8/15/03

The SEASNAKE

BY

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A NEW CONCEPT FOR THE ECONOMIC TRANSPORTATION OF OIL IN A MODULAR TANKER CONSISTING OF A TRAIN OF DETACHABLE BARGES WHICH CAN BE INDIVIDUALLY DELIVERED IN TO MOST ANY HARBORS.

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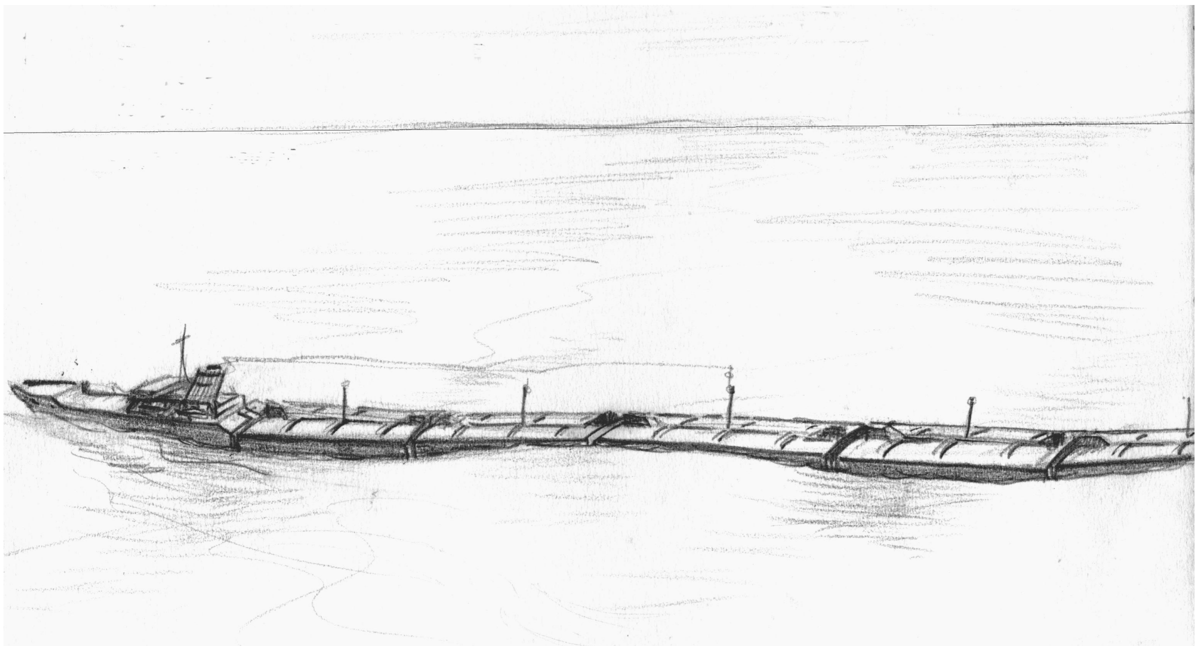
SEASNAKE



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INTRODUCTION

The Seasnake concept is a novel marine transportation system that is designed to lower the costs of delivering oil from Production Sites to refineries or storage facilities while greatly expanding its accessibility to draft restricted harbors.

It is particularly well suited to provide storage at the foot of the platforms and deliver the oil from offshore drilling sites to shore,

The essence of the system is a flexible modular ship consisting of a traction unit pulling a train of specially designed detachable barges closely coupled to each other by a mechanism equivalent to a ball and socket that when assembled behaves as a single hydrodynamic unit.

The mother ship (the train) remains at a suitable anchorage outside or inside the harbor while the last unit of the train, which is a modified powered barge, is used as a tug for delivering one or more barges into the harbor and returning any empty ones to the train.

The advantages in the Seasnake concept for moving bulk cargo are analogous to the advantages of the railroads without the disadvantage of being restricted to established railroad tracks. In another sense the Seasnake also has some of the advantages found in the container ship concept. The ship does not have to wait while the containers are being filled or emptied, it merely delivers the full containers and picks up the empty ones.

This ship can occupy practically all the niches in the oil transport business. It can function as a VLCC when configured as a long train with a 45 ft draft or it can function as small coastal tanker when configured to its smallest dimension, that is a traction unit joined to a caboose (24,000 LT for the 35 ft draft model). It is this versatility plus its low draft that makes it attractive to a ship operator, not to mention its ability to transit across the canals and other restricted water ways

The powering requirements as determined from tank testing at the University of Michigan are similar or somewhat less than of a conventional tanker of the same displacement but of a much larger draft. However when we compare the power requirements of the Seasnake with any tanker of the same displacement and low draft, the advantages of the Seasnake become readily apparent. On the other hand the power requirement of the Seasnake system is considerably less than the power requirement of an Integrated Tug-Barge. (In the order of 20%, See included graphs).

The cost of the ship has been determined be about 30% less than a conventional tanker. The size of the individual modules is such (260 ft long) that any shipyard along the Mississippi can build them.

CHARACTERISTICS OF THE SHIP

Initially the ship was conceived with a draft of 45 ft and a beam of 100 ft. and thus most of what follows applies to that ship which we will call **SS45**. Later it became apparent that for many services a lower draft would be required. A geometrically similar model was then conceived with a 35-ft draft and a 77.7-ft beam which is the **SS35**

The hull transverse under water section is circular. This maintains hull continuity as the barges roll relative to each other. The water does not know that the barges are rolling.

The barges are coupled to each other by a ball joint, situated at the center of the circle defined by the hull under water cross section. This allows relative rotational motion between adjacent barges in the three coordinate planes, (Pitch, yaw, rolling) but excludes translational motion. (Relative heaving and surging).

This free rotation of adjacent barges about their connection reduces dramatically wave induced dynamic torsional and bending stresses in the hull. In effect the ship behaves as a flexible floating string.

Hydro-pneumatic bumpers

To limit wave induced yaw and provide course stability, pneumatically springed and hydraulically dampened bumpers are fitted at the ends, at the outer edges of the barges. A suitable pneumatic pressure is maintained in the bumpers. This causes the ship to self straighten when disturbed from its initial direction and imparts limited rigidity in the horizontal plane.

Coupling device

The coupling device consists of a female mechanism mounted on the end of one of the barges. It is a self-aligning socket mounted on a carriage which rides on a pair of tracks. This allows the coupling socket to move vertically for the purpose of alignment with the mating male mechanism on the other barge.

The mating male mechanism on the end of the other barge consists of a pivot mounted shaft, which is free to rotate about a fixed point located at the geometric center of the circle described by the hull under water cross section.

Once the coupling has been achieved the coupling carriage is moved vertically on the track and locked at its predetermined position at the center of the circle described by the hull under water transverse section.

