# NAVY DEPARTMENT

## THE DAVID W. TAYLOR MODEL BASIN

WASHINGTON 7, D.C.

# MODEL FLOW STUDIES AROUND STERN OF U.S. NAVY FLEET TUG ATF-163

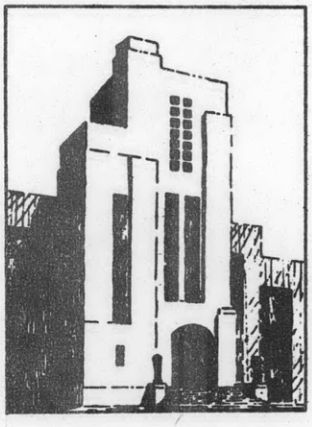
MODEL 3531



By

M. S. Harper and A. H. Weaver Jr.

Prepared for the Bureau of Ships



JANUARY 1952

Report 810
NS 712-064

## AUTHORIZATION

(a) BuShips ltr to TMB dated 6 November 1951.

## INTRODUCTION

The Bureau of Ships requested that studies be made on a model of the Navy Fleet Tug, ATF-163, to determine the flow conditions in way of the propeller with view to correcting the propeller excited vibration reported on this vessel thought to be due to propeller air drawing. The model was self-propelled in the circulating water channel where the flow was observed by means of yarn tufts attached to the hull ahead of the propeller and through dye emitted from a tube in the vicinity of the propeller. The Bureau of Ships also proposed that horizontal fins as shown in Plate 6 be fitted to the model hull above the propeller as recently installed on a Great Lakes Ore Carrier for the purpose of preventing propeller air drawing. The effect of the fins on the water flow to the propeller was observed for comparison with the conditions without fins.

## COMMENTS

The results reported herein are for the simulated ship conditions of 1630 tons at drafts (from keel extended) of 13.58 ft. forward and 16.75 ft. aft.

The conditions found in the tests in the circulating water channel are photographically reported in the following plates.

| Plate | V Kts. | Propeller | RPM | Description |
|---|---|---|---|---|
| 1 | 8 | 1844 | 95 | Normal stern |
| 1 | 8 | 1844 | 95 | Stern fitted with fin |
| 2 | 8 | 1844 | 95 | Normal stern with dye |
| 2 | 8 | 1844 | 95 | Stern fitted with fin with dye |
| 3 | 11 | 1844 | 95 | Normal stern |
| 3 | 11 | 1844 | 95 | Stern fitted with fin |
| 4 | 11 | 1844 | 95 | Normal stern with dye |
| 4 | 11 | 1844 | 95 | Stern fitted with fin with dye |

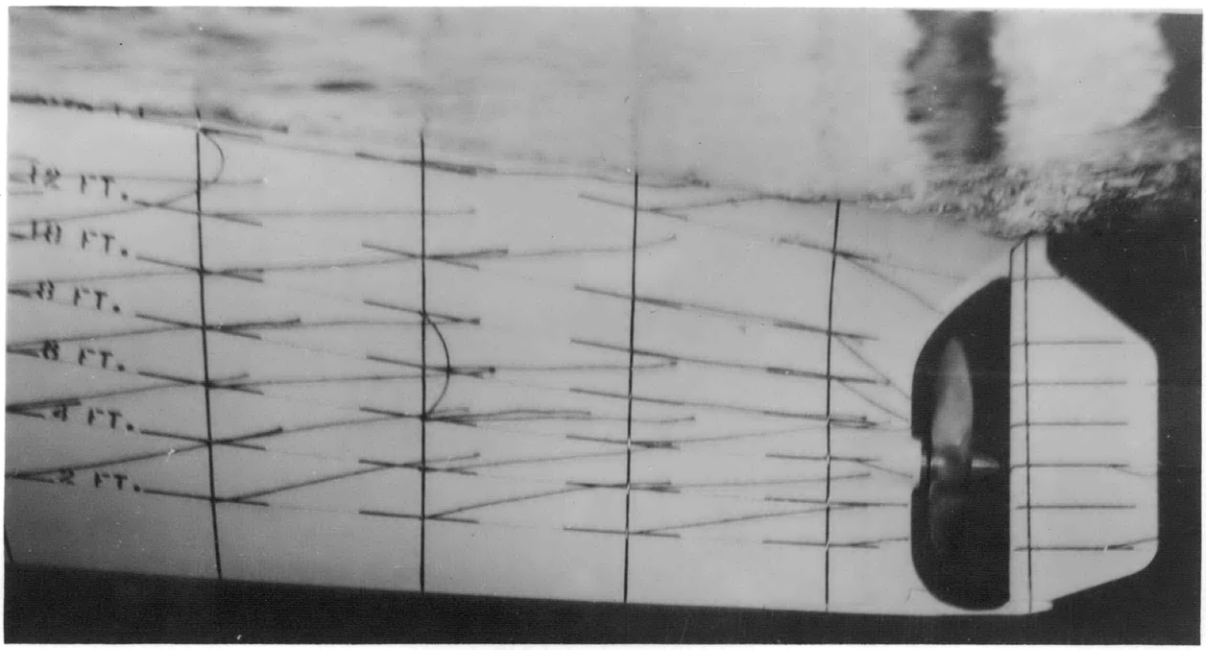
| Plate | V Kts. | Propeller | RPM | Description |
|---|---|---|---|---|
| 5 | 16 | 1844 | 141.5 | Normal stern with dye |
| 5 | 16 | 1844 | 141.5 | Stern fitted with fin with dye |

