Some Human Powered Submarine History... and something of the future

by Kevin Hardy

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Posted To: "SUBRACE LISTSERV"

Prompted by recent postings on the UCSD hosted WSI Subrace listserv, here are a few milestones on a brief timeline of our experimental submarine community. They are told from a perspective of event organization.

Thanks to Leo Benetti-Longhini's calm and accurate reply to Lee Harris' posting. The TTU webpage is a good, impartial third party recording of these submarine events. [...]

While examples of human powered submarines date back hundreds of years, the original idea for modern human powered submarine racing was brilliantly conceived by Dr. Stan Dunn, Director of Florida Atlantic University's Department of Ocean Engineering (FAU-OE), and H.A. "Hap" Perry, President of Perry Tritech Corporation. All modern submarine design challenges are traced to that beginning. Together they created an organization, originally directed by Maggie Linskey-Merrill, to organize the first International Submarine Races held in 1989.

The original ISR which ran their series of open ocean races in 1989, 1991, and 1993 was an organization composed of three parties: the H. A. Perry Foundation, FAU-OE, and the State of Florida. For a variety of reasons, the original ISR organization chose to disband following the 3rd ISR in 1993. FAU-OE today is a partner with UCSD/Scripps Institution of Oceanography (Scripps) in the World Submarine Invitational (WSI), continuing their contributions to the evolution of the sport they began. The H.A. Perry Foundation is no longer in operation.

Kevin Hardy, through Scripps, was a strong supporter of the first `89 ISR event, producing a series of articles for the Marine Technology Society's international publication, Currents. For 1991's 2nd ISR , a Scripps team developed and successfully operated the non-propeller submarine, SubDude. They also assisted with the starting gate light design including locating a corporate sponsor, shared with other teams a low cost source of clear bow domes, shared their submarine development checklist, and shared a source of underwater deadman switches developed for their submarine and still in commercial production today.

After the 1991 ISR event, Jim Richardson, with team Sub-Human (Mare Island Naval Shipyard, Vallejo, CA) began a campaign to convince Guinness to establish a category in their Book of Records for human powered submarines. After initial approval of the idea by the U.S. representative for Guinness, Richardson began correspondence directly with Guinness in England. After several months of international mail exchanges, Guinness agreed to establish speed and distance categories for human powered submarines. Initially, Guinness had only agreed to recognize the fastest speed or longest distance regardless of the mode of propulsion, i.e. propeller or non-propeller. Jim provided Kevin with the point of contact at Guinness to

convey the benefits of having two categories for human powered submarines. Guinness agreed, provided an event protocol and methodology was established to ensure the records, once established, would be fairly challenged in the future. Richardson then advocated a new timing system which would provide accurate, repeatable and verifiable results not subject to human error. Time trial speeds were an important factor in the original ISR awards. A good measurement of speed was vital. With consent, and following Richardson's idea, Scripps hosted a consortium to determine accurate speeds of vehicles underwater. As a result, the consortium developed the video based timing system, accepted by experimental submariners as the standard submarine timing system today. In late 1992, to demonstrate the effectiveness of the timing system and methodology, two representative submarines, Sub-Human II (propeller category) and SubDude (non-propeller category) established the first Guinness records for human powered submarines.

The video based timing system was then offered, camera stands and all, to the original ISR Committee with the provision that either Jim or Kevin be added to the Organizing Committee for 1-year to transfer the technology and methodology. Unfortunately, that offer was not accepted. Ultimately the original ISR Committee disbanded following the 3rd ISR.

Under the direction of Richardson and Hardy, Scripps Institution and its academic and industrial partners, stepped in to fill the void and fulfill the promise to Guinness, holding it's first open invitational in 1994. The WSI, then called the West Coast Submarine Invitational (WCSI) was created by submariners, for submariners. Building on the base of experienced submariners, a new event format was created. It became the second evolution in human powered submarine events, and a popular format among experimental submariners.

--Submariners challenged the clock, not each other;

--Submariners challenged the medium, not the environment;

--Teams were scheduled into the basin, offering significant reductions in the costs of participation by minimizing time spent at the event;

--Teams were offered the opportunity to run as many times as they could on their scheduled day. Less time at the event, and more time in the water;

--Submariners were encouraged to learn as much as they could about submarine performance by changing the configuration of their submarine with new props, different dive planes, alternate bow domes;

--Submariners were encouraged to press the limits of design. If they broke a part they were only out of the water long enough to fix it, instead of being out of the event altogether;

--Faculty advisors found an opportunity to share methods and ideas of integrating the event design challenge into their curriculum. The victory was in the hands-on learning process. One

instructor suggested an on-line research bibliography, which was implemented through the WSI web page;