Coupling procedure

The traction unit carries on board 2 or 3 small tug boats. These are launched and are used to approximate the mating barges to each other.

1. From one of the barges a cable attached to a winch and threaded through the female socket is connected to a cable attached to the end of the coupling shaft (male end) mounted on the mating barge.

2. Once the cables are connected the coupling carriage on the female end is moved up or down until it is horizontally aligned with the male end of the mating barges.

3. The mating barges are then winched together and the coupling elements are locked into their mated position.

4. The last step is to move vertically the coupling carriage to its proper final position.

WHAT IS ACHIEVED BY THIS SCHEME?

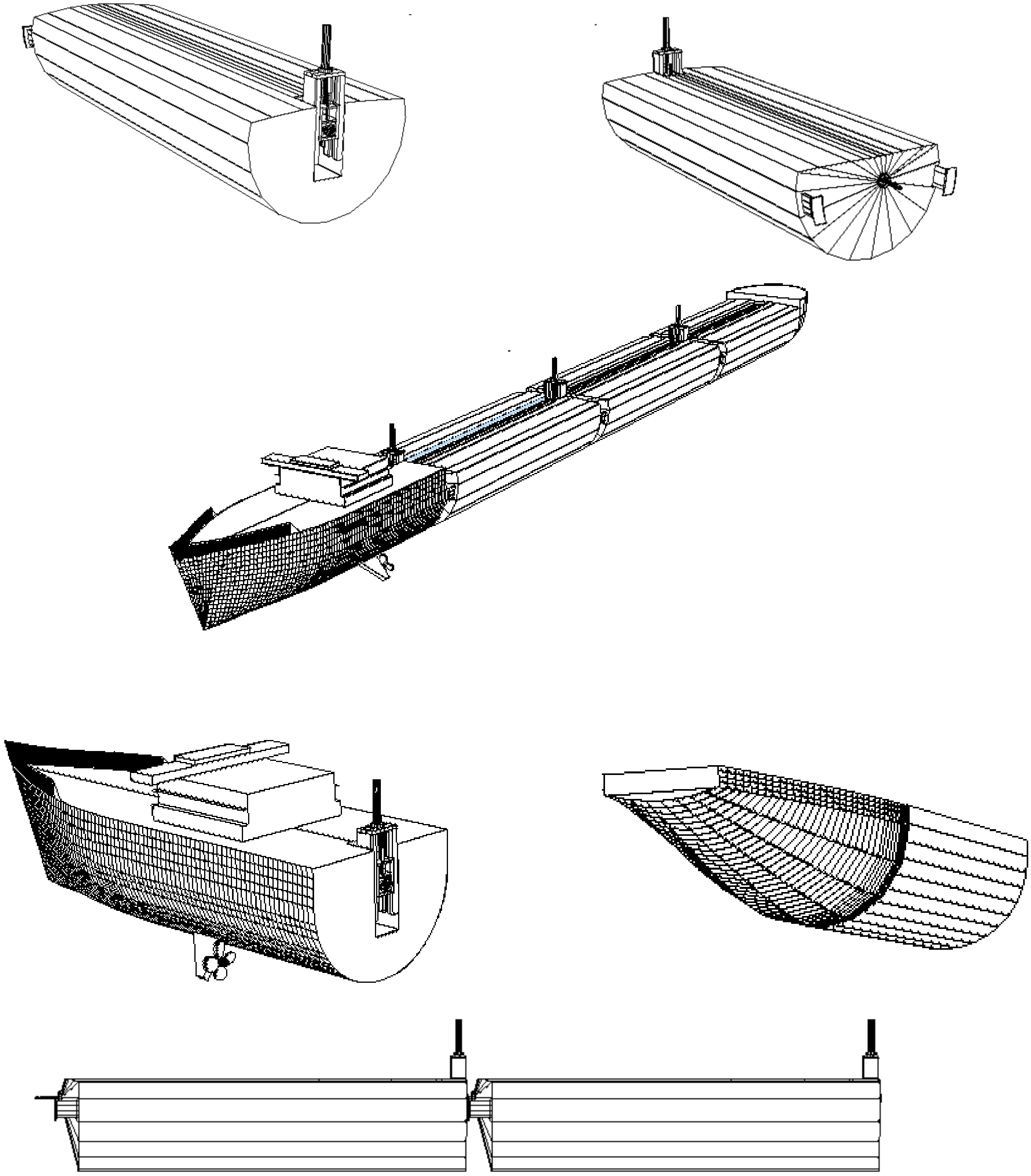
The sea snake is a flexible ship. This greatly reduces the bending and torsional stresses in the hull produced by the waves which allows a substantial saving in the amount of steel per ton of displacement.

The closely assembled barges and the over all elongated shape of the vessel should produces a low residual resistance which translates to a saving in fuel per ton of transported oil.

The barges can be individually unhooked from the mother ship at sea and delivered into most any harbor.

The relative low draft and low beam of the barges unlike conventional super tankers gives them access to most harbors as well as transit through the Panama and Suez canals and many other draft restricted passages.

SEASNAKE MODULES ILLUSTRATION



BUMPER ON SEASNAKE BARGE

The bumpers on the male end of the barge shown in the figure above are pneumatically loaded, hydraulically dampened and retractable under load. Once the units are coupled they exert and maintain a predetermined pressure on the mated barge.

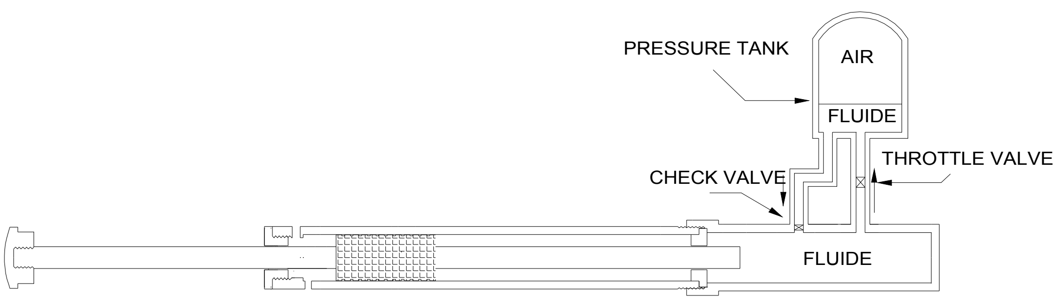
They serves 4 primary purposes:

1. - To stabilize and limit relative wave induced and hydrodynamic yaw between adjacent units

2. - To cushion the impacts during the coupling procedure

3. - To impart a limited lateral rigidity to the train, giving it a tendency to self - straighten, especially so when at rest.

4. - To absorb shocks between adjacent barges if the turning radius of the train exceeds the lower design radius limit.



