computational fluid dynamics (CFD) is a valuable tool in designing propellers and assessing the interaction of hull, propeller and rudder. A specialist in CFD solutions for the marine industry, the CD adapco group has offices in the USA, Europe and Asia. Its software portfolio includes three cavitation models, allowing the prediction of both the onset of cavitation and the unsteady phenomena associated with the build-up and break-up of large cavitation regions typically on the suction sides of propulsion systems. Detailed analysis of both steady and unsteady cavitation phenomena has been carried out successfully with the software by the Technical University of Hamburg-Harburg's Department of Fluid Dynamics & Ship Theory, HSVA and Voith Schiffstechnik.

Simulating flows around surface-piercing propellers is particularly complex, since the blades cut the free surface as they rotate. CD adapco software is capable of handling this situation. The predicted variation of thrust generated by one blade during its rotation reportedly well matches the experimental data, where standard tools based on potential theory fail.

Current commitments at Ravensburg-based VA Tech Escher Wyss include the production of CP propeller installations for the German F 124 Frigate program, with deliveries scheduled up to 2004. References in the megayacht sector were maintained last year with twin CPP systems for an 85m megayacht. The propellers were designed to meet strict requirements with regard to induced pressure pulses and cavitation. An earlier megayacht project called for twin Escher Wyss CPP systems featuring a synchrophaser which is active in the 80 to 100 per cent shaft speed range to minimize induced vibration.

Another German company, Lubeck-based Schaffran Propeller Service, draws on extensive experience in designing and producing fixed pitch and CP propellers up to 6,000kg in weight, including units for fast leisure, commercial and paramilitary vessels.

Valuable references are provided by the US Coast Guard's 26.5m Marine Protector-class cutters from Bollinger Shipyards, some 53 vessels of this type being delivered in 1997-2001. The twin-screw propulsion plant is based on MTU 8V 396 TE94 high speed engines driving Schaffran five-bladed 1.04m diameter propellers. Six P200-class patrol boats from Germany's Peene Werft were specified with a pair of four-bladed 1.4m-diameter propellers, each designed to absorb 2,054kW.

High performance propellers for fast megayachts are another speciality, Schaffran promising optimum efficiency, minimal noise excitation and cavitation in such applications. Among its references are the 35m *SunlinerX,* which features twin 1.22m-diameter four-bladed propellers absorbing 2,570kW apiece; *San Lorenzo 100* (twin 1.16m-diameter, five-bladed, 1,680kW apiece); the 43m *Aliosha V7I of Rurik* (twin 1.5m diameter, four-bladed, 1,015 kW apiece); the 45m *Shamwari* (twin 1.45m-diameter, four-bladed, 1,400 kW apiece); and the 53m *Destiny* (twin 1.79m diameter, five-bladed, 1,156 kW apiece).

Propellers from 500mm diameter and over are produced Piening Propeller, Hamburg, with casting mainly from high tensile strength marine bronze or nickel-aluminum-bronze. Tips and segments are also cast from these alloys to repair damaged propellers and blades. In addition, the company manufactures propeller shafts, shaft bearings and shaft struts, with lathe facilities allowing units up to 12m in length and 4m in diameter to be produced.

Alco Propeller AB, a Swedish specialist in the production and repair of CP propeller blades and fixed pitch propellers, is now under the umbrella of the Osterby Gjuteri group, whose other interests include the waterjet manufacturer Marine Jet Power.

An extensive reference list of over 15,000 propellers has been earned by China's Zhenjiang Marine Propeller Plant, which is keen to compete in the design and production of propellers for high speed vessels. An annual output of over 1,000 fixed pitch and CP propellers is claimed for diverse commercial tonnage and warship projects in China, elsewhere in Asia, Europe and the USA. Commercial and technical co-operation has been forged with leading overseas special-

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EXTENDING THE CHOICE OF PROPELLER SOLUTIONS

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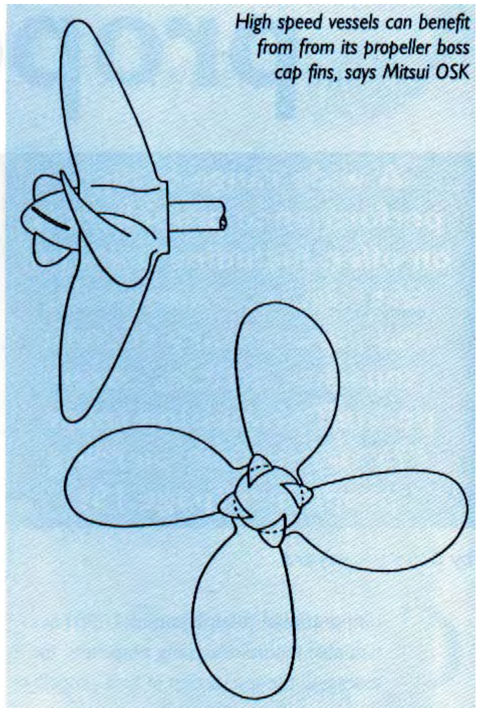
ists such as Lips, SMM, Schottel and Kawasaki.

A market beyond the Asia-Pacific region is targeted by the Indian propeller designer and manufacturer Shree Gajanan Prasad, which specialises in fixed pitch units with diameters up to 2m. The Mumbai-based company offers standard propellers exstock and custom-made designs in either manganese-bronze or nickel- aluminium-bronze. Among its design resources are the advanced software programs Propcad and Propexpert, which enable propellers to be optimised for the specific vessel and engine combination based on data supplied.

Well over 250 contracted and loaded tip (CLT) propellers are now in service or on order worldwide with tonnage ranging from fishing vessels and high speed craft to large cargo ships. These installations cover a power band from 75kW to 26.5MW and a wide propeller speed range, and more than 50 references feature CLT blades applied to CP hubs. Sistemar, the Spanish designer, cites the following merits for the CLT propeller:

- reduction in fuel consumption of more than 8 per cent or an increase in ship speed for the same consumption
- reduction/elimination of hull-induced vibrations
- improved manoeuvrability (smaller turning circle and shorter stopping distance in crash stop manoeuvres)
-enhanced course stability.

A wider market is sought in the high speed vessel sector for the Propeller Boss Cap Fins (PBCF) concept developed by Mitsui OSK Lines, the West Japan Fluid Engineering Laboratory and Mikado Propeller. The first installation was executed in 1987 and by June 2002 some 770 sets had been commissioned.



High speed vessels can benefit from its propeller cap fins, says Mitsui

Applicable at the newbuilding stage or by retrofit to fixed and CP propellers, the PBCF system exploits a boss cap with fins that rectify the propeller hub vortex and recover rotational energy otherwise in the slipstream.

The concept reportedly increases propeller thrust by over 1 per cent and reduces propeller torque more than 3 percent, thereby underwriting fuel savings of up to 5 percent. A speed gain of 1.5 percent can be delivered with the same engine output. Apart from enhancing propulsive efficiency, the system is said to reduce stern vibrations and propeller noise, and resolve a number of rudder erosion problems.

All vessel types with screw propellers can reportedly benefit from PBCFs, including those with CP screws: two RoPax ferries, each with 23.83MW shaftlines, are currently the highest powered vessels with CPP/PBCF combination. PBCFs were installed on three patrol vessel newbuildings in 1999, each of the twin props absorbing 1,471kW. Model tests had confirmed the effectiveness of the concept for high speed craft applications.

Sales are handled by the PBCF Division of Mitsui OSK Techno-Trade Ltd, which can advise potential customers of the anticipated benefits given installation. Restricted licenses to sell an produce the PBCF - now patented in 12 countries are held by the Japanese companies Mikado Propeller (which has sold over 300 units) and Nakashima Propeller and Samsung Heavy Industries of Korea.

THE "SCHLOER HYDROFOIL PROJECT" – THE FIRST COMBINATIONS BETWEEN SWATH AND HYDROFOILS

By Christof Schramm, IHS Member

In the 1970s the German engineer Dr. Ingo Schloer invented a hydrofoil concept to combine the advantages of displacement vessels with those of hydrofoils. His concept was designed as a military hydrofoil comparable to the PHM-design, which was discussed as a new project to replace the conventional Fast Attack Craft of the German Federal Navy.

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THE "SCHLOER FOIL PROJECT"

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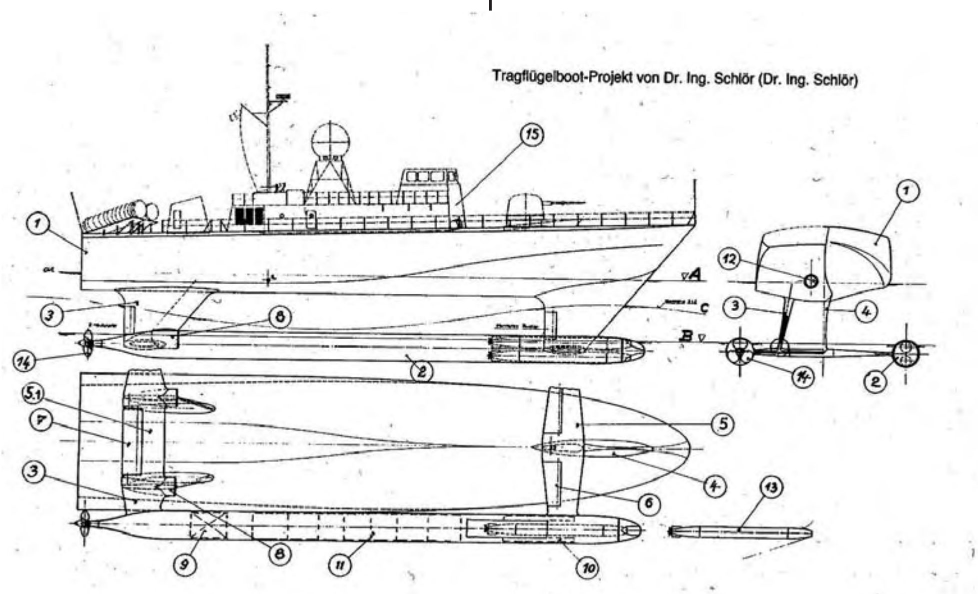
His concept never grew to an official project for the German Dept. of Defence. Since the PHM was canceled by the German Federal Navy, all developments and concepts of this type have been forgotten and buried in archives. Germany never developed a fast ferry industry as did Norway or other countries.

The speed of conventional fast craft depends on sea state. Hydrofoils with fixed foils are relatively independent of sea conditions, but they have a problem to find berths with a water depth suitable to the deep draught of hullborne hydrofoils with fixed foils. Hydrofoils that are able to retract their foils have to transit from their landing areas to their berths as conventional displacement ships at relatively slow speeds.



Sketch of the Schloer Hydrofoil

Dr. Schloer invented a solution with a variable draught. If the ballast tanks of the lower hulls are flooded, the ship will drop to the waterline level (A). In this state, the ship will be able to run at slower speeds in deep waters. If the ship has to run in shallow waters at slow speeds, the ballast would be blown out of the ballast cells, so that the boat rises to the level (B) having a very low draught. If the boat accelerates in the deep submergence state, the dynamic lift of the foils will raise the hydrofoil to the middle level (C). In this state the boat could operate as a hydrofoil in higher sea states stabilised by the front and the aft foils. When the boat decelerates, it comes back to lower level (A).

[Editor's Note: Although this is an interesting concept, the need to carry ballast in the lower hulls reduces volume available for fuel.]

Similar to the PHMs, two independent propulsion systems are used for low and for high speed operations. The propellers at the end of each lower hull are part of the diesel driven low speed propulsion. A gas turbine with a waterjet at the end of the main hull would be used for higher speeds – similar to the Boeing propulsion concept.

Was this design a true hybrid SWATH-Hydrofoil? The answer is "No," because the lower hulls would not have been used to reach a mid-submergence level (C) like semi-submersibles do. The ship has only been designed to run at two levels: fully submerged to the normal waterline of a displacement ship or with a very low draught at slow speeds.

Disclaimer

IHS chooses articles and photos for potential interest to IHS members, but does not endorse products or necessarily agree with the authors' opinions or claims.

FLYING A HYDROFOIL MANUALLY

By Christof Schramm, IHS Member

In the Sixties the German shipyard Luerssens at Bremen – well known for the Luerssen type "S-Boats" of the WW II – built a small test vehicle with full submerged foils. Lack an autopilot system, the engineers developed a control system for this small hydrofoil similar to that of the controls of an airplane.

During the first test runs, the test crew recognized that it was not easy to con-

Luerssen Test Hydrofoil (Photo by C. Schramm 2001)

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FLYING A HYDROFOIL MANUALLY

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trol the vehicle while foilborne. So they asked at a nearby German Airbase for help. After one of the pilot officers had tested the boat on foils he instructed the test crew, how to fly this boat manually.

The lack of the autopilot resulted in failure of the design, because nobody has been able to fly this boat manually for a long period through the waves – however, the boat reached a speed of more than 30 knots. This small hydrofoil has been preserved in a very good condition at the "Auto- und Technik-Museum" at Speyer, Germany.

WHAT DO HELICOPTERS AND HYDROFOILS HAVE IN COMMON?

By Martin Grimm, IHS Member

The two technologies that interest me most are helicopters and hydrofoils. When these both came together in a single application, I was most pleased.

The Erickson Air-Crane company based in the US has been operating a fleet of Sikorsky S-64 Skycrane helicopters for many years. These heavy lift helicopters are used for a range of specialist applications from aerial crane work to fire-fighting.

In the fire-fighting role, the helicopters are fitted with a custom designed tank that can carry up to 2500 gallons (~9500 litres) of water, retardant or foam mix. This load can be discharged at various rates depending on the nature of the fire being attacked. The tank can be filled while the helicopter is airborne by one of two methods. A snorkel unit connected to a flexible hose can be lowered into water reservoirs and the integral impeller within the snorkel can then be activated to refill the tank in as little as 45 seconds while the helicopter is in a low hover.

The second approach is even more novel. A rigid boom equipped with a ram scoop system is lowered from

Skycrane With Fire-Fighting Equipment

alongside the tank as the helicopter approaches for a low pass over a stretch of water. At the end of the boom, a hydrofoil unit is installed such that when the boom makes contact with the water, the hydrofoil forces the boom to submerge rather

Scoop With Hydrofoil Unit

than simply skipping over the water surface. The ram pressure of the water can then fill the tank through the scoop inlets in less than 45 seconds. A close up view of the hydrofoil and the water scoop inlets is shown here.

The Erickson Air-Crane website at http://www.erickson-aircrane.com has a good still image of one of their S-64E helicopters with that hydrofoil water scoop system in action as it flies low over the water. Even better, the selection of video clips that Erickson Air-Crane provides on their website includes footage of the hydrofoil water scoop system in action.

Detail of Scoop

One Erickson Skycrane named "Elvis" has been a regular visitor to Australia during the summer period, mainly fighting bush fires in Victoria. Last season saw significant bush fires in New South Wales, so two other Erickson Skycranes with the names "Incredible Hulk" and "Georgia Peach" were imported at short notice. All three earned a good reputation saving houses on the outskirts of Sydney and in rural communities. This year the helicopters and their crews have again been earning their keep fighting fires from Canberra south down into Victoria. A hydrofoil played a little part in it too.

Interested in hydrofoil history, pioneers, photographs? Visit the history and photo gallery pages of the IHS website.
http://www.foils.org

TRIMARAN DESIGN TARGETS TRIPLE BENEFITS

(Excerpts From Speed at Sea, February 2003)

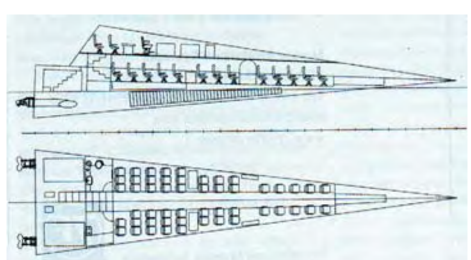
By Valentin Tugolukov [*Valentin Tugolukov is senior staff scientist at Ukraine-based joint stock company Feodosia Shipbuilding Company 'Morye'*]

A new design called the 'fast seakeeping craft' (FSC), as a 'spearhull' incorporates the best hydrodynamic qualities and characteristics - including shape and rough-water performance - inherent to three different advanced hulls: gliding monohull, lengthened trimaran, and deltoid wavepiercer. A fundamental requirement of the new hull was to maintain high speed in heavy seas without compromising the comfort and safety of the crew, and passengers. This had to be achieved with minimum costs for power, operation and construction. FSC can also stand for 'fast, safe and cheap'.

General views of the FSC 'Spearhull'

Without going into details about the FSC concept's design and hull hydrodynamics, it is still possible to provide a good idea of its characteristics with some examples. The same gliding deltoid three-section trimaran wavepiercer hullform can be scaled up or down to create a 'family' of boats, ships and vessels of various dimensions and functional purposes.

An example is a 21 m long interceptor craft (FSC 21) carrying a team of 10 to 16 commandos has a displacement of 20 tonnes. Two 525kW engines give this craft a speed of 70 knots.

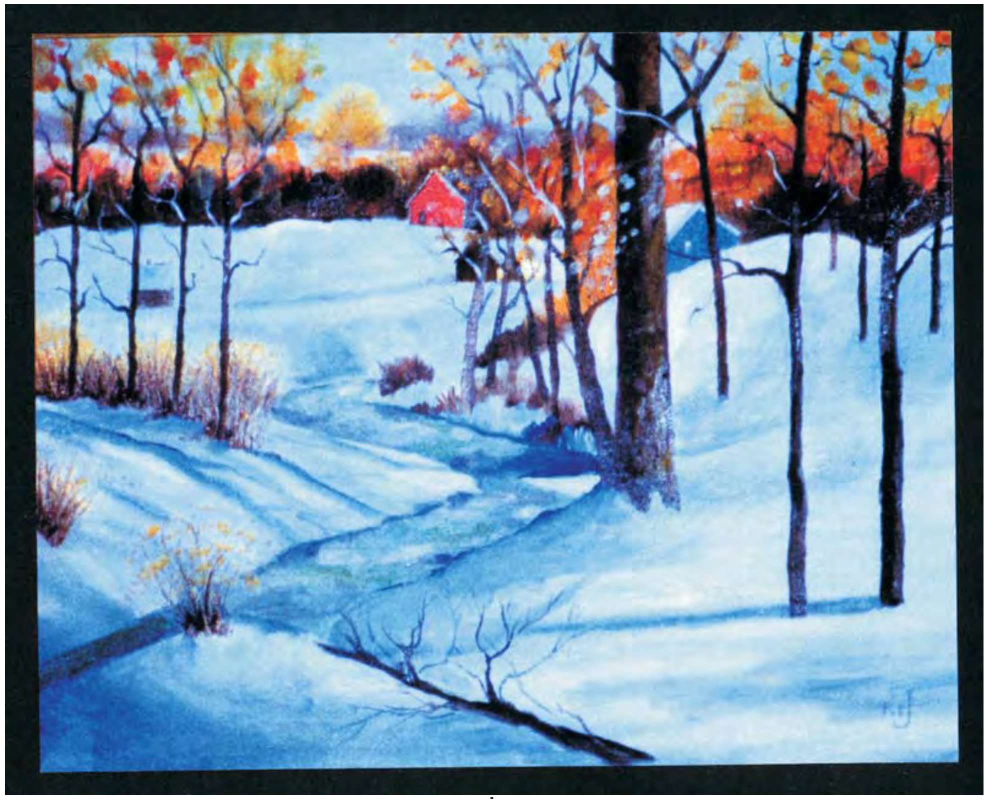


24.5m Version of a FSC Fast Ferry

Commercial application of the hull is for a 24.5m/61seat passenger fast ferry (FSC 24.5) for a Dutch company on the rivers Vaal and Rhine, and channels out to the Hague and Rotterdam, and even across the southern part of the North Sea into the Thames to London and back. Power needed to maintain 62 knots is just 2 x 846 kW, with a fuel consumption of no more than 2 x 182 kg/hr. The modest cost of building the steel hull means that this vessel would pay for itself within six months, making two return trips a day at $50 a crossing. The transport efficiency of the ferry is more than 1.3 to l.6 times the same index for comparable fast craft.

MARCIA JOHNSTON

IHS Honorary Life Member, Marcia Johnston, has continued to correspond with the IHS. She has, recently, amongst other generous gifts, sent your Newsletter Editor one of her many paintings. It is reproduced here for the benefit of all. Her talents also extend to completing in record time early in the morning, several crossword puzzles. Marcia continues to enjoy winters in Daytona Beach, Florida and summers in her beloved Rensselaer, Indiana.



HYDROFOIL SURFING

By Martin Grimm, IHS Member

Recently on the national news in Australia there was an item about some guys who had developed a hydrofoil supported surfboard. This seems to be an off-shoot from the hydrofoil based 'air-chair' towed behind ski boats. The footage on the news item was fairly impressive. There is a website on the subject, and all are encouraged to log onto: www.hydrofoilsurfing.com

Some pictures from the site are reproduced here. One can only be amazed by what these surfers do! It seems like they are able to stand a pencil on its point with little difficulty.

IN MEMORY OF EDWARD SEDGWICK

Edward Van Volkenburgh Sedgwick, PhD, IHS Life Member, age 89 passed away on December 26, 2002 in Mukilteo, WA after a lengthy illness from Parkinson Disease.

Dr. Sedgwick was born in Dixon, CA 15 June 1913, son of Charles Elbert Sedgwick and Katalina Hamlin (Clark) Sedgwick. He graduated from Dixon High School, attended Univ. of California at Berkeley. He received his BS degree, MBA, & PhD from UCLA in Business Management.

From 1963-1965, he was a lecturer at Long Beach College and an Assistant Professor at San Fernando Valley State College. He was appointed lecturer to UCLA's Anderson's School of Business 1969 to 1980 and visiting lecturer from 1980 until he retired at age 75.

Ed was a 4th generation Californian and resided in Los Angeles with his wife Janet for over 60 years. They moved to Washington State in 1998. Ed belonged to various professional and scholarly societies: Beta Gamma Sigma, American Institute of Industrial Engineers, Academy of Management, a Charter Member of the International Hydrofoil Society, and was a licensed Industrial Engineer in the state of California.

His interests were many and quest for knowledge unending. He loved antique motors of which he had a small collection, old cars, anything to do with trains, planes and fishing an interest that he pursued in later years. He earned his pilots license in the early 1940's.

WELCOME NEW MEMBERS
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Terry Hendricks - Terry's academic training is in elementary particle physics, but his professional work has been in coastal oceanography. After arriving in La Jolla to attend graduate school at UCSD in the fall of 1960, he became captivated with surfing and built his first wave-riding vehicle—a Gaylor Miller designed monofoil hydrofoil board. He has been building and riding boards of his own design since then, including revisiting hydrofoil designs beginning about six years ago. Much of his spare time now is spent experimenting with, and refining, his latest hydrofoil design to further improve its performance.

Gabor Karafiath - Gabor received an M.S. in naval architecture from the University of Michigan in 1972 and has spent his career at the Naval Surface Warfare Center. Currently he is in the Resistance and Powering department in charge of surface ship powering model tests. He has also worked in the High Performance Vehicle branch testing an early HYSWAS model, a partial hydrofoil supported planing hull model and more conventional high speed craft. More recent accomplishments involve developments for surface ship mono hulls such as the wedge, stern flap, bow designs, and pod propulsion.

David Newborn - David is currently employed by the Naval Surface Warfare Center, Carderock Division as a co-operative education engineering student trainee and is also a full time student at Florida Atlantic University. Starting in January 2002, as a co-op student employee, he has worked on the concept development and preliminary design effort for the Planing HYSWAS Integrated Node (PHIN) Unmanned Surface Vehicle (USV). David plans to graduate from Florida Atlantic University's Bachelor's of Science in Ocean Engineering.

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SAILOR'S PAGE

SCAT UPDATE

By Sam Bradfield, IHS Member

The first event in which SCAT was likely to participate was the Lauderdale to Key West race in mid January 2003. SCAT suffered structural damage en route from Canaveral to Fort Lauderdale to race Jan 12. Scat was clocked at 29.5 knots (GPS) on a broad reach when the incident occurred. She proceeded to Fort Lauderdale YC despite damage to her amas and standing rigging and having taken on nearly 200 gallons of water.

As is often the case with sailing hydrofoils, a means of establishing a fair handicap for SCAT in this race still needs to be found.

SCAT was not officially included but with temporary repairs by her crew at FLYC was permitted a late "unofficial" start . On the basis of comparative time from start line to finish line, she finished (carefully) this downwind race in the middle of the monohull fleet.

She was hauled at Key West, repaired, re-launched March 17 and is ready to go again. Her next exercise is performing for a flight video before she leaves Key West to return to her berth at CBYC in Port Canaveral.

The OSTAR 40 division was recently postponed until 2005. Development and testing of SCAT is planned to continue through 2004 and into 2005 when it is intended that the boat will be ready for Philip Steggall to participate in the Single-handed Transatlantic OSTAR 2005 race.

FASTACRAFT FOILER MOTH 'ON THE PROWL'

The previous Newsletter included an article by Ian Ward on his Bifoiler Moth. There is quite a band of Moth foilers in Australia and so this time another of their craft is described:

Contributed by John Ilett, IHS Member

John Ilett from Western Australia reports that he and is brother Garth the owner/sailor of the foiler Moth 'On the Prowl' attended the Australian Moth championships over the Christmas period on Lake Alexandrina at the mouth of the Murray river in South Australia. Garth brought the foils of 'On the Prowl' along with the intent of using them but the venue was so shallow that the foils would touch the bottom when the boat came close to the water surface. If this happened at speed it may have been fatal for the foils and the boat. None the less, Garth used the foils in the invitation race and also the first heat where he gained a 5th place in both races.

