

Influence of Outboard Development on Boat Hull Design

by: Rob Abbott

I thought it might be interesting to take a superficial look at how the emergence and change in outboard motors influenced and changed the design, shape and layout of boats. I'm limiting the scope of this article to, the popular common designs at the time, not specialized boats.

Prior to outboard motors, boats, for the most part were powered by oars, paddles, sails, or inboard engines. Without going into the detailed hydrodynamics, with these power sources being limited, the major factors to speed are: waterline length - the longer the faster; minimize turbulence - sharp bow entry, narrow beam, and sharp stern or up-turned bottom; and keeping the weight in the middle of the boat - which is mainly a way of maintaining the underwater shape to minimize turbulence.

It's not surprising then that racing sculls resemble a toothpick or that the Bluenose and Titanic sterns are smoothly curved.

Rowboats

Your typical utility rowboat or skiff, while it might have a flat stern, it either had a wineglass shape or the bottom rose up gradually so the bottom of the transom was out of the water. The minimum length for a "good" rowboat would be about 16 feet, with most averaging around 18 ft. Boats needed to be wide enough at the sheer line for good leverage on oars (about 40 - 48"), but less so below the water for a more streamline shape, so boat sides were often angled (flared).

Enter the outboard motor (or as it was appropriately described and designed then, the *detachable rowboat motor*) and you have this big heavy lump of cast iron hanging off the transom that required the operator to sit in the aft seat. While a passenger, cargo and ballast in the bow might help level the boat out somewhat, regardless of shape, that transom is going to be down in the water. The result was a lot of turbulence resulting in energy loss, resulting in reduced speed. The liberty drive, which put the engine and operator's weights centered, helped balance the boat thereby reducing the turbulence. This worked fine for the single digit horsepower of these early outboards and besides, outboards weren't the most reliable machines; there was a good chance you were rowing back. Consequently, having a boat designed to row easily was more important than one that went faster with an outboard. Generally, we're talking about pre-WWI era.



**Sixteen foot, "Round Bottom" boat designed & built by the Evinrude Motor Co. as shown in a 1918 Evinrude catalog.
(Image from Ken Kirk's collection)**

Compromise

In the 1920s, as outboards became more: popular, reliable, powerful and lighter, boat hulls began to change to accommodate. Hulls generally remained long, but transoms were strengthened and widened to handle the thrust and weight of the outboards and the bottom went straight back to the bottom of the transom, or just curved up slightly. At the back half of the boat, the sides became more vertical providing more buoyancy for the stern. The length typically stayed the same as longer still meant faster and it was still needed to balance the weight of the motor. Spray rails start to appear to keep water from coming up the sides. A modern example of this would be a square-back canoe or freighter canoe. Like most compromise designs, it was a trade-off between being faster fueled by gasoline versus cheeseburgers.

Unusual hull designs started to appear: concave/convex hull shapes in the forward section to sort of mimic the shape of the wave created by the hull at displacement speeds (hull wave) and hopefully get enough hull weight over the crest to get the boat up and over the wave; wedges or planning boards at the back or sides to try and lift the back end up and over the hull wave; step hulls with air injection to try and break the suction at the transition between displacement and planning speeds; and an inverted U shaped hull (Hickman Sea Sled) which somewhat mimicked a catamaran at lower speeds, and a modern tunnel hull design at planning speeds. Seat backs (removable of course as oars were still a necessity at times) for comfort become popular as now everyone is facing forward.

Evinrude Boats

Before the Evinrude became the popular means of boat propulsion, most boat builders insisted on building boats in the old way with weak, cutaway stern and narrow beam. So we decided to design good boats for Evinrude owners and such boats can be procured from boat builders who handle Evinrudes, through Evinrude dealers or direct from our stock at the Factory.

The knowledge of experienced boat builders and our knowledge of what was required in a boat for use with an Evinrude has been combined in the designing of those

suitable Evinrude boats. There is plenty of width of stern to insure an even keel, even when the only occupant sits in the stern. The depth is ample for comfortable leg room and is also a factor for safety. Generous beam makes for seaworthiness. Sturdy construction all around provides a strong, dependable boat capable of carrying capacity loads for a long period of years.