Wake downdraft was observed at all test conditions without the flow control fin. Formation of an intermittent air filled vortex directly above and leading into the propeller was observed at the 8 and 11 knot conditions, being most acute at the 8 knot 95 RPM towing condition. Pitching of the vessel greatly aggravated this condition causing large quantities of air to be sucked into the propeller. The installation of the fin eliminated the air drawing at these conditions and improved the flow into the propeller.

The still photographs taken do not adequately describe the phenomenon because of the speed with which the changes occurred. However, the photographs (Plates 1 and 3) show the effect of the fin on the vortex and the improved flow conditions at the stern.

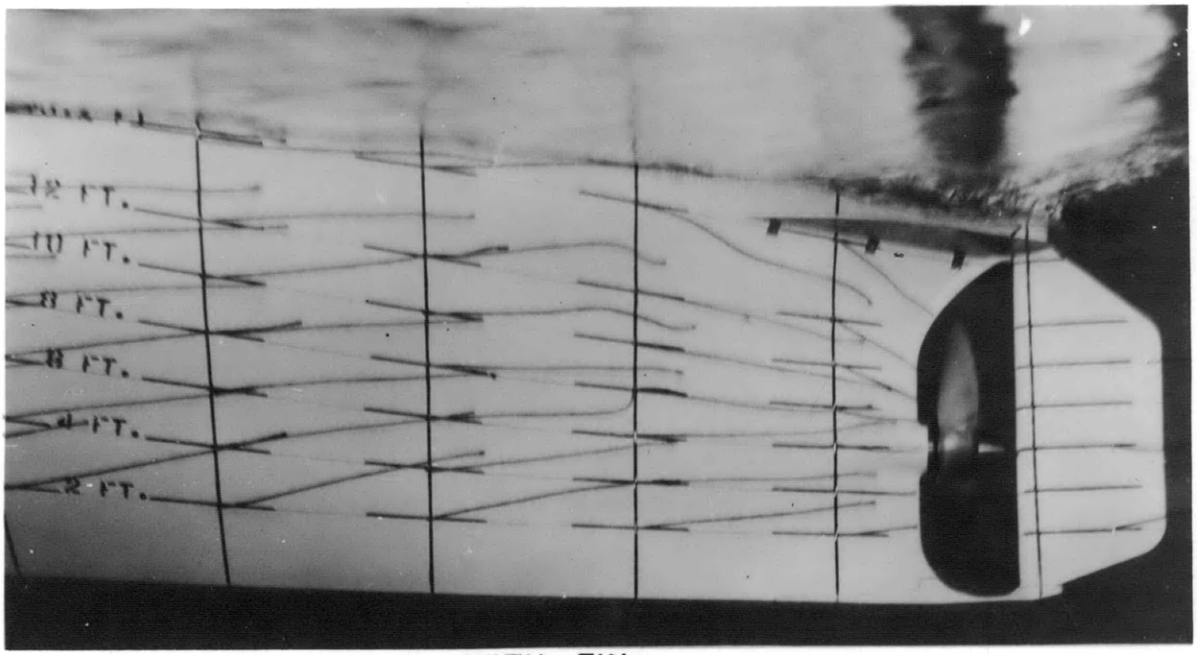
Plate 6, shows the fin fitted to the model. It is believed that the installation of these fins will not seriously affect the resistance characteristics of the hull.

