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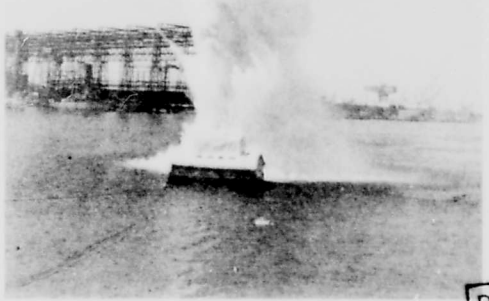
BuShips Project S-F013-10-03

UERD Report 7-61

THE FLOATING SHOCK PLATFORM

FOR SHOCK TESTING EQUIPMENT UP TO 30,000 POUNDS



May 1961

UNDERWATER EXPLOSIONS RESEARCH DIVISION

DAVID TAYLOR MODEL BASIN

Portsmouth, Va.

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Floating Dock Platform

MACHINE FORM

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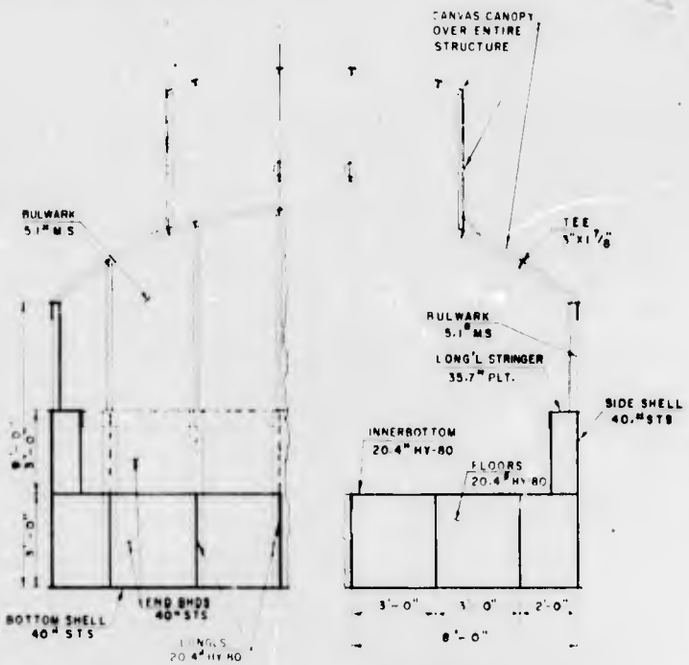
THE FLOATING SHOCK PLATFORM

Heavy shipboard equipment weighing up to 30,000 pounds can now be shock tested on a shock test vehicle by the Underwater Explosions Research Division (UERD) of the David Taylor Model Basin located at the Norfolk Naval Shipyard, Portsmouth, Virginia. This vehicle, called the Floating Shock Platform, was designed and built to provide a realistic environmental shock test facility to handle equipment exceeding the weight capacity of conventional impact shock machines.

The Floating Shock Platform was designed to represent the double bottom structure of a surface ship hull. However, because of freedom in design of supporting structure and equipment mounting it is possible to simulate a wide variety of ship type shock environments. The basic structure is a rectangular double bottom section with a working space 20 feet long and 14 feet wide. The plating, floors and longitudinal of the 3-foot inner-bottom structure are made up of 20.8-lb HY-80 plate and the sides and bottom are 40-lb STS plate. A 3-foot bulwark was installed to increase the freeboard, and the platform was outfitted with a removable canvas top cover to protect test equipment from the weather and plume spray.



END BULKHEAD
LOOKING FORWARD
SCALE - 3/8"=1'-0"

TRANSVERSE SECTION
AT FRAME NO. 5
SCALE - 3/8"=1'-0"

The platform weighs 66,000 pounds. It was especially designed for testing equipment in the weight range from 4,500 pounds to 30,000 pounds. Shock testing of equipment weighing up to about 40,000 pounds can be accomplished on it in special cases depending on the vertical position of the center of gravity.

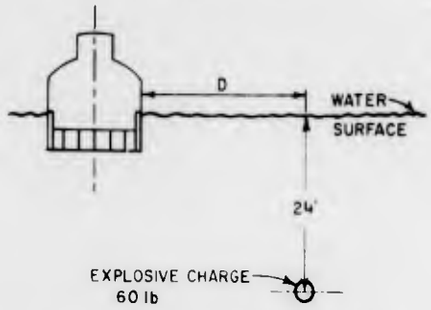
The equipment tested on the Floating Shock Platform is realistically installed on a foundation which duplicates as nearly as possible the prototype ship foundation; the equipment is in actual operation during the explosion shock test.

For shock testing of equipment the Platform is usually subjected to five underwater explosion attacks varying from light to severe shock intensity. A 60-lb charge is employed; shock severity is governed by the standoff. Tests are usually conducted in the Elizabeth River Turning Basin at the Yard.

A standard sequence of 5 tests of increasing shock severity has been established. The shock severity is expressed in terms of the peak input velocity measured at the base of the equipment foundation. The peak input velocities resulting from these tests depend somewhat on the mass and foundation of equipment being tested.

