Air Supported Vessel (ASV) Monohull Demonstrator. Design development, testing at sea and results proving the Concept.

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ABSTRACT: Current paper will highlight the design of Effect Ship International AS’ (ESI) innovative ASV Mono 65 IPS test vessel, and present results from testing of the patented concept at sea. Presented material will give an insight in the innovation process and motivation behind the first mono Air Supported Vessel (ASV) with pod propulsion (Volvo Penta IPS). Environmental- and efficiency aspects have been focal points for the ASV team. The vessel is outfitted and instrumented for scientific data collection in order to study and evaluate the performance of the new concept. Available test data from European leading Motor Boat & Yachting’s own testing have be used to compare the new concept with current State of the Art. The authors will acknowledge the excellent relation and support from SSPA Sweden (particularly Hans Liljenberg), Volvo Penta and Humphree. The paper will also present some illustrations of ASV Monohulls fitted with another pod propulsion system recently developed by Rolls Royce Marine, and give a brief introduction to another ASV mono hull form, the ASV mono Soft Motion version prepared for Rolls Royce Water Jets or alternatively pod propulsion. The latter hull form is focusing on onboard motion reduction / comfort enhancement, with wide exploitation span.

1. INTRODUCTION

Effect Ships International (ESI) and daughter company SES Europe AS (SE) have during the last decade been in the forefront developing and testing air assisted hulls, the majority being catamarans. In 2002, ESI patented the Air Supported Vessel (ASV) concept, a high efficiency “skirt less” concept covering a variety of mono- and multihull configurations. A comprehensive test and evaluation process, supported by EU, Innovation Norway and Norwegian Research Council concluded that the ASVs exhibited several important benefits compared with conventional “wet” hulls. The ASV technology further displayed unique flexibility allowing high level of “tailor making” to suite a wide range of applications and vessel sizes.

2. MOTIVATION BEHIND THE NEW ASV MONO POD PROPULSION CONCEPT

ESI was of the opinion that configuring the ASV design first to meet the demands in the yacht / pleasure boat market was the right way to go. This market seems to need a wake up call, and reduce the high fuel consumption of medium to high speed vessels in the 15 – 30 m size range. Most 20 – 35 knots fast conventional semi planing hulls, are fitted out with shaft propulsion, not only on the yacht market, but on most other segments too, including commercial-, paramilitary- and navy.

The yacht industry is now admitting that the environmental side of operating a boat needs to be given higher priority. With the radical ASV concepts ESI has taken this challenge.

The global pleasure boat market is large in value and numbers of vessels built. Almost each country
has its own industry. The ASV IPS monohull, was designed primarily for this market, but the results will also be valid for other sectors. The ASV mono Soft Motion variant, also to be discussed, will have paramilitary, patrol boats and navy use as key applications. In between the two several variants will be developed to meet operational- and end user requirements.

Commercialisation of the ASV mono hull form will start with boats in the 15 – 20 m category, and gradually move up in size to 40 m and more. The ASV hull exhibits space and volume equal to or better than most conventional hulls. All configurations (open, enclosed and fly bridge) can use the same basic ASV hull shapes.

Motor Boat and Yachting has tested and published consumption data for the majority of the market leading pleasure boats. Recent test data sets the benchmark level for conventional 60 – 65 feet boats, operating at speed between 20 and 35 knots to be 10 – 13 litres/ NM.

ESI set an ambitious goal: To reduce the fuel consumption for the ASV test vessel by 40% compared with market leading conventional hulls.

A tabulation showing actual fuel consumption for the competitors and predicted fuel consumption for the ASV was prepared.

Figure 1. Consumption data. Sources: Motor Boat and Yachting 08-09 for Fairline 65 and Princess V 62. + Volvo Penta and SSPA initial estimates / predictions for ASV M65.

The IPS “Inboard Performance System” pod propulsor was selected for several reasons; claimed high propulsion efficiency, relatively low weight, compact and simple installation, and finally excellent user interface.

New and reliable lift fan system and patented air cushion enclosure flap arrangement were also part of the research. The fan is a double width and double inlet fan (DWDI) produced in fibreglass and epoxy for the prototype. Powering is via a Bosch Rexroth hydraulic system. Electric operation is also possible. When the new ASV’s are going into ordinary production the fan and ducts will be constructed from carbon making the system even lighter and more competitive.

