

## 2016 Robotics Challenge Project

### Background

**Pontoons:** During WWII, one of the major engineering challenges was finding a way to get troops and supplies and equipment from the large transport and supply ships to the shore. The large ships needed deep water, and often big cranes to lift things from their decks or holds.

The Mulberries, as they called the temporary harbors used in the D-Day invasion, were mostly designed by the British military's engineers. American military engineers had developed related technology—pontoon boats and bridges. Pontoons were strung together to cross rivers like the Rhine, and were used extensively in the Pacific as piers, harbors, and docks



**Rhinos:** Pontoon boats called Rhinos were used to ferry tanks and other heavy equipment to shore..

Simply described, a pontoon is a floating device that is buoyant enough to support things on top of it. Pontoon boats are often used as recreational craft, having two long hollow chambers with a platform over them.





**Seabees:** The Seabees were members of the Navy's Construction Forces. In early 1942 the Navy started recruiting members, who were trained in combat but primarily had experience in construction and engineering and worked to build roads, airstrips, bridges and other infrastructure needed during the war. During WWII the average age of the Seabees was 37,



much older than the rest of the forces because of the way members were recruited. The Seabees (from 'CB,' or construction battalion) had the motto '*Can Do!*'.



## Project

Your 2016 National WWII Museum Robotics Challenge includes two parts—one of them is to program the robot to meet all the objectives on the table, and the other is to complete the project.

The project has 3 parts. You will 1) Design, build and test a pontoon ferry (a Rhino); 2) Diagram, document and describe your construction and testing; 3) Write a short proposal estimating the cost of building 1,000 pontoon ferries using your design.

**Design, build and test:** You may use the following to build your ferry:

- Two 30cm x 30cm pieces of corrugated cardboard (no more than 3mm in thickness)
- Three empty plastic water or soda bottles (no more than 500 ml volume)
- Ten feet of string or twine (less than 2mm thickness)
- 2 feet of duct or packing tape
- As many washers as you want
- A toy car that fits on the platform
- Other masses

Plan out your construction, then build and test it. Modify the design and test it again as many times as you wish. Be sure to record data from your tests, including how much mass it can hold. You may also want to find a way to measure the stability of your ferry in high seas. Video at least some of your tests.

**Diagram, document, and describe:** Make clear diagrams of your ferry's construction. Either by hand or by computer drawing is fine, but make sure to include clear labels and measurements. Clearly describe the procedures you used to make and test your ferry.

During WWII it was often impossible to find any one factory or manufacturer that could make all of a piece of equipment that was necessary. Therefore companies would openly share plans with others so that production goals could be met. This required very clear plans and instructions.

**Proposal:** What you built is a model. Models are used to test ideas, and then are scaled up to real sizes and materials and tested again. It's often cheaper and easier to test models before building a full piece of equipment. Using the attached table, calculate the cost of constructing a real ferry based on your model.

In your proposal, calculate the cost of building 1,000 ferries based on your model, and explain all your calculations. You may want to give design a logo and motto for your team, like the awesome one the Seabees have, and put it on your documents.

**Submission and Judging of Project:** By April 8 you must have 1) A video of part of your test uploaded, unlisted, to YouTube, and a link to it sent to Rob Wallace; 2) pdf documents of your diagrams, documentation, and description emailed to Rob Wallace, and 3) pdf documents of your proposal emailed to Rob Wallace. This will give judges a chance to look at your projects in advance of the Challenge Day.

On the Challenge Day, May 7, you must bring the final model of your ferry and a copy of your documents to be displayed for public viewing and judging.

<b>Model Component</b>	<b>Real Component</b>	<b>Cost per unit</b>
30 cm x 30 cm corrugated cardboard	30 ft x 30 ft aluminum platform	\$3,000
Empty plastic bottle of no more than 500 ml	Pontoon, Large (251-500 ml)	\$3,000
	Pontoon, Medium (151-250 ml)	\$2,000
	Pontoon, Small (150 ml or less)	\$1,500
Twine or string	Rope or Cable	\$100/foot
Duct or Packing tape	Aluminum banding	\$250/foot
Washers	Steel weights	\$100/each
Toy car	Tank or Truck	No cost
Masses	Cargo	No cost