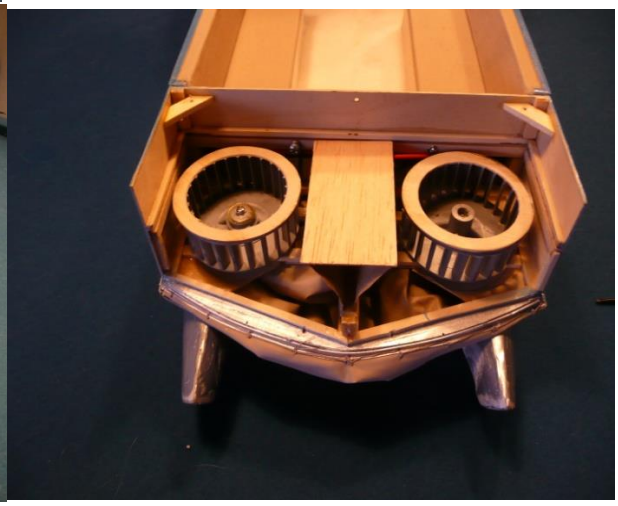
Hovertoon?

Sounds like a boombox on a hovercraft, but not so. It's actually a pontoon that converts into a hovercraft, so the name Hovertoon was chosen. It all started after meeting a couple of Australians that built hovercraft here in Berlin, WI. I was impressed with their engineering and got my first ride on their 15-passenger model and was even more impressed. As for myself, I have a 22-foot pontoon boat that I spend a lot of time running up and down the Fox River. In the spring, when the water is high, you can make the 20-mile trip upstream from Berlin to Princeton, but in the fall, when the water is low and sandbars are exposed that section of the river is not navigable. Even going downstream from Berlin towards Oshkosh can be a challenge. Then there's the hassle of putting the pier in and taking it out every year and the scummy mess that accumulates on the pontoons that requires cleaning a couple of times a season. So, while floating down the river, I thought to myself, I bet I can make this pontoon into a hovercraft and drive it up to the garage when not in use.

So, I crunched the numbers using the weight of a fully loaded pontoon boat and the surface area of the 8.5 ft. by 22 ft. craft and found it would be too heavy. Then the challenge became how to get more surface area and thus carry more weight and that's where the idea came to rotate the pontoons attached to the outside edge of the craft outward 135 degrees. Rotating the pontoons provided 50% more surface area. Running the new numbers through the lift calculator, a 5000-pound craft would take .125 psi to lift. A standard 22-foot pontoon loaded with people and gear is around 4500 pounds, so it looked like I was on to something. I started scanning the internet for anything out there that resembled the rotating pontoon idea and found nothing. I was either on to something or it was just a dumb idea that wouldn't work.

The first step, and least expensive, was use my RC hobby skills and build a "proof of concept" scale model. I found a paint stirring gizmo at the hardware store that, and when taken apart it provided two centrifugal fans for lift. For the thrust, I used a pair of ducted fans from the hobby store, the rest was balsa wood. It was controlled with three channels; lift, thrust, and rudders. I was able to drive it around the floor, but with only a 6 cell NI-CAD pack powering 4 motors, it ran out of juice in only a few minutes. But it did prove that the concept was possible. At that point, I talked to a family friend that happened to be a patent attorney to see if it would be worth filing a patent on it. He gave me some pointers and I started writing it up and doing the drawings. We first filed a provisional "patent pending" version which is good for a year and then we put together detailed drawings and narrative and filed for the utility patent. On April 16, 2013, the patent number US 8,418,638 B2 was granted.



With the patent in hand I sent letters out to a number of pontoon manufacturers to see if anyone was interested, to my disappointment, no one responded. With little interest and a wife that was mad because of all the time and money I put into the model and patent, I shelved it to keep peace in the family. That little voice in the back of my mind kept nagging me and telling me you've got to build it. Well, two and a half years later, in January of 2016, I talked my wife into the idea of building a full-scale version. The hardest part was finding centrifugal fans for the lift, these had to be built from scratch. Starting with plywood circles and aluminum airfoils, two mock-ups were made which handled 1000 rpm with no problem. However, the final versions were made from laser cut aluminum circles and .025 aluminum airfoils from Jay Manufacturing of Oshkosh. The skirt is a combination bag and fingers made from 18-ounce fabric using forms put into a CAD system then computer cut by Oshkosh Tent and Awning. Once the weather warmed up, I moved the operation from the basement to the shop and built a test platform, which is a silhouette of the surface area with the mocked-up pontoons in front. A 22-hp Predator engine from Harbor Freight was used for the lift fans that incorporated a centrifugal clutch from NORAM and single belt to drive the counter-rotating fans. Finding the right clutch and pulleys was a challenge, if I had any experience with hydraulics, the lift fans would be driven off the main 200-hp engine. The 22-hp engine did lift the 5000-pound test load of firewood and did distribute weight. I'm still not 100% satisfied with my skirt design, the center portion of the front and rear sections lifts off the

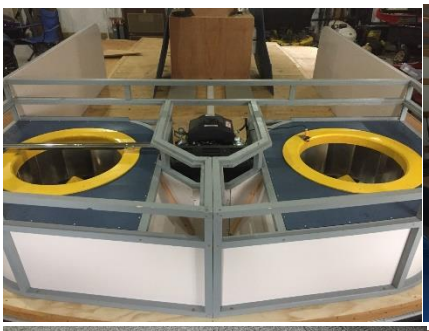
ground while the sides are still in contact. It will probably need some trimming on the sides, so if anyone has any experience with that please let me know.