Main function for the air cushion enclosure flap is to ensure a lowest possible air volume escaping from the air cushion chamber rearwards. Further the flap will contribute to improved onboard motions when the vessel is operated in a sea state. The function will be fully atomized, a new hard- and software package is under development.

3. THE ORIGINAL ASV M 65 IPS HULL

One main design aim has been to achieve low hull resistance over a wide range of speeds, another to reduce wetted surface area significantly. At speed the vessel will be supported partly by pressurized air, by planning surfaces and buoyancy. The support fractions for each element will vary with each design and speed.

From the outside the hull resembles any semi-planing hull. The sides are quite vertical resulting in a larger water footprint (and more interior volume). The main differences one will find below the waterline.

Figure 2: 3 D rendering of ASV M65 IPS original hull form

The hull bottom in the original form (Figure 2) had a large air cushion chamber with geometry as showing, two propulsion bodies and a segmented air cushion enclosure flap arrangement at the rear. The air cushion area was originally approx 38 m2. The propulsion bodies ended well forward of the...
transom, giving an almost full width cushion camber in the aft. The propulsion bodies give the innovative hull form some of the catamarans favourable roll resisting properties at rest and at speed. The air cushion is fed by pressurised air via a duct in the forward part of the cushion chamber.

The two propulsion hulls, accommodate the IPS pod propulsion. Although the small series 1, (320 kW) IPS 600 units are used in the 20 m prototype, the width of the bodies is designed to accommodate the larger series 2 units (515 kW).

In addition to housing the propulsion these planing bodies were set up to contribute with significant dynamic lift already at relative low speeds due to the high Fn v these relatively short planing bodies represent.

The idea was that the dynamic support should act around the LCG location of the vessel. When operating the vessel in a sea state the dynamic lift should contribute to a soft heave motion, contrary to a conventional planning vessel with large planing surfaces in the bow as well as in the aft, which will cause the vessel to pitch.

When the original configuration was tested the efficiency was found to be excellent, however the steering response and overall balance were not quite right.

4. THE REVISED ASV M 65 IPS HULL

The hull was then modified by extending the propulsion bodies rearwards all the way to the transom, repositioning the IPS drives, modifying and simplifying the air cushion enclosure arrangement. The resulting hull shape is showing in figure 4.

It should be emphasized that the test hull does not represent the optimum configuration for an ASV Mono of this size and type, rather what was possible without making too large changes to the first test vessel.

The air cushion enclosure flap is arranged to seal the aft part of the air cushion and reduce the volume of air escaping from the cushion at speed in a sea state. In short, reduced air escape is favourable to keep the fan power requirement at a low level. The stiffness of the flap and response can be controlled via air pressurized springs. The vessel will typically operate at close to neutral trim, while comparable monohulls from Princess and Fairline will have a bow up trim between 3 and 5 degrees. Most of the cushion periphery line is arranged for a close to uniform submersion in the water, with the exception of the propulsion body which needs to be fully submerged to secure green water to the props.

The lift fan system is situated in the bow. Air is ducted to the fan from both sides of the upper bow hull sides, into the fan room, and down into the air cushion chamber.

Figure 3. Construction of fan duct from lit fan to air cushion.

Figure 4. 3 D rendering of ASV M 65 IPS hull form revised.

Figure 5. ASV M 65 with revised hull geometry Please observe the size of the small IPS, and air intake to the lift fan forward.
The dimensions of the air intakes and outlet into the air cushion have been made to keep the average air velocity below 10 m/s during normal operation. The fan has a capacity of up to 15 m³/sec, at a pressure of 4.8 kPA, a higher volume flow at reduced cushion pressure. Power to the fan is via a purpose built hydraulic system. The system efficiency as specified will be approx 80%. A Volvo Penta D3 diesel engine, located in the main engine room is used to power the lift fan. This solution is chosen for the test vessel to provide larger flexibility in the testing and documentation of fan power requirements. Power could alternatively come from PTO on the main engine or electric drive.

For the test vessel air cushion support is approx 60% on other ASV designs up to 80% + of the total support.

Initial estimates showed that at 20 tons operational weight and 75% air cushion support on calm water the fan will need approx 50 kW of power, increasing to 65 kW at 26 tons. In a seas state the power consumption will increase due to more ventilation from the air cushion and increased volume flow. Estimates for fairly rough sea operations with above weights are 100 kW (20 tons) and 125 kW (26 tons).

5. TEST EQUIPMENT

An extensive test system has been built into the prototype. The test system has been set up to receive, process, transmit, monitor and log information and data from main engines, fan engine, hydraulic system, GPS data, air cushion and flap system.