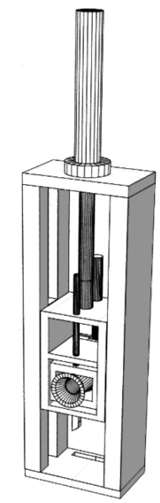
HYDRO-PNEUMATIC BUMPER

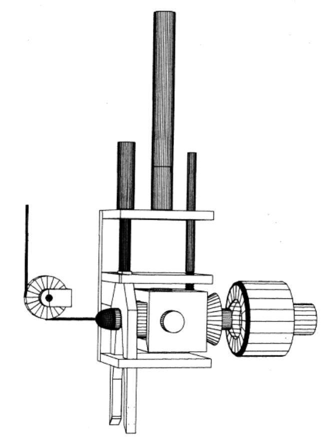
Under operating conditions, the bumper is pressing against the mated barge with a predetermined force provided by the air spring.

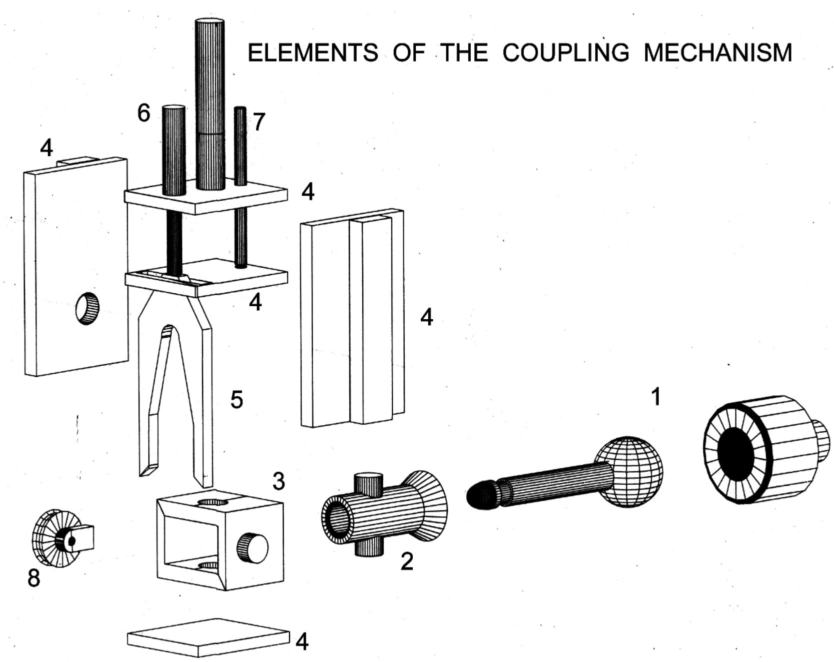
The damping is provided by the hydraulic piston, which forces the hydraulic fluid from the back of the piston, through the throttle valve, into the compressed air chamber. The setting of the throttle valve and the pressure in the pressure tank controls the degree of damping and spring force.

COUPLING MECHANISM

The illustration on the left depicts the complete female coupling mechanism
The illustration on the right shows a cutaway of the coupling carriage in the mated configuration. The female socket and the female socket housing are locked against rotation by the lock **collar** and the **set-screw.**
The male **coupling shaft socket** which is attached to the mating barge provides limited freedom of rotation.







1. **Male coupling shaft**
The male coupling shaft and ball are mounted in a socket attached to the male mating barge. The shaft is free to rotate in all directions

2. **Female socket**
Receives the male coupling shaft the socket is free to rotate in all directions while the coupling takes place.

3. **Female socket housing**
Allows rotation of the female socket within the housing in a horizontal plane and the housing is free to rotate in a vertical plane within the carriage for purpose of alignment of the female coupling socket with the male coupling shaft

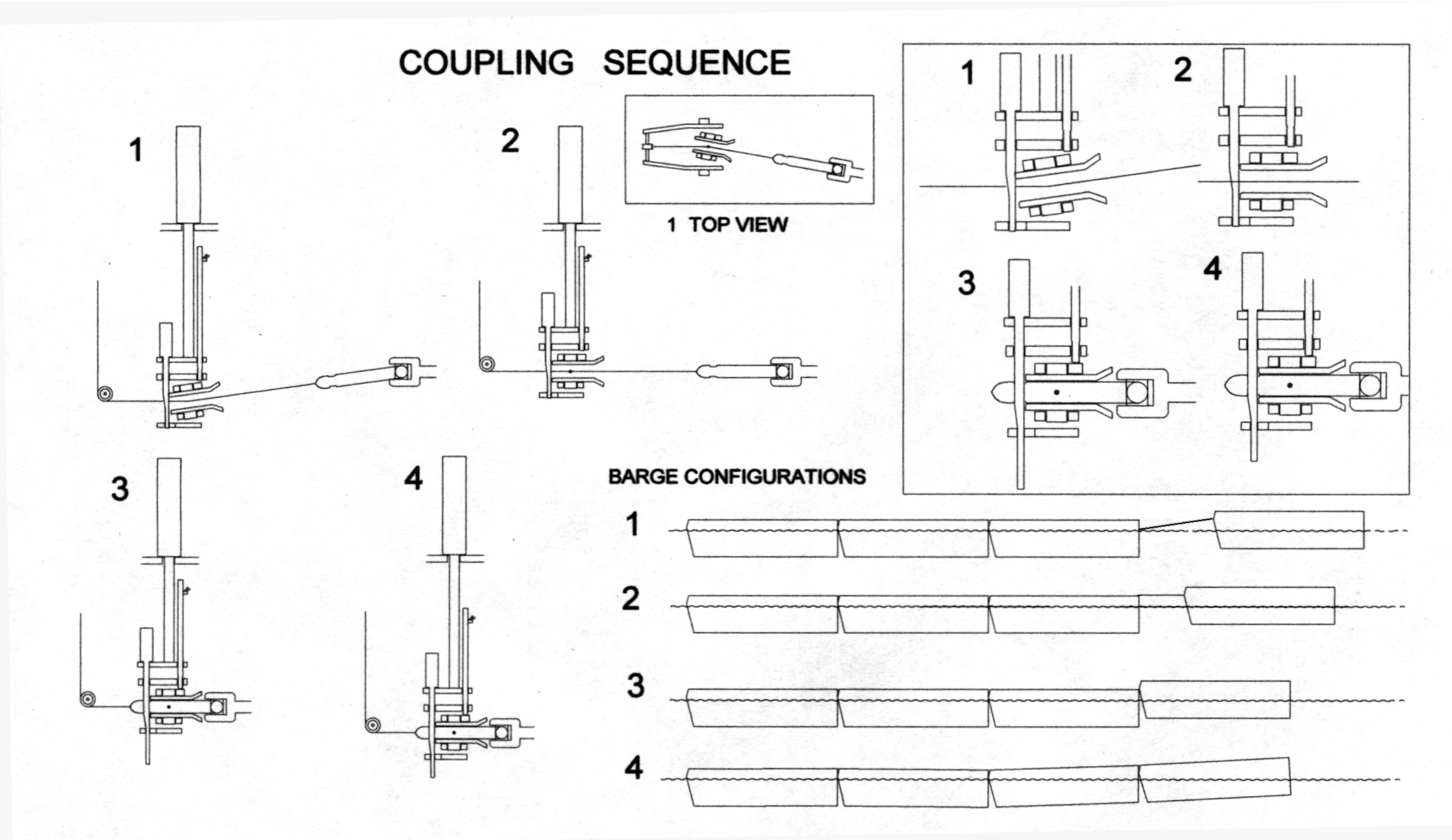
4. **Carriage housing**
Contains the female coupling mechanism. The carriage is free to move vertically in a pair of tracks (not shown here) for the purpose of horizontal alignment with the mating barge at the initiation and at the end of the coupling procedure.