Read the specifications below, they will prove more convincing of the underlying value of Evinrude boats. These specifications are guaranteed only for boats shipped out of our stock, as boat builders usually follow their own specifications.

The popular boat is the Evinrude Round Bottom. The lower left hand photograph reproduced on page right shows the boat in actual use.

The Flat Bottom makes an ideal fishing boat. Write for special boat folder covering boats, canoes and skiffs in detail.

Round Bottom



Side View of Evinrude Round Bottom Rowboat



Top View of Evinrude Round Bottom Rowboat

Flat Bottom



SPECIFICATIONS—Round Bottom

Length — 16 feet.
Beam — extreme — 51 inches.
Draft — to rabbet — 5 inches; extreme, 7 1/4 inches.
Depth — Bow, 22 in.; amidship, 30 in.; stern, 21 in.
Transom — White oak, 1 3/4 inches, screwed to oak dead wood. Keel — White oak, 1 3/4 inches x 2 1/4 inches.
Ribs — White oak or rock elm straight grain, 1/2" x 3 1/2"
Beam bent, properly spaced and fastened to keel.
Keelson at top of ribs, 1/2" x 2" white oak, securely fastened to keel and ribs.
Planking — Cypress, 3/4" thick, securely fastened to ribs of ample width.
Seat riser — Cypress, 1/2" x 1 1/2" fastened to each rib.
Seats — Clear Cypress, 1 1/2" x 12" braced with knees.
Flooring — Cypress in racks, removable sections.
Forward Deck — White oak, 1" thick, 18" long.
Coaming — White oak, 1/2" x 3 1/2", securely fastened.
Beams — Caulked and filled with putty to match color of planking.

Finish—Sheer streak inside and outside stained and varnished. Gunwales, transom, stern and all seats stained and varnished. Hull, natural finish. Inside, below seats, EVINRUDE gray.

Fittings—1 pair select 7/8 foot oars, row locks and bow casting.
Sail rig, including mast, spar, sail, corner-board, ropes and pulleys, extra.

Influence of Outboard Development
on Boat Hull Design Cont'd from pg. 11

Outboard manufacturers recognized that if boats were designed specifically for outboards they'd sell more outboards. In 1928 Lou Johnson produced a number of designs specifically for their outboards. Johnson published a book of these designs and distrusted them to boat builders across North America. The Peterborough Canoe Co. built several of Johnson's designs. Subsequently Johnson built their own line of boats in Canada & US from 1930 to 1936. Evinrude produced a line of boats from 1915 to 1926. There is also evidence that both Waterman and Caille built boats in the early days of Outboards.

(the depression limited the demand and WWII limited the supply). Hulls became shorter and wider and while oars and oarlocks were often fitted, the hulls were designed exclusively for outboard power. Steering wheels and cables make moving the helm from the stern possible and the outboard *runabout* is born. Outboard horsepower was still somewhat limited, but twin outboards doubled the power weight and (un)reliability. Boats with extra wide transoms with motor wells (to prevent the stern wake from swamping the boat when slowing down) are designed to handle the bigger and twin outboards. The bottoms of hulls get reinforced as wide flat surfaces are not the best at handling the forces from waves. In the later half of the 1950's, electric start outboards become popular and the helm moves from the middle to the front seat, away from the fumes and noise.

Run Rather Than Row About

Although available earlier, it was really after WWII that outboards and boats designed to operate primarily at planning speeds became popular

A new line of JOHNSON BOATS - - specially



The Canadian Johnson Motor Company Limited, now presents its new line of outboard boats—smart newcomers for the 1931 water motoring season.

Designed and built for Canadian waters at the Peterboro factory, these new models have been specially constructed to develop the maximum speed and performance of the world-famous Johnson Outboard motors. Low-priced, graceful, yet extremely seaworthy, they will quickly earn a popular place on every water highway. Their safety, comfort and roominess will make them favorites for use of every member of the family.

From the least expensive model to the most expensive, every boat is constructed in accordance with Johnson's jealously guarded reputation for quality and skilled workmanship.

Study the specifications and the prices—then you will realize the remarkable values offered for 1931.



The Imperial

The Imperial model might well be termed the flagship of the Johnson fleet for 1931. In it have been combined all the comfort, roominess and performance ability of much higher priced boats. Its appearance is trim and seaworthy from stem to stern—its safety is as certain as the reputation of its manufacturer.