Torque is continuously measured on the main engines shafts and on the lift fan shaft to verify actual powering requirements at all time.

Two video cameras are installed inside the air cushion chamber to monitor the conditions during operation, including water height inside the chamber (wetted surface evaluations), flap motion, spray and possible wave pattern(s) inside the air cushion.

Figure 6: RC-controller with CAN nodes

Accelerometers have also been used to log the motions when the vessel was tested in various sea states.

Figure 7: Air cushion enclosure flap air spring valves.

Logging of all test parameters has been done directly onto a spread sheet for later evaluation, or to a monitor. Evaluation of test data is extremely important for optimization of the ASV hull form and for improving the software handling the control system for operating the vessel, and planned ride control system to be developed.

The control system processes a lot of inputs including settings operated by the master at the helm station. These user settings will later give the user the possibility to choose an automatic setting or to select manual, with manual variations of several variables.
6. ASV 65 REBUILT - FIRST TESTING

The prototype has been constructed for testing, concept optimisation and documentation purpose. The hull, to main deck level, has the targeted shape and geometry, while the superstructure is a quite simple construction, built to secure a weather tight testing- and documentation environment. Approx lightship weigh prior to ballasting was approx 14 tons, giving the test crew, up to 13 tons ballast weight (at 27 tons total) to distribute for testing purpose.

After the rebuilt, the air cushion area was somewhat reduced, the wetted surfaces as well as buoyancy bodies increased; and the planing surfaces were larger than the original. The new set up resulted in more appropriate space for accommodation with the small and compact engine room located far aft.

After launch, the hovering occurred exactly as expected. The vessel lifted effortlessly and very rapidly out of the water due to the large capacities of the fan system.

Fan volume flow, pressures and pressure distributions inside the air cushion chamber were then recorded.

Taking the ASV out to sea without the fan system engaged the vessel felt and behaved just like any conventional semi planing vessel.

Engaging the fan and bringing the boat up on the cushion, the transit to cruising speed was almost without any “hump”, typical for conventional vessels of same size. Measuring the acceleration times from standstill gave the following impressive results:

<table>
<thead>
<tr>
<th>Acceleration</th>
<th>Time (seconds)</th>
</tr>
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<tbody>
<tr>
<td>0 – 15 knots</td>
<td>5</td>
</tr>
<tr>
<td>0 – 25 knots</td>
<td>13</td>
</tr>
<tr>
<td>0 – 30 knots</td>
<td>22</td>
</tr>
<tr>
<td>0 – 33 knots</td>
<td>30</td>
</tr>
</tbody>
</table>

Conditions: Calm waters, 22,5 tons displacement.

In comparison, the accelerations are much faster than i.e. a smaller Sea Ray with approx twice the power.

At top speed, 33,6 knots with the T3 propellers, 3450 RPM was recorded, very close to recommended RPM. The trim was slightly higher than the ideal, approx 2 – 2.5 degrees bow up, indicating that the vessel would benefit from a slight trim angle reduction, down to approx 1 degrees. With such a trim, the air cushion enclosure would be improved (reduced ventilation), giving a somewhat higher air support ratio and less wetted surface areas, all elements contributing to an overall resistance reduction.

With the new set up the steering problems were solved. Turing and handling at all speeds were safe and predictable. In harbour the joystick handling was a joy.

As a result of a strong collaboration with leading interceptor system supplier, Humphree of Sweden, work is ongoing to develop a new atomized Humphree system that will be a vital building block in a more advanced “ride control / ride optimizing system” for ASV monohulls.

The image of figure 9 is showing the transom/aft part of the ASV Mono IPS hull with the air cushion enclosure flap arrangement, the pod propulsion units and the interceptor system.
7. PRACTICAL APPROACH TO TESTING

When testing out a new concept a combination of trial and error in combination with a more scientific approach is important. The numbers of parameters that can be altered, and interactions between them, gives a huge number of alternatives. “Playing” with the vessel is important to narrow the path towards a sound optimum. Test and learn describes the process.

Compared with a conventional “wet” vessels an ASV have more “systems” that can be used for optimizing i.e. the efficiency at a given speed, or the ride quality in a given sea state / wave condition.

With the “basics”, including propulsion/hull integration, fan- and flap system function sorted out; feasibility of the concept and operational ability proven, the test team is now analyzing and trying to predict the effect of change for key variables, in order to prepare second generation designs with improved capabilities.