Next was the design of the thrust system. Two 42-inch 6-bladed multi-wing fans set at 50 degrees were used with a pair of 36mm poly-chain belts. I connected the shaft to the flywheel with a Merc flywheel adaptor and a splined shaft with the yoke cut off which was shaved to a 1.25-inch diameter with a keyway added. All this mounted to the bell housing with a laser cut adaptor plate and main bearing. I found a 4.3L V6 from a 2007 Silverado ($600), sent the computer off to LT1Swap to get reprogrammed where they removed the downstream O2 sensor/catalytic converter requirement and security interlocks. Once I had the engine mounted, and excess wiring removed, it started and idled fine, but there was no throttle control. Found out the in 2007 there were two different V6 ECMs used, I had the electronic gas pedal for the early version but needed the later version. Ordered a new accelerator, but while waiting for it I cleaned the throttle body… boy was that a mistake!!! Once you clean it, the engine has to go through an idle relearn sequence. Without a load on the engine, it idled ok, but after a few minutes it ramped up to 2700 rpm on its own and stayed there. Going through the relearn sequence didn't help, once the props were hooked up, the load helped and the ECM finally did learn the new

setting. But what a headache! I used an ELM327 ODBII WIFI and the Dash Command app on my iPad for the instruments and diagnostics.



To keep the test platform cost down, most of the construction is of wood, even the curved aluminum tube is simulated with 1.25-inch laminated plywood cut with a saber saw and the fencing inserts are painted hardboard. Once the unit is tested under its own power, I will have to invest in the aluminum to build the deck, fencing, pontoon tubes with the mechanicals just transferred over. The console and chair are just thrown together out of scraps, so they're not very pretty, but they didn't cost anything either. I'm looking for a source for the venturi ducting both lift and thrust, I'm thinking spun aluminum, but the set-up charges make them a little on the expensive side. In the interim, I have taken a common 2.5-inch diameter foam swimming noodle, cut it in half, glued it to a plywood backing, and then wrapped it with fiberglass cloth with an epoxy glaze. The noodle will bend to the diameter needed without kinking, and with the fiberglass cloth is applied it will regain its shape if struck with anything.

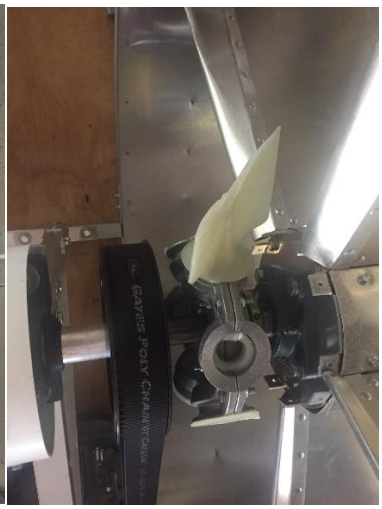



After adding a joy stick and rudder cables, and some guards around the lift fan intakes, the Hovertoon test platform's first flight was made around the back yard on August 2nd, 2018. The lift and thrust fans ran fine but some modifications to the bag portion of the skirt will be necessary to allow more airflow,

but overall it was a successful test. Drove the craft from near the river up a 6-degree grassy slope and into the shop.

For the second test flight, more airflow was added from the bag section to the lift section along with a third rudder for each thrust fan. This extra control allowed the craft to make a 180 degree turn on the slope. At the end of the second test flight, the motor was started to push the craft the rest of the way into the shop, however the motor backfired and drove one of the thrust fan blades into the stator which destroyed all six fan blades. Since then the clearance between the back of the blades and the stators was increased from .25 to 1 inch to account for the fan blade flex. The entire engine assembly was moved ahead by 1.5 inches to allow more room between the belt and leading edge of the fan blades as well.





As soon as the rainy weather breaks, the modifications to the lift fans, skirt, and inlet ducting for the thrust fans will be tested. When the cold Wisconsin weather sets in, we'll see how it does on snow and ice. And next year, the goal will be to obtain a pair of 22 ft. pontoons and build a new deck, then transfer the lift and thrust systems over to the new pontoon platform. Then I'll be able to take advantage of all the flooding we are experiencing in Berlin right now. I can see the Hovertoon being used by anyone that has a shallow/sandy beach front where a pier is impractical, for someone who lives on a shallow waterway, or for someone a shoreline like mine that is prone to flooding as in the picture below. I have posted videos on Hovertoon.com of the first and second flight along with other videos of the design and construction phases. My email is Dick.Schramer@Hovertoon.com if anyone would like to stop by and see the project.