Specifications
 Length 17 ft. 2 1/2 in. Beam 62 in. Width at Transom 56 in. Depth at Transom 20 in. Height of Motor Niche 16 in.
 Transom—Oak with lateral and knee type beams.
 Planking—Clear cedar 1/2 in. thick, shipped with all seams painted.

KEEL AND KEELENS—Oak
DECKING—Oak, open type made of running.
 BIRCH—Oak 2 1/4 in. center, shored hull on all. Insole and water stemlock. Sole consisting of 1/2 in. oak 1 1/2 in. high. Bow cushion 5 1/2 in. x 14 in. high.
DECK—Pine—Pine or Beech mahogany, length at gunwale 6 ft. 6 in. height at V 48 in.
SEATS—Cedar and hem, 14 in. wide, 1 in. cedar with oak trimmings, center beam and folding leebacks. Stern side seats 30 in. long x 20 in. wide, constructed so as to give clear passage to motor between seats.

Floor boards made up in 12 sections, easily removed for cleaning purposes.
 Canvas rigged and beam secured throughout. Varied inside and out with best Spar foot varnish. All fittings and gear brackets, nickel plated bronze. Tubs—Basswood, mahogany bottom.
WALRS—12 lbs.
MOTOR RECOMMENDATION—Any model of the Sea Horse or Standard line.
PRICE—\$2100.00 Each, Peterborough, including pair of 8 ft. spinn oars with oaklocks and leathers.



The Imperial De Luxe The Imperial De Luxe is actually the sport model of the Imperial boat. Its equipment includes a complete set of Kapok life-saving cushions, running light, bow chocks and cleats, and a pair of 8-ft. spinn oars. The price is \$275. Each, Peterboro.

THE NEW

The new Johnson Stern Drive Unit is here!
 After months of continuous testing, the Johnson research department has perfected a unique propeller drive for outboard-powered boats which brings to such type of water craft all

Cut out the Flat

The downside of these fast, wide, flat bottoms, was the pounding the hull and passengers take from the waves at these higher planning speeds. Also, at less than planning speed, the boat doesn't handle well. In the late 1950's catamaran designs became somewhat of a fad.

Essentially a revival of the aforementioned Sea-Sled design, the inverted vee behaved like a two displacement type hulls at lower speeds, while the water displaced on the inside of the vee helped lift the bottom of the boat, providing a reduced surface area for planning. They also provided a nice smooth ride in a light chop. These were well suited for twin outboards as turning these hulls with a single outboard could be difficult. The downside was all this energy from the between-chine spray winds up in the hull and passengers.

Versions of this design reappear in the 1960's with

OMC's Gull-Wing boats, Chrysler's Cathedral Hull, and to this day with Boston Whaler, among others.

Deep Vee

The solution to a smooth ride at planning speeds and rough water was a Vee bottom hull design. The Vee bottom cuts through the waves and the resulting spray is directed outward and away from the boat. However, this design requires significantly higher horsepower motors to get up on a plane and longer shaft length as the keel sits lower in the water. As outboard horsepower neared centenary numbers this became a practical design. Most are of a modified Vee bottom with a number of near horizontal strakes running fore and aft stepping up the Vee bottom of the boat. This is a bit of a compromise, as the flatter strakes help with speed and planning, while the stepped Vee make more comfortable ride.

constructed for Canadian Waters

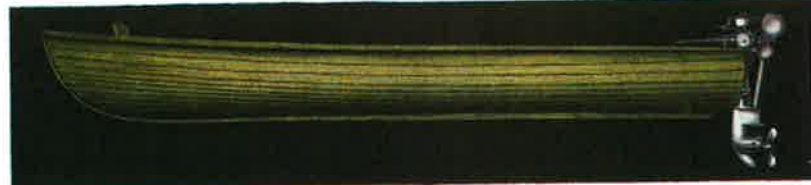


Stern Drive

the value and merits of the swing-back or tilting feature of outboard motors.

New engine efficiency, propeller steering, extreme maneuverability, ease of propeller repair . . . these features, added to the tilting arrangement whereby the propeller immediately swings upward upon striking any obstruction, make the new Johnson Stern Drive a most important water motor-ing innovation.