5. **Lock collar**
Centers and locks the male coupling shaft in the engaged position. Prevents the shaft from pulling out. It also restricts rotation in the horizontal plane and prevents clockwise rotation in the vertical plane

6. **Lock collar actuator**
Moves the lock collar vertically for the purpose of locking ore unlocking the male coupling shaft.

7. **Set screw**
Locks the female socket housing against counter clockwise rotation in a vertical plane

8. . **Pulley**
Guides the cable attached to the male coupling shaft through the female socket to a winch on deck which draws together the mating barges.



THE FIGURE ABOVE DEPICTS THE COUPLING PROCEDURE SEQUENCE

1. - Shows the original relative positions of the male coupling shaft to the female coupling socket.

2. - The coupling carriage is raised to the level of the coupling shaft

3. - The coupling shaft is drawn into to the female coupling socket and the lock collar and set-screw are lowered thus locking the female coupling socket against all rotation.

4. -The coupling carriage is lowered to its final predetermined position

The empty barge is now connected to the train but is riding high as shown in the figure above. Subsequently this barge will be ballasted by means of a transfer of oil from the train plus water ballast in its ballast tanks (double hull construction is assumed)

HOOKING UP

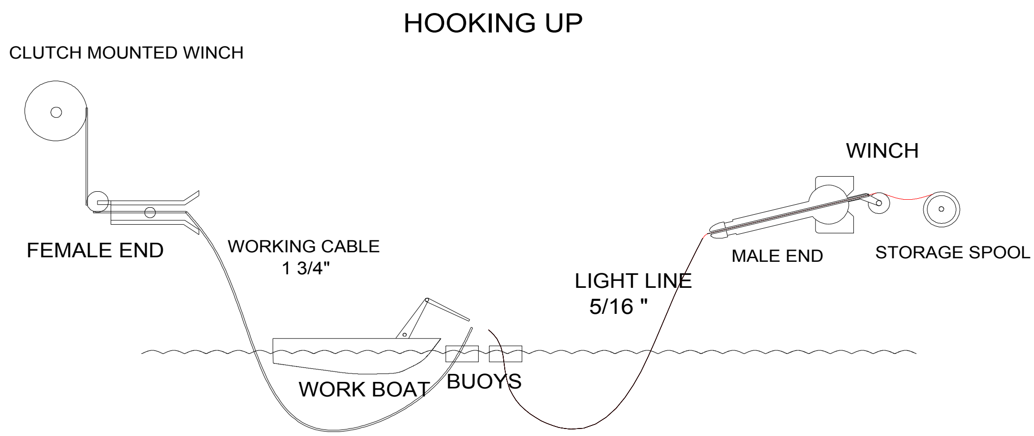
The traction unit carries on board 2 or 3 small tug boats. These are launched and are used to approximate the mating barges to each other.

1. From one of the barges a cable attached to a winch and threaded through the female socket is connected to a cable attached to the end of the coupling shaft (male end) mounted on the mating barge.

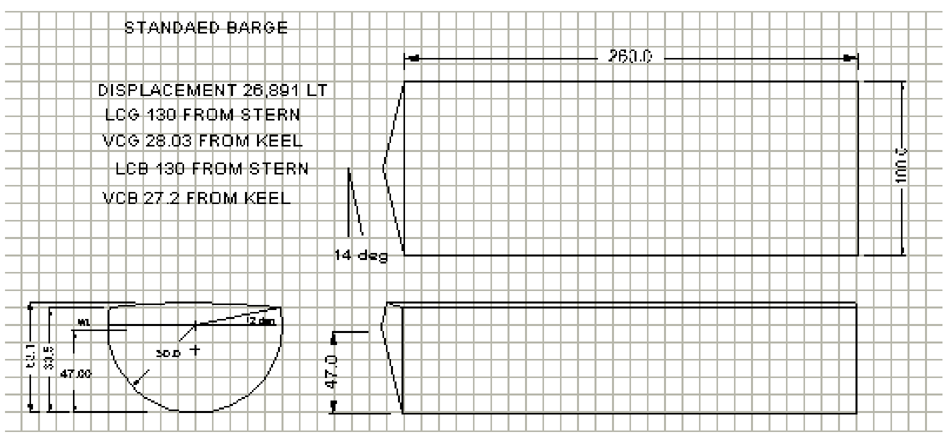
2. Once the cables are connected the coupling carriage on the female end is moved up or down until it is horizontally aligned with the male end of the mating barges.

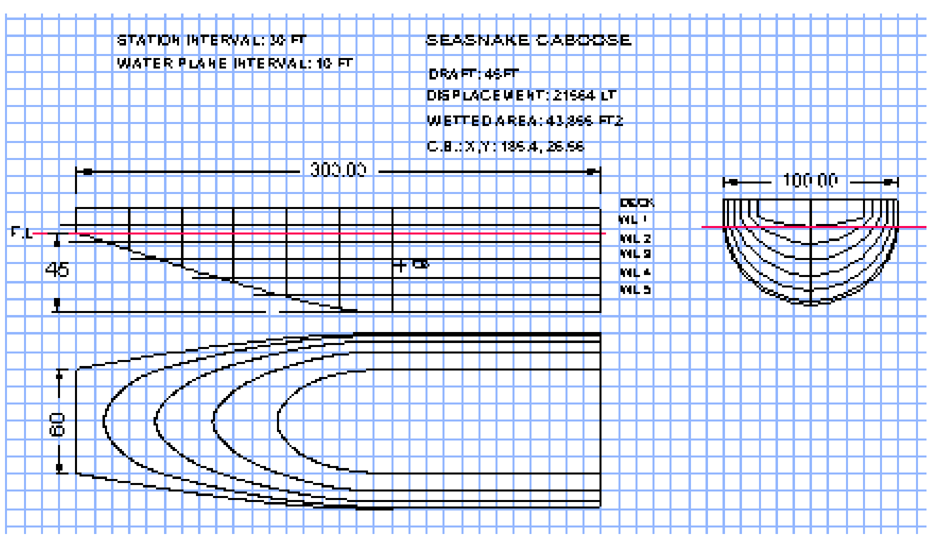
3. The mating barges are then winched together and the coupling elements are locked into their mated position.