Test No.	Charge Standoff D (ft)	Peak Input Velocity (At equipment foundation) (ft/sec)
1	60	4.5 - 5
2	40	7 - 8
3	30	9 - 10
4	25	11 - 12
5	20	13 - 15

After each attack, a thorough visual inspection is made of the equipment. Tests may be discontinued or delayed after a particular attack for repairs or replacements of damaged parts of equipment.

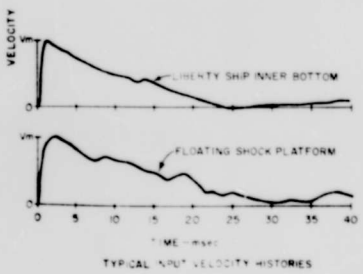


This is a schematic of the typical test geometry. Water depth in the Turning Basin where most tests can be conducted averages 40 feet. For testing equipment that may involve a hazard the Floating Shock Platform may be towed to an area remote from the Yard.

A 500-KW Turbogenerator is being installed on the Floating Shock Platform for underwater explosion testing. It has been mounted on its typical shipboard foundation and will be in normal operation when the tests are conducted.

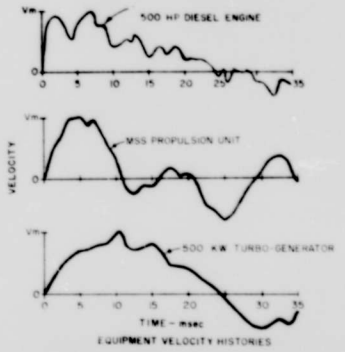
The Floating Shock Platform is towed to the Norfolk Naval Shipyard Turning Basin where the explosion tests are conducted. The canvas canopy has been hoisted into position to protect the equipment. A Company Representative and the DERD Project Engineer make final checks on operations at the site.

Motions of the shock platform from underwater explosion attacks are compared with the shock motion experienced by a surface ship at the inner-bottom level. Two types of motion are distinguished: input motion, defined as the velocity history measured at the base of the foundation; and response motion, defined as the motion of the equipment as a result of the input motion. Input velocity records from surface ships and the Floating Shock Platform compare well. And inasmuch as the equipment is installed on typical shipboard foundations the test produces realistic environmental motions. A certain degree of simulation of the shock environment of many submarine equipments is also possible.



TYPICAL INPUT VELOCITY HISTORIES

These velocity histories show that input velocities of the Floating Shock Platform compare well with those at the inner bottom of a surface ship.

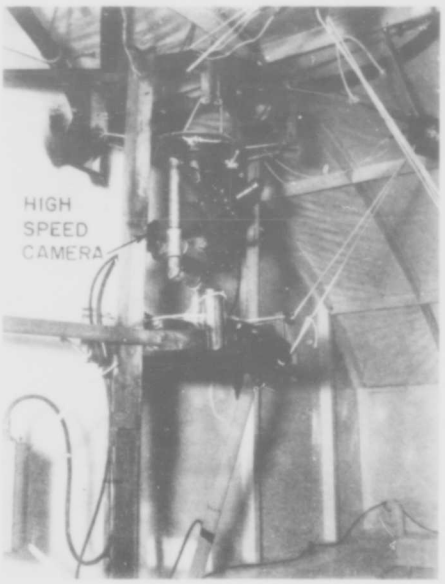


EQUIPMENT VELOCITY HISTORIES

The motion of the equipment will vary depending on the foundation rigidity and the mass of the equipment. These velocity records of the motion of equipment tested on the Floating Shock Platform illustrate this: the equipments have been subjected to essentially the same input velocities; however, the motions realized by the equipment are different mainly because of variations in foundation rigidity and equipment mass.

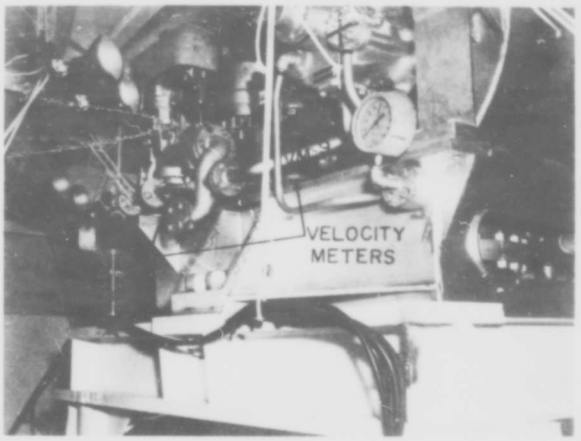
UERD personnel plan and conduct the tests in the Norfolk Naval Shipyard where all facilities and services required for this work are available. The presence of a Company or Navy Department representative who is familiar with the operation and makeup of the item is required during testing to assist in operation and inspection of equipment and for evaluation of damage.

UERD will usually provide all instrumentation necessary to measure input and response motions of the equipment. The placement and positioning of the gauges and high speed cameras are usually designated by the UERD Project Officer after consultation with the Sponsor and a study of the equipment to be tested. Special gauges or cameras may be added at the request of the Company or Navy Department representative.

