

The present of the study

1. The innovative remote-controlled concrete ships incorporate into the design practice of the capstone course of construction engineering at a low cost
2. Remote Control Concrete Boat Teamwork Performances

The aim of the course

1. The practice of basic skills and innovative ideas
2. The combination of practical and theoretical methods

A.Design

concrete boats are built with steel and fiber-reinforced concrete. Boats and their hulls come in various shapes and sizes, all hulls are designed to displace water or ride on it. This is called planning hulls or displacement hulls. The four common hull types are flat bottom hull, deep Ve hull, round bottom hull and multi-hull hull. The flat-bottom hull in this case is a selected design using AutoCAD or SketchUp. Because the boat with a flat-bottom hull is very stable, it is very suitable for sailing in calm small waters and other purposes. Figure 1 shows the hull view, side view and streamlined design of the concrete ship.

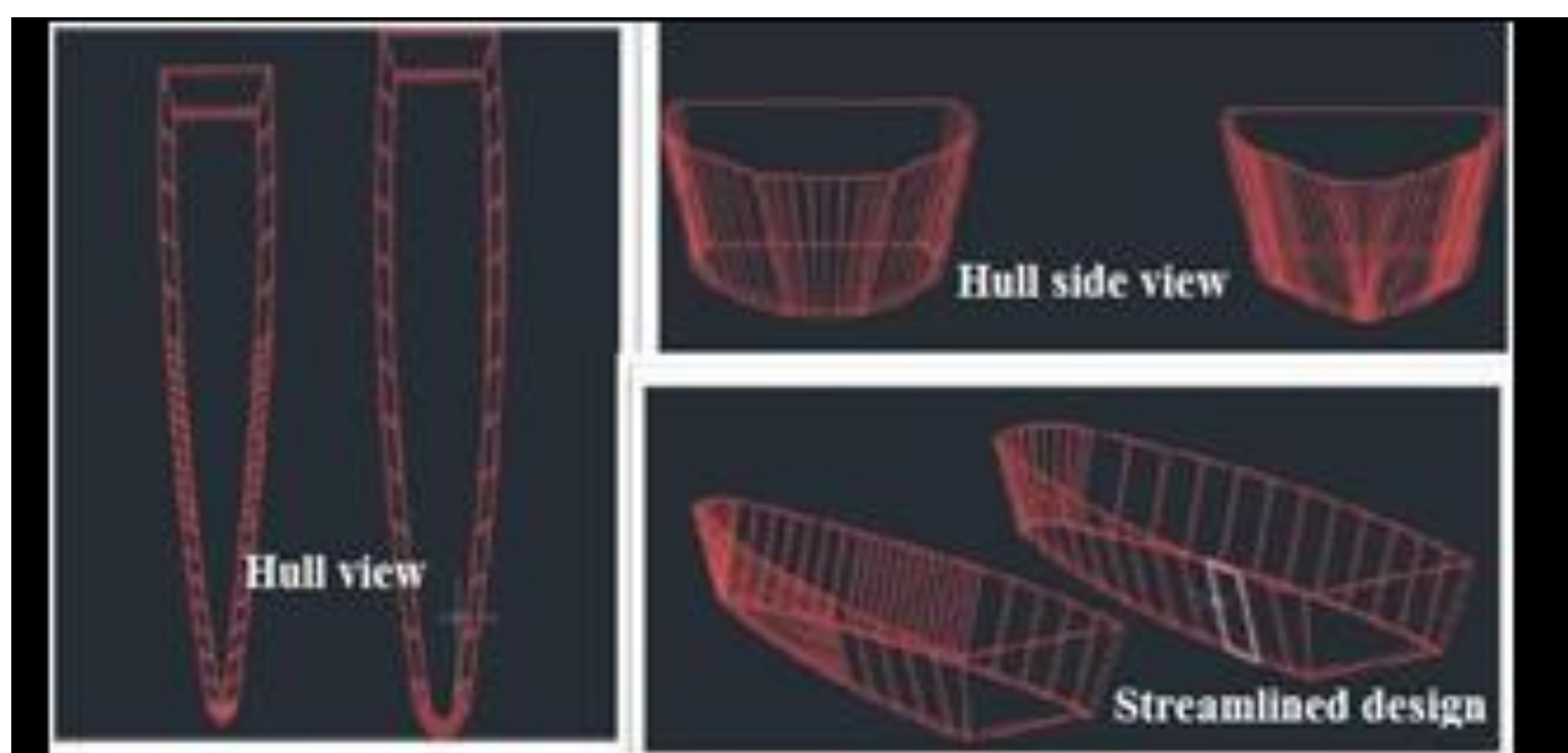


Fig. 1 Hull view, side view and streamlined design of the boat.

B. Construction

After the design of the concrete hull, the length, width, depth and thickness of the concrete hull are approximately 60 cm, 20 cm, 10 cm and 1.5 cm, respectively. Generally, the hull is made of lightweight concrete. In this case, rice husk is used instead of sand. The replacement percentages are 15%, 20% and 30% respectively. The water-cement ratio is fixed at 0.5, and the mix proportions of the rice husk concrete used are shown in Table 1. The volume percentage of Dramix steel fiber (SF) and polypropylene fiber (PPF) contained in rice husk concrete is 2% respectively, and the slump of rice husk concrete can exceed 10 cm.

The team began to purchase remote controls, transmitter systems, server motors, propellers installed on the rudder and tools for building the hull. The hull mould must be checked for minor defects. The first layer of reinforcing mesh or steel mesh must be placed on the hull mold, and the second layer of cement concrete must also be placed on the hull mold and reach a fixed thickness. Figure 2 shows some stages of the hull construction. Figure 3 shows the remote control assembly and field test for three remote control boats.

TABLE 1

MIX PROPORTIONS OF RICE HUSK CONCRETE

	C	FA	Sf	RH	SF	PPF	SP	W
#1	360	1148	63	31	7.2	7.2	3.6	180
#2	360	1148	63	31	7.2	0	3.6	180
#3	360	1080	63	42	7.2	7.2	3.6	180
#4	360	945	63	63	7.2	7.2	3.6	180

[Note] C: cement, FA: fine aggregate, Sf: silica fume, RH: rice husk, SP: superplasticizer, W: water



Fig. 2 shows some of the stages of boat hull construction.



Fig. 3 Assembly and field test for remote control boats.

C. Field Test

Three concrete boats successfully passed the floating waterproof certification and participated in the remote control mode test. The buoyancies of the three boats are 33.52 N, 81.42 N, and 99.05 N, respectively. The heights of the water lines where the three hulls meet the surface are 6 cm, 9 cm, and 13 cm, respectively. The remote control test is divided into three consecutive items, the first is a speed test, the second is a manipulation test (including right, left, forward and backward), and the third is a 30-minute field test of remote control driving. Figure 3 shows the field test of three remote-controlled concrete boats. Three remote-controlled concrete boats cruised at a speed of 1.5 ~ 2 knots proximately.

Summary

The performance content of the remote control concrete ship teamwork includes design, construction, field testing, capstone project evaluation, student feedback and teaching reflection. The curriculum core competency assessment scale for three groups is satisfactory, and the most pleased core competency was engineering knowledge, science or mathematics application ability. Three concrete boats successfully passed the floating waterproof certification and participated in the remote control mode test, including speed test, manipulation test and 30-minute field test.