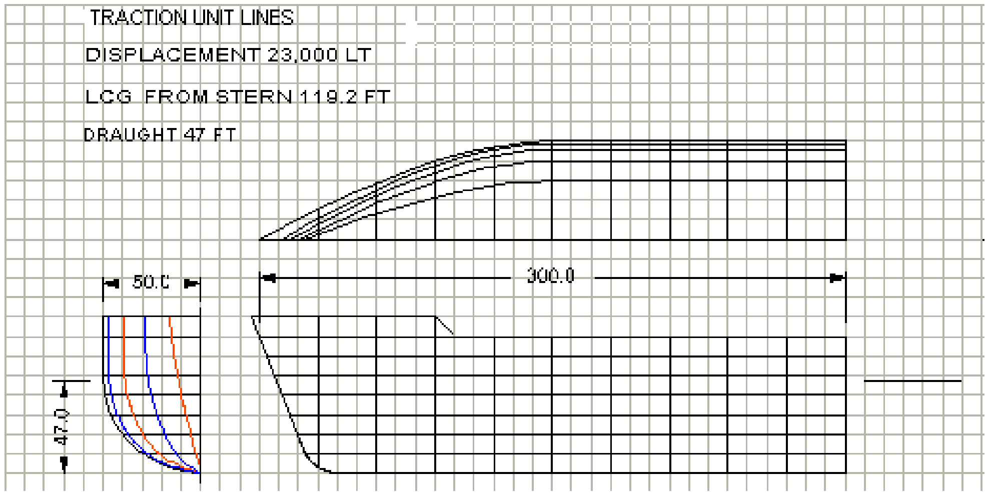
4. The last step is to move vertically the coupling carriage to its proper final position



HULL LINES for SS45







WHERE ARE WE NOW?

On January 20, 1999 a patent application was filed in the U.S. Patent office with the number 09/ 234,247 protecting all above mentioned features. In December 2000 additional Patents were filed in all major industrial countries. On Feb 6,2001 the U.S. Patent U.S. 6 182 593 was granted

A technical feasibility study was prepared by Carl Kountz, which shows the viability of the invention. This study reveals two very important aspects of the ship: First the cost of building the ship will be considerably less than a conventional tanker and secondly the cost of operating the ship will be less than a conventional tanker.

This study was then submitted to "**C.R CUSHING & CO., INC.**" located at 18 Vesey St. New York, an established Naval Architects and Marine Engineering consultants firm, for evaluation of the accuracy of the conclusions in the feasibility study.

The written conclusions submitted in the report dated September 1999 confirmed the validity of the feasibility study. As a result of their report, further engineering studies were warranted and undertaken.

In June and July 2001 and Jan 2002 series of tank tests on a scale model were performed at the Marine Hydrodynamics Laboratory of the University of Michigan at Ann Arbor to determine the power requirements and the sea-keeping characteristics. Simultaneously the department of advanced analysis of the ABS undertook a computer simulation study on the ship's response to waves and determine the forces acting on the connections
In March 2002 the Naval Architectural firm "Rosenblatt & Sons" was engaged to make an economic study of the system with the primary purpose of determining the cost of the ship and the operating cost. This study was completed in August 2003

The three primary questions were:

1. -The connection system and the Sea-keeping characteristics of the ship.

It had been noted in the feasibility study that the ship could be laterally unstable (uncontrolled yaw) under the actions of waves. Would the ship jack-knife? This led to the design and incorporation of the lateral stabilizing bumpers.
A five-module model of the ship was built and tested. It was at first towed without the bumpers. The ship started snaking.
Once the bumpers were activated and provided with a suitable stiffness the problem disappeared. The ship was course stable.

Unfortunately the results of the connection load tests were invalidated because an error in the setup of the experiment. This particular test will have to be repeated

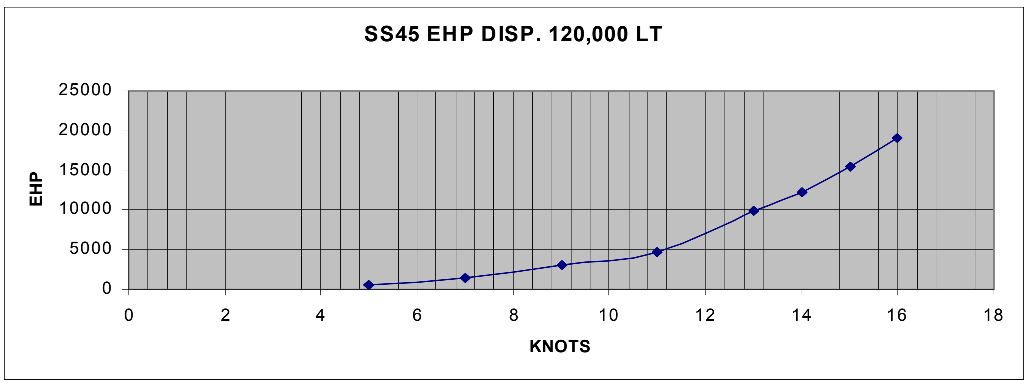
Numerous tests were made in waves including simulated hurricane conditions. The ship's response to waves showed excellent sea-keeping behavior.

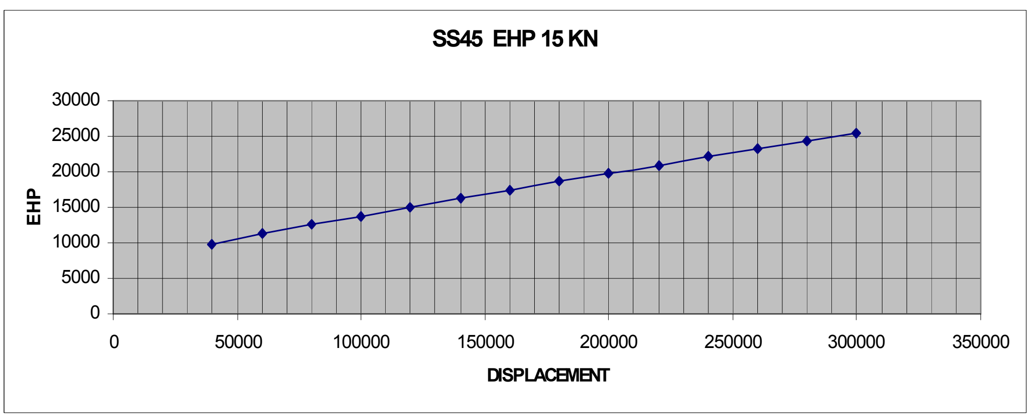
The results of the ABS study confirmed the anticipated connection loads in the original feasibility study.