PLATE I



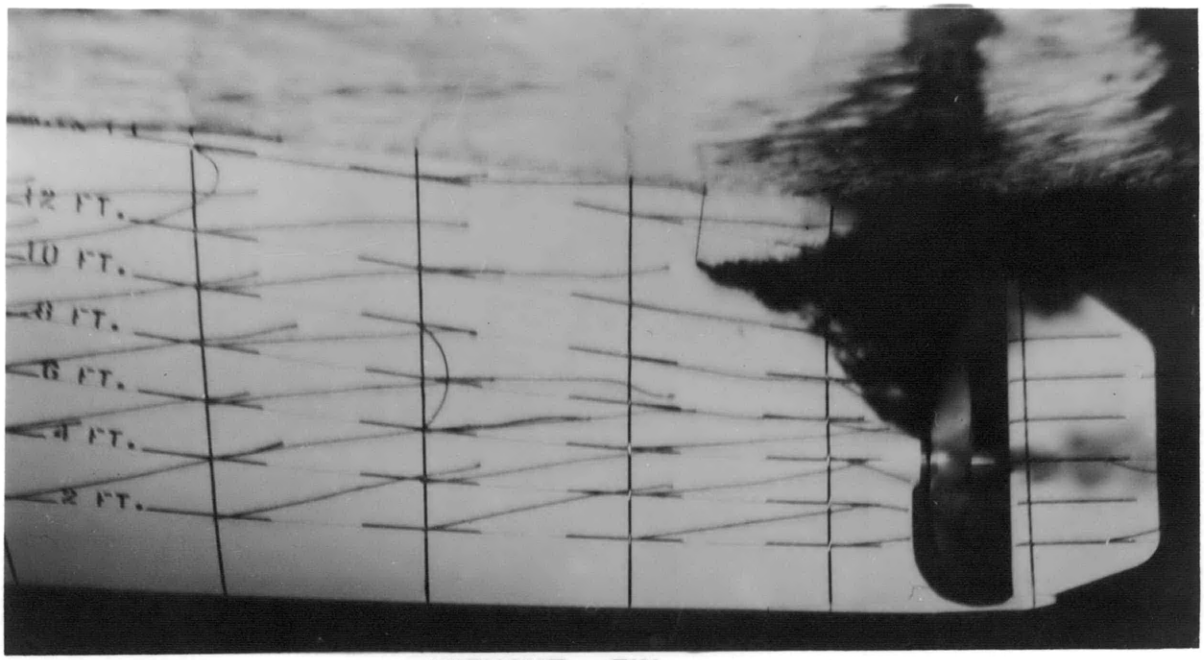

WITHOUT FIN

SPEED- 8.00 KNOTS RPM- 95



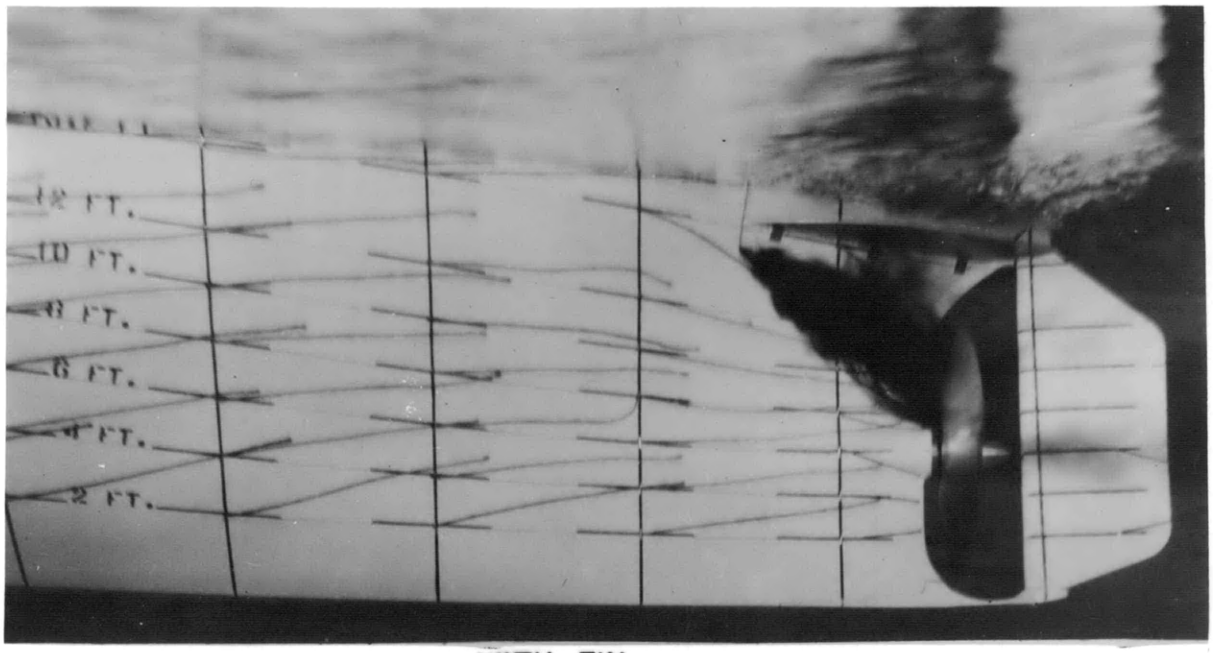

WITH FIN

PLATE 2