Side View Of BiFoiler

In the invitation race Garth chose the wrong side of the course on the first upwind leg and consequently he rounded the windward mark in 20th place but thereafter made a gain and at the following leeward mark was in 4th place. Upwind, the boat generally has a similar speed or was occasionally faster than the regular boats. It is considerably faster downwind when foiling. The more wind the greater the range of relative heading angles at which it can be foiled. In 10 knots the boat may only foil on a beam reach but with 15-18 knots of wind the boat can sail square downwind on its foils.

FOIL DESIGN

The current hydrofoil configuration is an inverted "T" style on each of the rudder and centreboard. The rudder foil has a trailing edge flap controlled by twisting the single tiller extension to operate a nylon worm type adjusting screw.

The centreboard foil also has a flap controlled automatically by a bow mounted sensor arm. Maximum flap incidence angle is set when the boat is in the water with the flap automatically reducing the lift as the boat rises. This sets the flying height at about 30-40cm above the water.

Front Quarter View Of Bi-Foiler

Foil Detail

Continued on Next Page

FASTACRAFT FOILER MOTH 'ON THE PROWL'

(Continued From Previous Page)

Both the vertical foil struts are timber cored; their sectional shapes were cut using a computer-operated router to give the precise NACA 0010 section. These foils were also vacuum bagged with carbon fibre. Both the hydrofoils are the same NACA 63412 moulded pre-preg section produced by Fastacraft. The hinge within each foil is kind of special. We have used a thin laminate of Kevlar impregnated with a rubber like epoxy resin. I think this is nothing new to the modeling enthusiast.

SAILING

Launching the boat means firstly tipping it up on its side in the water. Having to do this is often the normal thing on a Moth as many have a fixed rudder blade with no rudder box. The centreboard slides into the normal centrecase from the bottom of the hull and is pinned through at the deck with a ¼" toggle pin. Then the cable from the sensor arm attaches to the centreboards control rod with a simple ball and socket snap together fitting. The sensor arm and cable always remain on the hull so overall rigging actually takes no longer than a regular Moth.

Upwind the boat does not appear to be fully foiling but it actually is. The bow sits just clear of the water with the full stern still contacting the wave tops. Even though the boat is not out of the water the foils are still carrying the majority of weight. The wetted surface of the hull is reduced and as the weight is on the foils the boat does not pitch with waves as it does when hullborne.

Reaching is of course the best part. Whilst the rudder has a controllable flap it was found that once it is set, it does not need to be used at all. With the height automatically controlled there is nothing extra to do with regard to flying the boat. In 12 knots of wind the boat will lift within a few boat lengths, then everything goes quiet. The ride is quite smooth and very fast.

Downwind or generally sailing deeper is a little different to straight reaching. The helm needs to try and maintain constant pressure in the rig by following the apparent wind through changes in the wind strength or direction to keep foiling. This "T" foiler gives the sailor a lot of confidence sailing downwind. With the foils being below the water there is no influence at all on the boat from the surface waves and the ride is super smooth. It does feel pretty strange at first, sailing deep downwind crouched on the deck near the centre of the boat.

New Sensations Obviously there are a few that are strange or different to become accustomed to. Firstly steering at up to 15 knots of boat speed is OK but at higher speeds the steering just becomes very sensitive and tends to knock your confidence a little. Sailing into a lull in the breeze is also strange. As the wind drops, so does the downward pressure of the rig on the boat and so initially the boat will actually fly a little higher before coasting down to the water surface. It always seems as though you are landing a seaplane as you become so accustomed to there being almost silence until the hull again contacts the water. With the landing you feel you can relax again as focusing on steering for long reach can be a bit taxing on your mind.

So far the worst that can happen results when sailing into a sharp gust of wind. Should the gust freak you a little and you sheet out the sail, then this will also decrease the downward pressure on the boat which ends up with skipper naturally/defensively rounding up into the wind as the boat tries to launch itself out of the water. You rarely end up having a swim but you will see the centreboard foil break the water's surface before stalling and landing back in the water.

[The remainder of this article will appear in the Summer Newsletter]

WELCOME NEW MEMBERS

(Continued From Page 9)

Cristof Schramm – Chistof lives in his hometown of Hamburg, Germany and has worked as a sales manager and project manger in the multimedia industry for many years. He has spent a lot of time collecting information about the fast ships and is working to build up his own business in this special business field. Another field of interest is the history of hydrofoils and other fast craft in Germany.

Peter Segerblom - Peter lives in Stockholm, Sweden and is a sailor, but has an interest in Volga boats in particular, but in hydrofoils in general. He works as an event marketer, and owns his own business. He is anxious to get in contact with other IHS members. (Peter@apicius.se)

Richard Varvill - Richard is an Aerospace engineer with a lifelong interest in high speed sailing in addition to Aero/Astronautics. Together with a close friend, he is designing and building a sailing hydrofoil. This hydrofoil employs a catamaran configuration and is canard stabilised with superventilating bowfoils. Since this project is conducted in their spare time, it has taken them 8 years! However, they are hoping to get it in the water by the end of 2003. He cruises a Tornado catamaran around the west coast of Scotland for fun.

Jan Wennerstrom - Jan is a captain in the reserve in the Swedish Navy and did his service in the 1970s, mainly on the Motor Torpedo boats. He also qualifies as a ships mate. Jan owns a Volga hydrofoil from 1984 that he bought in Estonia. He had seen an ad at a yacht club, and 3 weeks later he had a wonderful ride in it. He plans to have it in the Stockholm Boat Show this Spring.

Chung Leung Yung - His English first name is Terence and his friends call him Terry. From1962 to1965 he studied Mathematics in the United College, The Chinese University of Hong Kong. He started his sea-going life in mid 1965 and has been a seafarer ever since. Terry has been working for Far East Hydrofoil Co Ltd of Hong Kong on board hydrofoils (PT50/60; RSH110/160) and, later Boeing Jetfoils and FBM Tricats as Chief Officer/Captain since 1973. The Far East Hydrofoil took over the Parkview-China Travel Shipping and the two merged in 1999 to form the present Shun Tak-CT Ship Management. At present, he is serving as a captain on board FBM Tricats of the ST-CT fleet.

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MEMBER BENEFIT

IHS provides a free link from the IHS website to members' personal and/or corporate site. To request your link, contact Bill White, IHS Links Editor at linksout@foils.org

RAY WRIGHT REMEMBERED

Contributed By Charlie Pieroth

With regrets I must inform the hydrofoil community that I received the message from Ed Hermanns, that our colleague of many years, Ray Wright, passed away in February. To those who never met him, Ray was the Chief Hydrodynamicist at Grumman up until his retirement. As such he was always a key member of the hydrofoil development team at Grumman.

Ray was a quiet man, dedicated to his faith in God and science. He was a true gentleman, and dedicated his professional career to the science of hydrofoil hydrodynamics. Few in this small field, knew as much about the subject as Ray, yet he was always willing to teach and discuss. He was deeply respected by his peers. I personally learned much from him about the field of hydrodynamics and life. It may come as a surprise to many to learn that while trained in aerodynamics, he had a very deep distrust of any airplane enclosing him that was not firmly planted on the ground. Those wishing to express condolences, may write his wife, Myra, at 2421 Meadowbrook Drive, Valdosta, GA

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LETTERS TO THE EDITOR

Testing a Drag Reduction System

[11/26/02] I found John Meyer's post at http://www.foils.org/ students.htm regarding the Georgia Tech Aerospace Engineering student project. I am currently working on the same project and was wondering if you had any suggestions for drag measurements. The purpose of the project is to design an experiment to test the drag on a hydrofoil equipped with a drag reduction system. The drag reduction system works by employing an electric field that interacts with the ions in seawater and changes the boundary layer. The only idea I have come up with so far is to use a water tunnel along with a force balance for measuring drag and an LDV system for examining the boundary layer. I found some information about water tunnels that use seawater, but I think you mentioned something about open water testing. What measurement techniques are available for measuring drag and boundary layers in open water? If you have any information or suggestions for me, I would really appreciate it. Thanks! Becky Massey; specky28@yahoo.com

Responses..If you can propel your test model with outboard motor(s) then you can measure thrust directly by reacting the motor with a load cell in place of the normal restraint mechanism on the motor bracket hinge. Boundary layer information can obtained by surface-mounted dynamic pressure sensors or, more expensively, using hot-film anemometry. We are currently testing a foil system using the outboard motor thrust cell and surface pressure measurement techniques with good results. We can determine both static pressure distribution (64 sensors over one half of the foil system), or local CP if you want that, and the amount of dynamic pressure activity in the boundary layer - and hence a good estimate of transition locations. Bill McFann; bmcfann@islandengineering.com

Following your train of thought, see Malin Dixon's 31 Mar 02 correspondence at http://www.foils.org/students.htm on use of a catamaran test rig. Barney C. Black; webmaster@foils.org

Drag Tests on TALARIA III

[12/1/02] As a measure of drag I tested the deceleration of TALARIA III recently. An accelerometer was linked to the on-board PC's DAQ, sampling at 50Hz. (Along with roll, roll rate, flap, roll control signal, rudder, and RPM.) The boat was run up to 29 knots and the engine cut back sharply. The prop free wheels. Three test were done. Taking the difference between a sample just prior to the engine cut back and the initial of the deceleration period, the boat decelerated at .23g +/-.02. This seems a bit high to me. From your experience any thoughts? Also I added to my web site a 13 second video of TALARIA flying. http://home1.gte.net/hlarsen0/;Harry Larsen; hlarsen0@gte.net

Response… [12/1/02] Those guys can do a good drag buildup, but I'd expect a glide ratio closer to 10 than 5. It's not induced drag so without seeing it yet, I'm guessing it's ugly struts/drive leg or something. The equivalent 'drag area' is about ½ square foot. Did the deceleration drop with speed squared as it settled? Jim Hynes; jhynes@socal.rr.com

Harry and Jim. The approach of estimating drag by measuring deceleration is an interesting one. For the benefit of other readers, I thought it might be worth elaborating how Jim estimated the 'glide ratio' (or Lift to Drag ratio) of TALARIA III based on the deceleration readings: Newtons Law: Force = Mass x Acceleration or in this case: Drag = Mass x Deceleration Also: Lift = Mass x Gravity Therefore: Lift/Drag = Gravity / Deceleration In this case: L/D = 1/0.23 = 4.3 My suggestion for why the L/D ratio is so low is that there is a lot of drag associated with the slowly turning propeller(s). Once the throttle is cut back, the propeller rapidly slows down also, particularly if it is direct coupled to the drive shaft that in turn is coupled to the engine. Even if the propeller is allowed to spin completely freely without any resisting torque from the propeller shaft, it still has a relatively high drag. If the propeller shaft RPM has been measured during the deceleration, then the inflow conditions into the propeller(s) could be estimated and the drag associated with them could be estimated from four quadrant B-series propeller charts and deducted from the total drag to get the drag of the foils and struts alone. Martin Grimm; seaflite@alphalink.com.au

The outdrive on Talaria (Volvo) has a freewheeling prop. The DAQ acquired the engine RPM during the test, but, because it is freewheeling, the propeller could have been turning faster. Is there any data on the drag of a freewheeling prop. For example, I could measure the torque required to turn the prop. I'll be doing another test in a week or so with improved aft foil hydrodynamics. Harry Larsen; hlarsen0@gte.net

[12/8/02] The drag on a windmilling propeller can be estimated if it is assumed to be similar to a B-series propeller. Other details of the propeller that need to be determined are its diameter, pitch-diameter ratio, blade area ratio and the number of blades. Either the RPM or the torque resisting turning also needs to be determined in order to calculate the drag. I have now looked more carefully at a B-series 4-quadrant chart and have realised that if the torque resisting the rotation of the windmilling propeller is near to zero, then there is in fact very little drag. My earlier message was misleading for that case. Martin Grimm; seaflite@alphalink.com.au

[12/29/02] The drag of a freewheeling prop can be substantially greater than the drag of a

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stopped prop. This is because of the lift on the blades. After all, this is how a helicopter autorotates for a power-off landing. There's a technique used in performance flight testing of light aircraft in which an electrical contact is installed in the crankcase so as to just make contact with the crankshaft when prop is not thrusting and is floating within the tolerance of the bearings. Glide tests are performed with the power set so the contact is intermittent, indicating zero thrust from the propeller. It might be possible to do something similar with Talaria. Tom Speer; me@tspeer.com

Foil Shapes

[12/1/02] In answering Michael Jaworski's original question: Hard to recommend anything without knowing more specifically what the requirements are. The hull shape appears to me to be entirely intended as a power catamaran. I would be very surprised if it had the performance under sail to take off with hydrofoils, as the wetted area is immense and the buoyancy of the hulls is low (a sailing catamaran must be able to support itself on one hull and still have freeboard left to provide stability in pitch). Since I don't know for sure whether the hydrofoils are intended for sail or power, I don't know what the speed range is. Perhaps you intend that the foil will fit in the tunnel; in that case, the craft is intended to be a foil-assisted catamaran instead of a flying hydrofoil? My recommendation would be to concentrate on efficient dagger boards and rudder for the sailing version. The planing hull shape will probably be about as good as a hydrofoil at high speeds. Tom Speer; me@tspeer.com

Responses...[12/1/02] Thanks Tom It's is going to be hydrofoil assisted, I am hoping to generate enough lift to plane at the lower end of the curve. I made the hulls 15% thinner to help reduce the wetted surface problem you mentioned. I was looking to achieve speeds around 15 kts under sail with a single dagger board in the center of the tunnel and a single rudder as well. I was hoping to achieve positive lift to help achieve planning at about 8 kts. I grew up on a 60 ft sailing cat from St martin called Shadowfax and found that most miles at sea were spent at 6 to 15 kts in 12 to 20 kts winds, we did hit 30 kts reaching quite often. I haven't been able to locate or maybe I should say understand the NACA information that is online. I need the destination points for a foil the will generate optimum lift between 5 to 10 kts. With a old 40 hp outboard that might be producing 30hp, the boats doing 30-32kts I was able to make the entry of the hulls very clean which greatly reduced pitching going to windward, with a engine any how. I haven't tried under sail yet. I have found the G's that the boat produced going into the wind is quite comfortable, I was very surprised at the ride I am getting at this point, but she needs to lifted out of the water a bit as the hulls are thinner than they should be. Thanks again for taking time to give me advice. Best Regards Michael Jaworski; michael@newmediadesigns.biz

[12/2/02] "Michael, you could go to a lot of effort looking at different complex foil geometries but I would suggest that you use a basic circular arc shape (flat underside, circular upper side) with a rounded leading edge and sharp trailing edge. Since your boat is hydrofoil-assisted, the foils operate fairly close to the surface of the water and in these conditions circular arc foils have been found to offer really good lift to drag ratios in some cases better than the NACA profiles commonly used as hydrofoils. Gunther Migeotte; migeotte@icon.co.za

Cavitation on Eppler E817 Hydrofoil

[12/3/02] I performed some measurements of cavitation on a Eppler E817 hydrofoil. The main results are given in the paper: ASTOLFI J-A, DORANGE P., BILLARD J.-Y., CID TOMAS I., 2000, An experimental investigation of cavitation inception and development on a two dimensional Eppler hydrofoil. March 2000, Journal of Fluids Engineering, Vol. 122, pp. 164-173. May be the paper could be useful for people working on the subject. André Astolfi; astolfi@ecole-navale.fr

How Does a Water Jet Work?

[12/8/02] How does a vessel like the PHM or the "Little Squirt" keep its propulsion when the jet drive is out of the water? Is it just the pressure of the water against the atmosphere like a fully opened fire hose? If so, it is amazing to me that these vessels can obtain such speed. What is the story behind the "Little Squirt"? Meaning, is it or something else like it, available to purchase? Scott McCaffrey; captainscott1@msn.com

Responses…[12/8/02] It is a common misconception that the jet out of the back of any fluid-propelled vehicle pushes against the medium that the vehicle is traveling through. It doesn't work like that. The physics are similar for propeller-driven vehicles, jet vehicles, and even rockets. If rockets needed to push against the medium to accelerate, they would be stuck as soon as they enter the vacuum of space. Jetskis and jetboats go fast enough that there is no water directly behind the stern, so the jets exit in air, even if only a few inches above the surface. You can try for yourself with a shower head. Turn it on full and feel the reaction force. It won't change if you put the shower head under water. What happens is that the vehicle pushes against the fluid that it is throwing out the back. The faster it can throw the fluid backwards, the more thrust. The more fluid that can be thrown out, the more efficient, as the fluid leaves with less energy. So for slow vehicles, you want big propellers. The problem with jet drives is that there is not a lot of area, so the jet velocity has to be quite high, and at low speeds they are not very efficient. Jetskis and jetboats have quite a lot of power, and as far as I know all water jet hydrofoils are

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gas-turbine powered. I think the propulsive efficiency is not good as the jet velocity is a lot faster than the boat speed even at full speed. As far as I know, there are no personal hydrofoils available, except the Russian V-foil boats. Malin; gallery@foils.org

[12/12/02] Malin, in responding to Scott you advised that the reaction force felt on a shower hear won't change if you put it under water as compared to when it is above the water. In fact my experience of doing just that is different, and opposite to what Scott may have expected! I find more force is apparently exerted when the shower head is above the water, and this reduces as the jet becomes submerged. Try to explain that one! Although my observations are not scientific, I wonder if the water flow (hence change of momentum) is retarded when the many individual water streams from the head emerge into water surrounding the head rather than air? Alternatively, perhaps it relates to the change of the pressure on the outer face of the shower head created by the water flow. In air, this would typically be at atmospheric pressure. Incidentally, an added complication and inefficiency for waterjet propelled hydrofoils is that the water typically needs to be sucked through a fairly small duct at the base of the aft foils, around a 90 degree elbow, up a thin hollow strut and around another 90 degree elbow before it even reaches the waterjet impeller. The frictional resistance in that portion of the system must drop total propulsive efficiency by a few percent compared to more typical waterjet installations on catamarans and monohulls. Martin Grimm; seaflite@alphalink.com.au

David Keiper's Work

[12/10/02] Reading over archives dated 24 Aug 98 David Keiper on Powerboat Foils David A. Keiper working on foils to outfit a powerboat of 1000 pounds +/- all-up weight would be suitable (about the same as a sailing catamarans). The article refers to 3" chord NACA 16-510 and strut section is NACA 16-008 which is good to 60 knots. He goes on to say, at this point we will not be making a capital outlay for the 16-510 lifter extrusion, but it likely in the next year or so, when sailors want to try to break speed records or when several power boaters approach us for foils. We expect to have our 3" chord aluminum extrusions at the beginning of Oct.97. It is very unfortunate he past on. Was any of this work ever completed. If so is there a supplier for the foils mentioned?? Matt Kirk; matric39@gte.net

Response… 12/11/02 The 1979 edition of Jane's Surface Skimmers on page 295 has a photograph of an operating motorboat with Keiper's foils. It is described in the caption as a 12 ft. dinghy equipped with DAK hydrofoils for an owner in New Zealand. Power is supplied by a 9.5 hp engine. Barney C. Black; webmaster@foils.org

Hydrofoil surfboard help

I am studying Surf Science at the university of Plymouth. I am looking into the application of hydrofoil technology to surfboard fin design for my third year project. I am going to construct a hydrofoil fin that can lift a surfer at between 8-20 knots. I have been researching foil cross sections but am at a bit of a loss as to which one too choose due to the vast amount of sections and data presented. My initial thoughts were to use a symmetrical NACA 0012 foil but then thought that something like the NACA 2412 would be more suitable and provide more lift. I also noted that many of the Eppler E8's such as E874 were recommended for hydrofoil use. How do symmetrical foils compare to nonsymmetrical, and do you have any recommendations for foil cross sections that I could use? Thank you. Ben Bryant. benjamin.bryant-mole@students.plymouth.ac.uk

Responses… I have been constructing various foils for testing on a windsurfing platform. The board is 9' long, weighs 20lbs, is 2' wide and displaces 152liters. The mast is mounted 4' from the skegg or fin. The forward foil is a hoop foil 4' wide X 1' deep(beneath the water's surface) this foil's section tapers from 6" (at the waterline) to 3" at the apex of the curve. The foil section is an Eppler 407. This foil is to be mounted initially in line with the mast. The aft foil is to be mounted using the rear skegg as a strut. This foil will be a "T" foil with the lifting surface being a straight 3" wide eppler407x 24" long. I am estimating these foils to operate between 10 and 20 MPH. My question is at what depth should I mount the rear "T" to the strut? My max depth is 51cm. Should the forward foil and the rear foil be in line on the same plane? Or would a differential be beneficial i.e. the rear lower? Any and all questions and comments are most welcome. Eric Dixon; wetpaintinc@earthlink.net

You may wish to read through the IHS correspondence archives on this subject at http://www.foils.org/sailbord.htm. And take a look at http://www.foils.org/miller.htm. Also, maybe some of the correspondence about student projects will be of interest. See: http://www.foils.org/students.htm. If you see any correspondence that interests you, please feel free to contact the author directly for discussions and help. Also, if you find any bad email addresses when you do this, please notify webmaster@foils.org so that I can inactivate the link on the website. Good luck with your project. Barney C. Black; webmaster@foils.org

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Letters To the Editor allows hydrofoilers to ask for or provide information, to exchange ideas, and to inform the readership of interesting developments. **More correspondence is published in the Posted Messages and Frequently Asked Questions (FAQ) section of the IHS internet web site at http://www.foils.org.** All are invited to participate. Opinions expressed are those of the authors, not of IHS.

Letters To The Editor
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I make a hydrofoil sailboard too, see http://gerard.delerm.free.fr I think your forward foil is not deep enough. The board must be about 20/30 cm (8/12 inches) high above the water surface when « flying ». So the forward foil being 1 foot deep (30 cm), it will be nearly fully out of water. For the rear foil, you have to fit it with the max deep possible (51 cm is good for me). There are two reasons : First, it avoids bad interactions between the two foils. Second, it reduces ventilation problems which can occur on the strut (fin) until the horizontal foil. Don't hesitate to ask me any thing, I will answer you if I can of course (I am not a hydrodynamics specialist) Give us news about tests please. - Gérard ; gerard.delerm@free.fr

I think your depths are good. From what I gather (mostly from studying Miller`s work) the forward (canard) foil has to be supercavitating for two reasons: The canard determines the ride depth of the rear foil. ie. if the rear foil is 1 ft lower than the canard it will ride at 1 ft below the surface. Also, once the rider lists the board into the wind to power up the rig the canard must only provide a vertical force or the board turns to windward. The way to do this is to keep the canard level with the surface. Miller did this by keeping the canard ON the surface! Your hoop foil sounds cool but it doesn't sound like it will be supercavitating, and I am curious how you will keep the board from turning windward. Do you have any pictures? Henry. hbomb59@hotmail.com

Strut Wave & Ventilation Drag Estimate

Does anyone have a simple method for obtaining a ballpark estimate of the wave and ventilation drag for a vertical surface-piercing strut? Specifically, for a NACA 0010 section, 0 degrees AOA, 0.33 ft chord.?

Response… [3/20/03] A reference from the IHS AMV CD Naval Undersea Research and Development Center, NUC TP 251, Spray Drag of Surface Piercing Struts) Says wave drag reaches a maximum at a Froude number of 0.5 based on chord length. After this, it is rapidly replaced by a thin film of water flowing over the strut then shedding as spray (typically at the trailing edge, but it will happen wherever something lifts it off and allows formation of ligaments and subsequent droplets breaking off). You will find in the paper, spray drag is primarily a function of body shape and thickness. for foil shapes Savitsky and Breslin measured the spray for 10,20 and 30% thick foil sections, presumably close to the NACA series. Drag(Spray)=0.03*qCt + 0.08qt where; q=1/2RohV^2, C=Chord, t=Thickness There is another formula by Hoerner, but I think this one is appropriate. Rick Loheed, Island Engineering; RLoheed@islandengineering.com

Sea Wing history?

[12/11/02] I've seen the picture of the passenger h/f Sea Wing in the Post Card section but have been unable to find much further information. USCG register has her listed as built 1965 and last inspected 1990 in New York. I believe she was used as a spare vessel by TNT Hydrolines in the late 80ies. Is there anybody who can give a short summary of her history? Especially who built her, who operated her and where did she end up? Eje Flodstrom; eje_flodstrom@yahoo.com

Response… Eje, My 1968-69 and 69-70 issue of Jane's Surface Skimmer Systems helps to shed some light on your question. The hydrofoil was apparently designed and built by the Ordnance Engineering Division of the FMC Corporation headquartered in San Jose, California. The specific hydrofoil type is the L548D. The description of that type indicates the hydrofoil was designed for fast, comfortable services across bays, lakes and sounds. The prototype has logged over 3500 miles during engineering tests in San Francisco Bay. Seating was for 48 passengers. Max operating displacement was 14.29 tons, useful load being 4.33 tons. CDesign cruising speed was 41 mph. Power plants were twin Cummins VT8-390M Diesels rated at 390 hp each. The company also produced a similar but smaller 12 passenger hydrofoil demonstration craft. I don't know who operated the craft, how many of the type were built or what became of it / them. Martin Grimm; seaflite@alphalink.com.au

Thanks Martin! Last night I noticed the similarities between Sea Wing and the FMCHY craft in the 1950s section of the photo gallery, so I nearly had it figured out. Could that be the 12-seater? Funny though, the 1972-73 Jane's doesn't mention the FMC craft at all except for the LVHX-2 in a separate Military Hydrofoils paper submitted by Supramar.. Eje Flodstrom; eje_flodstrom@yahoo.com

Eje, Yes, the craft you spotted in the photo gallery is the L312G 12 seater I described. Food Machinery Company / Corporation still exists today but is simply known by the name FMC. They still manufacture military equipment but they must have dropped out of the hydrofoil business in the early 70's. This is not unusual. For example, not even the earliest issue of Jane's Surface Skimmer Systems (1967-68) lists the Aquavion company that was based in the Netherlands. They built a fair number of hydrofoils but must have disappeared before '67. Another hydrofoil builder in Italy, Seaflight SpA, was established in about 1961 but had disappeared from the scene by the 80's. Martin Grimm; seaflite@alphalink.com.au

HRV-1 Hydrofoil Amphibian *Air Progress* Feb '68 issue vol 22 no. 2

EXTRA FOR THE ELECTRONIC EDITION

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Models and Mouldings

[13 Apr 03] I have spent the past few months researching information on the Jetfoil, and am now constructing a control system using a mini-computer and additional software including source code listings and computer interfaces.