Balance between hull body parts and sustention elements over speed is key. Effects from planing surfaces (relative to speed), LCG location and loading are other elements.

Simplicity in use and operation is a requirement for a successful commercialisation. Although a large as possible degree of atomization is an overall goal, a manual override opportunity will still exist. The master is the person in charge and will have the possibilities to make his own judgements with corresponding adjustments.

The air cushion enclosure is another important element in the ASV IPR. The better the air can be entrapped the less ventilation will occur, and the less power will be used for maintaining the optimum support rate. The lower part of the air cushion chamber, often referred to as the cushion periphery line should have an equal submersion in the water. A close to neutral trim (0 – 1 degrees bow up) will be beneficial.

With the air cushion enclosure flap aft, and an optional interceptor system, the vessel’s trim may be seamlessly adjusted to counter added weight aft and/or to position the vessel to reduced motions in a severe sea state.

During the testing, the settings of the lift fan system and the air cushion enclosure flap arrangement have been successively varied in order to determine the influence and relations to the speed vs. powering and ride quality onboard. In calm waters the interceptor system does not improve the efficiency, however in waves it has been seen that it could be used to bring the bow down, improve the enclosure of the air cushion and improve the motion damping characteristics of the air cushion.

For the fan, the fan RPM, volume flow, air speed and cushion pressure will be varied from no air at all via a more “air lubrication” mode to full air support.

During the testing the relation between fan power and vessel speed has been determined. In short somewhat more air is needed at higher speeds to reduce the wetted surface areas.

In a same manner the air cushion flaps, the setting (flap angle), the spring -ratio and -damping have been studied through successively variation of the settings. Input logged will be used to develop an automated ASV ride control system.

During the testing three main loadings have been used, design load of 19 tons, and 21,5 tons and a overload case of 26,5 tons. The LCG has remained the same even for the overload case (which in retrospect is not correct.). In practice such a simulation will reveal the differences between a carbon fibre ultra light weight construction and a heavy loaded conventional GRP construction.
Assessment of the wake wash characteristic of the ASV M 65 IPS, have been documented with pictures and comparison with conventional hulls. Wake-wash from conventional vessels of this size, and at all speeds above 8-10 knots represents a considerable problem when operated in sheltered waters with high traffic density. In short the ASV has much less wake-wash throughout the full speed range.

Tests to determine behaviour at higher speeds in a sea state have been carried out. A leading, non disclosed, boat building company has performed measurements of onboard accelerations and made comparisons with their own conventional hulled vessels. The results have been positive and in favour of the ASV.

Subsequent ASV M 65 IPS vessels will take full advantage of “the positive design spiral effect” from combining market leading hull resistance (due to the ASV principles of air support and dynamic lift), ultra light weight carbon construction, low power, light- and compact propulsion/driveline and in general saving weight on all systems and outfitting details.

Compared with i.e. the somewhat smaller Princess V 62 with a light ship weight of 20,1 tons (Motor Boat & Yachting), using 2 x 1200 HP (2 x 882 kW), larger tanks and conventional GRP construction; the ASV M 65 IPS could without too much efforts save several tons on system installations, hull weight and outfitting.

Prior to testing the vessel, SSPA Sweden prepared resistance and powering predictions for the three load cases. The predictions are based upon tank testing results from of more than 1000 tank testing runs with different ASV catamaran hulls, and a resistance prediction data model by project manager Hans Liljenberg of SSPA. The model naturally uses assumptions that are hard to fully duplicate during real testing at sea. One example is the trim angle of the test vessel, which typically was measured to be higher in the reality than used in the predictions contributing to increased drag. There are further some uncertainties about the assumptions on the efficiency of the pod prop drives over speed. In conclusions the two set of values should therefore be considered as indications only. With today’s accumulated knowhow ESI would have made various modifications to further improve the overall hull design and balance.
Figure 12: Installed power inclusive fan power for ASV M 65 IPS hull at 3 different displacements, SSPA predictions and measured values.

Of more interest for the practical user will be the effect of the ESI ASV concept on measured fuel consumption – total inclusive fan powering. With more than 100 hours of testing, and a considerable of this time with logged data, the ASV test team can compress the results in below curves.

Figure 13: Measured fuel consumption for ASV M 65 IPS in litres / NM at 3 different displacements. Please note a. The 21,5 tons case is not fully optimised for lowest overall fuel (was run on too much fan power) and b. The 26,5 tons case was operated at far too high (bow up) trim angle, causing additional hull drag and too high fan powering due to excess ventilation.