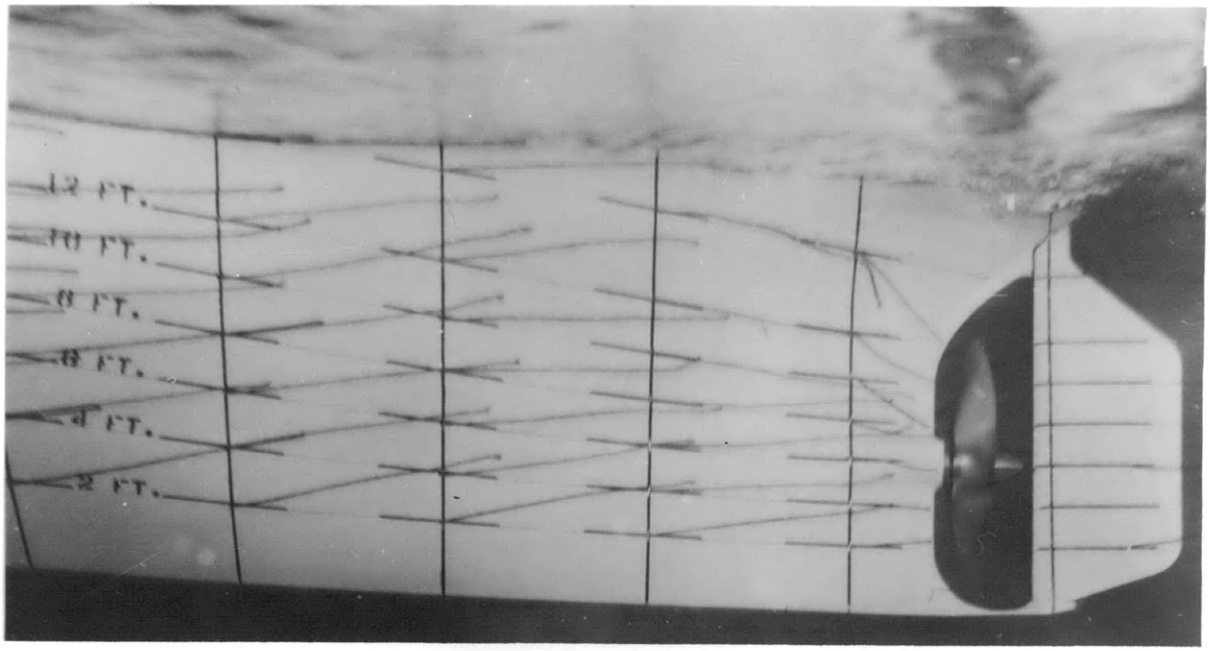

WITHOUT FIN

SPEED - 8.00 KNOTS RPM - 95



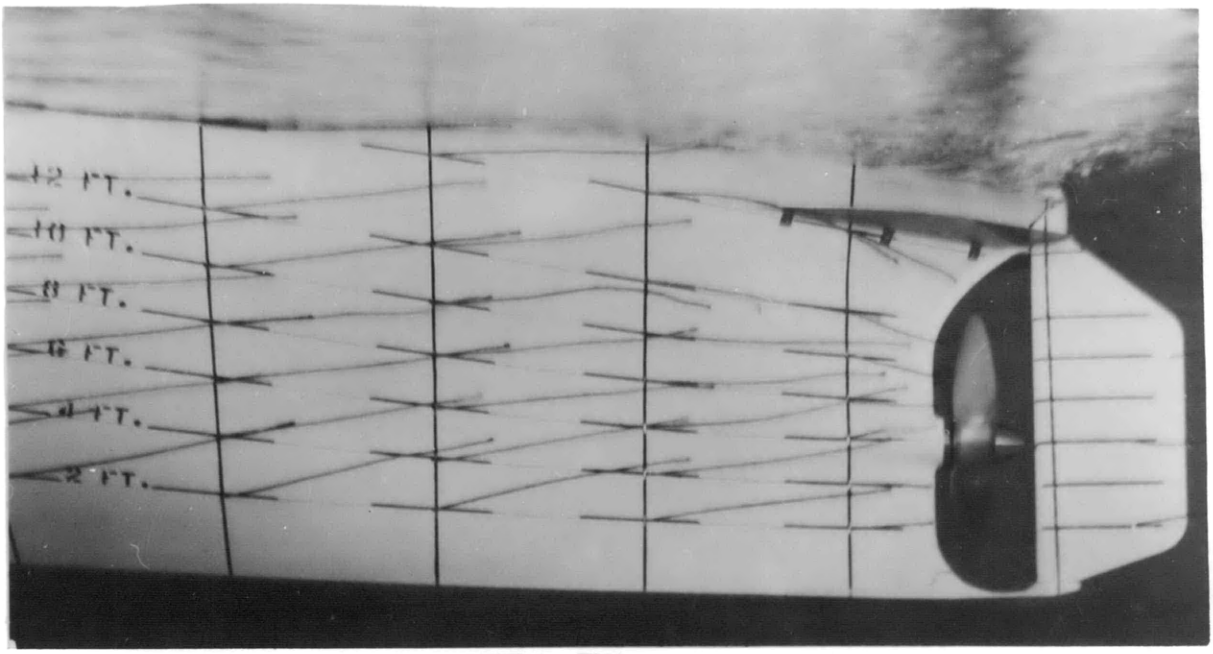

WITH FIN

PLATE 3