2. -<u>The powering requirements</u>

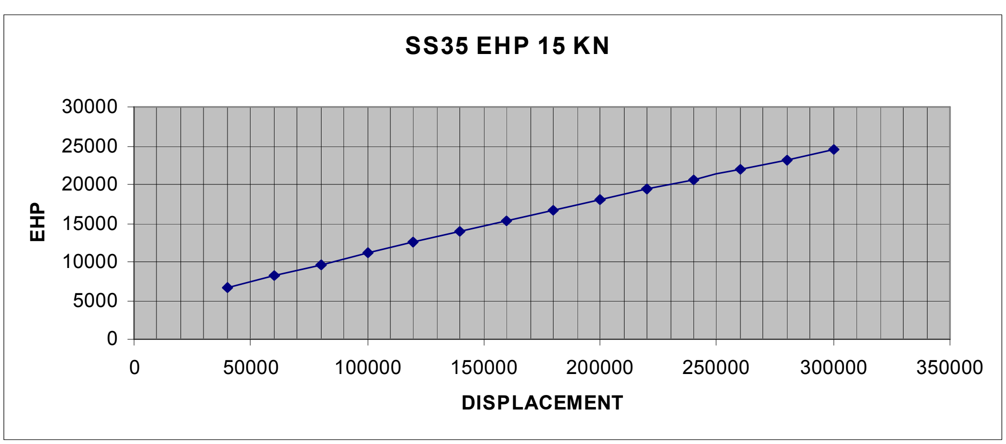
There was a concern that the gaps between adjacent barges would cause a power penalty. The results of the resistance tests showed that the drag penalty was in the order of 2%. The all over EHP was practically the same as for a conventional tanker, However when compared to a conventional tanker at the same low draft the superiority of the Seasnake is decisive.

For the 45 ft draft model

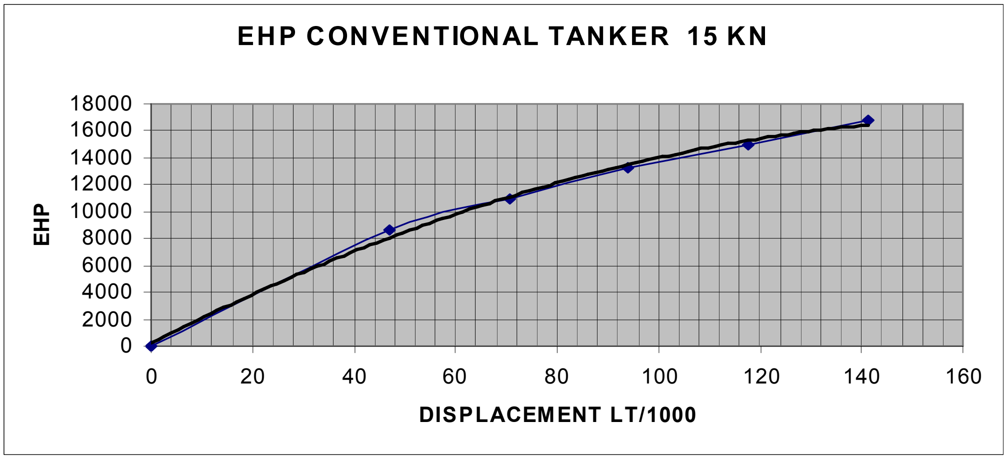




For the 35 ft draft model



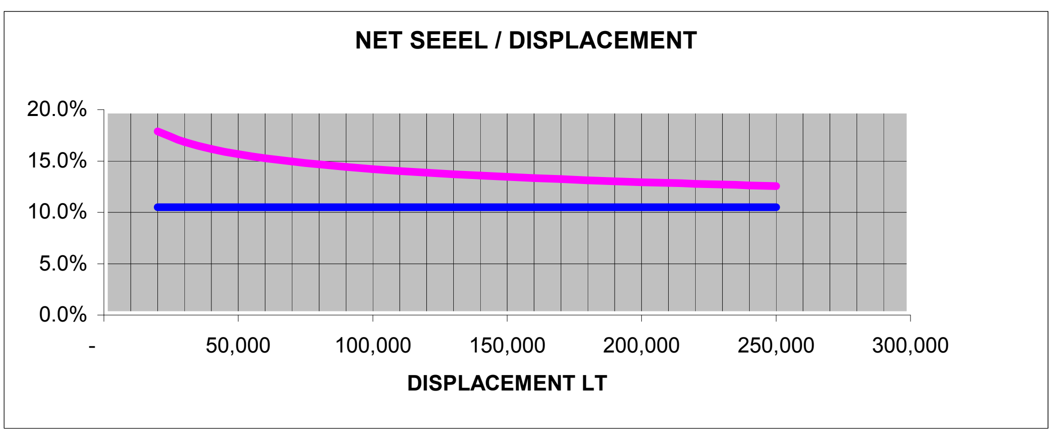
For purpose of comparison the following graph shows the power requirements for conventional tankers



An Integrated tug-barge with a displacement of 49,500 LT at 15 knots has an EHP requirement of 10,500 HP while the SS35 will require about 8,000 HP.

3. -<u>The cost of the ship</u>

A ship's cost has been found to be proportional to the net steel used in building it A dimensional analysis shows that the net steel to displacement ratio of the Seasnake runs about 11%. For a conventional tanker this ratio varies from 15% for a 50000-ton tanker to 12% for a 300,000-ton tanker. The above figures apply to single hull vessels and are given for comparison purposes. In the case of double hulls the figure for the Seasnake as well as for the tanker will be higher. However that great savings in steel will be partially offset by the cost of the connection mechanism.
The top curve in the graph below applies to the conventional Tanker while the straight curve below applies to the Seasnake. SS45



WHY THE SEASNAKE

It has been the tendency to build bigger and bigger tankers (Super tankers). The reason being is that as the tanker gets larger, the steel to displacement ratio diminishes and hence its cost. A 50,000 tanker has a steel to displacement ratio of 14.5 % while in a 300,000-ton tanker this ratio drops to about 12 %,

In the case of the Seasnake (SS45) the steel to displacement ratio is constant for all sizes (number of cars), about 11%.