Jetfoil (model or otherwise) needs an automatic control system. I now have to write the control source coding for the model, which I don't expect will take long. That means in the near future a prototype will be running. On completion of the prototype more info will be released to IHS as to where it can be obtained.

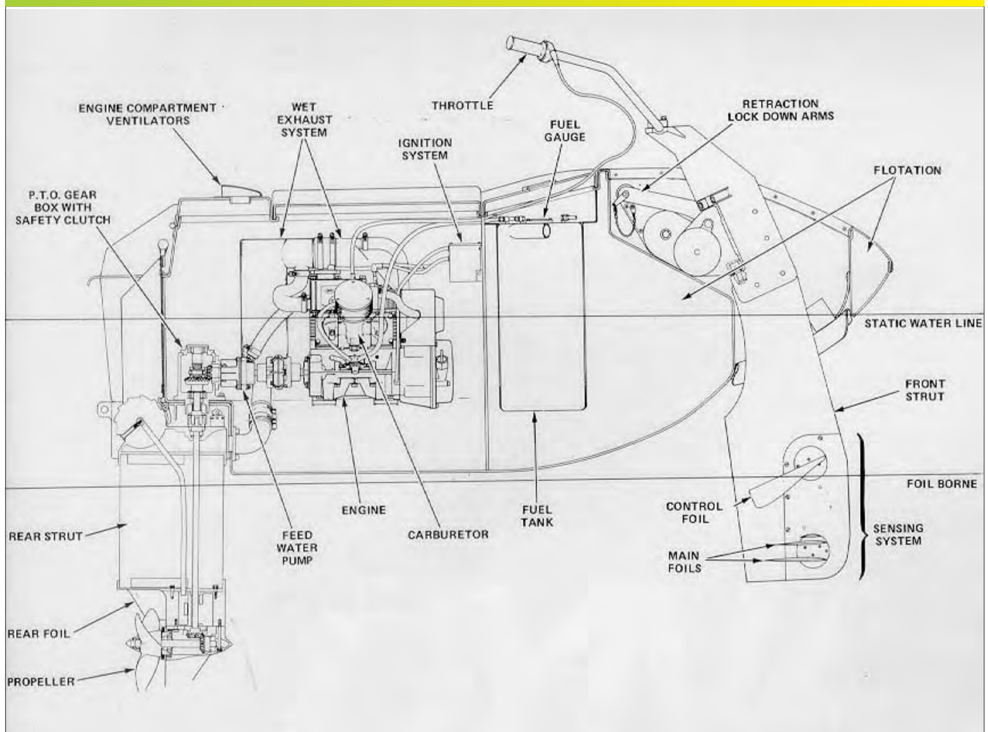
This has been a serious project for many years, and is now about to come to fruition. Having researched hydrofoils in general, Jetfoil is the culmination of many years research and development. Hence, a model Jetfoil is not far off.

Regarding hydrofoils in general, the surface-piercing systems - i.e. the standard hydrofoil configuration other than Jetfoil means that an intense programme of fibreglass mould construction for standard hydrofoils, i.e. PT50, PT75, PT150, RHS70, RHS150, RHS160 and 200 is underway, and I expect to be releasing these fibreglass moulds for sale by the summer 2003.

The website address where these mouldings can be obtained is hydrofoils-hovercraft.com. We expect the website to be up and running within the next four weeks. All enquiries, including hydrofoil enquiries, can be made to me directly by email.

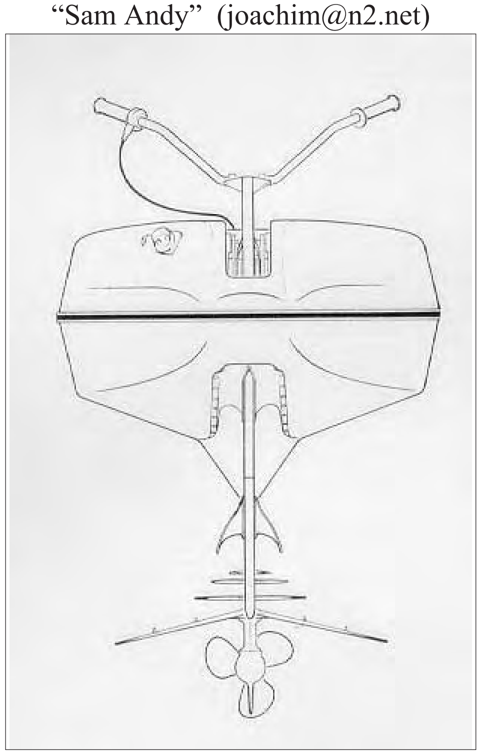
Peter Cahill
struts@talk21.com

Remember the Dynafoil?



Above: Dynafoil Side View
Below: Dynafoil Front View

Photo & Illustrations submitted by "Sam Andy" (joachim@n2.net)



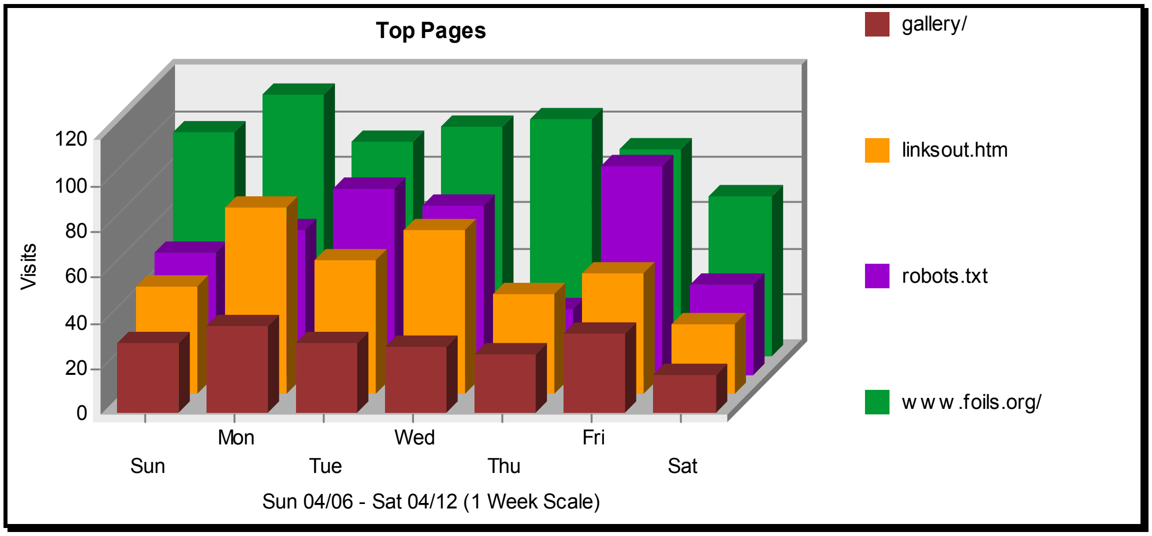
For more on the Dynafoil and other historical one-person sports hydrofoils, visit the IHS correspondence archives on this interesting subject at www.foils.org/oneperson.htm

Below: Mike Reuse stands a dynafoil on end. He weighs about 245 pounds and is about 5'11" tall.

IHS Page Popularity Scores for the Week 6 Apr 03 - 12 Apr 03

Top Pages

This page identifies the most popular Web pages on your site, shows you how often they were viewed, and displays the average length of time the page was viewed.



Top Pages					
Pages		**Views**	**% of Total Views**	**Visits**	**Avg. Time Viewed**
1	http://www.foils.org/	802	9.78%	673	00:01:22
2	http://www.foils.org/robots.txt	438	5.34%	435	00:00:01
3	http://www.foils.org/linksout.htm	457	5.57%	388	00:03:41
4	http://www.foils.org/gallery/	222	2.7%	207	00:00:33
5	http://www.foils.org/modelrc.htm	205	2.5%	175	00:03:43
6	http://www.foils.org/popmags.htm	180	2.19%	168	00:01:53
7	http://www.foils.org/yourown.htm	147	1.79%	136	00:03:48
8	http://www.foils.org/dak.htm	135	1.64%	135	00:04:13
9	http://www.foils.org/pioneers.htm	139	1.69%	134	00:01:48
10	http://www.foils.org/buyferry.htm	126	1.53%	122	00:05:53
11	http://www.foils.org/bjohnseu.htm	120	1.46%	120	00:04:50
12	http://www.foils.org/gallery/world.htm	119	1.45%	116	00:01:14
13	http://www.foils.org/popbook.htm	114	1.39%	107	00:01:37
14	http://www.foils.org/basics.htm	109	1.33%	106	00:01:15
15	http://www.foils.org/gallery/models.htm	107	1.3%	103	00:01:19
16	http://www.foils.org/gallery/sail.htm	112	1.36%	101	00:01:07
17	http://www.foils.org/students.htm	107	1.3%	101	00:04:00
18	http://www.foils.org/announce.htm	107	1.3%	101	00:02:25
19	http://www.foils.org/ps1-91jpg/	105	1.28%	100	00:02:49
20	http://www.foils.org/refs.htm	101	1.23%	95	00:02:05
Subtotal For the Page Views Above		**3,952**	**48.22%**	**N/A**	**N/A**
Total For the Log File		**8,195**	**100%**	**N/A**	**N/A**

More Website Statistics for Week 6 Apr 03 – 12 Apr 03

Summary of Activity for Report Period

This page summarizes general server activity.

Summary of Activity for Report Period	
Average Number of Visits per Day on Weekdays	824
Average Number of Visits per Weekend	1,525
Most Active Day of the Week	Mon
Least Active Day of the Week	Sat
Most Active Date	April 07, 2003
Least Active Date	April 12, 2003
Most Active Hour of the Day	14:00-14:59
Least Active Hour of the Day	02:00-02:59

Summary of Activity for Report Period - Help Card

Average Number of Visits (per day on weekdays) - The average number of visits for each individual day of the week.

Average Number of Visits (per weekend) - The average number of visits for both Saturdays and Sundays combined.

Least Active Date - The least active date in the report period.

Least Active Day of the Week - If the report period is for one week or less, the Least Active Day of the Week will tell you which specific day was least active during that week. If the report period is for more than one week, the Least Active Day of the Week will tell you which day of the week that has the smallest amount of activity on average.

Least Active Hour of the Day - The least active hour of the day after activity for all hours is added up. This is not an average.

Most Active Date - The most active date in the report period.

Most Active Day of the Week - If the report period is for one week or less, the Most Active Day of the Week will tell you which specific day was most active during that week. If the report period is for more than one week, the Most Active Day of the Week will tell you which day of the week that has the largest amount of activity on average.

Most Active Hour of the Day - The most active hour of the day after activity for all hours is added up. This is not an average.

This table is useful for determining the best day of the week to perform system maintenance.

The NEWSLETTER

International Hydrofoil Society

P. O. Box 51, Cabin John MD 20818 USA

Editor: John R. Meyer | Summer-2003 | Sailing Editor: Martin Grimm

HYDROFOIL REVIVAL EXPLOITS TECHNOLOGY ADVANCES

Extract From Speed at Sea, June 2003 Article by Paul Hynds

Ships of the future or ships of the past? The performance versus cost ratio efficiencies now achievable with catamaran hull design seem to have halted demand for hydrofoil passenger craft newbuilding. But technological progress means that old ideas can be successfully revisited and commercially exploited.

The Rodriquez Foilmaster design was introduced in 1994

In this context, hydrofoils are defined as craft fully supported by a dynamic foil arrangement that lifts the hull clear of the water surface. Apart from this particular application, the use of foils continues to attract widespread interest as a means of reducing wetted area drag in semi-displacement craft, such as foil-assisted catamarans. And foil technology has been - and continues to be - applied widely as a means of enhancing passenger comfort. As a method of ride control, foils may be used on the full range of both monohull and multihull vessels. Additionally, foils as a ride control application appear to be a viable solution on all sizes of hull and payload capacities.

See Hydrofoil Revival, Page 3

AMV CD-ROM #2

IHS announces the second Advanced Marine Vehicle (AMV) CD-ROM in its series of reference and historical AMV document releases. The new CD has 61 documents:

- Eleven Documents Applicable to Multiple AMV Types
- Seventeen Documents on Air Cushion Vehicles (ACVs) and Surface Effect Ships (SESes)
- Thirty Docs on Hydrofoils
- Three Docs on Planing Hulls

Cost is US$12 for members; US$15 for nonmembers. IHS accepts payment by personal check, bank check, money order or cash (all in US dollars only). We have also arranged for payment by credit card (online only!). To see abstracts of the documents or to order on line, go to the IHS publications page at www.foils.org/ihspubs.htm.

INSIDE THIS ISSUE

PRESIDENT'S COLUMN

At the July IHS Board meeting, ballots for the election of Board members for the Class of 2003-2006 resulted in the unanimous endorsement of the four candidates: Mark Bebar, Dennis Clark, George Jenkins and William Hockberger. These four candidates were, therefore, elected. Please see the full Board member listing on page 12.

The four incumbent officers were all present at the July Board meeting. No other volunteer candidates for any of the officer positions came forward and the four incumbents agreed to continue in their posts. A motion was made, and unanimously endorsed, to elect the incumbent slate: John R. Meyer (President), Mark Bebar (Vice President), George Jenkins (Treasurer) and Kenneth Spaulding (Secretary).

All IHS members are reminded that AMV CD#1 is still selling on the IHS website. A lot of time and effort has gone into generating AMV CD#2. You can get all the information about this second CD also on the IHS website. It will sell for $12 for IHS members and $15 for non-members. Barney Black has prepared abstracts for the CD#2 documents; a very significant and useful contribution.

During the last several IHS Board meetings, the Board has committed to a "soul searching", "planning" effort in which we reconsider IHS objectives/goals and play them against ongoing and projected activities. Resources are a key factor but priorities come first. New Board member, Dennis Clark, is leading the planning effort. He has had a lot of experience in this area as Director of Strategic Planning at the NSWCCD. in March he presented a "Planning Framework and Approach". The Board discussed, and endorsed Dennis' approach and resolved to move forward. The initial step is to be a group meeting, to be held in September. Dennis Clark will be the facilitator during this meeting of "brainstorming". We will keep you posted on the outcome of this initiative.

Your Society continues to grow with new members joining every month. Since the beginning of 2003, 24 have been added to the membership list. By the way you can view the Membership List by logging onto the IHS website (www.foils.org) and put in the proper password. All IHS members have been informed of this password. If you have been missed or forgot, please contact the webmaster (webmaster@foils.org).

Another initiative that started some months ago was to place all of the IHS Newsletters dating from the 1970s to the present on a CD-ROM. This effort has moved along very slowly because of the emphasis on the AMV CD#2. However, we can expect that the NL CD will be available soon. So keep an eye on the IHS website from time to time for an announcement.

Best regards to all...

John R. Meyer

President

WELCOME NEW MEMBERS

Iason Chatzakis - Iason is a naval architect from Athens, Greece, and is doing an MSc (and possibly PhD) in Ocean Engineering at M.I.T.. His research is currently focused on the optimal stochastic control of hydrofoil craft, and hence he joined the IHS. He has written a simple, fast CFD code for hydrofoil craft and now he is going into controls with the code as a basic tool.

J. Duncan Coolidge, MD - Is a physician specialist in adult medicine living in New Hampshire. He has a background in engineering, a love for sailing, and a thirst for speed. Sailing experience ranges from boards, to catamarans in Hawaii , and gales off the New England coast. His main interest in foils derives from an desire to pursue a wind powered waterborne craft speed mark exceeding 50 mph. Soon (within a few weeks) a hydrofoil trimaran will begin being used as a test platform for alternative wind powering. There is a conceptual plan for the craft configuration, control system, power source, and foil. Whether or not it would deserve to be called a sailboat or even a boat is arguable. A steep learning curve is expected regarding the foil design.

Richard Harrison – Richard is a Senior Process Engineer working in the Florida phosphate industry. He is currently beginning graduate studies in Mechanical Engineering at the University of South Florida. His interest in hydrofoils began after reading about Icarus, Flying Fish, and May Fly. Richard's favor-

Continued on Page 12

HYDROFOIL REVIVAL
(Continued From Page 1)

Within certain limitations, the true hydrofoil does however offer important performance advantages over other fast craft design forms, not least in terms of favourable fuel consumption, provided a number of problems can be satisfactorily addressed. Chief amongst these problems are the consideration of the weight of hull structure, internal fittings and installed machinery; the design of the foils themselves; and the propulsion system.

While catamarans and monohull fast ferries are first choice for most operators of high speed passenger services, some designers predict that, as with air cushion craft, the hydrofoil passenger ferry has yet to have its day.

The overall weight of the craft is critical to its transport efficiency and its revenue earning capability. While this may be true of any commercial craft and of high speed ferries in particular, these aspects are acutely highlighted with hydrofoil operations.

There has been little development of true hydrofoil craft over the past 10 years or so since the Rodriquez Foilmaster design was introduced in 1994. However, the Rodriquez shipyard in Italy and its associate engineering companies continue research, and have delivered enhanced craft to operator Ustica Lines. During this period, there has been significant progress in the strength-to-weight performance of aluminium alloys used in both extrusion and sheet products. New joining technologies such as friction-stir welding have made a considerable contribution to the better performance of alloy structural materials. Similarly, parallel technical progress of composite materials and adhesives has widened the options available to fast craft designers. Such materials can be used in the construction of the craft structures and for the fabrication of the foil and strut components.

There is also potential to save weight in the area of interior outfitting. When hydrofoils were being produced in large numbers in Italy and the former Soviet Union countries for domestic operations and export, the seating choices were limited and were drawn from aviation, rail and road transport sources. In some craft the individual seats weighed in excess of 20kg. Today there are seating options available for short route commuter operations that return a weight of less than 5kg per unit. New lighter-weight non-structural materials for use in walls and ceilings together with new surface coverings will also contribute to the positive aspects of the performance equation.

Two main foil concepts have been proven throughout the development of hydrofoil passenger ferries. The surface-piercing type, primarily exploited by Rodriquez, has a significant degree of dihedral that allows the craft to find its own combination of lift and stability to determine its hull ride height above the surface.

The fully submerged foil type, as mainly developed by Boeing Marine Systems for its Jetfoil range of craft, is a much more complex design that was originally stimulated by a naval requirement to develop a high speed but stable weapons platform. By having the foils fully immersed there is no point of inherent stability and optimum ride height. Consequently, these desirable qualities need to be artificially influenced using a complex and expensive arrangement of sensors and hydraulically operated movable surfaces. *[Ed Note: The reader should be aware that modern automatic control systems have become much smaller, lighter, and less expensive than those of the 1970s and 1980s.]* The ride comfort of the Boeing Jetfoil has been universally praised, and high levels of passenger satisfaction were achieved right up to the craft type's normal operating limitation of 2.5m waves.

Unlike conventional craft that have a relatively shallow curve of performance degradation as prevailing sea condition deteriorate, hydrofoils -

and the Boeing Jetfoil in particular - have a sharp cutoff point. *[This is due to broaching of the forward foil. -Ed.]* In operation normal service speeds were closely maintained in adverse weather until the limitation was reached, when services were terminated. Once wave heights prevent on-foil operation, hydrofoils in general are restricted to sub10 knots speed resulting in continued pas-

Continued on Next Page

HYDROFOIL REVIVAL
(Continued From Page 3)

sage being neither comfortable nor practicable. *[Although hullborne, motions are ameliorated, compared to monohull vessels, by the deeply submerged foils. -Ed.]*

In parallel with these two main types of foil the Alexeyev system employed on hydrofoil craft developed in the former Soviet Union since the early 1960s was configured with a very shallow dihedral but often seen with multiple lift surfaces. These craft in several guises were widely produced and many exported, mainly to the Mediterranean. As development progressed and craft became larger and operated on more open sea routes, the foil areas and dihedral have increased, culminating in probably the most technically successful craft of its type, the Olympia, through not produced in any numbers.

Development of larger craft operating on more open sea routes culminated in the Russian Olympia

The other key area influencing hydrofoil performance is that of propulsion. Machinery weight has been a major limiting factor. The gas turbine option has been technically successful in the Boeing/Kawasaki craft and less so in a large Russian design, the 250-passenger 42-knot Cyclone. However, the first and on-going costs associated with gas-turbine technology do not fit comfortably with a relatively low capacity craft in today's competitive market place. While diesel engines offer a better package of economics, the weight factor is significant to the hydrofoil design. By way of comparison the Allison 501 series gas turbine unit as installed in Boeing/ Kawasaki Jetfoils weighs around 1,150kg, the MTU 16V396TE74 diesel engine found in the Rodriquez Foilmaster hydrofoil weighs in at 5,000kg per unit.

The Rodriquez Foilmaster offers a significant advantage in transport efficiency over predecessor hydrofoil designs when measured in terms of installed power, passenger capacity and service speed. The Foilmaster makes use of lighter materials, including composites, in load bearing structures, fittings, and in the foil design where carbon fibre is used extensively.

Development of lighter structural materials and better power-to-weight ratio machinery benefits the fast ferry industry as a whole and is therefore a continuing process. It is the development of the dynamic performance of foils themselves that will stimulate a resurgence of interest in hydrofoil passenger ferries. In the marine industry much of the research into foil performance is directed at stabiliser systems and other ride control use. In aviation there is a much broader approach to wing design and there will undoubtedly be a marine spinoff value.

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SUPERFOIL 40 OPERATIONS

Contributed by Y. Eero, Managing Director, Seahawk Ltd.

Additional recent information from "Seahawk" indicates that the present owners are still interested in exchanging the vessel for bigger ones (but similar type as fuel consumption is very low). The *Superfoil 40* has been declared for sale, even though successfully operating between Tallinn and Helsinki. In case of any interest, Seahawk Ltd advises that the sale price is USD 8.0M.

Photo by Y. EERO on outer Tallinn Road in mid May 2003.

As reported earlier in the Winter 2002-2003 IHS Newsletter, the catamaran was constructed by Almaz Marine Yard, designed by the St.-Petersburg branch of the British company "MTD" (Marine Technology Development). They claim that it is the fastest passenger ferry at a speed about 55 knots (more than 100 km/hour). Now it takes only 50 minutes to travel from Tallinn to Helsinki.

The Superfoil-40 will again start operating between the Estonian and Finnish capitals in the beginning of this summer and will perform 5 return trips daily. 300 passengers to be accommodated both in business and

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SUPERFOIL 40
(Continued From Previous Page)

economy class cabins equipped with comfortable aircraft type seats and the panoramic windows will provide excellent view. When traveling passengers may visit bar and duty free shop. Wide two-leaf doors arranged on both sides allow to reduce essentially time of landing and disembarkation of passengers. The estimated time assigned for this operation makes about half an hour including cleaning of cabins and refueling.

SUPRAMAR 50TH ANNIVERSARY

By Ken Spaulding, IHS Member

May of this year marked the 50th anniversary of the initiation of scheduled hydrofoil passenger service. In May of 1953 the 30-seat Supramar PT 10, *Freccia d'Oro*, began service on Lake Maggiore between Locarno in Switzerland and Stresa in Italy. Cruising speed of this craft was 35 knots.

***Freccia d'Oro* PT-10**

Freccia d'Oro was the creation of Baron Hanns von Schertel, first President of IHS, and Gotthard Sachsenberg. Von Schertel's hydrofoil development began in 1919 with the construction of a small experimental craft with surface piercing foils. Studying at the Technical University in Berlin from 1923 to 1927, von Schertel developed hydrofoil concepts and several test craft. By 1936 he had demonstrated eight hydrofoil test craft. In that year the Koln-Dusseldorfer Steamship Company, having followed with great interest in these developments, placed an order for a 30-passenger craft with the Sachsenberg Shipyard under license to the Schertel-Sachsenberg syndicate. This passenger craft was never completed as hydrofoil activities were diverted to the emerging German war efforts. During the war a number of hydrofoil craft were developed, including patrol craft, a minelayer, a tank transporter and a 60-knot torpedo boat destroyed in an air raid just before launching.

As the war ended the Russians occupied Dessau-Rosslau Sachsenberg Shipyard and acquired the surviving hydrofoil craft, technology and personnel, which formed the base for development of the many Soviet hydrofoil craft built during the cold-war years. Sachsenberg and von Schertel escaped to the West and, in May of 1952, formed Supramar, A.G. in Lucerne, with the support of the Swiss Verwaltungs-Bank, Zug.

As they say, "The rest is history." After the PT 10, Supramar went on to develop the PT 20, PT 50, PT 75 and the PT 150. Construction of these craft was licensed to a number of builders, including Rodriguez in Italy, Hitachi Zosen in Japan and Vosper Thorneycraft in the UK. Over 150 Supramar craft have been built. Many are still in service around the world.

Baron von Schertel died in April of 1985. Supramar AG continues to provide consulting services for hydrofoils and advanced marine concepts in Glattbrugg, Switzerland.

The reader is referred to two articles available on the IHS website on the subjects of Hanns von Schertel, the PT craft, Supramar, (Hydrofoil Pioneers) Baron Hanns von Schertel (from Oct 1985 N/L), and The SUPRAMAR PT Series Hydrofoils by John R. Meyer.