The big question is how well will an ASV stand the competition from the conventional monohulls?

As the fuel consumption is a very close relation to kW used to propel the vessel to a given speed, it was decided to use test data published by Motor Boat and Yachting for a Princess V62 as a bench mark level.

Whereas the Princess V62 (2 x 1200 HP) or a smaller Riva 56 SR uses between 10,5 and 11 litres pr NM, at speeds between 25 and 32 knots, the ASV Mono 65 IPS (2 x 435 HP + fan power = less than 1000 HP) consumes less than 5 litres or less than half!

Figure 14: Comparison of fuel consumption over speed for a number of renowned and market leading pleasure boats of comparable size.

Interesting to notice is the huge improvements are valid over the entire speed range, with almost flat consumption curves for any speed between 10 and 30 + knots.

The big question is how well will an ASV stand the competition from the conventional monohulls?

9. FAN POWERING

Measurements have been made on fan powering vs. totally consumed power over speeds to achieve the optimum overall efficiency of the vessel when operating in calm waters for 3 different load cases – 19 tons, 21,5 tons and 26,5 tons.

Figure 15: ASV M 65 IPS at 30 knots + outside Finike, Turkey.

Figure 16: Fan system using hydraulic power in the bow.
For the 19 tons case the fan power typically represents 4 – 5% only of totally consumed power, somewhat more for the 26,5 tons overload case, which is higher than for an optimized hull form operated with the right trim and less ventilation (= power consumed). The 21,5 tons case was not run at optimum/minimum fan power. Overall the fan power to achieve a hull resistance reduction of more than 50% is with the proprietary solutions of ESI very low indeed.

10. **ASV MONO - SCALABILITY**

The presented ASV M 65 IPS represents the first ever ASV Mono designed to accommodate pod propulsion. The combination seems to be a perfect match, no disadvantages have yet been spotted. Although the results achieved with the prototype are excellent, there is still considerable untapped optimisation potential.

 Several variants covered by the patents and IPR may be tailor made to enhance various features requested by the market. ASV Mono hulls can be optimized towards efficiency/reduced fuel consumption, speed capability, onboard motion aspects, low draft or even accommodation space.

Whereas Volvo Penta opened the market with their smaller series 1 IPS systems (same as fitted on the test vessel), they soon expanded the market with the larger series 2 units and lately the series 3 units (IPS 1200) with 900 HP (660 kW) engines. Other similar systems from other manufacturer have also been presented lately, including Cummins, ZF and soon to be launched the larger 900 kW pod propulsors from Rolls Royce Marine AS. Even larger units are in the pipeline.

Scaled to a 40 m vessel size, the ASV M IPS concept show very competitive resistance values from below 20 knots, and with a remarkable modest...
resistance increase gradient up to 40 knots. Both from an economical and environmental point of view this is very interesting.

11. ASV MONO DESIGNED WITH FOCUS ON “SOFT MOTION”

To illustrate the variation possibilities with the ASV Mono concept, the below variant was originally designed for duties as a navy / paramilitary / patrol boat concept. Motivation behind this initiative was a strong request for more capable medium to high speed hulls, offering improved ride qualities, efficiency and robustness.

Having visited ESI in 2008 in Norway and tested an ASV catamaran prototype with WJ propulsion, representatives from US Navy and Israel Navy concluded very positively on the motion damping effects of the ASV. An informal request was made – would it be possible to develop an ASV mono – designed with focus on reduced impact and enhanced onboard comfort?

A vessel in the 20 – 30 m size could be a suitable size. Speed up to 50 kn + depending on mission and engines/systems installed. WJ propulsion for shallow draft operation alternatively pod propulsion.

ESI took the challenge and a new ASV concept with the following principle dimensions and characteristics were created:

- Hull length net approx 22 m.
- Beam net ex fenders approx 5m.
- Design max draft on / off cushion: 0,7 m / 1,3 m
- Installed total power: Up to: 2 x 1400 kW (propulsion + lift fans).
- Propulsion: 2 x Water Jets
- Range in calm waters @ 40 + kn speed, with operational displacement 38 t load – min 500 NM
- Design speed: 50 + knots
- Coastal missions.
- Hull and superstructure construction material: Reinforced carbon sandwich.

