AD-A009 046

STABLE FLOATING PLATFORM

Fred N. Spiess

Scripps Institution of Oceanography
La Jolla, California

30 June 1970

QUARTERLY PROGRESS REPORT

June 30, 1970

SCRIPPS INSTITUTION OF OCEANOGRAPHY
University of California, San Diego
Dr. William A. Nierenberg, Director

ADVANCED OCEAN ENGINEERING LABORATORY

Sponsored by

ADVANCED RESEARCH PROJECTS AGENCY
Advanced Engineering Division
ARPA Order No. 1348

Project: "Stable Floating Platform"

Principal Investigator: Dr. Fred N. Spiess

Administered by the Office of Naval Research

Contract N00014-69-A-0200-6012

STABLE FLOATING PLATFORM QUARTERLY PROGRESS REPORT June 30, 1970

By the close of the quarter ending March 31, 1970 the wind/wave channel at the Hydraulics Laboratory had been filled with water and preliminary debugging of the whole system began. In the quarter just completed, calibration of the system as a whole commenced, including appraising various adjustments of the wave generator, selecting optimum beach conditions, and running tests on various measurement systems. Variations of wave pressure vs. depth have been measured and taking into consideration the 1/100th scale modeling factor, deep ocean waves of 13 seconds and less can be duplicated, whereas longer period waves follow the finite water depth theory. A detailed technical report describing this new facility will be forthcoming.

A bi-axial auto-collimator has been selected as the prime sensor for measuring the motions of the 1/100th scale models. By measuring the x and y values at two locations on a model; heave, surge, and pitch may be determined. This analog information is fed into the IBM 1130 computer and on-line cross-spectral analysis is performed simultaneously with that from the wave staffs and pressure sensors. One can then ascertain to what degree the models are achieving the freedom from motion we are striving for.

We have written some 50 computer programs for the IBM 1130 in connection with the model testing. About half these are for reading analog signals from various sensors, digitizing, and performing the spectral analysis. The others are utility programs for electronic testing of the systems and presenting the data analysis in various forms on the plotter.

A 1/100th scale model of FLIP (Floating Instrument Platform) was built during this quarter and used in the calibration and evaluation of the wind/wave channel. Since we possessed qualitative data on FLIP's response in the open sea, it was an obvious thing to compare this to the model's performance in the tank, and to use the model in the system check-out.

In May, a meeting was held to lay out the next few month's work and course of direction for the program. (Minutes and attendees in App. I). It was decided to follow two essentially different lines concurrently with the major effort really focused on the design of a platform to support oceanographic research including underwater acoustics. This would be to build and test models of a 3-leg platform, and the other would be a 2-leg platform with the legs connected rigidly together. Both types would have a hinged-type platform for the upper or "lab-space" section. A 1/100th scale model of a 350' 2-leg platform was built during this quarter and 1/100th scale models of a 250' 2-leg and a 250' 3-leg platform were started. Design plans for 1/8th* scale 2 and 3-leg models were also begun.

It is our intention to complete the 1/100th scale model testing in September, finish the construction and commence testing of the 1/8th scale models before the end of September, and make a decision in October on what type to pursue at full scale. Negotiations for a contract for engineering plans and specifications will be started in November depending on the receipt of funds in the amount of $200,000 which were included in our budget proposal (UCSD #3242-Rev. 1) and which were deferred until FY71 by ARPA from the amendment dated 2/6/70 to ONR Contract N00014-69-A-0200-6012, ARPA Transfer Order #1348, Amend. #3.

* A 1/8th scale model is of a size which will allow enough payload to permit an engineer or technician to ride the platform during flipping operations. This is not nominally true of a 1/10th scale model.

UNIVERSITY OF CALIFORNIA, SAN DIEGO

BERKELEY • DAVIS • IRVINE • LOS ANGELES • RIVERSIDE • SAN DIEGO • SAN FRANCISCO | SANTA BARBARA • SANTA CRUZ

SCRIPPS INSTITUTION OF OCEANOGRAPHY
Advanced Ocean Engineering Lab.

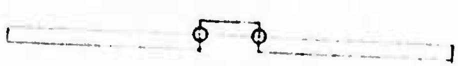
POST OFFICE BOX 109
LA JOLLA, CALIFORNIA, 92037

May 27, 1970

MINUTES OF MEETING ON FLOATING RESEARCH PLATFORM

May 22, 1970

Attendees:
- Dr. W. A. Nierenberg (short time)
- Dr. F. N. Spiess, presiding
- M. W. Johnson, G. H. Fisher, R. Oversmith of AOEL
- L. R. Glosten of L. R. Glosten and Associates, Inc.
- Ben C. Gerwick and W. J. Talbot of Santa Fe-Pomeroy, Inc.