LAKE WORTH FIRM ENVISIONS HYDROFOIL RUN TO KEY WEST

By Susan Salisbury (Palm Beach Post Staff Writer)

Lake Worth, Florida — Love going to Key West, but hate the long drive down on U.S.1, the only road leading there? Hydrofoils Inc., a company headquartered in Lake Worth, wants to provide the solution to what can be an aggravating trip.

CEO Kenneth Cook, 63, an engineer who has spent his career working for companies such as Motorola, envisions a 90-foot high-speed hydrofoil. Traveling at 80 mph, the boat would rise out of the water on foils and fly 8 ½ feet above it. It could make the trip from Miami to Key West in 1 hour, 50 minutes.

So far, the hydrofoil is designed but not yet built, awaiting money for an $8.3 million prototype that's already partially financed by investors.

"We have the prototype three-quarters funded. We need another $1.8 million," Cook said from the company's yacht, Zytiron, at the Riviera Beach Marina. "Our biggest problem has been that we have to build the first full-size boat. We need final funding. It will open up the floodgates."

Steven Krasnor, president of Arrowsmith Financial Group in Hol-

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HYDROFOIL TO KEY WEST
(Continued From Previous Page)

lywood, is poised to buy and operate a fleet of four hydrofoil ferries once Hydrofoils Inc. produces a working ferry. Initially, it would go from Miami to Key West and, if successful, be expanded to cities to the north.

A model of one of Cook's boat designs.

"Ken recognized the need for the service," Krasnor said. "We recognized that need also." A hydrofoil ferry has been a dream of Cook's for about 15 years. Although ordinary ferry boats have been used for years on waterways near major cities such as New York, technical problems have been common with hydrofoil boats.

Seajets Inc., which provided passenger service between Grand Bahama Island and the Port of Palm Beach beginning in 1999, filed for bankruptcy in 2001. The Boeing 929 Jetfoils, which used 35-year-old technology, had mechanical problems and didn't always run on time. Krasnor heard about Seajets, and at one point considered buying the company. He learned what went wrong.

Krasnor believes Cook has come up with an improved hydrofoil that can succeed as a commercial ferry.

"One of the issues, aside from identifying the market, is having the right project," Krasnor said.

Carroll Oates, senior sales manager for Detroit Diesel, said his company wants to supply marine turbines for Cook's hydrofoils. Detroit Diesel, a division of Daimler Chrysler, is the largest producer of marine power systems in the world. "

One of the things we don't do enough of here, we don't use the waterways for transportation," Oates said of the ferry proposal. "If people knew there was a reliable high-speed service on waterways to get them somewhere, that is a fantastic way to travel."

If Cook's dream is realized, it will be the culmination of hydrofoil research that began more than 30 years ago, stemming from a love of racing boats that began at age 3. Cook founded the company in 1972, a five-person firm that has never made a sale, except for small remote-control vehicles developed as prototypes. It's been strictly a research and development firm that over the years has worked toward perfecting hydrofoil technology. "We've never tried to sell boats," Cook said. "That has not been our goal. Our goal was to make a very controlled high-performance marine vehicle." Once the money is obtained, Cook expects the prototype to be completed 11 months after a contract is signed.

Disclaimer

IHS chooses articles and photos for potential interest to IHS members, but does not endorse products or necessarily agree with the authors' opinions or claims.

RODRIQUEZ RHS 140 MODEL WAVE/WAKE MEASUREMENTS

By Martin Grimm, IHS Member

In October 2002, wave wake measurements were performed on a 1:20 scale model of a Rodriquez RHS-140 surface-piercing hydrofoil at the Australian Maritime College (AMC) Wave Wake Measurement Facility**.** The tests were conducted by Mr Gregor Macfarlane, Manager of the Ship Hydrodynamics Centre of the Australian Maritime College in Launceston, Tasmania, Australia. They are part of the process of gathering experimental wave wake data for a range of hullforms to support Gregor's PhD research. The tests were the first of a hydrofoil model in what is already an extensive database of wave wake measurements. The tests performed at AMC to date have been of either monohulls of catamarans.

1:20 scale Rodriquez RHS 140 'Curl Curl' model suspended below towing rig, Australian Maritime College (AMC) Wave Wake Measurement Facility, Survival Centre.

To be able to undertake such experiments, AMC has adapted its survival centre pool to serve as a model test facility when it is not committed to survival training for mariners attending the college. The tests are performed with a winch driven cable arrange-

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RHS-140 MODEL MEASUREMENTS
(Continued From Previous Page)

ment that tows the model but allows it to pitch and heave freely. A series of wave height probes are positioned in a plane transverse to the track of the model and off to one side. In the case of the tests with the hydrofoil model there were six probes positioned from 1.5 to 5.8 metres off the centreline of the model track. These probes record the local wave elevations as a time series signals. The data can subsequently be processed to determine parameters such as the maximum crest to trough wave height, wave period, and wave height decay rates with distance from the centreline of the vessel. The data can also be used for validation of computational methods for predicting wave wakes.

RHS 140 model underway during wave wake measurements. Nearest wave probe just in view to port side of model.

Predicting and measuring wave wake from fast ferries is becoming an increasingly more important facet of naval architecture as concerns are raised about the impact of vessel wakes on other waterway users and erosion of river shorelines.

In June of this year, the model was once again put to use as part of an undergraduate thesis project examining the foilborne transverse stability of surface piercing hydrofoils. These tests were performed by AMC final year student Colin Johnson. On this occasion, the model was towed in the AMC towing tank at a range of heel angles and speeds. The aim of the project is to determine the foilborne righting arm curves and correlate these with predictions from a numerical method. The results of the tests may be reported in a future newsletter.

The hydrofoil model was originally built by IHS member, Martin Grimm for recreational use as an electric powered and radio controlled scale model of the "Curl Curl" which once saw service on Sydney Harbour. For the tests, the model was stripped of its electrical and radio control gear and ballasted to the correct weight and centre of gravity. It was originally the subject of resistance and head seas seakeeping tests in 1994 thanks to the support of the Australian Maritime College.

For further information and references related to wave wake measurement, refer to: G. J. Macfarlane and M. R. Renilson; "Wave Wake – a Rational Method for Assessment", International Conference on Coastal Ships and Inland Waterways, 17 & 18 February 1999, London. RINA.

Note: All photos courtesy of Gregor Macfarlane.

SEASTATE SYSTEM INTRODUCES RETRACTABLE FOILS

(From Speed at Sea, February 2003)

Three Austal-built 47.5m passenger catamarans for New World First Ferry of Hong Kong all feature a Seastate motion control system. The 416-passenger catamarans operate between Hong Kong and Macau at a speed of approximately 42 knots. The Australian company said that due to the seasonal sea conditions on the New World First Ferries route, the operator requested that Seastate develop a motion control system that provided an optimum solution between motion control and speed. As a result each of the ferries, delivered in October last year, have a new retractable foil configuration.

The motion control system consists of Seastate interceptors aft for trim, pitching and rolling motion control and high-speed retractable foils forward for pitching and rolling motion control only.

The retractable foil configuration gives the operator flexibility in the amount of motion control provided, said Seastate. in calm conditions - when motion control is not required - the system can be operated in trim mode only with the foils retracted. The interceptors control the static trim of the vessel and maximise speed. With the foils retracted the drag of the hull is also reduced, allowing an increased speed.

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Interested in hydrofoil history, pioneers, photographs? Visit the history and photo gallery pages of the IHS website.
http://www.foils.org

RETRACTABLE FOILS
(Continued From Previous Page)

Seastate's high-speed retractable foil provides the operator with flexibility in the amount of motion control required. In slight conditions the interceptors can be operated in active mode to provide a reduction in pitching and rolling motion. As the sea conditions worsen that foils can be deployed to give maximum motion control.

A hydraulically driven slewing mechanism extends and retracts the foil. When extended, varying the angle of attack of the trailing edge flap produces lift and controls the vessel motion.

The high speed retractable foil is an active flapped foil, actuated by a single hydraulic servo actuator, with the ability to be deployed or retracted into the hull. The retraction mechanism comprises a pair of cylinders driving a slewing platter, to which the foil is attached. The foil control surface consists of a cast stainless main wing with a cast nickel aluminum bronze flap, which is hinged from the trailing edge.

LARGE CAVITATION CHANNEL TESTS ENHANCE UNDERSTANDING OF DRAG REDUCTION

By William Palmer and Bob Etter
(Excepts, by NSWCCD permission, from Wavelengths 14 March 2003)

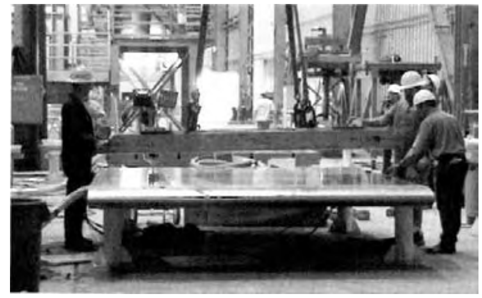
In principle, several methods of reducing drag on a ship's hull have been recognized for some time, but the feasibility of implementing them in the Fleet has not been as readily apparent.

Now, however, with a renewed interest in increased payload at conventional speeds and in high-speed ocean-going vehicles, drag reduction may finally have a laboratory platform on which it can demonstrate its advantages.

The Defense Advanced Research Projects Agency (DARPA) is developing a multi-scale modeling capability, which will ultimately allow researchers to conduct full-scale numerical experiments on a computer platform as part of its Friction Drag Reduction Program. As a component of the research effort, Carderock Division's William B. Morgan Large Cavitation Channel (LCC) in Memphis, Tennessee, and operated by the Hydromechanics Directorate, was chosen for conducting near-full-scale experiments and contributing to the validation of computer-generated large-scale models.

The LCC, a detachment of Carderock Division, is the most advanced and largest pressure-controlled recirculating water tunnel of its type in the world. About 239 feet long and standing 65 feet tall, the LCC, which recirculates 1.4 million gallons of water with a 14,000 HP pump, is capable of producing test section velocities of 35 knots in a 10 by 10 foot cross section. Navy, government, and private-sector sponsors come to the LCC when they want to test propulsor power, efficiency, and acoustics of large-scale models of surface ship and submarine designs.

Robert Etter is the Division's coordinator for the **HiPlate** project, the name of which is derived from the descriptive phrase "high speed flow over a flat plate."



The front section of the HiPlate, showing the elliptical leading edge of the section. ***Photo by Bob Reiss,***

"The important thing," Etter said, "is that if you want to have high-speed ships, such as a high-speed sealift vehicle capable of 50 to 70 knots, and you start looking at the range and fuel consumption, you realize you've got to do something about drag." But, Etter explained, drag reduction techniques are also attractive at 15 or 20 knots, if you consider what is referred to as "proportional payoff."

Dr. Lisa Porter of DARPA pointed out that "at constant speed, one can get a reduction in power that translates into a proportional reduction in fuel and the potential for a significant payload increase."

Surface ship drag reduction is not a new concept, and technologies to accomplish it have been of interest for several decades. In the 1960s and 1970s, interest in highspeed surface craft gave rise to the Surface Effect Ship (SES) program, out of which came several SES test craft and the design of a 3,000-ton ship which could cruise at 80 knots. The program was abandoned because it was not possible to fit a mission to the ship, and therefore justify its cost and because it had short-range and tremendous fuel consumption (high drag). High-speed hydrofoils were also pursued, but it was found again that fuel

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Cavitation Channel Tests
(Continued From Previous Page)

consumption was very high, the craft could carry limited payload, and the design was practical only for short distances. [Ed Note: Reference is made to the PHM. Readers should be advised that the PHM was design and built for a specific mission, and performed as required. Larger hydrofoils have been designed to satisfy longer range requirements.]

However, with the design and testing of high-speed oceanic transport vehicles in progress and the desire for increasing the payload of ships with conventional speeds becoming more practical, the subject of drag reduction was resurrected. DARPA and the Office of Naval Research funded the series of test runs at the LCC in response to a proposal by the project's principal investigator, Professor Steve Ceccio of the University of Michigan.

The University of Michigan planned and executed the test program, assisted by Etter, LCC engineer Dr. Mike Cutbirth, who provided measurement and data analysis support, and the LCC staff, which tended to facility, instrumentation, and rigging requirements. Personnel from Penn State University Applied Research Lab and private companies VioSense, Tao Systems, and others have contributed to the project. The testing program began in mid-December and continued through January 2003.

This particular experiment involved injecting microbubbles into the boundary layer water flow right next to the plate surface. To realize a reduction in drag, a ship moving through the water has to reduce the frictional shear force imparted on the ship's hull by the water flowing past it. If air, being less dense than water, could be combined with the water, the shear force on the hull, and thus the drag, would be reduced. Other theories of the complex role of the bubbles interacting with the ship boundary layer also may explain the drag reduction. In any case, the theories are in need of a better experimental database including detailed flow field characterization.

A drag reduction experiment using a flat surface of this size had never been done. Tests had been performed on plates of much smaller dimensions. Since it was not practical to extrapolate findings gleaned from such small plates onto a full sized naval surface ship, it was decided to use a larger plate, one with dimensions more closely approximating that of a surface ship's hull and to test at higher speeds. The product of dimension and speed determines a parameter important to scaling fluid flows, that parameter being Reynolds number.

Testing of this concept involved an elaborate setup . Three separate sections were fabricated because the HiPlate, as a unit, was too long and heavy for insertion in the LCC's test section opening. Each section was constructed of epoxy-painted internal carbon steel frames and half-inch stainless steel surface plates top and bottom. The sides of the model provided access to extensive internal instrumentation and the bubble injection inserts. Bolted together, the sections made a single plate 41.3 feet in length, 10 feet in width, about 8 inches deep, and weighing about 15.5 tons. Two blocks of sintered (porous) metal, as long as the width of the plate and resting in slots in the stainless steel surface, acted as the medium through which compressed air was pumped to diffuse the air into small bubbles. In between and downstream of these slots were interspersed shear force measurement and other sensors. The shear sensors used strain gauges to detect the drag on a round surface flush with the plate's stainless steel surface and thus sense local shear forces between the water and the plate.

At the start of testing, no air was injected into the water, and a baseline measurement was recorded. Next, air was injected through the plate into the water, and the closest shear sensor downstream of the bubble stream saw a significant reduction in the shear force imparted on the sensor. Parameters varied including the test section speed, air injection rate, and distance from the injection to the measuring stations. Additional instrumentation included video cameras and miniature Laser Doppler Velocimeters (LDVs) imbedded in the plates to measure boundary layer velocity, pressure measurement sensors on the plates, and video cameras and external gamma ray source and sensor to measure the amount of bubbles in the flow.

At this time, further testing is not scheduled, but the results of the experiments conducted at the LCC and currently under analysis may have paved the way for a better understanding of the physics of frictional drag reduction and for more serious and informed consideration of microbubble injection as a means of reducing friction drag on a ship's hull.

SAILOR'S PAGE

SCAT FOILBORNE IMAGES

By Sam Bradfield, IHS Member

In previous IHS Newsletters, a description of SCAT and updates on developments with this fully submerged hydrofoil sailboat have been provided. This time we are pleased to be able to feature some foilborne images of SCAT.

Sam reports: "We finally got together all the people and cameras and camera boats required to photograph SCAT flying off Cape Canaveral on Saturday April 26. We had barely enough wind (true wind speeds between 10 to 15knots) to fly SCAT". The photos show the boat flying in these minimum conditions. Video footage was also obtained during that outing.

An extract of the notes from the trials log for SCAT and summary of the performance of the boat on that day is as follows. The location for sailing was about two miles offshore from Port Canaveral.

Boat speeds (Vs) in flight while reaching: from 13 to 20 knots over afternoon. Maximum observed boat speed (Vs max): 24 knots. Average true wind speed (Vt ave) at site: 11.5 knots. Wind heading at site: 240 degrees. Wave height (recorded at 20 mile buoy): 3.6 ft. Average true wind speed (at 20 mile buoy): 16.8 knots.

The maximum boat speed observed for SCAT so far was during the Florida to Key West race in January when 29.5 knots (GPS) was achieved with the main sail and jib set in an average true wind speed between 15 to 18 knots.

It looks like SCAT will live up to theoretical expectations based on what we've observed so far; i.e., she'll reach [*Ed: this is a heading at which the true wind is between about 60 to 155 degrees off the bow]* to 2.0 times true wind speed in winds of between 10 to 20 knots. We're not likely to push her beyond 35 knots boat speed.

ACCOUNT OF THE SCAT TRIP UP FROM STOCK ISLAND

By Tom Haman

It was about 2 p.m. April 4 when we left the dock with SCAT and began to lift the main foils so we could navigate the narrow channel, after flying them both up we were out. Hoisting the main and then the jib we were under way about 2:30 p.m. All the boards were half way down setting us with a draft of 4ft. We took a short tack out on port (150 to 160 degrees) and tacked again inside the reef to starboard (50 to 60 degrees).

We held for awhile. One more short port tack out and another long tack put us to New- found Harbor south marker off Big Pine key where we tacked again and headed out to sea on port tack. As soon as we cleared the reef, I lowered the port foil and set the bungee, then I lowered the rudder.

We sailed out for about 2 hrs as the sun set between 6 and 8:00pm, the sea state was running 6-8 with an occasional 10 foot, with the swell on our beam. SCAT rode nicely through this swell. I had set the windward bungee tension tight so as to bury the wand a bit; when I slacked it off the weather ama rose and depressed the leeward ama a bit. The leeward ama still was very buoyant and the boat felt much looser, even with the lee main foil half way down, incidence set to max. The foils stabilized the ride quite a bit dampening the roll, very little pitching in the beam sea condition.

Our boat speed was around 8 kts. After tacking to starboard we were able to hold starboard all night at a heading of about 160 and getting lifted as we headed north. This part of the trip was the roughest, the wind was east against the stream, causing a 6 to 8ft swell that Scat hobby-horsed nicely through (though the ride was wet) as she would take the top off the occasional wave. During the night we logged 16 to 17 kts at one point, with the lee ama clear of the water about

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SCAT TRIP UP FROM STOCK ISLAND

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two feet and the main hull skimming. At this point, the ride was like turbulence in an airplane, with very little pitching and rolling and a lot of up and down motion. This motion was greatly dampened by the hydrofoils. By morning the wind was beginning to fade. We pulled the reacher and needed it the rest of the way as the wind never built back up. Scat was north of Fort Pierce, we could see the highly lit bridge inside the inlet, as the sun set. I thought this was quite good progress, as the wind never did build much more than 10 to 12mph during the day.

As night fell, so did the wind. The rest of the trip was a drifter, yet we still arrived in the inlet at 9:00am and tied to the Cocoa Beach Yacht Club dock.

FASTACRAFT FOILER MOTH "ON THE PROWL"

[This is a continuation of an article by John Ilett appearing in the Spring 2003 IHS Newsletter. - Editor]

FIRST DAYS

Initially things did not work so well. While the system is really simple to rig and operate there are actually quite a number of moving parts. It took almost three months sailing most weekends to tune it, adjusting cables and ratios within the linkage and also a diamond saw to cut and modify the foil. It did foil on the first day out in very minimal wind but then on another day in around 20 knots wind there was a big crash at speed from a fair height.

Fastacraft is a small Perth based business run by John Ilett. The focus is on manufacturing foils using the pre-preg process and carbon fibre. There are currently two moulded dinghy foils available in pre-preg, both are a tapered section with the original patterns being shaped by computer operated router. The smaller is a NACA 0012 section, 1000mm long with a 175mm chord and the other is a NACA 0011 section 1200mm long with a 205mm chord. Also the original 120mm constant chord hydrofoil as used on the Moth is available in up to 2100mm length and now a symmetrical NACA 0012 section with 120mm chord and 2100mm length. Custom foils are also built with blanks cut by the same computer operated router, then vacuum bagged with epoxy resin and carbon fibre.

John is a qualified shipwright but has become more of a composite enthusiast since gaining experience in the UK manufacturing formula 1 race car bodywork. Additional details are available on the Fastacraft website at: http://www.fastacraft.com This includes video of the boat sailing at: www.moth.asn.au/multimedia/rohan_perth_feb03_movie2.wmv To view this clip you will need a current version of Windows Media Player.

LE FOILBOARD

By Gerard Delerm

Project History

In 1995, I helped a friend to build a custom sailboard. The goal was to obtain a board with modern lines at moderate cost. As we finished the board, we realized the price of a good commercial fin was disproportionate compared to the cost of our board. So I started to study and to build some fins. After testing many profiles and construction technics, I settled on a fin design of moulded fibreglass / resin manufacture that met my requirements for structural strength and for being "spinout proof". This successful result was obtained at a reasonable cost so all our goals were met.

In 1997, after reading a sailboard review, I produced a hydrofoil fin whose function was not to raise the board completely out of the water, but rather to help it begin planing. This foil was fitted into the original fin box of a 1990 SHREDDER Mistral board (length 298 cm/9.8 feet, width 59 cm/1.9 feet and narrow stern). After some tinkering, particularly with the foil's angle of attack, I got promising performance. I could start planing with 8 to 9 knots of wind speed using a rather old 7.4 m² (80 square feet) sail and while the board was supporting my weight of 90 kg (199 pounds). This could not be achieved with the same board without the foil.

In June 1999, I met a group of young undergraduates at the "Ecole Nationale Supèrieure de Chimie et de Physique de Bordeaux" (ENSCPB) which had taken on a project to design and build a hydrofoil sailboard that would successfully take off and sail on its foils. Of course, I jumped at the chance to associate myself with this project. I decided that, while the team was conducting their initial theoretical study, I would use my earlier practical experiments to produce a first prototype to narrow down the range of problems, thus helping to develop a successful design and construction method…. Thus was born "Le FOILBOARD" idea.

To be continued in the Autumn 2003 IHS Newsletter.

New Members

(Continued From Page 2)

ite historical vessel is Forlanini's, and is interested in learning more about personal hydrofoil craft.

David Rynders – David is an attorney practicing environmental law on behalf of a number of environmentalists. Although he has no specialized knowledge of hydrofoils, he is utilizing the IHS website to learn more. He intends to add hydrofoils to his boat and is just getting the broader picture with the help of the Society.

Graeme Paulin - – Graeme hails form New Zealand and has always had an interest in things mechanical, be it construction equipment, trucks, planes, or ships. He spent six years in the RNZN (Royal New Zealand Navy) as a marine engineer. Graeme is currently employed as a process engineer in a Wellington manufacturing plant. Recently he has been researching possible candidates for a fast ferry service round New Zealand's coast This lead him to the IHS's excellent web site, and subsequently to join the IHS.

Walter Wohleking – Walter is a Charter Member of the North American Association of the International Hydrofoil Society. He spent the first 25 years of his professional career with the Grumman Corporation, taking over management of the company's hydrofoil boat activities after Robert J. Johnston left that position in 1976 to join the David Taylor Model Basin. As Grumman's Director of Marine Programs, Mr. Wohleking dealt with the maritime nations of Europe, the Far East, the Mid East, and North and South Americas, as well as with the U.S. military and agencies of the U.S. Government. In 1982 he left Grumman and with Bob Johnston founded Advanced Marine Systems Associates (AMSA), a marine consulting firm. Following this Mr. Wohleking consulted independently, engaging in high-speed ferry feasibility analyses for private and public sector clients, advising ferry operators on the implementation of fast ferry services.

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WAVERIDER UPDATE

By Ray Vellinga, IHS Member

I have taken the Waverider twice. The evening boat leaves San Diego at 5:35 PM and reaches Oceanside in 1.5 hours. You can enjoy a restaurant dinner at the Oceanside harbor and walk or taxi to the Amtrak station to catch the 9:23 to San Diego, arriving two blocks from your departure. The boat costs $5.00 and the train is about the same. The program is temporarily subsidized by a government grant.

The "Wave" is a 149 passenger boat with four 1,000 HP diesel engines powering two water jets. The hull is supported by submerged foils fore and aft. These foils partially elevate the hull, and the load is shared by the planing hull.

This hybrid system has advantages over a pure planing hull. It uses less power and fuel. It has a relatively small wake that allows 45 MPH passage through the crowded San Diego harbor. Its motion at sea is relatively comfortable. Less roll, pitch and pounding.

For those who live near Southern California there is a now hydrofoil boat service between San Diego and Oceanside. You can learn more about it at www.TakeTheWave.com.