Similarly, as the tanker gets larger the required power (EHP) to displacement ratio drops. In a 50,000-ton tanker this ratio is 0.18 while in a 140,000 tanker this ratio is 0.12

In the case of the Seasnake the power to displacement ratio (EHP / Displacement tons) also drops with size being about 0.15 for a Seasnake (SS35) of 50,000 tons and.0.11 for a Seasnake (SS45) of 140,000 tons

However for the conventional tanker there is a penalty to be paid. The large draft imposes restrictions to the entry into many harbors and passage across shallow or narrow waterways. Furthermore one must consider the safety factor. These large ships in spite of modern navigation equipment and stricter regulatory construction features (double hull etc.) are unwieldy and accident-prone. When an accident does happen, the consequences of the resulting oil spills are severe.

The advantages in the Seasnake concept for moving bulk cargo are analogous to the advantages of the railroads without the disadvantage of being restricted to established railroad tracks. In another sense the Seasnake also has some of the advantages found in the container ship concept. The ship does not have to wait while the containers are being filled or emptied, it merely delivers the full containers and picks up the empty ones.

SOME OTHER SPECIFIC ADVANTAGES ARE AS FOLLOWS:

The cost of the ship is estimated to be about 30% lower than a conventional tanker.

> The reason being that the ship is flexible and consequently is subject to lesser wave bending moments in the individual hulls therefore requiring less steel for hull girder strength

The building of the barges and the traction units does not require huge specialized shipyards.

> A 260-foot length is workable for any shipyard

The cost of operating the ship is competitive in fuel

> The power requirement is slightly less than in a conventional tanker and greatly less than in an (ITB) integrated tug-barge system, which is weather, restricted.

The cost of operating the ship is about 25% lower in crew than in a tanker.

> The barges are unmanned.

The accessibility to the number of harbors is vastly expanded due to the relative low draft and beam.

> Presently there are projects in Texas, Arabia and other places to build offshore terminal islands for unloading or loading large tankers and piping the oil from or to shore.

The access to limited dock space for loading and unloading is greatly increased

> The individual disconnected barges have a length of 260 ft as compared to 890 ft for a 130,000-ton tanker

The loss in down time for periodic maintenance is eliminated

> The units are sent to maintenance and replaced on a rotational schedule

The time loss in loading and unloading is reduced to a fraction of what it is at he present

> The drop and swap method of delivery insures short turn around time
> The barges are self-loading. They carry pumping equipment

Safer in case of collision.

The damage will be restricted to one barge. You do not loose the ship

Safer in case of fire.

The burning module can be quickly isolated by the quick disconnect mechanism.

Redundancy in the case of a power failure in the traction unit.

The rear unit takes over.

Passage through restricted waterways

Passage through the Panama and the Suez Canal is allowed because of the relatively low 43-ft draft and 100 ft beam. This means that the trip for super tanker from Kuwait to the Atlantic Ocean will be replaced by a trip of the Seasnake through the Suez Canal and not around the HORN OF GOOD HOPE

Versatility

The size of the ship (Number of units in train) is adjusted to the commercial needs of the carrier. The same ship is used for the delivery of 300,000 tons through the open sea, as for the delivery of 43,000 tons. in restricted waterways or for destinations requiring a smaller amount of cargo.

Temporary storage tanks

The individual barges can act as temporary floating storage tanks in harbors or at the base of offshore drilling rigs

Environmentally safer

In the case of a collision where a tank is ruptured the oil spill in a 200,000-ton tanker would be 17,000 tons. If the ship is lost, the potential for the spill could be far greater.
On the other hand in the case of a collision in a Seasnake barge (SS45), the spill from a ruptured tank would only be 2,200 tons or eight times less.

The situation for the possible acceptance of the Seasnake is analogous with the advent and acceptance of the container ships in the 1960's. It was found far more cost effective to move cargo in containers than in the previously traditional cargo ships. The cargo was packed in containers that were bodily unloaded from the ship and transferred either to the bed of a truck or to a railroad car. It took a few years for the world to adapt itself to the new mode of transporting cargo. Ports had to be revamped with special cranes and other equipment Eventually traditional cargo ships became obsolete and were gradually phased out.

HISTORY

Back in 1974 Carl Kountz was working as a mechanical Engineer in ship maintenance for a shrimp fishing company in Frontera Tabasco Mexico, called PERMARGO. One of the major stockholders in the company was Diaz Serrano who later became the CEO of PEMEX. Those were the years when Petroleum exploration in the Mexican Southeast was at its apogee As the new oil fields were being discovered the question of shipping the oil became of great interest. The problem was that the draft of the harbors in the Gulf of Mexico was too low to accommodate the large Tankers (VLCC) that were being built.

In was then when he conceived the idea of a modular ship that would retain the advantages of the large tankers and eliminate their disadvantages. He started to prepare a technical analysis which convinced him of the feasibility of the concept.

However the magnitude of the project was overwhelming and was shelved.

In 1992 Carl met his present associate, John F. Marcley. John became impressed when Carl revealed to him his dormant project. He actively encouraged Carl to revive his project and to apply for a Patent which was done.

Carl Kountz prepared a formal feasibility study and submitted it for evaluation to "C.R. Cushing & Co.", an established Naval Architect & Marine Engineering firm in New York City.
In September 1999 they finished their report with a favorable outcome. Carl then made some refinements and adjustments to his design.

On January 2000 Kountz and Marcley founded the "SEASNAKE LLC" with the stated purpose of developing the Seasnake system

The patent was granted on Feb 6, 2001 with the number U.S. 6182593B1.Thereafter the Patent was extended to a number of other countries.

In the January 2001 issue of the "MOTOR SHIP MAGAZINE" an illustrated article was published, titled " The Seasnake rattles conventional Wisdom"

In January 2001 the Advanced Analysis Department of the A.B.S undertook a computer analysis to determine the wave-induced forces acting on the hull and the connection system.

In July 2001 tank tests on a 1:94.1 scale model were made at the University of Michigan in Ann Arbor. These tests determined the power requirements and the sea-keeping features of the ship.

In March 2002 the Naval Architectural firm "Rosenblatt & Sons" was engaged to make an economic study of the system with the primary purpose of determining the cost of the ship and the operating cost.