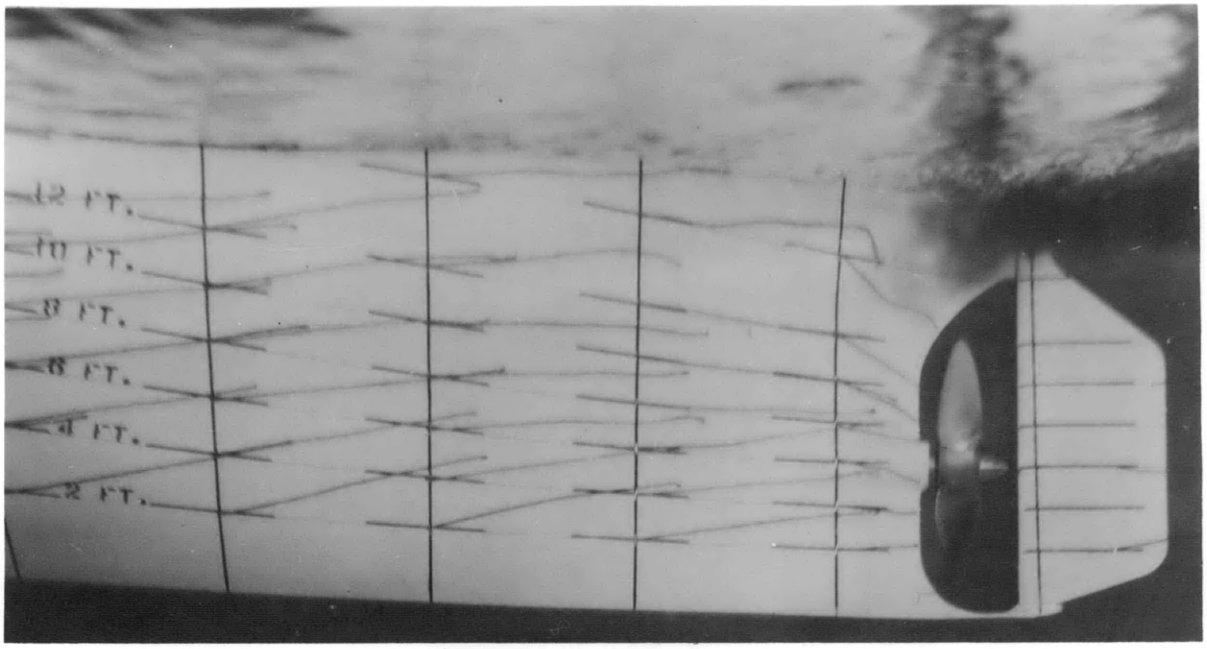

WITHOUT FIN

SPEED-11.00 KNOTS RPM-95



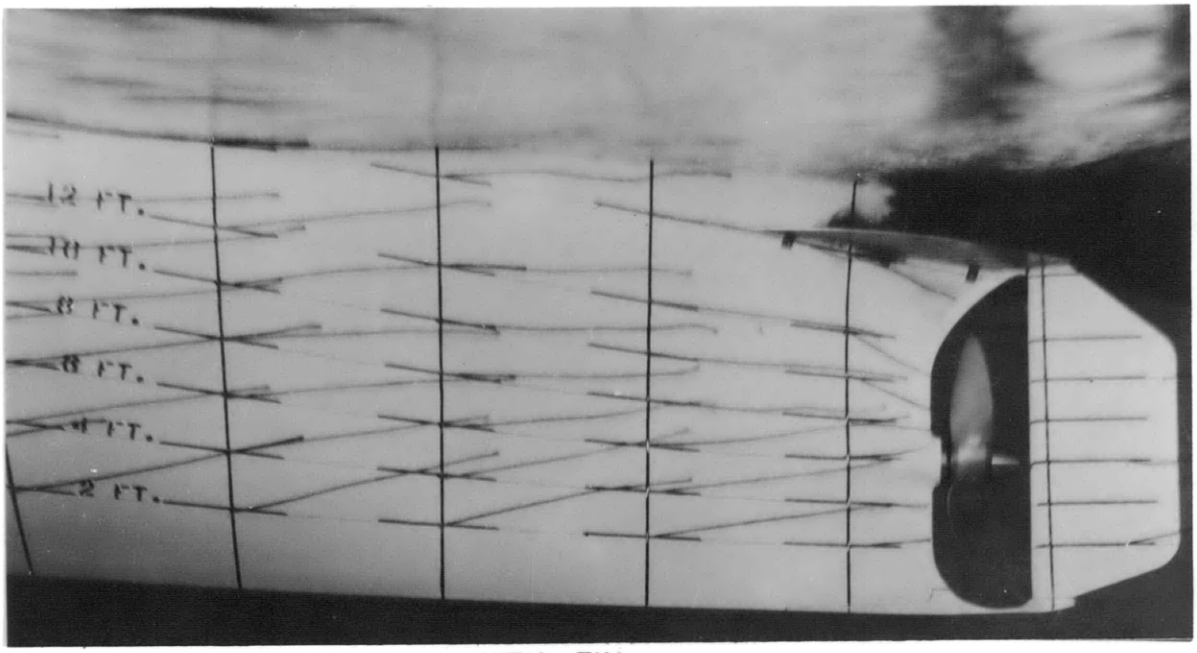

WITH FIN

PLATE 4