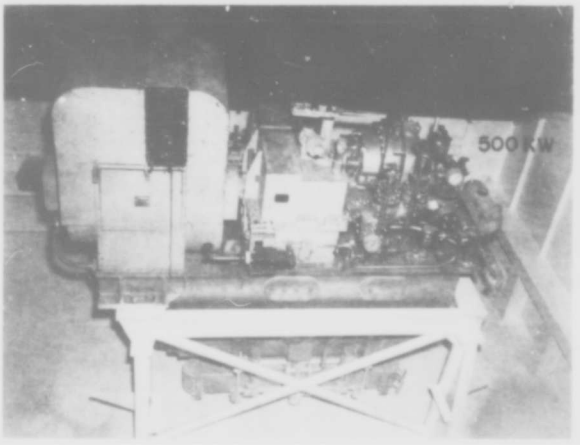


A high-speed motion-picture camera has been installed so that the equipment being tested will be in its field of view. It will be triggered to operation shortly before detonation of the charge so that all motion that the equipment undergoes will be recorded.

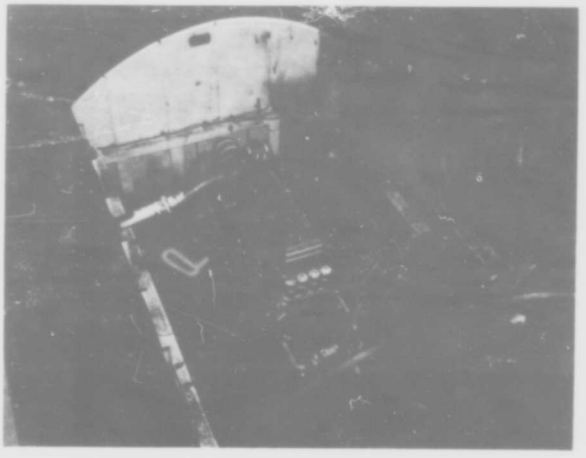
A velocity meter (VM) is used to measure the shock severity at the base of the foundation.



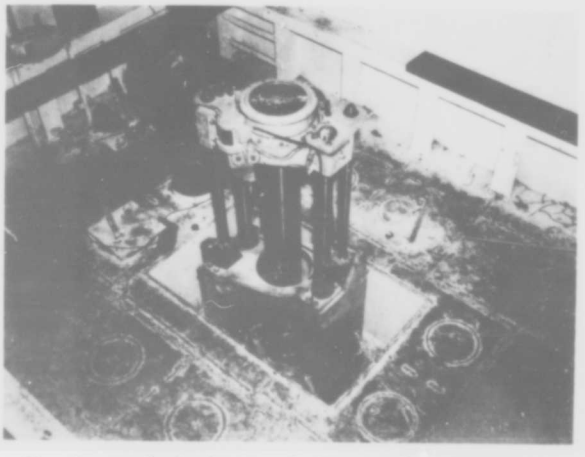
Velocity Meters, VM-9 mounted on equipment subbase and VM-3 mounted on top of foundation, record the equipment response. Instrumentation will necessarily vary with each equipment test.



This view depicts the installation of a 23,000 lb 500-KW Turbogenerator with a flexible type foundation. The equipment components are realistically mounted on a subbase which, in turn, is realistically attached to the foundation.



This 500 HP Caterpillar Diesel Engine was mounted on its rigid shipboard foundation and tested.



Though primarily developed to shock test surface ship items, the Floating Shock Platform may be utilized to shock test submarine equipment. It was adopted to suit the installation of this MK II Secondary Propulsion System. The unit was installed on a simulated submarine pressure hull.

The cost to shock test equipment on the platform can vary greatly; however, an average cost will be between $20,000 and $30,000. This figure includes cost of planning, designing, manufacturing and installing the foundation; mounting the equipment to be tested on the foundation; conducting five tests; and a report on the results. Factors that govern the cost are:

- Complexity and size of foundation structure
- Nature of equipment preparation prior to tests
- Facilities required to operate equipment, e.g., air, steam, power and hydraulic system, etc. The facilities for operating equipment normally provided by a naval shipyard are available to UERD for these tests. Special facilities can be provided as necessary.
- Instrumentation requirements (high speed photography, velocity meters, strain gauges, etc.).

Inquiries concerning Shock Tests should be directed to:

Underwater Explosions Research Division
David Taylor Model Basin
Portsmouth, Virginia
Telephone: EXport 7-6541, Extension 2989

Any inquiries should outline general test requirements so that cost estimate and plans necessary for establishing a tentative test schedule can be made.

The Underwater Explosions Research Division has prepared a sound motion picture (Ships 6-60) entitled "Shock Testing of Heavy Weight Equipment" that further describes the use of the Floating Shock Platform. Request for loan of this documentary film should be directed to:

Chief, Bureau of Ships
Attn: Code 423
Department of the Navy
Washington 25, D.C.

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