A complete list of Canadian boat builders who will incorporate this feature in their new models, will be supplied upon request.



The Speedskiff

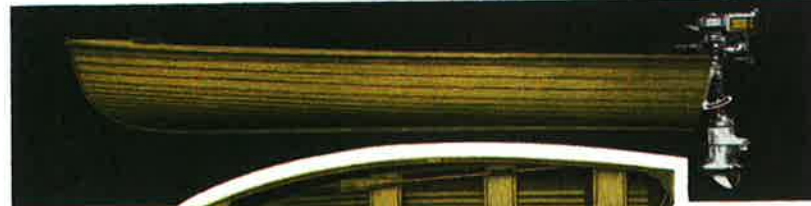
The Speedskiff is a remarkably trim and roomy fifteen footer at an exceptionally low price. A glance at its specifications and price will show what amazing strides Johnson has made in building such a quality product at a price everyone can afford to pay.

Specifications:

LENGTH - 15 ft. BEAM - 48 in. DEPTH MOTOR - 13 1/2 in. HEIGHT OF TRANSOM - 16 in. MOTOR MOUNT - Hatch 13 in. WEIGHT AT TRANSOM - 55 lb. DRIVE AT BOE - 18 in. GUNWALE - Tummy and water, oak, open to top. KEEL - Kevlar, foam and water atom oak. RIBS - 1/4 in. x 1 1/2 in. oak, with square corners. TRANSOM - oak. FINISHING - Clear cedar 1/4 in. thick, splayed construction with all seams painted. DECK JOIST - Oak. SEAT - 10 in. x 1 1/2 in. thick, cedar with vinyl base. BOW HOLE AND LASHING - Lash. FLOOR BOARD - 1/4 in. cedar, built up in two sections

so that they may be easily removed for cleaning purposes.

Galvanized nails with aluminum coated fittings. Hull and beam trim with bow ring. Varnished inside and out with best Spar boat varnish. Optional cedar deck green. WEIGHT - 155 lb. TYPE - Round bilge, runcove bottom. MOTOR RECOMMENDATION - See Horse 1, 2, 3, 4 and 5. Light Twin OH 35 and Standard Twin OH 35. PRICE - \$100.00 Cash. Porethane oak, including one pair of seven foot oars and oarlocks. Special Kevlar hull - seven foot oars and oarlocks. Special Kevlar hull - seven foot oars and oarlocks. At above - copper nailed and brass wired, with floor beam fittings, \$115.00 extra.



The Knockabout

The Knockabout is another 15 footer - but of slightly wider beam and heavier construction. In build, finish and appearance it ranks next to the Imperial, and at its reasonable price offers the ideal boat for the use of everyone in the family.

Specifications

LENGTH - 15 ft. BEAM - 54 in. WEIGHT AT TRANSOM - 60 lb. DRIVE AT TRANSOM - 17 in. HEIGHT OF MOTOR MOUNT - 13 in. DEPTH MOTOR - 20 in. DRIVE AT BOE - 21 1/2 in.

TRANSOM - Oak, with Island and Loo type beam. KEEL - Kevlar, foam and water atom oak. RIBS - 1/4 in. x 1 1/2 in. oak, half oval 3 inch centers. GUNWALE - Tummy and water, oak (open top). FINISHING - Clear cedar, 1/4 in. thick, splayed with all seams painted. DECK - Figured hollyhog with oak caming. SEAT - 14 in. wide x 1 1/2 in. thick, cedar with oak trimmings, vinyl base, and large bow seat of cedar. FLOOR BOARD - 1/4 in. cedar, made up in sections, very easily removed for cleaning.

Copper nailed and brass wired throughout with polished brass fittings. Varnished inside and out with the best Spar boat varnish. Optional cedar deck green. WEIGHT - 215 lb. TYPE - Round bilge, runcove bottom. MOTOR RECOMMENDATION - See Horse 1, 2, 3, 4 and 5. Light Twin OH 35 and Standard Twin OH 35. PRICE - \$120.00 Cash. Porethane oak, includes pair of eight-foot oars with leathers and oarlocks. Special Kevlar hull - seven foot oars and oarlocks. At above - copper nailed and brass wired, with floor beam fittings, \$135.00 extra.