

Department of the Navy
Bureau of Ordnance
Contract NOrd-16200
Task I

AN EXPERIMENTAL DETERMINATION OF DYNAMIC COEFFICIENTS FOR THE BASIC
FINNER MISSILE BY MEANS OF THE ANGULAR DYNAMIC BALANCE

Taras Kiceniuk

Reproduction in whole or in part is permitted for any purpose
of the United States Government

Hydrodynamics Laboratory
California Institute of Technology
Pasadena, California

Report No. E-73.3
June 1957

Approved by:
Haskell Shapiro

INTRODUCTION

Equipment developed in this Laboratory permits the determination of eight of the dynamic coefficients useful in describing the force and moment reactions on a submerged body moving in water. These coefficients comprise the partial derivatives of moment (about the yaw axis) and of force (in the horizontal plane, and perpendicular to the longitudinal axis) with respect to velocity and acceleration components in specified directions. So long as the instantaneous angles of attack are small and scale effects are absent, these coefficients have constant values. A complete list of coefficients is given in Ref. (1), as are definitions, sign conventions and formulas for making the coefficients nondimensional. The eight coefficients tabulated below are those pertinent to lateral translation and rotation about the yaw axis for a body of revolution:

| | |
|---------|--|
| N_r' | coefficient of rotary moment derivative |
| N_r'' | virtual moment of inertia coefficient (angular acceleration) |
| N_v' | coefficient of static moment derivative |
| N_v'' | virtual moment of inertia coefficient (lateral acceleration) |
| Y_r' | coefficient of rotary force derivative |
| Y_r'' | virtual inertia coefficient (angular acceleration) |
| Y_v' | coefficient of static force derivative |
| Y_v'' | virtual inertia coefficient (lateral acceleration) |

where the prime indicates that the coefficients are in dimensionless form.

It is the purpose of the experimental program undertaken at this Laboratory to determine the numerical values of the above quantities for