NEW BENEFIT

IHS provides a free link from the IHS website to members' personal and/or corporate site. To request your link, contact Barney C. Black, IHS Home Page Editor at webmaster@foils.org

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LETTERS TO THE EDITOR

Help With A Dynafoil

[5/30/03] I recently acquired a Dynafoil by Hydrocraft (a jet ski size hydrofoil built around 1970). It is in good shape but the fuel pump doesn't work. I was wondering if anybody knew anything about this particular hydrofoil or even knows where to get parts for one. If any one has information please call me. Jonathan Javetz 706 714 4903, schwartz1101@cs.com

Response: Rebuild kits are available for the injectors on the Dynafoils, but I need to know which size engine you have, the 440 or the 340. It can also be with dual Mikunis for a rated HP of 55, but not necessary to have the extra HP. Scott Smith ssmith@syntheon.com

Hydrofoil Surfboard Details

[6/24/03] Can you steer me to a site that shows a hydrofoil surfboard in detail? I want to know more about how this concept works. Merv Rice MervLaura61585@aol.com

Response: IHS has no design details unfortunately, though these surfboards appear from a distance to have something in common with the Air Chair and other hydrofoil waterskis. Laird Hamilton is the pioneer in this. He has a video out on DVD, and supposedly the bonus materials on the DVD have information about the hydrofoil surfboard. See our page at www.foils.org/popvideo.htm. I have not seen the video, so I don't know if the hydrofoil info is a little or a lot. We have some archived correspondence on this subject on our website. Barney C Black webmaster@foils.org

Foil-Borne Draught

[6/10/03] I have a 14' fibreglass planing hull that I am considering adapting for use with a hydrofoil. The distance between the bottom of the keel and the horizontal centreline of the propellor is about 8". Is this enough draught to enable a hydrofoil to operate effectively? My boat has a 50 hp outboard on it and the speedo goes right up to 60 mph (52.6 knots). I know that a well-designed foil will increase fuel economy at high speeds. Will using a foil also result in greater acceleration and/or higher top speed? Mike K. ame2000@lycos.com

Response: The good news is you do have enough water above the prop for foils, assuming mostly smooth water. Using foils will increase you fuel economy. The bad news is they may not increase your performance for this boat. Subcavitating foils are fairly simple to make, I can send you plans. But they are limited in speed. If your boat already does 60 mph as indicated, you are already at about the highest speed you can expect to go on subcavitating foils. Adding them would help your fuel economy, but might slow your takeoff a tad. Supercavitating foils might help you go faster, but there is less info available on them. You will be lucky to be able to make supercavitating foils that work for that boat. Had your boat had less power, say 25hp, then you would see real benefits in speed and economy. As it is, it won't gain you much to add foils, but will cause you trouble in shallow water, docking, etc. Scott Smith ssmith@syntheon.com

Response: Thanks for the reply, Scott. I plan to run mostly on lakes, and the engine is not working as of yet, so I haven't actually tested the boat as fit out. I got it for free. Sounds like I can get nearly the same big-engine performance with a much smaller engine and a foil. If I bought a new 25 hp engine, would it be worthwhile to get one with a longer vertical power shaft, so as to increase the distance between the hull and the foils? Mike K. ame2000@lycos.com

Response: I don't know if I would go so far as to say you'll get the "same performance as the big engine", that's really comparing apples and oranges. Your performance with a 25HP engine and foils will certainly be better that a 25hp and no foils, but different from the 50hp. With the 25 and foils you will get good top end, excellent fuel economy, and a cushioned ride. But you have to get it all working together. With the 50hp you will have more pulling power, docking will be easier, and take-off will be faster, it just depends on what you want. Anyway, yes you can put a long shaft on the boat to get more lift. I put a 15HP extra long shaft on my 14' aluminum boat for a hydrofoil experiment. Even with no foils it doesn't hamper performance enough to notice. But you may need to add some strategic sheet metal deflectors to keep the extra shaft length from entraining water up the tower and into your boat. Not a problem when foilborne. Trailering and shallow water operation can be a pain if the engine is really low, like in my case. Transom plates don't allow but a few inches of lift. In short, adding a long shaft won't affect you much, and will help with the foils, adding an extra long shaft will require some compromises. I found the easiest and cheapest way around the extra-longshaft problems was just to use a trolling motor for docking and shallow water.

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Letters To The Editor

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BTW, if you can afford it, I love my 4-stroke, and it runs forever on a tank of gas :) Yes, if you are intent on getting this flying, a long shaft outboard will work really well, but if you never finish the project, it may hamper the resale value of the boat, being smaller hp and a longshaft. Scott Smith ssmith@syntheon.com

Lift Coefficients For Surface Piercing Vee Foils

[6/09/03] Can anyone provide me with values of lift coefficients for surface-piercing Vee hydrofoils of the type Gordon Baker used so successfully for his motorboats? He used the NACA 16-510 foil section, about 40 degree dihedral, and the lower corners of his foils had circular-arc curvature. Such lift values, with, of course, the associated values of aspect ratio and angle of attack, would be very much appreciated. Eugene Clement, Eclement5@aol.com

Response: There are many effects that should be taken into account in calculating the lift (and drag) of surface piercing hydrofoils. These include for example lift loss of foils operating near or cutting through the water surface. I would recommend Chapter 3 of the book *High Speed Small Craft* by Peter Du Cane (1974 edition) as an ideal reference to use to prepare an estimate of the lift generated by a particular foil arrangement. In that chapter Michael Eames specifically considers surface piercing V foil arrangements. The various equations are too involved to repeat here but could be incorporated in a spreadsheet calculation or similar.

The alternative is to back the overall lift coefficients out of the particulars of a known hydrofoil. What you need to determine is the speed, submerged planform area (at that speed) and weight of the boat. I have tabulated that for a few surface piercing hydrofoils of the Supramar type and the typical CL values for the overall craft are in the order of 0.26 to 0.43. I don't know the details of the foil profiles in those cases however. Martin Grimm, seaflite@alphalink.com.au

Variable Geometry Foils

[6/05/03] I've seen many people ask about using various aircraft techniques to improve some aspect of a hydrofoil design. Somebody even went as far as to ask if a rotating foil design similar to a gyroplane might be made to work, although I can't imagine gaining anything from that exercise. One problem that seems to come up a lot is the need for high lift at takeoff, and reduced drag at cruising speed. This is made more critical for limited power applications like human powered craft. A common solution is an extra foil that retracts at speed. I wonder if variable geometry might be an answer. Two common aircraft applications are the 'swing wing' like the f-14 Tomcat, and the 'scissor wing', usually an elliptical wing that rotates as a whole on a pivot point above the center of the fuselage. Would producing a variable geometry 'swing wing' help to reduce drag at higher speeds and give better low speed lift? Or am I barking up the wrong tree? I've never heard of a hydrofoil design using this feature. Scott Smith ssmith@syntheon.com

Response: I have been wondering the same thing. Is the fact that there are no 'swing wing' hydrofoils due to the operating speed of current hydrofoils not being high enough for it to be of any benefit? Aircraft speeds in the range from mach 0.5 to mach1.0 (approx 300 to 600 knots) apparently benefit from increasing wing sweep angles. Is there a good correlation between aerodynamics and hydrodynamics? Could the above speed range be converted to the equivalent for a hydrofoil wing? One assumes the speed would be much slower given waters much higher density. How is cavitation affected by a swept wing? It would also be of benefit for coming alongside as the wings could be over swept (as per the F-14) so the are in side the hull line. Graeme Paulin, paulin@paradise.net.nz

Response: Hydrofoils wings have to be very much thinner than aeroplane wings to support the same weight, so they have to be proportionally stronger. It is therefore difficult to build in the sort of features that let aeroplane wings change shape, like extending flaps and droops, as they would weaken the wing too much. That is one reason why hydrofoils have a relatively small speed range (about 2:1 full speed to take off) compared to aeroplanes (often 4:1 full speed to take off). As for swing wings, they are fitted to supersonic aeroplanes to reduce drag and leading edge heating at supersonic speeds. Hydrofoils get nowhere near supersonic speeds, especially as the speed of sound in water is about 3000 mph. Hydrofoil top speed can be limited by cavitation, and swinging a wing would do very little to reduce that. Cavitation can only be reduced by making the foils even thinner, or, of course, slowing down. Many submerged foil hydrofoils have foils that can be swung up out of the way to reduce draft and sometimes beam for docking, but these usually swing the whole strut and wing assembly. Even small irregularities in a

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Letters To The Editor
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wing would cause cavitation which would damage the wing, so the designers have felt that it best to keep the mechanisms at the top of the strut and out of the water. Malin Dixon, gallery@foils.org

How Foils Lift

[5/18/03] When reading general descriptions of how foils work, it is easy to believe that there is more suction on the upper surface of the foil due to the lower pressure there, than deflection of fluid below the foil. While I can find information on the pressure profiles above and below the foil surface which lead to this conclusion, I would like to know what proportion of the total lift is generated by deflection of the fluid downwards, compared with the total suction upwards by negative pressure above the wing. Ian Ward ianward@ozemail.com.au

Response: There are at least two ways of determining the lift generated by an airfoil or hydrofoil. As you have already suggested, the first is to integrate the pressure distribution over the top and bottom of the foil from leading edge to trailing edge to determine the net upthrust. For a wing, I have heard that the contribution to lift from the suction (upper) side is typically about three times that of the pressure (lower) side. I will have to check whether that is about right with a typical case sometime.

The second way of determining lift is to calculate the change of momentum of the air or water as it passes over the foil. If you consider a 'control volume' of the fluid around the foil bounded by a streamline far above and below the foil and with an inlet and outlet far upstream and downstream of the foil, then the lift generated by the foil should equal the mass flow rate of the fluid through that control volume multiplied by the change in the vertical velocity component of the fluid. In short, the greater the downwash, the greater the lift. The downwash can't be associated with just the bottom of the foil or just the top for that matter. The streamlines passing a foil are determined by the combined effect of both surfaces and the angle of attack etc. If you have a particular foil profile and angle of attack in mind, let me know and I will give you more specific numbers for the 2D case. Martin Grimm seaflite@alphalink.com.au

Response: The texts I have seen usually show very smooth streamlines locally around a wing foil which give little indication of the massive downwash and vortex turbulence which must also exist. The implication is that the deflection of fluid downwards and its reaction on the wing surface upwards is only a small component of the total lift, and that the low local pressure on the upper surface provides the majority of the "lift". I am keen to have your comments on this. While I agree with you that it is the total effect of what happens both above and below a foil which generates the total result, and that downwash is the result, I was wondering about the relative proportions of the contribution of suction on the upper side and positive deflection on the underside, as this would help me to explain for myself at least which of the descriptions of how a wing works best fits the facts. If I refer to many common explanations I could be led to believe I always need an asymmetrical airfoil section to create the necessary low pressure to get lift, when in fact a simple paper glider with thin flat wings works remarkably well. I see many L/D curves and pressure graphs in the near vicinity of a wing, but unfortunately no figures or relative proportions are given. Ian Ward ianward@ozemail.com.au

Foil Design For Velocity

[4/24/03] Is there a theoretic velocity limit for foils? Is there a direct relationship between lift, speed, and cavitation onset? Are foil designs available that are self defouling or that deflect submerged objects? Are foils designed for specific velocities? J. Duncan Coolidge, jcoolidg@tds.net

Response: For subcavitating foils, it's hard to design a system for much over 40 kt. There's probably no intrinsic limit for supercavitating foils, but material strength may limit the loads at the thin, sharp leading edges. Tom Speer, me@tspeer.com

Response: There is a page on the IHS website covering the arguments for and against ultra-high speed hydrofoils at www.foils.org/knots.htm. Ken Cook is a proponent of such hydrofoils. See the article in this issue on page 5, column 3; also his website at www.hydrofoil.com/. Barney C. Black, webmaster@foils.org.

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Letters To the Editor allows hydrofoilers to ask for or provide information, to exchange ideas, and to inform the readership of interesting developments. **More correspondence is published in the Posted Messages and Frequently Asked Questions (FAQ) section of the IHS Internet web site at http://www.foils.org.** All are invited to participate. Opinions expressed are those of the authors, not of IHS.

Letters To The Editor

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Supercavitating Foil Design

[5/10/03] I have seen a lot of info on designing sub-cavitating hydrofoils, but little on super-cavitating ones. And most of that was theoretical and required considerable effort to understand. Can someone direct me to a designer's guide to super-cavitating or super-ventilated hydrofoils? Mac Stevens, stevensm@earthlink.net

Titan Aluminum X-Craft Experiment

[7/28/03] I'm sure that the selection of an SES (Raytheon-Umoe team) as one of the 3 Littoral Combat Ships (LCS) concepts chosen for further development had something to do with the speed and range and draft requirements and objectives. The next phase should be interesting; it is likely that the other two concepts will incorporate dynamically assisted lifting technology - foils and/or lifting bodies - to try and meet the same overall performance objectives. Bill McFann, bmcfann@islandengineering.com

Thanks

[6/9/03] Dear Mr. Meyer: On behalf of SUPRAMAR I thank you very much for your congratulation letter of May 8, 2003 reminding me of the inauguration of the first passenger hydrofoil service. It is certainly a date worth remembering. Shortly after this inauguration Sig. Carlo Rodriquez saw the little boat on Lago Maggiore and he was impressed, and made contact with SUPRAMARIN, Lucerne. It did not take long, and his shipyard in Messina became the first licensee of SUPRAMAR which was founded only a year before. All the rest is well known and many PT 20 and PT 50t type hydrofoils were built in Messina. However all this would not have been possible without the efforts and the ingenious ideas of Baron von Schertel and numerous other engineers which promoted the hydrofoil. I am proud and grateful at the same time that I was one of those dedicated engineers. From 1957 I worked in SUPRAMAR with Baron von Schertel until he passed-away in 1985. Sincerely, Volker W Jost, President, Supramar AG

PHMRON 2 Veterans

[6/16/03] This July 30th will be the 10th anniversary of the PHM squadron decommissioning. I wish to extend all best wishes to our shipmates, the veterans of the PHM crews, MLSG and PHM Squadron 2 staff. I look forward to raising a glass (splice the main brace) at Turtle Krawls in Key West on this date, to you all. Steve Novell (Jolly-OS1, PHM1) sjnovell@mindspring.com

Large Hydrofoil Passenger Liners

[04/13/03] Large, ocean-going hydrofoils were once a popular dream and even considered inevitable for the future... including a nuclear powered design. Take a look at our page on popular magazine articles at www.foils.org/popmags.htm. The earliest article on this subject we cite there is "To Cross Atlantic in Thirty Hours," Technical World Magazine, Oct 1907, by Wm. G. Fitz-Gerald. The most recent is "100 Knot Liner Has Sea Wings," *Popular Science* March 1959 by Alden P. Armagnac. Bob Johnston once answered the more general question as to why there are not more hydrofoils this way: "First, regarding size, the foil lifting capacity is an area function, increasing with the square of the speed. So in the practical speed range of 40 to 50 knots with the size of the hydrofoil craft increasing by a cubic function, the foil dimensions become relatively quite large. A Navy study concluded that a 2,000 ton hydrofoil was about a limiting size. Range is another consideration. Hydrofoils can be shown to compete commercially with aircraft up to about 300 miles on a time basis for downtown- to-downtown routes. This considers time to and from airports and ability of the hydrofoil to go downtown to downtown. Hydrofoils have demonstrated they can provide superior rough water passenger comfort. So in adverse sea conditions, sea state three and above, their ride quality and speed are better than other high speed sea craft. The real problem is that hydrofoils have a high first cost on the basis of cost per seat mile. It has been shown that the acquisition cost is the driving factor in most acquisition decisions. To increase the use of commercial hydrofoils, studies that I have been involved with indicate that there is a market for small, 100 to 300 seat capacities, at speeds in the 40 to 50 knot speed range, with submerged foils and automatic control systems. But the first cost has to be made more attractive than hydrofoils on the market today. I would like to see some concentrated design effort put into this area." Barney C. Black, webmaster@foils.org.

Here ends the printed edition. The electronic edition has 3 more articles on 5 more pages with large color photos. Why not go now to www.foils.org and view the Newsletter on line. It's in color, and it's easy. If you have trouble, we will help you... contact webmaster@foils.org.

EXTRA FOR THE ELECTRONIC EDITION

PHM 5 Update

News from the *USS ARIES* Hydrofoil Memorial, Inc.

by Eliot James
www.ussaries.org

Work has progressed this summer in preparation for hullborne cruising. We are proud of how clean the ship is, and we will keep her that way so as to be better prepared for giving tours. We are maintaining walk-on access... we don't have the ship open everyday, but she is always available with a little notice. We constructed a new hatch and have it installed in the plate covering the gun turret opening where we installed a staircase to give access for tours.

We have been working on the IBS (Integrated Bridge System). There are four LCD touch screens set into aluminum plate that replace most of the bridge controls. One pair in front of the pilot, one on the port side in front of the co-pilot. These screens are being connected to the ship control computer that is housed in the old navigational console in the Combat Information Center (CIC). The monitors in that console have been replaced with color CRT screens and will reflect the same information displayed on the bridge units.

Integrated Bridge System

Ship Control Computer in CIC

One of each pair of the screens will display ship system information from the PLCs that control and monitor the propulsion, HVAC, bilge pumps, seawater system, fuel system, etc. The second will display conning information, compass, navigation, radar, depth soundings, etc. The IBS will lower manning requirements.

The new generator is being plumbed into the seawater system, and the HVAC system is undergoing rebuild. The chilled water system was extensively damaged, with nearly all the room chilling units split open from being frozen. Each one had to be removed (a major pain) and welded back together. Japh Howard of Flicker Forge lent his extensive welding capability to that project. We are grateful. See his web site at www.flickerforge.com. I suppose no one thought to add antifreeze to the chilled water system when the ships were moved north to the inactive naval shipyard. The units on the sister ships were also broken.

We are applying to be placed on the register of historic ships, and we could use some help. If anyone is willing to write down some reasons why this ship should be considered historic and consequently preserved, please email that to me to include in our application. It seems obvious that what the ships represents technically is reason enough by itself, but we need to educate the reviewing panel on the why. Any help will be appreciated. Once the application is approved, we will be eligible for grant monies from programs such as "Save America's Treasures" grants and others that will help us get the ship flying again.

We procured more spares from the sister ships, including foilborne propulsion parts. There are more available, but getting and storing them is expensive.

ex-*ARIES* (PHM-5) on Grand River Waterfront Brunswick, Missouri

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PHM-5 UPDATE

(Continued From Previous Page)

Diana and Bob have added many pictures and video clips to our website. Not only are there clips of the ships flying, but also pics of the ex-*GEMINI*. You won't believe how different she looks since being purchased by someone who is turning her into a private yacht. The "Observation Dome" in the bow reminds me of the *NAUTILUS* from *20,000 Leagues Under the Sea*. The superstructure wasn't built when I last saw the ship, but I believe work has begun on that.

GEMINI's current owner is a contractor from Chicago, I believe. He contacted me after reading about the ships, and I put him in contact with Jim Lovelace, who sold him the ship. He is working on her there in Wilmington, NC. He removed all foilborne propulsion, purchased 2 hullborne drives from the ex-*HERCULES*. One is a spare, the other he mounted in the center in place of the foilborne drive. This gives him three hullborne propulsors. I believe he will be driving with 12-92 Detroit. As to the center propulsor, he doesn't plan on vectoring the nozzle.

We regret we weren't able to put together a trip to Key West for a PHM reunion commemorating the 10th anniversary of the decommissioning. We are working towards sailing back to Key West and having that reunion. If someone wants to get involved in helping prepare for it, we need to secure docking facilities in Key West. Someone who could get us docking for a month or two, time enough to earn cash from tours to put fuel in the tanks for a return trip, would be welcome to cruise along with us the week or so it would take to get to Key West.

Thanks to all that have helped and supported our project.

Ex-GEMINI (PHM-6) Undergoes Conversion to a Private Yacht in Wilmington, NC

Ex-ARIES Saved From the Scrap Pile

The fleet of six PHMs was decommissioned in 1993. The ships were moved to a shipyard and stripped of all salvageable systems.

The ex-*ARIES* was purchased by Eliot James and B. J. Meinhardt via Internet auction originally for scrap purposes. However, once they realized the unique nature and amazing technology it represented, they could not scrap it. After months of research and work, they managed to retrofit enough of the ships systems to begin their voyage to the Grand River in Brunswick, Missouri.

The ex-*ARIES* remains in Brunswick, where rehabilitation efforts have been ongoing. The ship was opened for its first public tours the weekend of October 4, 2002 in conjunction with a local festival. In excess of 130 people took the tour, which included three decks, a video of the ships flying, several photos, a brief history of hydrofoils, and a display of a Dynafoil (1970s personal water craft) utilizing hydrofoil technology.

A newly formed non-profit organization, the *USS ARIES* Hydrofoil Memorial, Inc., is dedicated to the rehabilitation of the only remaining Patrol Hydrofoil Missile (PHM) with foils. The organization recently received 501(c)(3) status, allowing it to accept tax deductible contributions to the memorial.

What do Helicopters and Hydrofoils have in Common?

by Martin Grimm

The two technologies that interest me most are helicopters and hydrofoils. When these both came together in a single application, I was most pleased.

The Erickson Air-Crane company based in the USA has operated a fleet of Sikorsky S-64 Skycrane helicopters for years. These heavy lift helicopters are used in specialty applications ranging from aerial crane work to firefighting.

In the firefighting role, the helicopters are fitted with a custom-designed tank that can carry up to 2500 gallons (~9500 litres) of water, retardant, or foam mix. This load can be discharged at various rates depending on the nature of the fire being attacked. The tank can be filled while the helicopter is airborne by two methods.

(1) A snorkel unit connected to a flexible hose can be lowered into water reservoirs and the integral impeller within the snorkel can then be activated to refill the tank in as little as 45 seconds while the helicopter is in a low hover.

(2) The second approach is novel. A rigid boom equipped with a ram scoop system is lowered from alongside the tank as the helicopter approaches for a low pass over a stretch of water. At the end of the boom, a hydrofoil unit is installed such that when the boom makes contact with the water, the hydrofoil forces the boom to submerge rather than simply skipping over the water surface. The ram pressure of the water can then fill the tank through the scoop inlets in less than 45 seconds.

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Photo by Peter Clark

A ram scoop hydrofoil allows the Helitanker to refill from fresh water or sea water sources in less than 45 seconds. Your intrepid author (he is Martin Grimm) is shown photographing the business end of the scoop on the "Incredible Hulk."

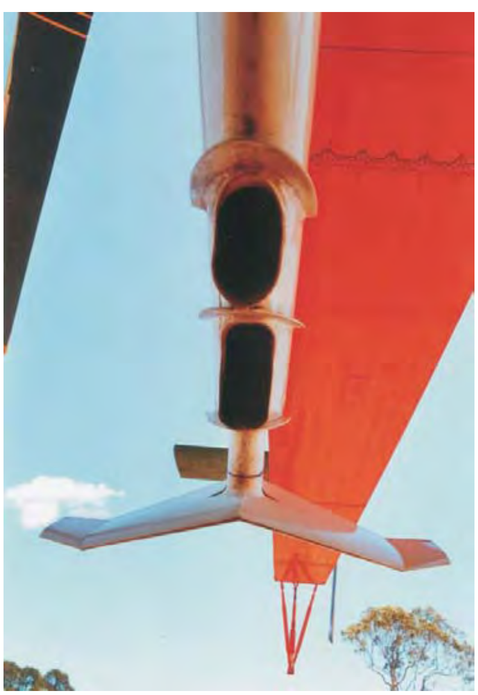
HELICOPTERS & HYDROFOILS

(Continued From Previous Page)

The Erickson Air-Crane website www.erickson-aircrane.com has a good still image of one of their S-64E helicopters with that hydrofoil water scoop system in action as it flies low over the water. Even better, the selection of video clips that Erickson Air-Crane provide on their website includes footage of the hydrofoil water scoop system in action.

One Erickson Skycrane, named "Elvis" has been a regular visitor to Australia during the summer period, mainly fighting bush fires in Victoria. The 2002 season saw significant bush fires in New South Wales, and so two additional Erickson Skycranes named "Incredible Hulk" and "Georgia Peach" were imported at short notice. All three earned a good reputation saving houses on the outskirts of Sydney and in rural communities. This year the helicopters and their crews have again been earning their keep fighting fires from Canberra south down into Victoria.

A hydrofoil has played a little part in it too!



Model Hydrofoils: They Are Fun and Affordable To Build and To Operate

Martin Grimm's model of *CURL CUR*L

Nick James's *CONDOR I.* For 22 years he searched for a PT-50 Super Comet Model kit. He finally found it in a model shop in Italy.

Mark van Rijzen's PT-50 in Holland

Lenny's VS-8 Skims the Waves. Made from a kit by 32nd Parallel Corp. (out of business)

Aurora TUCUMCARI (PGH-2). These models can often be found on www.ebay.com

Ian Wrenford's display PT-50 model *FAIRLIGHT*

Malin Dixon's Design with Fully Submerged Hydrofoils and ACS

The NEWSLETTER

International Hydrofoil Society
P. O. Box 51, Cabin John MD 20818 USA

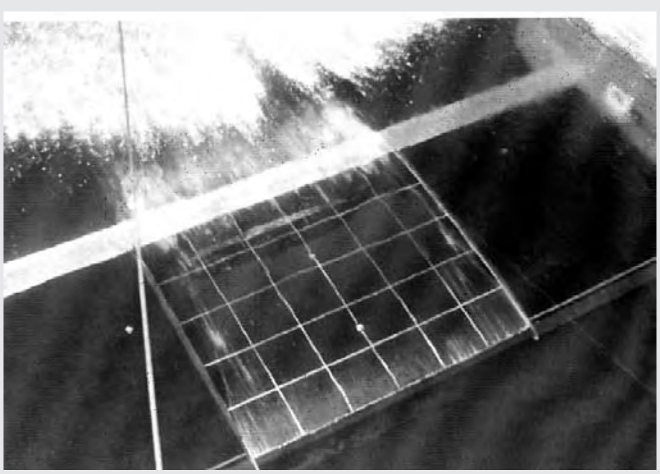
Editor: John R. Meyer | Autumn-2003 | Sailing Editor: Martin Grimm

COMPREHENSIVE TESTING OF A PROPRIETARY MODEL OF A LOW-DRAG HYDROFOIL CONCEPT

Excerpts, by permission, from Wavelengths, 10 May 2003, Naval Surface Warfare Center, Carderock Division, by William Palmer

A team of test engineers in the Carderock Division's Marine and Aviation Department performed comprehensive testing of a proprietary model in May 2002 of a low drag hydrofoil (LDH). The LDH concept was invented by Dr. Thomas Lang (IHS Member) and the model was designed by his company, Semi-Submerged Ship Corporation (SSSCO) of Solana Beach, CA.

Center personnel conducted the tests to determine if an air cavity, injected into the water flow along the leading edge of the hydrofoil would remain intact and stable at speeds of up to 35 knots, and whether the concept was feasible. Testing was conducted on Carriage 5 at the NSWCCD. Funding for the test was provided by the Defense Advanced Research Projects Agency.