--Divisions were created to allow teams to challenge their peers. A new high school division was created based on the example of Steve Barton, a 16-year old who wasn't allowed to operate the submarine he built at the 1991 ISR in Florida. Separate WSI event records were posted for collegiate teams, and an open division;

--New categories were created to separate propeller and non-propeller designers, to encourage innovation in the area of non-traditional propulsion systems;

--The new 1-person category was created to enable faster speeds. Subshimi, built by UCSD ASME students, was the first 1-man human powered submarine built from the keel up for any race, and was successfully operated at the WCSI'94;

--Tow buoys, not needed in a basin, were eliminated, allowing submarines to go faster still;

--Misfire prone deadman switches, which automatically release an emergency buoy, were replaced with optional diver activated keelweight releases;

--Associated K-12 science and technology outreach programs were successfully implemented.

It was expected most participants would be from colleges and Universities, so design guidelines and event details were published on-line to make their access simple. As a result, the WSI web page won a website award (Top 5%) based on content and interest. The International Human Powered Vehicle Association (IHPVA) joined Guinness in accepting the protocol and methodology, creating 4 new International awards, for 1- and 2- person, prop and non-prop human powered submarines. That year, FA U-Boat broke Sub-Human II's existing world propeller record. SubDude's non-propeller record was challenged, but not broken.

During Christmas break 1995, the first east coast in-basin event was run by a newly created ISR, independently operating through a private non-profit, and following the Scripps/WSI example. The protocol and methodology, written to protect the integrity of the records and safe conduct of the event, were not followed and the event was not sanctioned. Speeds achieved established event records for the new ISR.

The 1996 WSI in California saw demonstrations of new divisions for Diver Propulsion Vehicles and electric submarines join those established for human powered submarines. Gold, Silver, and Bronze Champion Medals were struck. Opening ceremonies included Aaron Copeland's "Fanfare for the Common Man," capturing the feeling of underwater flight, and the rise of human spirit to a challenge. Thanks to an Arnold Schwarzenegger movie, a mammoth water heater was available and the San Diego basin was heated to over 80 degrees F. Bill Nicoloff's 1-man SubStandard established the new standard for subs. SubDude's non-prop record was challenged by two teams, but not broken.

In friendly cooperation with Scripps, FAU-OE sponsored the WSI'97/FAU, the first Florida open ocean race since 1993, successfully run May 2-4, 1997, in Ft. Lauderdale, FL. Jennifer Ripple and Sue Fish were event co-directors. (A prior story was published on this listserv and is in this month's issue of Sea Technology.) That prototype event anticipates a full-scale event in 1999 at FAU-OE's new Dania, FL facility, a short drive south of their main campus. The event's success defines an effective new format for offshore events.

In June 1997, the new ISR repeated it's version of the original WSI in-basin event. Rather than accept WSI event protocols, event organizers chose to remain "internally sanctioned," and speeds achieved there challenged existing ISR event records only.

WSI'98/SIO is planned for summer 1998 in southern California. Firm dates have yet to be established. Speeds of submarines are getting fast enough that our favored site, the Offshore Model Basin, is becoming a little small at 300-ft, and may be a bit narrow for the electric boat event. New venues are being explored which might be more conducive to the suite of submarine activities. WSI organizers recognize their responsibility as event organizers to select a site appropriate to the safe operation of submarines attempting to achieve high speeds underwater. Clear water, without suspended sediments, well lit, and safe for prolonged human exposure are some of the basic criteria. We will continue to meet the other components of the protocol, originally developed to maximize safety, enhance learning opportunities, and retain the integrity of the world records. Jim Richardson, VP-Underwater Division of the IHPVA, will review and assure compliance with the established norms. Questions regarding event protocol and methodology can be forwarded to him [....]

WSI'99/FAU will return with a major open ocean event near Dania, FL.

Through the WSI, Scripps and FAU-OE, together with the IHPVA, are presently working with a northern European Institution to establish WSI/Europe, hopefully to run in 1999.

WSI is a worldclass event grown from the grassroots level by submariners, for submariners. Each WSI event has seen the world record for propeller submarines moved up substantially, and innovative, new design challenges added at a rate consistent with the growing field of experienced experimental submariners. The academic partners, industrial associates, and dedicated volunteers which today comprise the WSI, have together defined the second and third evolutions in submarine events.

We are part of the beginning of a new era where cockpit submarines useful to sport divers, ocean researchers and light commercial divers will be commonplace. There are new developments to come, in habitats and life support systems, and in new working partnerships between government, industry, and academia.

And possibilities beyond those. Let's go explore them.