The ASV mono can in popular terms be described as a mix between a catamaran and a monohull, where air support and reduced wetted surface area are combined with displacing bodies and planing surfaces. With the selected set up the vessel will have self righting properties at rest (off the air cushion) and at speed (on the cushion). The vessel has been designed to operate at close to neutral trim (0 – 1 deg bow up). If required the trim can be modified by means of interceptors, cushion flaps and air cushion management.

The innovative hull is further characterised by a sharp bow section, with a narrow bulbous bow, arranged to stay out of the water when the vessel is travelling at high speed in calm waters, and acting as a combined volume body / pitch damping unit when travelling at speed in waves. Above this wave piercing bow, the lower part of the hull is quite narrow at first, widening out to meet a knuckle line – arranged high at the utmost bow and gradually dropping until it meets the wide spray rail where the hull widens out. The purpose is to reduce accelerations resulted from fast wave impacts.

The vessel’s “water foot print area” is largely taken up by a V-shaped air cushion, starting directly behind the bulbous bow and running the full length of the hull until meeting the air cushion enclosure flaps, arranged primarily to maintain the air inside the air cushion. Pressurised air to the air cushion is fed by a hydraulic powered centrifugal fan designed to maintain a steady pressure inside the cavity even in quite serious sea states and with a max capacity (volume flow) to maintain a full air cushion without “cushion collapse” or green water slamming through the air cavity and hitting the cushion ceiling. At the sides of the hull, propulsion bodies are located. These bodies will give buoyancy (as pontoons), will act as dynamic / planing surfaces at speed and will house the propulsors, in this case Water Jets, alternatively pod props. The short length and suitable angle of attack for these planing surfaces will give a positive and significant effect.
already at relatively low speed. The planing part of these bodies are situated around the LCG, consequently the forces generated will give the vessel a soft heave support, contradictory to a conventional planing boat where the planing surfaces rather will generate bow pitch than heave at LCG.

Around the water jet pick up the bodies have a somewhat deeper hull element for suction of green water to the water jets. The water jet pick up, designed by ESI has been successfully CFD tested by Rolls-Royce Kamewa.

At maximum air support (85%) in calm water, the vessel can be raised even more out of the water and the wetted surface area can be further decreased, to improve the overall efficiency and performance. Additional elements to set the vessel in the optimum operational mode are interceptors (Humphree) arranged on the aft edge of each propulsion body and at the air cushion step (not showing on presented 3D images); and the adjustable air cushion enclosure flaps.

12. HULL RESISTANCE PREDICTIONS

Estimates on hull resistance and hull effective power for the 22 m ASV Soft Motion Mono WJ made by SSPA Sweden show very promising results. Whereas most conventional monohulls exhibit a “hump” or increase in resistance in the transition to planing/fast speed mode, the ASV will benefit from high level of air support and reduced wetted surfaces already at low speed, as seen on the ASV test vessel.

Without going into too much detail, the ASV exhibits less resistance throughout the full speed range, and less penalty for added weight (improved transport efficiency), when compared with a conventional hull.

As operation in mid range (cruise) speeds of 25 – 40 knots will represent a high percentage of the total operational profile, high efficiency at medium speed will have significant importance.

13. CONCLUSIVE REMARKS

The ASV Mono hulls represent innovation long overdue for medium speed pleasure boats and yachts.

In the opinion of the authors most yards and boat-builders have closed their eyes to the reality that the commonly used hull forms of conventional “wetted” are inefficient, uneconomical in use and polluting.
Full scale results from the ASV Mono IPS test vessel; and predictions for the ASV Soft Motion designs (WJ and Pod Prop) document that significant improvements can be achieved.

A few weeks ago ESI won the “European Power Boat of the Year 2011 – Innovation Award” with the ASV achievements.

A wide range of tailor made ASV designs, suiting a similar wide range of operational missions / applications / sizes are now available.

Construction of the first ASV crew-boat with a hull form being a mix of the ASV test vessel and the Soft Motion form has just started. Design of other ASV’s for pleasure boat use is ongoing.

The fact that ASV’s combine so well with both pod propulsion and WJ’s secures highly interesting “ASV packages” for both the medium to high speed range and the high to very high speed segment. As Volvo Penta, ZF and lately also Rolls Royce are expanding / have plans to expand their pod units in size/ kW capacity upwards to 2 MW or more pr unit, ESI foresee environmental friendly, cost efficient ASV mono configurations with length of 40 – 50 m and more.

Interested yards, boat builders and end users, are encouraged to contact ESI to discuss licensing arrangements for access to the ESI ASV IPR and patents.

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