1. Dr. Spiess opened the meeting by stating 2 ground rules:
   - Bare ship cost not to exceed $3.5M
   - Advancements in technology required
2. General requirements set forth by Dr. Spiess:
   - Small motions
   - Vertical period 25 sec. or greater
   - 12 scientists + 6 crew
   - 100 T PL (including on board winches & electronics)
   - Ability to handle large objects (20-30 T) over side or thru well
   - Operate from San Diego Bay (40 ft. depth)
   - Transit 6 kn 2000-3000 hp tug
   - Drift or 1-point moor
   - Orientation capability
3. Design concepts sketched by Dr. Spiess:
   - 1-hull FLIP
     - Lab body pivoted and remains horizontal
   - 2-hull FLIP
     - Legs interconnected rigidly
     - Lab body pivoted and remains horizontal
   - Similar but
     - Legs not interconnected 
   - 3-leg platform
     - Legs pivoted, cushioned, or fixed
   - Large hollow cylinder
     - Formed from pie-shaped barges on end

4. Mr. Gerwick reviewed real concrete structures dating back to 1948:
   Concrete barges
   San Rafael bridge 16 ft. D 8 in thick tubes
   San Mateo bridge 14 ft. D 8 in thick tubes
   Webster tube 39 ft. ID 2.5 ft. wall
   Antwerp tube 150 ft. wide 421 ft. sections
   Pretensioned barges 198 ft. long
   Dutch bridge 14 ft. D 160 ft. sections
   Drift River jackup 14 ft. D 285 ft. legs
   Telescoping lighthouses
   WW2 barges and drydocks zero maintenance

5. Mr. Gerwick discussed proposed concrete structures:
   Pomeroy Arctic drilling, working, storage rigs
   Gerwick Sr. barge delivery of twin legs
   Electric Boat submarine tanker 20 ft. D
   Pomeroy seafloor storage rig 326 x 105 x 54 ft.

6. Group discussion of specific designs, starting with 1-leg hinged structure having large center well. A number of disadvantages appeared as details were developed (problems of draft and stability in horizontal mode). Multiple barge-large shell concept rejected because gross dimensions indicated cost would be too high. 3-leg (Sea Legs type) model given low priority because large platform dimensions (dictated by need to use platform to secure legs while horizontal) also indicated high cost.

7. Discussion focused on 2-hull FLIP having concrete legs rigidly connected by concrete cross structure (sketch attached). 2-hull configuration provides good horizontal stability, thus allowing much better utilization of displacement than with single leg. 2-hull design is ideal test bed for evaluating added mass, damping, wave propulsion (station keeping) devices.

8. Item 7 discussion resulted in decision to pursue study of feasibility and cost of 2-hull concept. Analysis to be done in way to also determine feasibility and cost of 3-leg platform.

9. Assignments:
   Study feasibility and costs of 2-hull and 3-leg platforms
   Glosten - steel structures
      Collars above elev. + 15 ft, trunions, lab body
      Weight distribution and data from files (1 week)
   Pomeroy - concrete structures
      Legs and interconnecting structures
   2 leg drafts 200 and 300 ft.
   Cross consultation
   Oversmith be kept informed
   Finish feasibility and rough cost study by end of June, 1970

10. Advancements in technology with 2-hull concept:
    Versatile test bed for trying future engineering concepts (e.g.- large damping discs, wave propulsion fins, etc.)
    Lab body remains horizontal
    Hinging and locking of structures subject to wave forces while towing
    Concrete
    Small horizontal motions due to beam
    (G. H. Fisher pointed out after meeting that it may be feasibile to group such structures to form large platforms.)

11. Decision to build 1/100 and 1/10 scale models of 2 leg and 3 leg platforms as soon as weight distribution and tankage can be established reasonably.