Low-drag hydrofoil in 35-knot test on NSWCCD Carriage 5; Photo by Martin Sheehan

The hydrofoil that was tested can produce 15,000 pounds of lift. If air is injected into the water flow on the hydrofoil, air displaces the water, reduces the wetted

See Low-Drag Hydrofoil, Page 3

AMV CD-ROM #2

IHS announces the second Advanced Marine Vehicle (AMV) CD-ROM in its series of reference and historical AMV document releases. The new CD has 61 documents:

- Eleven Documents Applicable to Multiple AMV Types
- Seventeen Documents on Air Cushion Vehicles (ACVs) and Surface Effect Ships (SESes)
- Thirty Docs on Hydrofoils
- Three Docs on Planing Hulls

Cost is US$12 for members; US$15 for nonmembers. IHS accepts payment by personal check, bank check, money order or cash (all in US dollars only). We have also arranged for payment by credit card (online only!). To see abstracts of the documents or to order on line, go to the IHS publications page at www.foils.org/ihspubs.htm.

INSIDE THIS ISSUE

PRESIDENT'S COLUMN

Dear IHS Members,

All of you are reminded that AMV CD#1 is still selling on the IHS website. A lot of time and effort has gone into generating AMV CD#2. It was released this summer, and you can get all the information about this second CD also on the IHS website. It sells for $12 for IHS members and $15 for non-members. Barney Black has prepared indices and abstracts for the CD#2 documents. You will find these a very significant and useful contribution to the CD.

As mentioned in this column of the Summer Newsletter, during the March and May Board meetings, the IHS Board of Directors has committed to a "soul searching", "planning" effort in which we would reconsider IHS objectives/goals and play them against ongoing and projected activities. Board member Dennis Clark is leading the planning effort. In March he presented a "Planning Framework and Approach". At this meeting the Board discussed, and endorsed Dennis' approach and resolved to move forward. The initial step was a Planning Meeting held on September 10. It was attended by six of the Board members (G. Jenkins, K. Spaulding, W. White, J. Gore, J. Meyer and D. Clark), plus two invited guests (W. Ellsworth and B. Black).

Following a welcome by the President and opening remarks, the group reviewed the planning philosophy and process. After reviewing current "Purposes" and "Objectives" of the IHS, the group held an open discussion as each member described his own impressions of what is positive and negative regarding the various activities of the Society. Then these impressions/opinions were grouped into five areas, namely:

1. Communication Tools
2. Knowledge Management
3. Membership
4. Educational Outreach
5. Society Management

These then became the Society goal titles. At the conclusion of the meeting, each member was assigned the task of defining these goals taking into account the preceding discussions. Results will be reported in the Winter 2003 issue of the Newsletter.

Follow-up planning meetings will be held to discuss and approve the final goals. These meetings will continue with definition of future actions to meet these goals. All of this has the intent to improve the services offered by the Society to its members.

Your Society continues to grow with new members joining every month. Since the beginning of 2003, 31 have been added to the membership list. By the way, you can view the Membership List by logging onto the IHS website (www.foils.org) and put in the proper password. All IHS members have been informed of this password. If you have been missed or forgot, please contact the webmaster (webmaster@foils.org).

John R. Meyer

President

WELCOME NEW MEMBERS

Greg Ketterman – Greg is VP of engineering for Hobie Cat Company in Oceanside, CA. which is very fitting since he learned to sail on one of the first Hobie 14's. Inspired by Crossbow and Icarus he grew up building many model sailboats and hydrofoils with the dream of breaking the world speed record for sailboats. In college where he earned a BSME from Cal Poly Pomona he built a model hydrofoil trimaran which became Longshot and the TriFoiler. After building several full size prototypes Longshot broke the world speed record and the record still stands at 43.55 knots. He firmly believes that hydrofoils are the future of high performance sailing and is currently working on a new boat that will be faster and more practical than the TriFoiler.

Niklas Lundberg - Niklas a student in vehicle engineering at KTH University in Stockholm, Sweden. His interest in hydrofoils started with doing a short summary about hydrofoils. His biggest interest is in sailing hydrofoils and hopes to build one in the next 5 years for fun. I have read about the Icarus project (1970) and am inspired about hydrofoils

Philip McKay – Mr. McKay served six years in the United States Navy as an Electronic Warfare Technician. He served aboard the U.S.S. Tarawa (LHA1) from 1978 to 1980 and then aboard the U.S.S. Pegasus (PHM-1) from 1980 to 1983. He was honorably discharged from the Navy as a Petty Officer First Class (E-6) in 1983. After the Navy, Philip

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Low-Drag Hydrofoil

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surface of the foil, and thus reduces frictional drag on the hydrofoil. SSSCO had experimented with the concept at the California Institute of Technology, Pasadena, CA, using several models with chord lengths of 6 inches. For the Model Basin tests, Maritime Applied Physics Corporation (MAPC) of Hanover, MD, constructed a foil having a span of 9 feet and a chord of 3 feet.

To test the concept, a rig was used to support the hydrofoil as it traveled through the water. Two vertical struts supported the foil at its ends. The center 3 feet of the foil is the ventilated test section, and two 3-foot unventilated sections are on either side to eliminate flow influence to the air cavities from the vertical struts.

Testing was performed at a depth of 2 feet in the towing basin. An air compressor was used to provide air through two banks of 13 air valves per bank, one bank supplying flow to the upper side of the leading edge, the other bank to the lower side. A video recording system was employed to monitor and document how the injected air cavities behaved during a test run. Instrumented load cells supported the rig weight and measured the total lift and drag generated by the submerged foil. A linear bearing system isolated axial movement of the rig as it moved through the water ensuring accurate drag measurements.

The hydrofoil itself could be tilted to vary the angle of attack, or the angle between the oncoming water and the chord line. A control surface at the trailing edge of the hydrofoil was also used to vary lift. The number of open valves for each valve bank was varied to change the flow rate over the upper and lower surfaces respectively for different run conditions. The hydrofoil was tested with three differently shaped leading edges to see if the shapes affected air cavity formation.

Test results revealed that water-borne drag on the hydrofoil is reduced when air cavities are used. Visual data from the video system showed that there are specific air pressures which will generate what appears to be stable air cavities. The data analysis was conducted by SSSCO.

RIDING THE WAVE

By William Hockberger, IHS Member

When a ferry operator chooses a hydrofoil, it's because he believes his route requires it. A hydrofoil brings some added complexity and cost, which must be repaid by higher ridership and revenue attracted by the boat's superior performance, reliability and comfort. Stan Siegel, a naval architect and IHS member with a long career working on advanced ships and craft, recognized from the start that the offshore route he planned to serve required a hydrofoil.

That route runs along the California coast parallelling Interstate 5, which is choked with traffic that steadily grows worse. Stan saw a market and convinced the California Transportation Department (Caltrans) to fund a year-long test of the feasibility of an offshore ferry service and its ability to attract travelers off the highway. Although his longer-range objective was to operate to points west and north of Los Angeles, for this initial test Stan proposed a service between San Diego and Oceanside, well south of LA.

Caltrans allocated $5M for development of the service and a year's operation. The company Stan set up for this project, SCX, Inc., received $400K in late 2001 for initial planning, followed by $2.5M in July 2002 for environmental studies, harbor preparations, and the first six months of operation. The service began operating in March this year. As explained later, however, it was concluded prematurely in August. Accordingly, most of what follows is expressed in past tense.

For this test, SCX leased the hydrofoil originally named Westfoil, which was built in 1991 by Westfoil International, of Westport, Washington. Pacific Marine & Supply Co, Ltd., of Hawaii, acquired it in 1997 and operated it on a trial ferry service carrying commuters between Barbers Point and Honolulu. That service was terminated when its grant money ran out and no commercially viable market had developed.

Westfoil originally had fully submerged foils and was driven by a pair of ducted air propellers when foilborne and a pair of Arneson surface drives when hullborne. Pacific Marine removed the air propellers and surface drives and installed waterjets. They also removed the original foils and installed a new incidence-controlled forward foil. However, they left the after hull supported only by buoyancy, which facilitated

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RIDING THE WAVE

(Continued From Previous Page)

the waterjet propulsion as well as simplifying the overall construction and control. Stern interceptors and a new integrated ride control system were installed, enabling the craft to achieve high maneuverability and a smooth, comfortable ride. The boat is 85 feet in length with capacity for 149 passengers. Its four Detroit Diesel 12v92 TA engines (each rated at 1050 bhp at 2300 rpm) give it a 40 knot calm water cruising speed.[Ed Note: The reader is referred to IHS Autumn NL for a picture of WAVE and a related story.]

The San Diego to Oceanside route is 46 miles long and took the Wave about an hour. The boat could make its full 40 knots within San Diego harbor without causing any objectionable wake—a unique hydrofoil capability other operators should eventually come to recognize. Once outside protected waters it regularly traveled at 36-37 knots in the 4-6 foot offshore swells typical for that area, and passengers said they found it comfortable. However, when wind waves were superimposed on the swells (less than 5 percent of the time), it became less comfortable. (On two days in March, sea conditions were bad enough to cause SCX to cancel operations.)

As a grant-funded operation, SCX was not constrained to charge a ticket price that would fully cover its costs and yield a profit for investors, so the price could be part of the experiment. Early-on it was thought that $15 each way might be appropriate, including ground transportation to parking at each end. By the time operations began, that had been reduced to $10 each way. However, the competing "Coaster" commuter train between San Diego and Oceanside was charging $4.75 one-way, and in late April it was decided to charge $5 for the Wave.

Ridership was very light through most of the period. In March, with the $10 fare, an average of 14 riders made the morning southbound run, from Oceanside to San Diego, and 10 made the return trip in the evening. At the beginning of April the charge was eliminated entirely, to attract attention and riders. April ridership averaged 19 southbound and 29 northbound. In May and June the Wave averaged only four passengers southbound and six northbound. However, in July a major change was made in the schedule which made it possible to serve tourists and day-trippers rather than commuters. In July the numbers were up appreciably to an average of 49 passengers southbound and 16 northbound. Ridership continued increasing during August, and in its final week the Wave was actually running full and turning away a large number of people—a dramatic end for the experiment - on the final free day there were 120 passengers from Oceanside southward.

Despite that late surge and the belated appearance of a willing ridership, the experiment had to end. One condition placed on the state grant was that funding for the second six-month period would be released only if SCX had succeeded in lining up an investor to pick up the service after the initial year. That had proved impossible by that time. However, in the actual circumstances, when the time arrived for the second block of funds, California's budget problems had grown so huge and contentious it is unlikely the additional money could have been provided in any case.

Is Stan Siegel morose about the untimely demise of the ferry service he worked long and hard to establish? Not at all. He points out two major things: One is that the highway congestion problem will only keep getting worse, and the need for a ferry will continue to grow. The other is that San Diego to Oceanside was never his ultimate objective. It was a scaled-down version of what he really wants to do, but big enough to demonstrate the feasibility of it to people who have never considered the possibility that small boats on an exposed ocean route could ever provide a reliable and safe alternative mode of transportation. He believes that has now been demonstrated.

Stan's real objective continues to be a route from San Diego to the area west of Los Angeles, which is difficult and tedious to reach by any land transportation mode or route. He is particularly attracted to Marina del Rey, which is only a five minute bus ride from the LAX airport. Although its harbor is congested with recreational boats and somewhat difficult to get in and out of, it would be a feasible location for serving that area. For this market he sees a need for about six larger hydrofoils having fully submerged foils and capable of 50 knots in the open ocean. Farther up the coast, Santa Barbara is another attractive location to connect to San Diego by water.

Stan continues to market and promote the idea and believes prospects are good that real service he envisions could eventually be brought into being.

54' FOIL ASSIST SURVEY CATAMARAN

(From Kvichak Web Site, May 2003)

The first of two foil-assist catamarans constructed by Kvichak Marine for the United States Army Corps of Engineers (USACE) was recently delivered to the USACE's Mobile District. The S/V IRVINGTON's mission is to conduct hydrographic surveys in support of dredging and channel maintenance operations. The second vessel, which had a summer 2003 delivery, will operate in the New York District.

Kvichak Marine's S/V Irvington

The USACE's Marine Design Center in Philadelphia handled the project management and was instrumental in all design stages of the survey catamaran as well as monitoring the construction details from start to finish. "We chose a catamaran for its increased stability and for the ability to install a moveable strut between the hulls to mount multiple transducers." said USACE's Mike Collier. "The partial foil support of the design provides the high cruising speed and the more comfortable ride we were looking for."

Designed and constructed by Kvichak, the 54' x 20' aluminum catamaran incorporates the Hydrofoil Supported Catamaran (HYSUCAT) foil design. The HYSUCAT system provides the operator with increased fuel efficiency, improved speed and low wake wash. The fully adjustable aft trim foil provides ultimate control for variable loads and sea conditions. "The IRVINGTON is one of the most efficient vessels that Kvichak has ever built," said Scott Weiler, Kvichak's project manager. "I am very pleased with our new generation of HYSUCAT foils."

Powered by Caterpillar 3406 engines rated for 700 BHP at 2200 RPM, the I*RVINGTON* has a top speed of ~34 knots and a cruising speed of ~28 knots. "The distances between the channels surveyed by the IRVINGTON are significant," explained Collier. "The high cruising speed allows us to travel to a work site much faster and spend more time surveying thereby providing a substantial increase in operational efficiency over our existing monohull vessel."

UNMANNED CRAFT COMBINES TWO HULIFORMS

(From Speed at Sea, August 2003)
by David Foxwell

Developed by the Carderock Division of the Naval Surface Warfare Center (NSWCCD) as part of a broad survey of potential designs, the Planing Hydrofoil - Assisted SWATH Transport (PHAST) is one of a number of hullforms - and probably the most advanced - that are being examined for their military potential as unmanned surface vehicles (USVs).

Interest in all types of unmanned vehicles is growing rapidly and widespread use is already made of unmanned air vehicles (UAVs), with growing use by the military of unmanned underwater vehicles (UUVs).

From the viewpoint of the US Navy, the main advantage of USVs is that they present a potentially highly effective means of conducting many operations without risking the life of a highly trained sailor, whose training may have cost many millions of dollars to complete. USVs could thus be deployed in 'high threat' areas where it would be unacceptable to send a manned vessel, and can remain on station for a long time without re-supply or human intervention.

Although US Navy ship and boat designs tend to develop slowly, it was quickly recognised that USVs might called for completely different hullforms, or modified versions of existing hulls, so concepts such as a very slender vessel, a surface effect ship (SES), wing-in-ground effect (WIG) craft, several multihulls and semi- submersible craft have all been examined. Also, innovative propulsors such as advanced waterjets, surface-piercing propellers, power vent technology, vortex combustion, and podded electric systems have been considered.

Recognising that certain hullforms have characteristics that make them more suitable to certain operations than to others, and to enable the USV to have dual operating modes, both at low speeds carrying a useful payload

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UNMANNED PHAST & PHIN
(Continued From Previous Page)

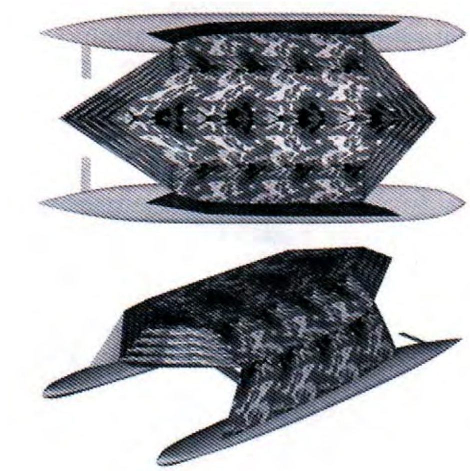
and at high speeds when in transit, the hullform of the PHAST was modeled on that of a Small -Waterplane - Area Twin-Hull (SWATH) vessel combined with foils to provide lift.

At low speed, the PHAST will behave as a SWATH, providing efficiency, seakeeping and stealth, and at higher speeds it would operate in a dynamic planing mode. The pontoons for the SWATH have V-shaped bottoms to provide stable planing surfaces when the USV is operating at high speed. While planing, the main foil will supply 50-80 per cent of the lift necessary for the pontoons to plane.

Scientists at the NSWCCD who developed the PHAST design say they were faced with many challenges combining the two hullforms effectively. The most challenging was positioning the foils and propellers, which would affect the trim of the craft, which affects lift, which in turn affects its overall efficiency. To do so, they adopted an approach based on optimising planing performance by making all of the necessary adjustments at 30 knots. At other speeds, the only adjustment allowed was to change the angle of attack of the rear trimming foils.

At lower speeds, the hull was modeled as a SWATH. At higher speeds, it was modeled as a planing catamaran, with the addition of lift from the foils. The resulting vehicle is 14.5m in length and displaces 24.5 tonnes. It has a maximum beam of 7.47m and a draft of 1.82m.

Another study carried out by the NSWCCD team focused on a different hullform, a Hydrofoil Small



Combining the attributes of a hydrofoil and a SWATH, a PHAST would provide a stable. Seaworthy platform that is also capable of transiting at high speed

Waterplane Area Ship (HYSWAS). This 3.9m-long vehicle, the Planing HYSWAS Integrated Node (PHIN), was designed to deploy an autonomous sensor network based on a number of small, unmanned vehicles, and has a range of 1,095 nautical miles.

[Ed Note: See IHS NL Autumn 2002 (p.5) and the article below for related information.]

PLANING HYSWAS INTEGRATED NODE UNMANNED SURFACE VEHICLE (PHIN-USV)

(*Extracted, by permission, from NSWCCD Wavelengths, Aug 2003)*
By David Newborn and Leslie Spaulding

With the Navy's emphasis on littoral warfare, unmanned vehicles are gaining momentum and popularity inside the Department of Defense. They can provide an effective, yet low cost, alternative to risking the lives of our military personnel. A potential answer to this need is the Planing HYSWAS Integrated Node Unmanned Surface Vehicle, or PHIN-USV. The PHIN-USV development effort is being carried out by David Newborn (IHS Member) and others to evaluate the technical issues of the concept.

The PHIN-USV hull form is a derivative of the Hydrofoil Small Waterplane Area Ship (HYSWAS) hull form, which was developed at the Division in the mid1970s and demonstrated as 4-man carrying demonstrator, called QUEST in 1995. The HYSWAS hull form is comprised of three main sections (listed from the baseline up): a body of revolution, a slender vertical strut, and an upper hull, or superstructure. Attached to the body of revolution are lifting foils, which allow the vehicle to "fly" to a dynamic waterline that corresponds to roughly half way up the vertical strut. For example, the draft of the PHIN-USV decreases from 7.1 feet at zero speed to 4.4 feet at foilborne speed. As a result, the hull can pierce through choppy waves. In general, the high speed seakeeping characteristics of a HYSWAS hull form is very good through a range of sea states. Also, unique to the PHIN-USV is a trimaran superstructure, which provides good low-speed seakeeping and calm water hydrostatics.

Because of the excellent seakeeping and high-speed capabilities of the PHIN- USV, the mission effectiveness is predicted to be significantly better than first generation USVs. The intended missions of the PHIN-USV are mine countermeasures (MCM) and intelligence, sur-

Continued on Next Page

PHIN

(Continued From Previous Page)

veillance, and reconnaissance (ISR). As such, the goal of the PHIN-USV design is to provide an offboard mine reconnaissance and organic mine clearance capability to future amphibious support and littoral combat ships. The MCM capability of the PHIN-USV provides a means by which to locate, classify, and, if need be, neutralize bottom and moored mines that may threaten operational maneuvers from the sea. The PHIN, says Newborn, can also provide an organic, close-in information gathering capability for future surface combatants and amphibious support ships.

Rendering of the PHIN design

Currently at the concept stage, Newborn plans to fabricate and test a model or prototype of the PHIN-USV to validate hydrodynamic predictions and demonstrate the active control foils of the vehicle. Several avenues to accomplish this are being pursued, including graduate research for Newborn. "My personal goal for graduate school is to focus my research on control theory as applied to advanced marine vehicles," said Newborn. "This would be a perfect fit."

[Editor's Note: Cooperative education at the NSWCCD provides a growth opportunity for both students and mentors. David Newborn has been a CO-OP student for several years, shuttling between the Center and Florida Atlantic University. It is especially gratifying when a student is determined to make every moment of that opportunity count, and even more special when a bright, ambitious student meets with a wide open technological field. Such is the case with David Newborn, who created an unmanned surface vehicle (USV) design, and recently won the *Florida Career Professionals Association Co-op Student of the Year Award*. David's recognition as *Co-op of the Year* is very much deserved. The work he has produced on a concept he conceived and developed is impressive.]

LIFTING BODY TECHNOLOGY STARTS LARGE SCALE TRIAL

(From Speed At Sea, August 2003)
by David Foxwell

Lifting body technology under development in Hawaii is designed to make a wide range of conventional hullforms more stable at low speeds and more efficient at higher speeds, as well as giving them extended range. These hullforms include monohulls, catamarans, trimarans, small-waterplane-area ships as well as decp-V, partial hydrofoil and hydrofoil hullforms. The work is being carried out by Navatek, whose primary customer is the US Navy's Office of Naval Research (ONR). Navatek is based in Honolulu and is a wholly-owncd subsidiary of Pacific Marine.

The company's novel hullforms are tested in the open ocean in the waters off the Hawaiian Islands. Tank tests are also conducted at small scale to evaluate concepts. Computational fluid dynamics (CFD) analyses are undertaken using a supercomputer in Maui, which is the 12th largest computer center in the world, and Navatek also operates a 128-proccssor Linux cluster at its headquarters.

Navatek Ltd's parent company Pacific Marine is a majority partner in Pacific Shipyards International LLC, Hawaii's largest commercial ship repair facility, where a former US Navy SES has recently been converted into a Hybrid Small Waterplane Area Craft (HYSWAC) using a lifting body developed and tested by Navatek.

Funded by the ONR to the tune of US$18 million, the 48.75m (160ft), 30-knot-plus HYSWAC has a full-load displacement of 345 tonnes and was due to start builder's trials in mid-August 2003, with performance trials on behalf of the ONR due to commence in October. If the trials are successful, it is understood that the lifting body technology developed by Navatek could be proposed by a number of' the industry consortia bidding

Continued on Next Page

Disclaimer

IHS chooses articles and photos for potential interest to IHS members, but does not endorse products or necessarily agree with the authors' opinions or claims.

LIFTING BODIES

(Continued fron previous page)

to provide the design for the US Navy's Littoral Combat Ship (LCS).

The Navatek-designed lifting body was installed beneath the hulls of the former SES-200

The HYSWAC is designed to confirm, on a large scale, the three major benefits of underwater lifting bodies vcrified on an earlier, small-scale 20m (65ft), 51 tonne Navatek lifting body demonstrator, *Midfoil.* Such, benefits are supported by extensive CFD studies conducted by the company. The advantages of the lifting body technology highlighted by Navatek include a superior ride in all seas, all headings and all speeds (including zero/loiter to maximum speed); higher transport efficiency at all speeds; and extended range/payload.The lifting bodies that Navatek specialises in designing are underwater appendages attached to the hull of the parent craft using struts. Having a cambered foil cross-section, a large planform area and low lift coefficient, they generate dynamic lift at higher speeds.

Navatek's project engineer Todd Peltzer says the lifting bodies reduce fuel consumption by dint of their high lift-to-drag ratio, and by reducing friction and wave drag. They also enhance seakeeping, at low and high speeds, due to their reduced waterplane area, the use of passive damping, dynamic control and careful selection of the parent hullform. The lifting body installed on the HYSWAC displaces around 163 tonnes as it has a volume of around 160 m^3 (5,600 ft^3), and measures 2m x 10m x 12.6m (6.6ft x 33ft x 41.5ft). Thus, it is large enough to provide a significant useable volume and can accommodate propulsors.

The former US Navy SES was selected as a suitable parent hull for the HYSWAC. During the two-year design and conversion process, Navatek removed the existing SES air-lift system and all related components, and installed the lifting body, which incorporates a new drive train (engines, gearboxes, shafts and propellers), all housed within it.

The HYSWAC can be operated with variable immersion as speed increases, with the parent hull fully out of the water at maximum speed. An aft foil was also added for pitch stabilization and control, along with a proprietary advanced ride control system (ARCS).

[Editor's Note: See related article in IHS NL Summer 2002 (p.7)]

The lifting body houses the drive train: engines, gearboxes, shafts, and propellers

WATERIETS SERVE WARSHIPS FERRIES AND YACHTS

(Excerpts FromSpeed at Sea, June 2003) by Doug Woodyard

Rolls-Royce is taking the waterjet to another level of evolution with an order to supply two Kamewa VLWJ235 units for the Japanese Techno-Superliner (TSL) ferry project. Each will absorb 27MW, some eight per cent more power than any currently available waterjet.

Impressive progress continues to be made in waterjet development across the power spectrum for commercial and naval applications

Commissioned by Techno-Seaways, a Japanese consortium, the 14,500gt TSL will carry up to 725 passengers and 210 tonnes of cargo on a 1,000 nautical mile route between Tokyo and the Ogasawara Islands. A service speed of 37 knots will cut the current voyage time by 10 hours to 16 hours. The aluminium-hulled SES design, with an overall length of 140m and a beam of 29.8m, will be built by Mitsui's Tamano yard for handover in 2005.