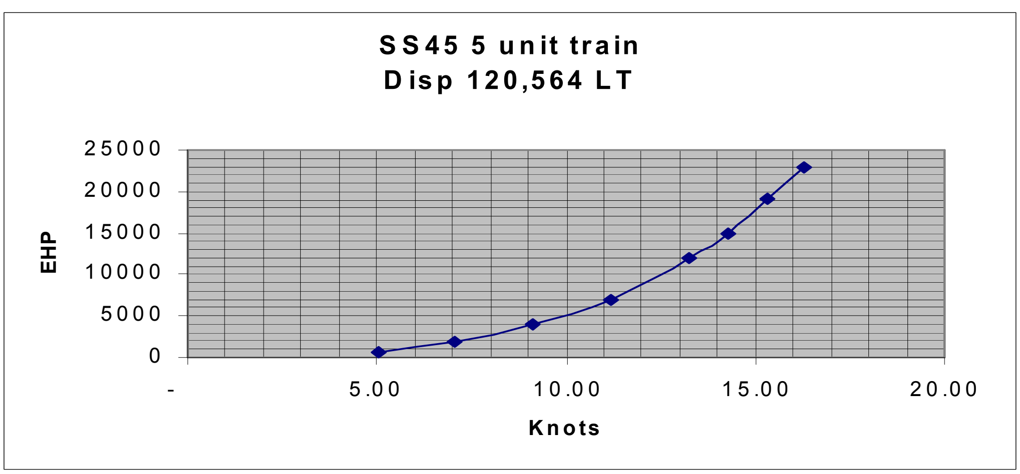
In the June 2003 issue of the "THE NAVAL ARCHITECT" International Journal of the Royal Institution of Naval Architects, a 3 page article was published, titled "Seasnake an alternative tanker proposal"

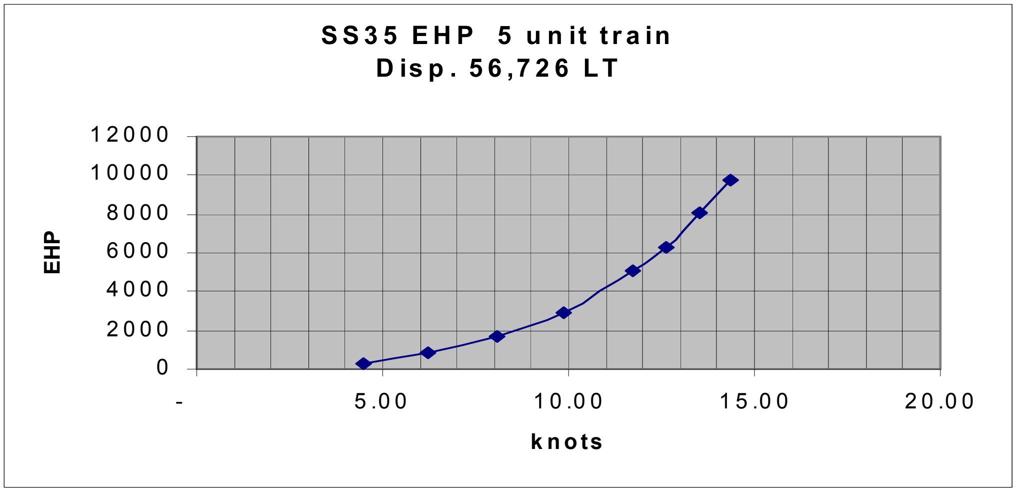
In August 2003 "Rosenblatt & Sons" concluded its economic study. This study confirmed the significant cost saving in building the SEASNAKE.

RESULTS OF TESTS AND STUDIES

For full details see the attached studies

RESULTS OF THE TANK TESTING AT THE UNIVERSITY OF MICHIGAN





RESULTS OF THE ABS STUDY

A computer simulation to determined the wave induced forces acting on the connections
The long term extreme values corresponding to the 10 $^{-8}$ probability of occurrence are:

	SS45	SS35 (Deduced)
Vertical Bending Moment	134,292 ton-m	49,144 ton-m
Axial load on connector	6465 tons	3,911 tons
Vertical load on connector	2743 tons	1,291 tons
Horizontal load on connector	2671 tons	1,257 tons

8/15/03

RESULTS OF THE "ROSEN BLATT" STUDY

Based on the trend-lines for deadweight/displacement ratio and steel/displacement ratio, the displacement and steel weight of tankers having the same deadweight as the SEASNAKE can be estimated for purposes of comparison. The results are presented in the following table
A Seasnake train consists of a Tractor a Caboose and a varying number of barge units

	Tanker	SEASNAKE
Zero SEASNAKE Units		
Displacement - Lt	45,067	43,164
Cargo Deadweight - Lt	35,250	35,250
Steel Weight - Lt	7,411	4,946
SEASNAKE Steel/Tanker Steel		**66.7 %**
Steel Wt/Displacement Ratio	0.1645	0.1146
Steel Wt/Deadweight Ratio	0.2103	0.1403
One SEASNAKE Unit		
Displacement - Lt	71,705	68,984
Cargo Deadweight - Lt	57,750	57,750
Steel Weight - Lt	10,920	7,887
SEASNAKE Steel/Tanker Steel		**72.2 %**
Steel Wt/Displacement Ratio	0.1523	0.1143
Steel Wt/Deadweight Ratio	0.1891	0.1366

Two SEASNAKE Units		
Displacement - Lt	97,718	94,804
Cargo Deadweight - Lt	80,250	80,250
Steel Weight - Lt	14,139	10,918
SEASNAKE Steel/Tanker Steel		**77.2 %**
Steel Wt/Displacement Ratio	0.1447	0.1152
Steel Wt/Deadweight Ratio	0.1762	0.1360
Three SEASNAKE Units		
Displacement - Lt	123,297	120,624
Cargo Deadweight - Lt	102,750	102,750
Steel Weight - Lt	17,167	13,949
SEASNAKE Steel/Tanker Steel		**81.3 %**
Steel Wt/Displacement Ratio	0.1392	0.1156
Steel Wt/Deadweight Ratio	0.1671	0.1358
Four SEASNAKE Units		
Displacement - Lt	148,542	146,444
Cargo Deadweight - Lt	125,250	125,250
Steel Weight - Lt	20,054	16,980
SEASNAKE Steel/Tanker Steel		**84.7 %**
Steel Wt/Displacement Ratio	0.1350	0.1159
Steel Wt/Deadweight Ratio	0.1601	0.1356

From the above it can be seen that the SEASNAKE has a distinct structural advantage over the conventional tanker, both on an absolute steel weight basis and steel weight per ton displacement and per ton deadweight bases.

The steel savings of **33%** to **15%** for the SEASNAKE are significant and should make the concept viable and attractive for commercial tanker construction

Further reduction in steel

The scantlings were developed by the application of the ABS rules for steel barges. These rules assume that the hull cross section is rectangular. The Seasnake barge has a semicircular cross section which by the nature of its geometry is vastly stronger in resisting lateral hydrostatic pressure and resisting plate buckling in the longitudinal direction of the barge. This fact is not considered in the present design and thus the design can be further optimized.

A significant reduction in required steel could be obtained if use was made of the inherent properties of curved shells.

For the ABS to approve such reductions, calculations and structural drawings showing the rationale for the reduction in structural sizes have to be submitted to the ABS for their review and approval with the request that the structure be “reassessed for minimum scantlings” by having the curvature of the hull shape considered.