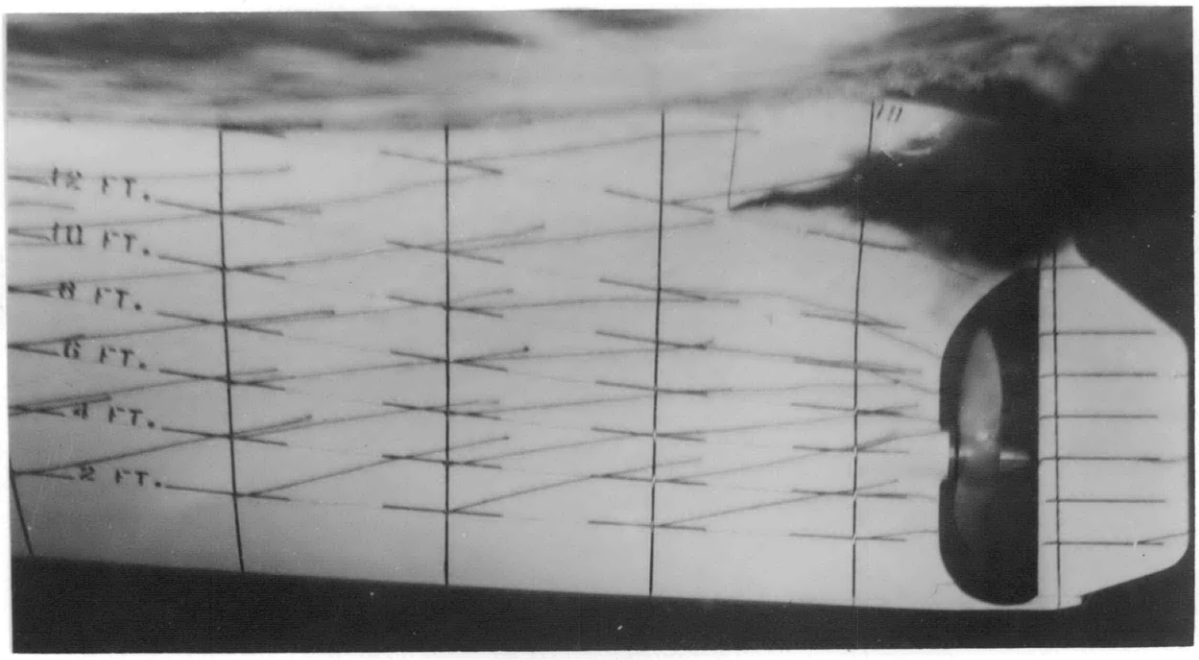

WITHOUT FIN

SPEED-11.00 KNOTS RPM-95



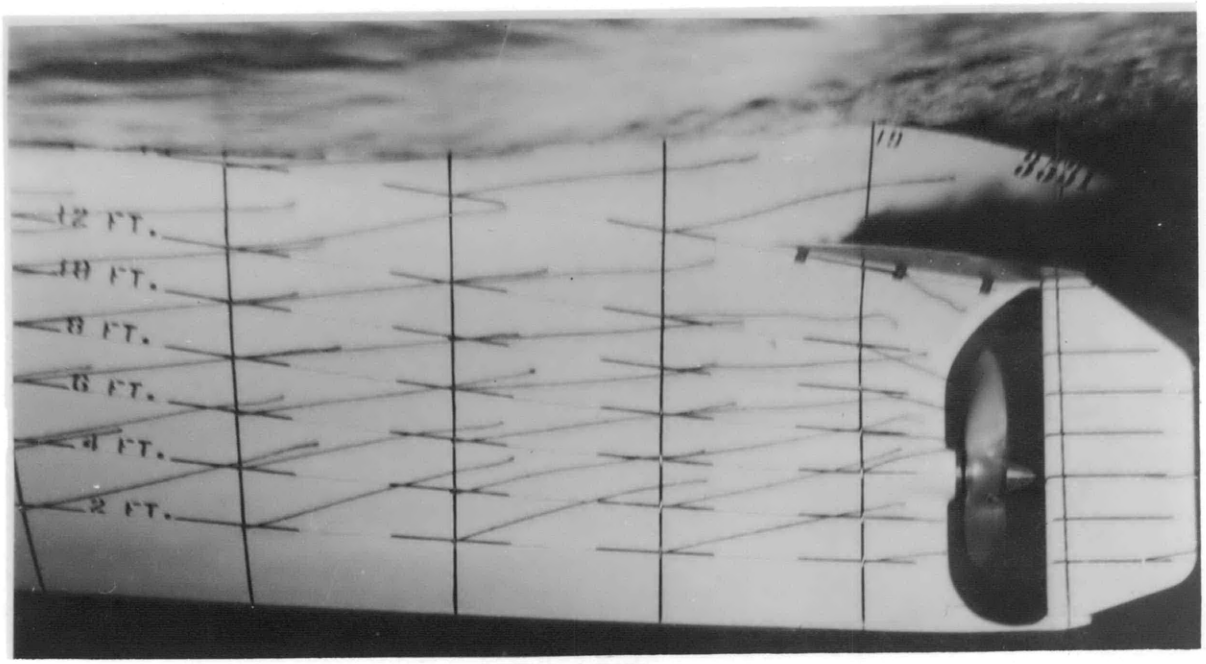

WITH FIN

PLATE 5




WITHOUT FIN

SPEED - 16.00 KNOTS RPM - 141.5




WITH FIN

# PLATE 6

STERN FIN
FOR
U. S. FLEET TUG (ATF 163)

DAVID W. TAYLOR MODEL BASIN — WASHINGTON 7, D. C.

3 DECEMBER, 1951