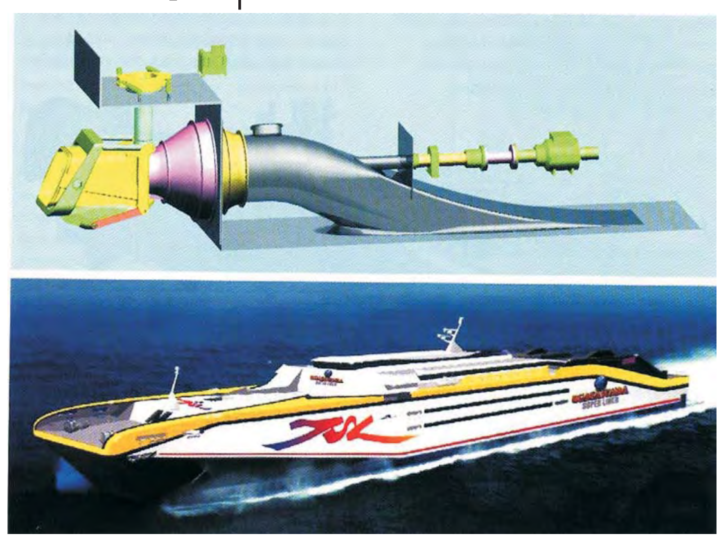
Due for delivery next year from the Rolls-Royce facility in Kristinehamn, Sweden, the waterjets will have an impeller with a diameter of around 2.35m and a different constructional configuration to the current Kamewa SII waterjet design (whose largest model features a 2m-diameter impeller). Kamewa SII series units have proven efficient and reliable propulsors but when the input power is doubled, and impeller diameters exceed 2m. A fresh approach to waterjet construction is then necessary, according to Rolls-Royce.

Design work on waterjets larger than the existing SII standard range has progressed for a number of years and the knowledge gained from an R&D programme, which has studied unit input powers up to around 50MW, will benefit the TSL project.

The VLWJ (very large waterjet) is divided into a series of elements, with the inlet duct integrated into the hull structure; the impeller chamber is bolted to the duct and the transom. Outboard of the impeller chamber is the guide vane chamber and the steering and reversing unit, which is operated by a hydraulic steering actuator located inside the vessel and stem that protrudes downward from the compartment over the waterjet units. The impeller shaft is supported by a water-lubricated bearing in the guide vane chamber, with the seal box at its inboard end on the inlet duct, and supported within the hull by a split bearing.

The massive thrust is taken by a separate thrust block in the hull, connected to the impeller shaft by a stub shaft and coupling.

Kamewa 125 SII waterjets have been selected for the X-Craft, an experimental high speed aluminium catamaran which may be used to prove technologies for application to the US Navy's Littoral Combat Ship. Designed by UK-based Nigel Gee & Associates, the X-Craft, 73m-long and 22m-wide will be built by Nichols Brothers Boat Builders in Washington State for the US Navy's Office of Naval Research (ONR) and evaluated for advanced hydrodynamic performance, structural behaviour and propulsion system efficiency. Speeds up to 50 knots with high manoeuvrability are sought from four waterjets with a combined power input of 50.4MW Mixed-flow type pumps contribute to the 90 per cent-plus efficiency rating of the Kamewa 125 SII units.



Rolls-Royce is supplying two Kamewa VLWJ235 units for the 3 7-knot 14,500gt Japanese Techno-Superliner. Each will absorb 27MW

Over 180 Kamewa waterjets are currently in use with the US Navy on vessels such as the Mk V class and 11m RIBs deployed extensively by the Special Operations Command; and more than 1,550 units are operating worldwide in 20 classes of naval tonnage.

Continued on Page 12

LE FOILBOARD

by Gerard Delerm

[This is the second part of the "Le Foilboard" article that appeared in the Summer NL.]

Principle

Le Foilboard consists of a standard sailboard with hydrofoils connected beneath it.

For this first project an old 80's custom 'funboard' with following characteristics was used:

Length: 2.90 m (9.5 feet); Width: 0.59 m (1.9 feet); Volume : about 110 litres (6713 cubic inches)

The board has a narrow stern because it is an old design. Modern boards have a wider stern. In fact the board shape is not very important because, when the sailboard is running, it is "flying" on its hydrofoils without the hull contacting the water. The board I used had a very important advantage: It was FREE.

The hydrofoils arrangement consists of an inverted T main foil fitted at the board rear and a planing surface (called "canard") fitted near the board bow. The main foil was built out of plywood. This was hand made using classical tools, namely a file and sand paper. I used templates to obtain accurate foil profiles but you can easily imagine that the result is not perfect. A CNC milling machine could give a better result. None the less, subsequent tests showed it works! The foil was then laminated with fiberglass and polyester resin and reinforced at the strut junction.

The main foil position on the longitudinal axis is very important for the board pitch stability when running on its foils. Not accurately knowing the centre of gravity of the sailboard when flying, I had to make a long adjustable foil box to accommodate the main foil strut.

The canard planing surface works is able to track the water surface at any speeds beyond takeoff. As such, it provides the pitch stability for the sailboard. The width of this planing canard also provides roll stability. This canard was made out of moulded fiberglass and polyester resin. It is connected in a standard box fitted in the board nose. The dimensions and angle of attack of this planing surface allow the bow to take off quickly.

Tests and Performance

The first tests were a little surprising. I was concerned I may have some problems with the lifting forces generated by the foils because I was not sure about my hydrofoil planform area calculations. In fact, the board took off on the third test, when the wind speed was strong enough (about 15 knots). However two problems appeared. Firstly, there was a poor balance between the centre of lateral effort and centre of lateral resistance which made the board luff. Secondly, ventilation occurred at the main foil strut. To try to eliminate these two problems, I equipped the main foil strut with fences to avoid ventilation and I fitted a fin at the rear of the board. This modified design steers well and takes off in 15 to 18 knot winds.

The speed of this design is not wonderful being about the same as a classical board, and ventilation initially

still persisted at high speed. I made some further minor changes on the main foil and that overcame the ventilation problem.

Having solved the original problems, I decided to take "Le Foilboard" out in stronger winds. A new problem then appeared. When my friend applied the maximum sail power in a 20 knot wind, the front canard took off and the board pulled its nose up. This can be seen in photos on my website. In short, I think this is due to the main foil position not being correct in relation to the foot-straps and the rig. Unfortunately, I could not move the main foil back any further and so I needed to make and fit another foil box.

More than one year has elapsed since the last modification. There were no significant tests in the intervening period, mainly due to a lack of strong winds. At last, on 2 January 2003, we had strong enough wind (about 25 to 30 knots) so the modified board was again tested. Now it isn't running correctly: take off is difficult and once

Continued on Next Page

LE FOILBOARD

(Continued fron previous page)

flying, sailing is also a little difficult (due to unsteadiness). There is however a positive point: the board no longer pulls up by the nose. It appears that the main foil angle of attack is not ideal during take off and so the design will need to be further refined.

The Future

The second prototype, designed and build by the undergraduates of ENSCPB is almost ready. This is called “Le Foilboard II”. Some of its characteristics are:

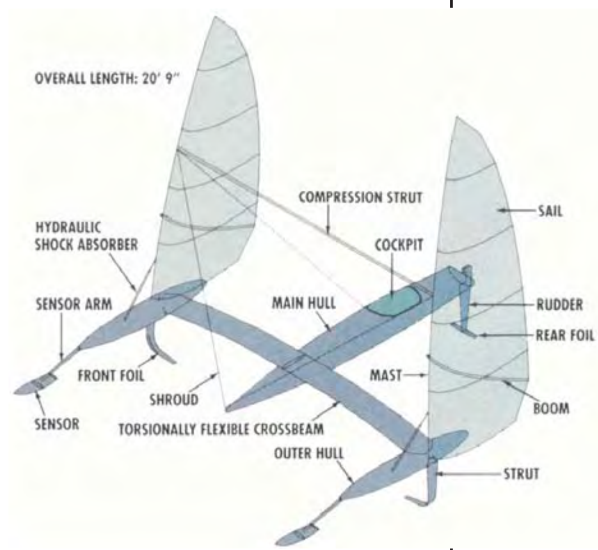
Board Length: 2.70 m (8.85 feet); Width: 0.75 m (2.46 feet); Volume: 150 litres (5.29 cubic feet)

The foils configuration is also a canard type, but the main foil is further aft than for the first prototype. The bow canard foil is a surface piercing V type hydrofoil. The main foil has two struts to give more strength than the prototype. A second main foil type will also be tried, that having a V foil with 3 struts.

For more pictures of “Le Foilboard” and ”Le Foilboard II” please visit: http://gerard.delerm.free.fr/clair/b_page2a.htm which I will update from time to time. If you have any comments to offer please email me at: gerard.delerm@free.fr

Greg Ketterman’s Trifoiler Longshot

Elsewhere in this Newsletter, we welcome Greg Ketterman to IHS. Greg’s speed sailing hydrofoil *Longshot* was briefly described in an article concerned with speed sailing in the Spring 2001 Newsletter. However now is an ideal time to revisit this neat and fast design. A full article on the *Longshot* appeared in the January 1991 issue of Popular Science.



Longshot was designed by Greg Ketterman and built with his brother Dan. As seen in the illustration, the craft has a trimaran layout with the crewman seated in the central cocoon. The outriggers (or amas) each support a sailboard type rig and a pair of L-shaped foils. An inverted T-foil rudder is mounted at the stern of the centre hull. To provide roll and pitch stability, the incidence of the pair of outrigger-mounted foils is controlled by small planing surface sensors attached rigidly to the outriggers. As these planing surfaces track the water surface they twist the carefully tailored glass-and carbon-fibre reinforced composite cross beam attaching the outriggers to the centre hull and in turn regulate the angle of attack of the outrigger mounted foils. This elegant solution avoids the need for any mechanical linkages.

‘Pilot’ Russell Long gained the world sailing speed record in Class A at 37.18 knots with *Longshot* at Stafford Lake in Alberta during the early 90’s and later this was improved with a top speed of 43.55 knots, a record which is still held in its class (sail area of 10 to 14 square metres).

In the Popular Science feature, Greg Ketterman compared the design of *Long- shot* to an ice boat: “One of the reasons an ice boat is fast is because its sail always stays upright in the wind, where it generates maximum forward thrust”. The same result is achieved with *Longshot* through the incidence control of the L-shaped foils.

When he studied mechanical engineering at California State Polytechnic University, he wrote a program that determined the critical dimensions needed to achieve maximum speed with a sailboat.

The trifoiler attracted the interest of Yamaha’s recreational-product development group, which acquired the right to use Ketterman’s patents to produce a consumer version of the craft, however, production never eventuated. The Hobie Cat company subsequently adopted Ketterman’s design for a production sailboat which is known as the Hobie *TriFoiler*. This design will be reviewed in a future Newsletter.

WATERJETS
(Continued From Page 9)

Under another contract with the ONR, RollsRoyce is developing and testing the underwater discharge AWJ 21, an advanced wateriet for future naval vessels evaluating reduced signatures and improved manoeuvrability. R&D is assigned to Bird-Johnson in the USA, part of the Rolls-Royce naval marine business. Compact and with a short inlet tract less susceptible to air entrainment, the AWJ 21 unit is flange mounted to the vessel, as with conventional waterjets, and also has comparable nozzle and bucket steering/reversing arrangements. Contributing to a pump efficiency of 92 per cent are: an advanced mixed-flow design and patented forward skewed blades delivering excellent cavitation characteristics; an inlet tract fostering a very uniform inflow; and a diffuser section that cancels swirl imparted by the impeller.

Kamewa waterjet families spanning power ratings from 40kW to 50MW are offered by Rolls-Royce in aluminium or stainless steel, the smallest (FF) series typically specified for naval craft, search and rescue vessels, workboats and fast leisure craft. Only the impeller, shaft and steering/reversing rods are made of stainless steel, all other components (including the inlet duct) are of aluminium construction based on strength calculations to minimise weight.

An FF-series jet installation was specified for Astra-Marine's new Masmar 75J fast superyacht, the Finnish yard claiming a maximum speed exceeding 60 knots for the 23m design. Propulsive power is provided by three Caterpillar 3412E diesel engines, each rated at 1,030kW and driving a bucket for reverse drive. The outer pair also have integrated Kamewa interceptor trim tabs yielding a fast response at all speeds.

[Editor's Note: The multi-page article goes on to describe many other waterjet developments and applications.]

IHS OFFICERS 2003 - 2004

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Ken Spaulding	Secretary

WELCOME NEW MEMBERS
(Continued From Page 2)

went back to school and received a B.S. in physics from the University of California, Los Angeles in 1990, cum laude. He then went on to law school and received his J.D. from the University of Southern California Law Center in 1993. He was admitted to the bar in California and is licensed to practice before the Northern District of California and the Court of Appeals for the Ninth Circuit. Mr. McKay has been an intellectual property attorney since 1993. Prior to joining Gunnison, McKay and Hodgson, he worked as a Patent Attorney in a large Silicon Valley law firm and as Senior Patent Counsel for a Fortune 200 Corporation.

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There are several New Members who have not provided brief biographiocal sketches for this Newsletter. They are:

Peter Cahil – from Hastings, East Sussex, England

Andrew Essex - from South Lincolnshie, England

John Foster – from Alemeda, CA

Adrian Moitie – from Ashford, Middx, England

Lee R. Wahler – from Falls Church, Virginia

Gareth Watson - from North Yorkshire, England

NEW BENEFIT

IHS provides a free link from the IHS website to members' personal and/or corporate site. To request your link, contact Barney C. Black, IHS Home Page Editor at webmaster@foils.org

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The NEWSLETTER

International Hydrofoil Society
P. O. Box 51, Cabin John MD 20818 USA

Editor: John R. Meyer | Winter-2003-2004 | Sailing Editor: Martin Grimm

CNB FOIL ASSISTED CATAMARAN ENTERS SERVICE IN VIRGIN ISLANDS

Extracted, by permission, from Fast Ferry International
November 2003

Construction Navale Bordeaux (CNB) has released details of a Voyager TM Cat 27 catamaran that entered service in September 2003 in the Caribbean. The vessel, *Caribe Surf, is* similar to two Voyager TM Cat 27s delivered to operators in the region in 1999 - apart from one significant feature, *Caribe Surf* is fitted with two full width fixed carbon fibre foils.

The builder reports, "The foils, designed and built in our yard in collaboration with our usual partners, were added to a proven hull. Indeed, during tank testing, the hull proved to be very efficient even without foils. The goal was to reduce the overall power needed to maintain a loaded cruising speed equal to or superior to 25 knots.

Photo Courtesy of CNB

Voyager TM Cat 27 Caribe Surf being launched at the CNB yard in Bordeaux

See Foil Assisted Cat, Page 3

WHERE ARE YOU IN CYBERSPACE?!

IHS relies on electronic communication with the membership to improve timeliness and reduce mailing costs. If you are a member with email, **let us know your email address!** Thank you.

2004 DUES ARE DUE

IHS Membership is still only US$20 per calendar year (US$2.50 for students). Your renewal or new membership is critical. IHS accepts dues payment by personal check, bank check, money order or cash (all in US dollars only). We have also recently arranged for payment of regular membership dues by credit card using PAYPAL. To pay by credit card please go to the IHS membership page at <http://www.foils.org/member.htm> and follow the instructions.

INSIDE THIS ISSUE

PRESIDENT'S COLUMN

To All IHS Members:

Belated Holiday Greetings from myself and the members of the Board of Directors of the Society. We hope that you all had a good year in 2003 and that 2004 will be even better.

As for your IHS, 2003 was a banner year in several respects: The Society continued to grow with 41 new members added to the Membership roles. Sumi Arima, Membership Chairman, continued to write to all non-members who contacted the IHS for any reason. Advanced Marine Vehicle CD#2 was released, and many members and non-members have ordered copies.

As mentioned previously, the IHS Board of Directors has committed to a "soul searching", "planning" effort in which we would reconsider IHS objectives/goals. Board member, Dennis Clark, is leading the planning effort. The initial step was a Planning Meeting held on September 10. It was attended by six of the Board members plus two invited guests. A photo taken by Board member, Jerry Gore, is shown here.

Front row, L to R: J. Meyer, B. Black, D. Clark. Back row: K. Spaulding, W. Ellsworth, W. White, G. Jenkins

At the conclusion of the meeting, each member was assigned the task of defining these goals taking into account the preceding discussions. Results will be reported in the Spring 2004 issue of the Newsletter.

I regret to report that our long- standing webmaster, Barney Black, has resigned his post due to the press of his newly assigned professional duties. He has assured me that he will continue to be active in the Society, but not at the fast, time-consuming pace he maintained before. At the December 2003 Joint meeting that the IHS held with the Society of Naval Architects and Marine Engineers (SNAME) Ship Design Panel No. 5, Barney was presented with a letter of appreciation from the IHS. In part it stated: "You have served as the 'Voice of the IHS' on the Internet, initiating and then tirelessly improving and updating the IHS web page, and fielding inquiries from around the world relevant to hydrofoil technology. Your responses have always been impressively quick as well as incisive and thorough. Through your efforts, you have succeeded in increasing the awareness of hydrofoil and allied technologies for thousands of people. You have done this not only by your personal communications but also by promoting greater interaction among other IHS members.“ Board member, William White, has agreed to take on the duties as IHS webmaster. We all appreciate Bill's willingness to serve in this most important role.

John Meyer, President

WELCOME NEW MEMBERS

Christophe Bouvier - Christophe is a naval architect from Lorient, France. He works for DCN (Direction des Constructions Navales) a famous European shipbuilder (FLF frigate, PACDG aircraft carrier). His interest in hydrofoil began when he was in charge of the hydrodynamic design of the surface vessel. He has joined the IHS to obtain some information about this technology, that is not really well developed in France.

John Foster – John's love of sailing began with reading the Swallows and Amazons children's books. John's messing about in boats continued right through his earning a Ph.D. in Marine Geophysics at Columbia University. In conventional sailing, John has logged over 300 days of on the water experience as a sailing instructor in the last five years. In "outside the box" sailing John enjoys messing about with a Catri 27 foil assisted trimaran, a Kiteship Outleader kite sail, and the development of a canting crab claw sailing rig.

James MacLean – James is currently studying for a Masters in Small craft technology in the Marine Technology Dept. of the University of Newcastle Upon Tyne, England. Having always been interested in the concept of hydrofoils and advanced marine concepts, he is about to embark on his third year dissertation that will be entitled "Practical design of a hydrofoil sailing craft". James intends to study the design procedures of hydrofoils with regards to adding a sailing rig

Continued on Page 12

FOIL ASSISTED CAT

(Continued From Page 1)

"The twin foils also add stability and reduce pitching. Other advantages are gains in volume due to smaller engines, weight savings, lower noise levels, better fuel consumption, less pollution, and ease of maintenance, all of which translate to less expensive purchase costs and operation.

The Carbon Fibre Foils are Positioned Midships and Aft

"As a speed of 20 knots is reached, the vessel gently rises 35 cm to settle on her planing trim, which reduces drag and underwater displacement by 40%. During the first sea trials that took place on location in real operating conditions, the recorded speed was 28 knots."

LIFTING BODY HULL TECHNOLOGY FOR SMALL LITTORAL CRAFT

(Extracted, by permission, from Navatek's Web Site)

Navatek's patented lifting body technology has been incorporated into a deep-Vee monohull. This hybrid concept is predicted to offer certain advantages over conventional hull forms.

Navatek's Hybrid Deep Vee (HDV) hull combines a patented blended wing underwater lifting body with a proprietary Serter deep-Vee hull to produce a small craft that is more stable at zero speed, more efficient at high speed, and offers extended range/payload.

Conventional monohulls suffer from significant added resistance and motions in a seaway. Their designs are generally prone to slamming and large heave and pitch motions which force operators to reduce speed or risk structural damage. The motions also increase resistance and reduce speed. The Serter deep-Vee hull design minimizes slamming, motions, and consequently has better transport efficiencies and seakeeping while operating in a seaway, and also improves crew comfort. The Serter design accomplishes this by using a Vee design that incorporates a fine entry and subtle hull contouring with high deadrise.

Deep Vee Monohull with Navatek Lifting Body (HDV-100)

The addition of an underwater lifting body, with a forward foil for heave and pitch control, further improves the performance of the Serter deep-Vee monohull. At zero/loiter speed, the added mass of the lifting body dampens motions, making the monohull more stable, allowing for safer, easier deployment and retrieval of autonomous unmanned vehicles, equipment packages and personnel. A 100-foot HDV could also provide a platform stable enough to allow for small helicopter operations. At high speeds, the lifting body provides enough lift to elevate the hull clear of the water and eliminate hull drag. The lifting body lift-to-drag ratio is higher than that of the hull and, as a result, far less power is required to achieve speeds in excess of 40 knots. The underwater lifting body also offers a third benefit. The additional displacement from the underwater lifting body can increase the monohull's payload by 15-20%, allowing it to carry more supplies, equipment, personnel, or fuel to increase its range of operations. Lastly, the separate lifting body and hull components can be designed to be reconfigured/separated to allow air transport.

Recognizing the scalability and wider acceptance of monohull designs within the Navy community, and the performance advantages of the Serter deep-Vee monohull, Navatek secured in 2001 the exclusive U.S. license to Serter designs. In Sept. 2002, the company conducted successful, at-sea model tests of its hybrid deep Vee (HDV) concept, using a 40-foot monohull incorporating a 10-foot, 2-ton Navatek lifting body. The company is currently building a 100-foot HDV demonstrator scheduled for launch in Spring 2004.

Navatek's first lifting body technology demonstrator, the 65-foot, 50-ton multi-hull MIDFOIL, underwent successful sea trials in 2000, validating the company's CFD codes and confirming the predicted performance and advantages (speed plus stability) of an underwater lifting body. ONR subsequently awarded a

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Lifting Body
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contract to Navatek to convert an existing Navy SES-200 surface effect ship into large scale, 350-ton multi-hull lifting body demonstrator called HYSWAC. It underwent successful sea trials in waters off Hawaii in December 2003. [Ed Note: See IHS Autumn 2003 NL, p.8, for related article and pictures.]

Navatek is also currently designing for the Office of Naval Research a lifting body for the Navy's prototype Littoral Support Craft (LSC-X), to be attached to a catamaran hull being built by Titan Industries of San Diego, CA.

MAHART CELEBRATES 40 YEARS OF FAST FERRY OPERATIONS

(Excerpts, by Permission, from Fast Ferry International, October 2003)

One of the longest established fast ferry operators in Europe celebrated the fortieth anniversary of its first scheduled service earlier this year. Hungarian state-owned company Mahart Magyar Hajozasi Reszvenyta, took delivery of its first Raketa hydrofoil, *Siraly I*, in autumn 1962. After successful trials on the River Danube, the vessel was introduced the following spring on a route between Budapest, Hungary, and Vienna, Austria.

By 1963, Mahart had acquired another two Raketas, *Siraly II* and *Siraly III.* Twelve years later, its first Meteor hydrofoil, *Solyom I,* entered service. A Voskhod, *Vocsok I,* followed in 1977, allowing Mahart to withdraw two Raketas.

A major expansion in the fleet took place during 1986-1988, with the introduction of three more Voskhod (*Vocsok II, Vocsok III,* and *Vocsoik IV)* and Meteor *So1yom II.* The company's final Raketa was withdrawn in 1987.

Photograph copyright 2003 Fast Ferry International

Polesye ***Bibic I starting the 6 hour 20 minute journey from Budapest to Vienna***

Much has changed in both Hungary and Mahart during the past 40 years. The political upheaval of the late 1980s and early 1990s eased international travel and reintroduced free enterprise in Hungarian business.

In 1994, Mahart was divided into four subsidiary companies. One of these, Mahart PassNave, became responsible for the operation and marketing of the hydrofoils. The company also operates a fleet of 20 ships on tourist excursions and charters, provides on board services through Mahart Catering and owns Mahart Tours, a travel agency.

Five years ago, the Hungarian government reduced its holding in the four Mahart subsidiaries to 51 % when it sold shares to three private companies. The process of privatization continues and last month the government announced that it was to sell its remaining holding in Mahart.

Mahart subsequently became an early operator of the Polesye hydrofoil, introducing *Bibic I* and *Bibic II* in 1992 and *Bibic III* and *Bibic IV* in 1993. More recently, the original Meteor and Voskhod hydrofoils have been withdrawn and, earlier this year, the company purchased a Meteor from Fast Flying Ferries in the Netherlands. The vessel has joined the fleet as *So1yom* III.

[Editor's Note: The article in FFI goes onto further describe the Mahart operations, and shows numerous very good pictures of hydrofoils still operating in the area.]

THE STORY OF TALARIA

By Harry Larsen, IHS Member

In the late 70's I decided I needed a hobby. I chose to attempt to develop a powered submerged foil hydrofoil. The reasons were that such a project would compliment my work at Boeing. Also, I had the marine facilities and machining resources that would be needed.

The technical objective was to demonstrate that such a hydrofoil could be developed using marine rather than aerospace technologies. Also, the resulting craft would have no deficiencies versus a comparable plea-

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TALARIA
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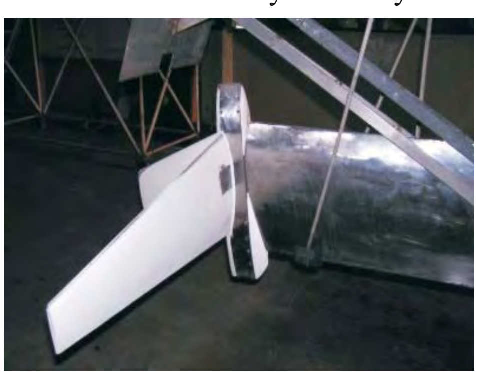
sure boat, e.g. docking, draft, trailer-ability, maneuverability on the hull, and would be at least as safe as a planing craft of the same speed. Its flying speed range was to be wide and it would have a large take off load margin. It would utilize a popular boat with all of its accommodations. Its performance objective was to provide a smooth ride in waves without slowing down, e.g. 30 knots. (Small planing boats typically drop to 10 knots or less when the waves exceed 1.5 to 2 ft.. And it is not fun to bounce around for a couple of hours getting back to the harbor.)

