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THE HYDROFOIL CORPORATION

TECHNICAL MEMORANDUM HM-19

Subject: Gilruth Boat

Prepared for

Office of Naval Research

Washington, D. C.

Contract No. Nonr-13601

by

Frederic E. Bolliger

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1. Introduction.

A hydrofoil craft designed as a sail boat and known as the Gilruth Boat became the property of The Hydrofoil Corporation. It was decided to convert the boat to an engine driven, experimental hydrofoil craft.

2. Design Features.

a. Platform.

For simple and inexpensive manufacture combined with low weight and good rigidity a wooden structure with plywood reinforcements was used for the platform which was mounted on the catamarans, struts and foils of the boat.

The pilot's seat is adjustable fore and aft on the platform.

b. Propulsion.

The craft is equipped with a standard 5 H.P. outboard motor which is carried by a coil spring balanced parallelogram that permits ready depth adjustment of the propeller.

A float chamber is built around the engine to guard against submergence of the engine.

c. Controls.

The controls are arranged as follows:
The right hand of the pilot operates:

1. Main stick to control elevation flap on rear foil.
2. Rotatable knob on main stick to control engine throttle and spark advance.

The left hand operates:

3. Auxiliary stick to control dual rudder.
4. Rope and cam action jam cleat to control engine position.

The feet operate:

5. Dual pedals to control the ailerons.

3. Physical Data.

- **Length overall**: 13'2"
- **Beam (Span of main foil)**: 11'0"
- **Draft with crew, maximum**: 2'10"
- **Weight of craft**: 405 lbs.
- **Weight of crew**: 180 lbs.
- **Weight of craft with crew**: 585 lbs.
- **Main foil NACA 64-208**
  - **Chord, main foil**: 12.5"
  - **Thickness, main foil**: 1.0"
  - **Area, projected, main foil**: 10.9 sq. ft.
- **Rear foil with elevation flap NACA 64-208**
  - **Chord, rear foil**: 9.25"
  - **Thickness, rear foil**: 0.74"
  - **Area, projected, rear foil**: 3.95 sq. ft.
- **Ailerons, NACA 61-412**
  - **Chord, ailerons**: 6.0"
  - **Thickness, ailerons**: 0.72"
  - **Area, projected, ailerons (each)**: 1.25 sq. ft.
  - **Estimated speed on foils**: 5 - 7 knots

4. Load Distribution and Foil Loading.

   a. With pilot in seat and seat in full aft position:
The main foil and ailerons carry 86.8% of the weight

The main foil loading is 37.9 lbs/sq.ft.

The rear foil carries 13.2% of the weight

The rear foil loading is 19.5 lbs/sq.ft.

b. With pilot in seat and seat in full forward position:

The main foil and ailerons carry 88.3% of the weight

The main foil loading is 38.6 lbs.

The rear foil carries 11.7% of the weight

The rear foil loading is 17.2 lbs/sq.ft.

5. **Propulsion Unit.**

The propulsion unit consists of a standard Mercury KF-5 outboard motor with a rated output of 5 H.P. at 4200 R.P.M.

The propeller has a 6 3/4" diameter and 6 1/2" pitch.

6. **Conclusion.**

The craft has been tested under varying conditions. The craft can be flown easily with manual controls. The performance of the craft in straight flight and in turns is very satisfactory.

Frederic E. Bolliger
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<th>Length Overall</th>
<th>Beam (Span of Main Foil)</th>
<th>Main. Draft with Crew (Afloat)</th>
<th>Weight of Craft</th>
<th>Weight of Pilot</th>
<th>Weight of Craft with Crew</th>
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<tr>
<td></td>
<td>13' 2&quot;</td>
<td>11'</td>
<td>2' 10&quot;</td>
<td>405 LBS.</td>
<td>180 LBS.</td>
<td>585 LBS.</td>
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**Main Foil**
- **NACA 64-208**
  - **Chord**: 12.5"
  - **Thickness**: 1"
  - **Area Projected**: 10.9 SQ FT.

**Rear Foil**
- **NACA 64-208**
  - **Chord**: 9.25"
  - **Thickness**: 0.74"
  - **Area**: 3.95 SQ FT.

**Ailerons**
- **NACA 64-412**
  - **Chord**: 6"
  - **Thickness**: 0.72"
  - **Area Projected (Each)**: 1.25 SQ FT.

**Load Distribution with Crew**
- **Seat Full Aft**
  - Main Foil Carries 508 LBS
  - Rear Foil Carries 77 LBS
  - **Seat Full Fore (4 1/2")**
    - Main Foil Carries 517 LBS
    - Rear Foil Carries 68 LBS

**Percentage Distribution**
- **Main Foil Carries**: 86.8%
- **Rear Foil Carries**: 13.2%
- **Seat Full Fore**: 89.3%
THICKNESS
AREA PROJECTED

LOAD DISTRIBUTION
SEAT FULL AFT
MAIN FOIL CAR
REAR FOIL CAR
SEAT FULL FOR
MAIN FOIL
REAR FOIL

PROPULSION
MERCURY KF5
 PROPELLER DRIVE

MOTOR SUPPORT
SPRING BALANCE
MAX. VERTICAL

CONTROLS:
RIGHT HAND OF
A. STICK FOR
B. REVOLVING
AND SPAR

LEFT HAND OF
C. AUXILIARY
D. ROPE FOR
FEET OPERATE
E. DUAL PEDALS

STICK
STICK WITH REVOLVING KNOB
DUAL PEDALS
PROPULSION
MERCURY KFS OUTBOARD MOTOR
PROPELLER DIA. X PITCH
5 H.P.
6 1/2 x 6 1/2 IN.

MOTOR SUPPORT
SPRING BALANCED PARALLELOGRAM
MAX. VERTICAL MOVEMENT
2'.

CONTROLS:
RIGHT HAND OPERATES:
A. STICK FOR ELEVATION FLAP CONTROL
B. REVOLVING KNOB FOR ENGINE THROTTLE
   AND SPARK ADVANCE CONTROL

LEFT HAND OPERATES:
C. AUXILIARY STICK FOR DUAL RUDDER CONTROL
D. ROPE FOR ENGINE LOWERING.

FEET OPERATE:
E. DUAL PEDAL FOR AILERONS CONTROL
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Date Oct. 15, 1958
Signed, Richard E. Reed
OFFICE SECURITY ADVISOR