R. Oversmith
Robert H. Oversmith
Sr. Dev. Engineer

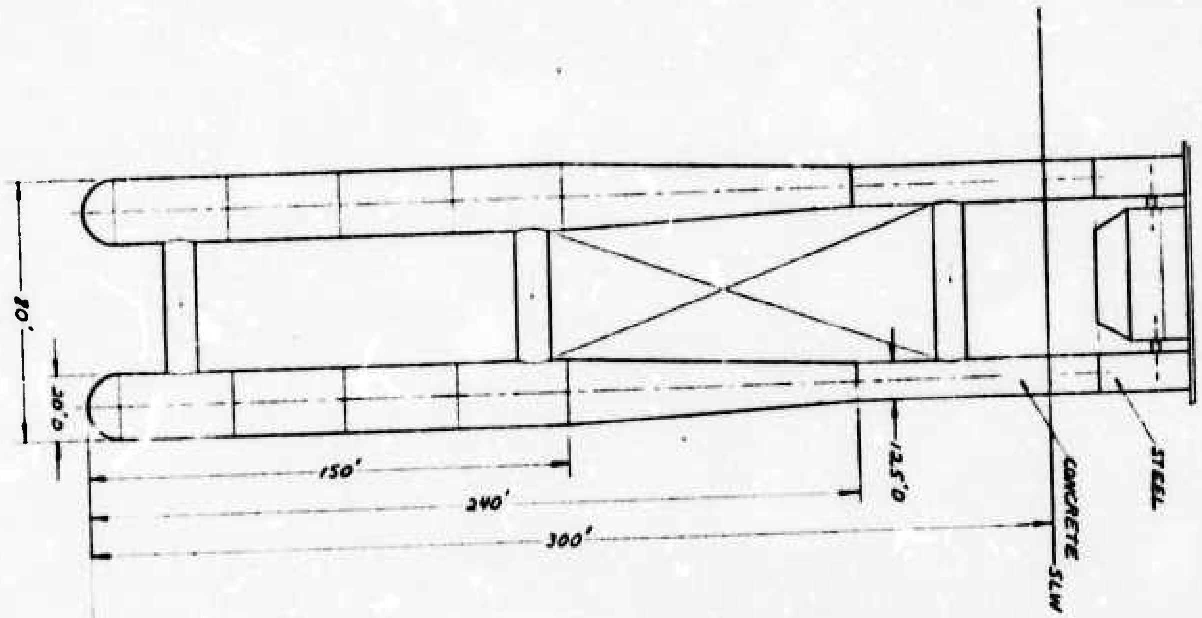
Approved by:

F N Spiess
Dr. F. N. Spiess
Principal Investigator

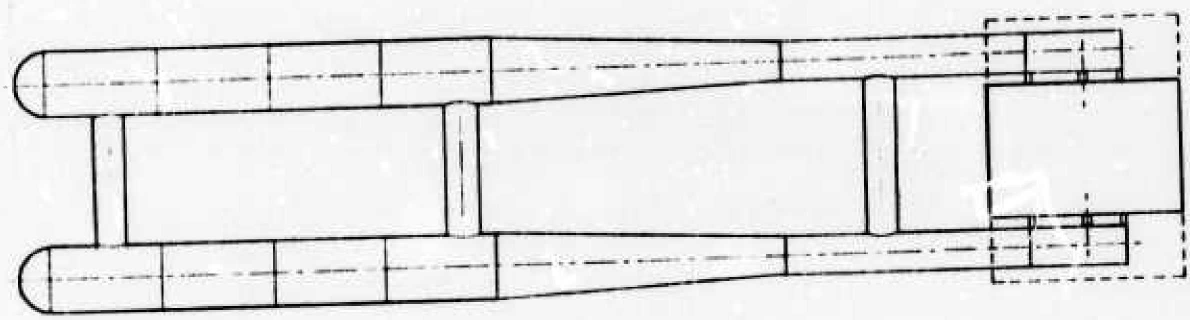
RHO:dty
Distribution:
All Attendees
Dr. C. J. Wang

2-HULL FLIP

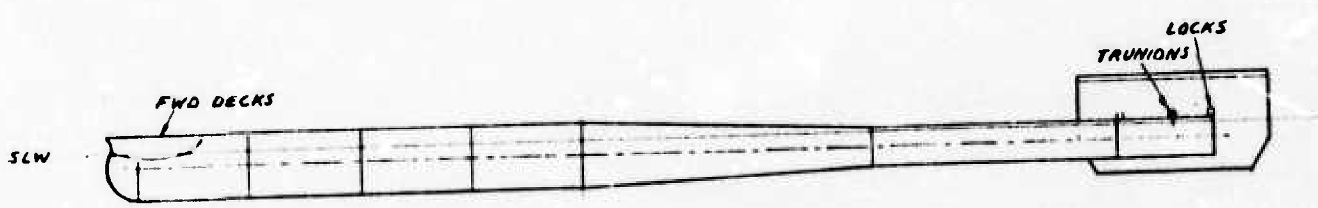
S.O MOEL DWG A-56 5-29-70 RNG



STATION-KEEPING MODE



TRANSIT MODE - PLAN VIEW



TRANSIT MODE - SIDE VIEW