Talaria in Flight

I started out with towed models and test rigs exploring many different configurations. I took a 14 foot, 25hp power plywood boat and added several different foil systems, over some years, moving from the inherently stable to eventually a fully-sub-



Talaria Bow Foil

merged foil computer stabilized (Commodore 64) design.

In 1989, I bought a 24' Bayliner with a 200hp Volvo outdrive. In 1992 it had its first flight.

Talaria Aft Foils

Since 1992 I have, from time to time, replaced a few components. For example: a new front strut of stainless steel and front foil bearing similar to Sea Legs' design, the hydraulic pump with one with a lower flow rate and simplified the hydraulic plumbing, and changed the black and white cockpit display to color. During the last few of years I have been exploring higher speeds.

[Editor's Note: Harry Larsen was featured on the History channel in November 2003. The highlight was Harry's part of the show with his interview and scenes of his boat skimming over the water. He is to be complimented on what he has done - all on his own!! You are invited to visit Harry's website via: www.foils.org/talaria.htm]

MANU WAI

By Gary Fry, IHS Member

Still trying to sort out what to do with Manu Wai, the best prospect seems to be in Thailand to join the two RHS 70's ex Red Funnel from Patong to Similan Islands. Prospects in Australia sadly still very poor.

It hasn't been announced officially yet but it is 99% certain that the Jetcat service between Sydney and Manly will be scrapped next July. The Jetcats will be sold and the high speed service, inaugurated in 1965 by PT-20 and later, PT-50 hydrofoils will be discontinued. That being the case there is a business opportunity for any private operator that would like to take the run on.

Manu Wai Running Close to Shore

I'm doing an initial feasibility study to see if it would be viable to operate a high frequency 3 boat (140-150 passenger hydrofoil) as the service was at it's peak back in the late 70's to mid 80's.

YEARS OF PROTOTYE SERVICE BENEFIT NEW SERIES

(From Speed at Sea, August 2003)

by David Foxwell

The design of three 27m hydrofoil -assisted passenger catamarans being built by Vosper Thornycroft is based on *Sea Shuttle 1,* a 22.5m x 7.2m asymmetric catamaran built in South Africa eight years ago, Ray Kalley told *Speed at Sea.* He is a director of Fast Ferry Leasing Company, which will own the new passenger ferries. *Sea Shuttle I* was built for another of

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HYDROCRUISER

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his companies, Competitive Concepts (Europe) Limited, and was featured in the first issue of *Speed at Sea:* September 1995.

Designed for a speed of 35 knots fully laden, the new 150-passenger catamarans - which are branded Hydrocruisers - have tankage providing a range of 300 nautical miles and are destined, at least initially, for the Caribbean once they enter service.

Computer-generated impression of the Hydrocruiser

"Everything we learnt with *Sea Shuttle I* has been put to good use in the Hydrocruiser," said Mr Kalley. Designed, like *Sea Shuttle 1,* by Teknicraft in New Zealand, the Hydrocruiser employs a combination of symmetrical and asymmetrical sponson shapes to combine the attributes of both shapes in one hull. On *Sea Shuttle 1,* the hulls were joined aft and just forward of amidships by two fixed hydrofoils, an arrangement which Mr Kalley claims has provided superior seakeeping performance compared with a conventional catamaran hullform. "The prototype of the design that we are building now at Vosper Thornycroft has been operating for the last 67 years all over the world, in places such as the Baltic, on the Helsinki to Tallinn route, on the river Elbe in Germany, in Spain, and in France," Mr Kalley explained, "and has proven the advantages of the hydrofoil- assisted hullform, and given us a lot of experience with this kind of craft."

The symmetrical bow-section ensures directional stability in short swell conditions and following seas, whilst the asymmetrical midships and aft sections ensure softness of ride and reduced wetted area, which enhances comfort and economy.

The catamaran hull has a high tunnel ceiling with a large opening between the sponsons, which allows free movement of wind-waves without slamming on the wet-deck. Horizontal steps on the inside of the tunnel walls act both as chines to deflect green water from the hull surface, and to break up the solid water into spray. The hull is particularly soft riding, due mainly to the vertical inside shape of the sponsons, which reduces the planing area, thereby reducing the vertical acceleration forces.

A further important feature is the action of the longitudinal chines on the inside of the tunnel walls. As solid green water is broken up into spray whilst being deflected from the hull, it mixes with air streaming down the opening between the sponsons. This mixture of spray and air creates a high-density medium inside the tunnel, which causes a dampening effect each time the hull moves through a trough of a wave. Since the vertical accelerations caused by wave action on this type of hull is lower than most other types of craft, the vessel can maintain service speeds in relatively rough conditions without compromising the comfort of its passengers.

The action of the longitudinal chines inside the tunnel, as well as wide chines on the outside, both deflecting water away from the hull, reduces the wetted area and therefore the resistance of the hull, and the vertical inside shape of the sponsons minimises wave interference between the sponsons which further reduces drag.

The hydrofoil consists of an underwater wing profile spanning the tunnel at approximately amidships. The lift produced by the hydrofoil reduces the hull resistance, which increases speed, whilst at the same time increasing the load-bearing capability. The foil action reduces the power needed to maintain service speed, and therefore fuel consumption and running costs are reduced.

Unlike conventional hydrofoils, which lift the hull completely out of the water, the hydrofoil is designed to only partly reduce the draft, thereby reducing resistance, but still maintaining good seakeeping by having the hull still partly submerged, explained Teknicraft's owner, Nic de Waal. The hydrofoil further enhances the softness of the ride, especially in choppy seas.

Powered by two MWM V16 diesels each developing 810kW and driving a Hamilton *422* waterjet through a

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Reintje gearbox, *Sea Shuttle I* was capable of *25* knots when fully laden with *103* passengers. The new larger craft will be significantly faster, achieving some *35* knots fully laden. "Following our successes in previous high speed catamaran designs, we opted for a quadruple engine and propulsion package," Mr. de Waal said, which not only provides redundancy in the event of an engine problem, but reduces overall weight and cost compared with a twin installation of similar total power". With each of the Caterpillar *3412E* engines driving its own Hamilton *391* waterjet independently, the vessel can be operated on two engines only in slow speed areas, thereby reducing engine operating hours.

The Hydrocruisers are designed and constructed to DNV HSLC rules, as well as the HSC Code, and are configured with the majority of the 150 passengers on one deck, divided into an economy and a business class area. Six seats are fitted on the mezzanine deck on the level of the bridge and control station.

IMPROVED GAS TURBINES READY FOR UPTURN

(From Speed at Sea, August 2003)

by Doug Woodyard

In 1960 marine gas turbines had an efficiency of around 25 per cent at their rated power, while second generation aero-derivatives were introduced in the 1970s with efficiencies of around 35 per cent. Subsequent advances - design refinements, new materials and cooling techniques, and the appropriate matching of higher compressor pressure ratios - have resulted in some large simple-cycle turbines achieving efficiencies of over 40 per cent.

More complex gas turbine cycles can deliver specific fuel consumption closely approaching the very flat curve characteristics of larger diesel engines. Part-load efficiency can be improved in a number of ways, notably through the intercooled recuperated (ICR) cycle which uses the exhaust gas to heat the combustor inlet.

GE Marine Engines' LM-series offers five simple cycle aero-derived gas turbine designs with maximum power ratings from around 4,500KW to 42.75MW and thermal efficiencies up to 42 per cent. Valuable experience from naval propulsion applications ranging from patrol craft to aircraft carriers was tapped by the US group in the 1990s to penetrate the cruise ship and fast ferry sectors.

By June 2003 the 36 LM-series gas turbines installed in 16 catamaran and monohull high speed ferries had accumulated over 600,000 operating hours. The fleet includes the three Stena HSS 1500 class passenger/vehicle ferries delivered by Finnyards (now Aker Finnyards) in 1996/97 for UK-based Irish Sea and North Sea services.

Each of these 120m long x 40m beam semi-SWATH vessels is powered by twin LM2500 and twin LM1600 turbines in a COGAG arrangement, the combined output totaling just over 66MW and delivering a service speed of 40 knots. The installation serving *Stena Voyager* has logged over 160,000 hours in service, the highest of any GE powered fast ferry.

GE is gaining further valuable service experience from cruise ship applications: in March 2003 some 22 LM2500+ and five LM2500 gas turbine generator sets were in operation or slated for installation in 22 vessels (including four options). Due for commissioning in January 2004, Cunard Line's *Queen Mary 2* will feature a CODAG plant incorporating a pair of LM2500+ sets.

Excellent reliability and availability is reported from the plants in service, GE citing its "reliability centered" maintenance philosophy as a key factor. Land-based specialists can track critical system parameters, the daily monitoring and trending helping to identify demands for maintenance actions in advance of an unscheduled event.

LM2500+ gas turbines are also established in fast ferry propulsion, an example being the Corsaire 14000-class monohull fast ferry *Aeolos Kenteris* delivered in 2001 to NEL Lines of Greece by Alstorn Leroux Naval. The 66.2MW CODAG plant links twin

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LM2500+ sets (each rated at 25MW) and a pair of 8,100kW SEMT-Pielstick 20PA6B STC medium speed engines driving Kamewa waterjets for a service speed of over 40 knots. The package was assembled by MTU of Germany under its marine supplier agreement with GE Marine Engines.

Lower installed and life-cycle costs per unit kW were sought from the LM2500+ derivative released in the late 1990s with a 25 per cent higher power rating than its precursor. An introductory rating of 27.6MW was achieved with a thermal efficiency of more than 37 per cent; release at the design rating of 29MW and a thermal efficiency of 38 per cent followed early sets in service demonstrating the traditional reliability and availability of the LM2500. The current maximum rating is 30.2MW with a thermal efficiency of 39 per cent.

Pictured here is an LM2500

Warship references were recently extended the selection of LM2500 turbines to power four Horizon-class anti-aircraft frigates under Joint development by the French and Italian Navies (marking the first application by the French Navy of LM-series turbines). The eight propulsion sets required will be supplied to the yards via FiatAvio, a GE packager. Some 29 navies have now specified LM-series gas turbines for propulsion applications ranging from patrol craft to aircraft carriers.

A contract from Northrop Grumman Ship Systems calling for twin LM2500+ turbines for the US Navy's eighth LHD WASP (LHD 1) class multi-purpose amphibious assault ship represents the first military application of' the uprated model.

The potential of its highest powered design for diverse propulsion duties is promoted by GE, citing the LM6000's trouble-free service on power barges, platforms and floating production, storage and offloading vessels. By March this year the industrial LM6000 fleet numbered over 600 sets with aggregate running hours of more than seven million and a reliability factor of 99 per cent.

Introduced in 1990, the LM6000 now has an efficiency of 41.9 per cent at the ISO rating point and a power output up to 42.75MW. A single set could serve as the boost engine for large fast ferries in combination with diesel engines, while multi-sets would satisfy high speed deep-sea freight carrier propulsion demands.

GE's dominance in the commercial propulsion market will be challenged more effectively by a wide-ranging program of simple-cycle and advanced-cycle aero-derived gas turbines from Rolls-Royce covering outputs up to 50MW.

A new simple-cycle marine gas turbine with a thermal efficiency exceeding 40 per cent, the British designer's Marine Trent 30 is scheduled for commercial availability from early 2004 offering outputs up to 36MW from a package weight of' 25 tonnes.

Availability, reliability and maintainability were prime goals in setting the design parameters for the MT30, the engine featuring some 50-60 per cent fewer parts than other aero-derived turbines in its class. A sound basis is provided by an 80 per cent commonality of parts with the aero Trent. Specialised coatings are applied where necessary for protection against the marine environment; and component longevity is fostered by internal temperatures and pressures substantially lower than those at the aero engine take-off rating.

A rating of 36MW is available at the power turbine output shaft at ambient air temperatures up to 26 degrees C, with a corresponding specific fuel consumption of 207 g/kWh; under tropical conditions (32 degrees C air temperature) the output is 34.1MW Competitive efficiency is sustained down to 25MW and thermal efficiency is similar to that of high speed diesel engines, Rolls-Royce reports. The MT30 is designed to burn the widely available distillate marine fuel grade DMA.

The first MT30 development engine ran in September 2003. An output exceeding 40MW was achieved during tests which also reportedly confirmed cycle efficiencies and fuel consumption, and proved low noise and low emission characteristics (including no visible smoke).

Early breakthroughs have been made in the naval sector, the MT30 selected for the engineering development model for the US Navy's

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DD(X) future surface combatant's integrated power system.

Rolls-Royce will deliver an MT30 generator set in early 2005 to Northrop Grumman in the USA, which is responsible for the total DD(X) ship system design as well as for developing and testing 11 associated engineering development models. The set will be used to drive the model at the US Naval Surface Warfare Centre's test site in Philadelphia.

The MT30 development will serve as the basis for a more powerful aero Trent marine derivative, the 50MW MT50, specified for the long- gestating transatlantic Fast Ship freight carrier project. A full power specific fuel consumption of around 200 g/kWh is anticipated for the MT50.

Rolls-Royce also offers the only advanced-cycle marine gas turbine on the market. Developed with Northrop Grumman, the WR-21 is the first aero-derived gas turbine to incorporate compressor inter-cooling and exhaust heat recuperation to achieve a low specific fuel consumption across the operating range: a fuel burn reduction up to 30 per cent over simple-cycle turbines is reported. The inter-cooled recuperated (ICR) propulsion system package, designed to occupy the same footprint as existing power plant, has achieved a 42 per cent thermal efficiency across 80 per cent of the operating range.

[Part II of this article will appear in the Spring issue of the IHS Newsletter]

INTERESTING MESSAGES

Some interesting messages have popped up on the IHS Bulletin Board that you may have missed. Here are several:

Hydrofoils - Models: For sale: PHM: Patrol Hydrofoil Missile ship. This is a Radio Controlled model of the USS Aquilla, one of the PHM class hydrofoils used by the US Navy. The model is built in a scale of 1:30, this makes her length 135 cm, beam 48 cm, and the weight is 12 kg. The model is built according to the original drawings of the Boeing Company. The aft foil can be controlled by a servo and gyro. If you take away the deckgun, you can see the bow thruster and the mechanism to steer the bow foil. The deckgun and radar rotate and the bow foil is used for steering. It has a bow thruster (Bugschraube) for maneuvering. Deck, deckhouse and foils are made of aluminum. Included: - Model - mould, to make a new PHM hull – photo book, with many original photo's - many original drawings of the complete ship from Boeing - 18 cell NiCd 4 Amp (25.2V) - 4 cell NiCd 4,8 V for receiver - 4 cell NiCd 4.8 V for bow thruster – receiver. Capt M van Rijzen Email: dutchhydrofoils@wanadoo.nl

Hydrofoils - Military: PHM-3 USS TAURUS . "Give me a fast ship for I intend to go in harm's way." John Paul Jones would have loved to have any one of the PHMs under his command! All the ships were a bit unique and temperamental, and each crew loved theirs the most. Being from the Gemini crew I am pretty partial to her, but IMHO serving on any of the PHMs was better than being on any other surface combatant. Besides a PHM, only the sight of one of the Battleships passing close aboard would pull the crew out of their racks to line the rails on whatever warship they were on, just to get a glimpse of a PHM flying past. It was a funny thing to encounter another PHM at sea. At first, all you could see would be a white smudge on the horizon. As she got closer slowly this gray form would take shape, perched atop this mountain of white froth. As she passed, the wake kicked up by the aft struts, combined with the main propulsor output, left a clear indication with the dramatic rooster tail of foam that something special had just flown by. Nothing else like them. Very sad that they are gone. If you served on a PHM you will really enjoy a visit to the last one left in Brunswick, MO. Very respectfully, Jon Coile former LT, USN Chief Engineer, USS GEMINI (PHM- 6), Email: jon@coile.com

Hydrofoils – Military: PHM-3 USS TAURUS The PHM's were a proud and unusually tight-knit community of sailors. They were excellent ships, killed before their time by a short-sighted Navy bureaucracy. I was privileged to serve as XO of PHM-3. USS TAURUS was a great ship, with a fantastic crew, and an enviable operational record. She was the best of the lot, more reliable than most and often called upon to pick up commitments missed by broken siblings. No brag, just fact. From 1988-1990, she busted a lot of dope, and quickly saved the five survivors of a USCS helicopter crash in bad weather at night during a high-speed pursuit (which she was engaged in at the time.) She subsequently acted as SAR On-scene Commander of an eight-ship and multi-aircraft search

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SAILOR'S PAGE

FIRST UNIFOILER SCOW MOTH

By Ian Ward, IHS Member

I would like to share some ideas and experience.... I have recently modified an old non-winged scow Moth hull, placed a single foil on the centreboard and a retractable surface running foil at the bow. No rudder T foil at all. Total cost of materials to make the foils is about $200, even less if you simply modify your existing centreboard! I took it out last Sunday and got it up and going in about 10-12 kts of wind. There are many things to improve yet, but in principle it all works fine, no capsizes and some good bursts of speed on reaches!. It is really amazing to realize it is possible to sail with only ONE foil in the water! The principle is not new, Rich Miller has a sailboard already doing fantastic speeds up to perhaps 35 kts with a similar arrangement. This is just the first application to dinghies.

There is a long way to go yet, but 35kt Moth is a real possibility. This means it is possible to use existing, old boats and adapt them to foils. I see no need for a new range of specialist hulls just for foiling. In fact some of the older and more stable hulls may perform even better as they are still good in light winds. It is also relatively cheap to make the necessary modifications. The boat is launched in the same way as a normal dinghy. In conclusion, it is indeed possible to have a low cost, high speed, easy to handle foiler suitable for beginners and speed demons alike. In my opinion, most of the fears about foiling in sailing circles comes from not being able to imagine what is possible, not actually having a go and even worse, doing nothing to actively develop a solution! Some of those who looked at the original Brett Burville trifoil Moth contraption were horrified at its ungainly, impractical but fast foils and immediately wanted to ban these from the Moth class. It is only with imagination and some real drive from the Isletts, Rich Miller etc that we have made real progress, and I am sure there is a lot more to come in terms of simplification, speed, handling and low cost! There is only one way to find out, I encourage all of you to give it a go and develop your own solutions! I believe the International Moth class should be proud to be the only International sailing class currently prepared to allow foil development. Without such an open forum, Moths would have remained Scows and foiler development would have ceased at Trifoilers. In the long run I am sure Moths and all future sailing classes will benefit.

FOILING AT MOTH WORLDS IN FRANCE

Report by Rhohan Veal, International Moth Class Association. Photos by M. Poitevineau - Sports Nautiques Sablais

Les Sables d'Olonne, situated on the west coast of France, was the venue for the 2003 International Moth World Championships, also the 75th anniversary of the Moth Class.

Held in the last week of August, 45 boats from nine different countries were represented, including nearly all current World, European and National Moth champions, not to mention a number of ex-champions, including two-time World champion, Roger Angel from the UK sporting a new Skippy 3 hull with hydrofoils. Due to lack of time and development, this Moth only sailed a few times.

During an initial practice race, with a building sea breeze, conditions were perfect for hydrofoiling as demonstrated by current Australian champion, Rohan Veal. Dual World champion Mark Thorpe from Australia, and brother Les Thorpe sailing conventional Moth's, lead early. Veal managed only an average start, but immediately powered up to lift the boat completely off the water upwind to round the top mark first. Veal never looked back from here literally flying downwind and winning the race by a comfortable margin.

The first heat was held in a breeze of 5-10 knots on flat water. Veal chose not use his hydrofoils but still managed to demonstrate exceptional speed upwind and downwind on the first lap by rounding the top mark in first place with Mark Thorpe close behind. From here, the two were inseparable and never managed to get more than 15 seconds apart from each other for the duration of the race, Thorpe claim the first heat from Veal,

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FOILING
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while ex-European champion and current German National champion, Sven Kloppenburg claimed third place. Veal was later disqualified for hitting a start mark.

Heat two was sailed soon after the first with a building sea breeze of 10-15 knots. Mark Thorpe lead from start to finish, with Les Thorpe and Veal close behind.

The following day proved to have the strongest wind of the whole regatta, starting at 10-15 knots, and reaching about 18 knots by the end of the day with a choppy swell. In the first race for the day, Robinson and Veal started well at the favoured end. Veal was using his hydrofoils and screamed up to the top mark in first place followed closely by Mark Thorpe. However Veal was racing with his foils in unfamiliar conditions downwind and as a result had four spectacular high-pitch capsizes. This left the door open for the two Thorpe's to control the race finish in the first two places with Forsdike in third closely followed by Veal.

With the wind getting up to about 15-18 knots in the afternoon, Veal started the next race by heading straight in shore foiling the whole way on one tack and over the short chop to the lay line, while the Thorpe's went to sea. Veal had a small lead at the top mark, but it wasn't until all three reached the first gybe mark for the first lap, that Veal demonstrated the real speed potential of the hydrofoiled Moth, achieving about 15 knots to the next mark sailing clear of the waves, followed by an airborne gybe to the leeward mark.

It seemed as though Veal needed the first race of the day to learn how to sail his boat in this unfamiliar conditions whilst foiling, but by the second race he sailed his boat like an expert. Veal's lead extended to over five minutes by the finish of this race.

Heat five commenced in a fading 2-4 knots of wind. Current Swiss National champion and light weather expert Frederic Duvoison, got a perfect start in front of Veal and Simon Payne from the UK. Duvoison and Payne sailed straight for the shore to escape the tide influence. Other light wind specialists also sailed well to pace Duvoison including 1996 Olympic medallist, Yumiko Shige and veteran Swiss sailor Patrick Ruf, however Duvoison won comfortably.

Three heats were raced on Friday. With a building sea breeze of 10 knots in a 1.5m swell and a choppy sea, the Australians and Japanese seemed comfortable with the conditions. In heat 7, Veal (who was not using his hydrofoil configuration), won the race followed by Mark and Les Thorpe. Thirty skippers started heat 8, with Mark Thorpe winning the race by about 30 seconds over Veal and Les Thorpe.

For the final race of the day and after five hours on the water, Mark Thorpe and Veal pulled away early from the fleet, both sailing an excellent tactical race and never getting more than a few boat lengths away from each other. Thorpe slipped inside on the second last mark to win the heat.

The weather forecast for the final day of racing was for a moderating 5-10 knots. In heat 9, there was an all international podium with Veal finishing first using his hydrofoils, Tim Steinlein from Germany in second and Harrison from Great Britain in third.

The final race for the series was started in a fading breeze of about 8 knots. Kloppenburg got a great start and lead the pack to the top mark. Veal just able to foil his boat downwind in the light air, caught Kloppenburg by the second lap. The wind then dropped dramatically and Veal fell back within the fleet due to the inefficiency of the hydrofoils when the boat is not airborne. Thorpe managed to win the race from Kloppenburg and Shige.

Mark Thorpe sailed an excellent and consistent series to claim his third world championship victory. Brother Les finished in second overall, while Veal placed one point behind in third in his first world championships.

[Part II of this article will appear in the Spring issue of the NL.]

WELCOME NEW MEMBERS

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and to create a design for a general purpose small cruising/passenger vessel. As part of his course he has been shown how to effectively use CAD programs alongside the traditional lines plan to develop his design. James wanted to become a member to connect with a community that maybe able to help him to refine his ideas.

Chris Tejirian - Chris is not sure what has given rise to his interest in hydrofoils, but has had a passion for watercraft and boat design for several years. He paddles a folding kayak, for which he recently ordered a sail and outriggers. He is interested in both sail and power boats, large and small. Chris is currently posted overseas, and his previous overseas post was to the nation of Georgia. While there he found several derelict hulls of Volga hydrofoils, and had the opportunity to tour the factory in Poti, Georgia, that produced the Kometa passenger hydrofoils. He has posted several photos of the latter visit on his webpage (www.tejirian.com -> letters -> letter 8 under "August 2").

Vidar Tregde - Vidar received his MSc from NTNU in Trondheim, Norway in 1995. Shortly after he started to work at UMOE Mandal (former Kværner Mandal). This is a shipyard building composite boats, among other things, ten SES's for the Norwegian Navy. He worked there for 3-4 years, and has been working on a PhD thesis within ship design at Faculty of Marine Technology at NTNU in Trondheim. In February 2004 he will defend the thesis. He is now back at the yard in Mandal. His interest in hydrofoils goes back to his childhood in Mandal, where he was fascinated by the hydrofoil boats being built and tested at the Westamarin yard in the early 70's. Vidar is a passionate sailor, and has a dream of building a trimaran or catamaran sailboat with hydrofoils.

Lee R. Wahler – Lee has been directly involved in acquisition and introduction of over 17 ships of various types into Military Sealift Command fleet over the last 10 years. He has been involved in the development of operational requirements, operation plans and made logistic arrangements for 22 chartered ships in Afloat Pre-positioning (Prepo) Force. Lee managed up to 17 Prepo ships simultaneously for 11 years, loaded and deployed them to locations worldwide. While on active duty with US Navy he served as Executive Officer at an MSC office. He was promoted to LCDR in Selected Naval Reserve, and currently is in the USNR-R inactive reserve.

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INTERESTING MESSAGES

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group for the next 16 hours, winning the USCG MUC for that excellent performance. In 1988, her forward foil nose cone broke off in heavy seas due to repeated over stressing of the mounting tangs, caused by an immature and rash CO frequently hard turning and rapid landing her in fits of boyish abandon. A new nose cone was fabricated at Runyan Shipyard, Pensacola, FL out of 4" thick aluminum plate stock, and machined, welded, bent into shape. Ask any crew member from 1989 about being beaten severely by the anchor while foilborne at midnight off Panama in 15+ foot seas! She won the PHMRON-2 Battle "E" during that extended competitive cycle, and rightly so. Am I proud of her crew and her record? You bet!! David Lloyd LCDR, USNR (ret.). Email: KristiHdrx@aol.com

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