SESSION ON ASPECTS OF OCEAN ENGINEERING WHICH ARE RELEVANT TO THE ITTC.

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Dr.N.Hogben Dr.G.van Oortmerssen Mr.F.N.Biewer

During this session papers on invitation were presented by Mr. F.N. Biewer, Dr. N. Hogben, Dr. G. van Oortmerssen, Mr. A. Tørum and Dr. Y. Yamanouchi. Comments presented during the session on aspects of ocean engineering which are relevant to the ITTC are given in the following.

F. TASAI - Kyushu University, Research Institute for Applied Mechanics, Fukuoka, Japan

Ocean technology group and ocean physics group in Research Institute for Applied Mechanics, Kyushu University, have conducted a joint research project for four years from April 1974 to March 1978. The main purpose of the project is to develop a small and stable floating type sea observation platform. The outline of the project is presented in the following.

1. *Location of experimental site*

Experimental site was set up 2 km off the coast, from Tsuyazaki Sea Safety Research Laboratory, where mean water depth is 16 m. From autumn to winter ocean waves generated by a north westerly wind often reach there.

2. *Fixed type sea observation platform*

In order to get the reference data about oceanographical and meteorological phenomena in advance of setting a floating station, we built a fixed type sea observation platform in September 1974. The fixed platform was composed of three steel pipes of diameter 0.8 m. The pipes were struck into sea bottom and fixed at an interval of 7 m from each other to form a triangle plan view (see figure 1). By use of this platform, we have successively measured up to the present, wind velocity, temperature, waves, current, water temperature, salinity, tide, together with acceleration of the platform caused by random vibration and wave pressure acting on the piles. By virtue of the fixed platform we acquired the sufficient environmental informations of the experimental site.

3. *Single point mooring spar buoy type sea observation platform*

It was estimated that the maximum tidal current velocity was 1 knot, the wind velocity 40 m/sec., the wave height 5 m, and energy of waves for long period greater than 10 sec. would be extremely small at the experimental site. In order to develop a small floating type sea observation platform exhibiting excellent performance under these conditions, we made theoretical investigations and performed tank tests by using several models.

3.1. *Floating station*

The body of the station consisted of a column with a footing and three fins. The most remarkable feature was a large horizontal discus fin perforated with circular holes. The fin makes the natural heaving period T_z and the waveless period T_O large. While, the holes increase the heaving damping force and stabilize the wakes of the station. As a result of calculations for various combinations of shapes for the column, the footing, and the discus fin, assuming the mean water depth of 16 m, the final dimension was selected as shown in Figure 2.

The characteristics of this station were T_O= 9 sec., T_z= 21 sec., and the heaving amplitude of the station at the experimental site was not exceeding 10% of the incident wave amplitude, if the wave period was less than approximately 10 sec. This was also confirmed by the tank tests.

3.2. *Mooring system*

Single point mooring system was employed. It consisted of a concrete made sinker, a sub-surface buoy, and the floating station as shown in figure 3.

3.3. *Measuring items*

Measurements were made in terms of the wind direction and wind velocity at 10 m above the sea surface, waves (through the capacity type wave probes), the motions of the station such as the pitch, the roll, the azimuth, and three components of acceleration, together with the mooring line tension, and the bending stress of the column.

4. *Comparison of significant wave heights obtained at both platforms*

Analysis of the data obtained at the fixed and the floating station are now in progress. The whole results will appear in the subsequent paper. In the meanwhile, as an example, significant wave heights obtained at the both platforms are shown and compared in figure 4. It was found that the influence of the buoy motion was negligible small. In the figure, nevertheless, the data obtained at the floating station were shown after eliminating the small amount of effects of the buoy motions. The agreement of the measured values ob-

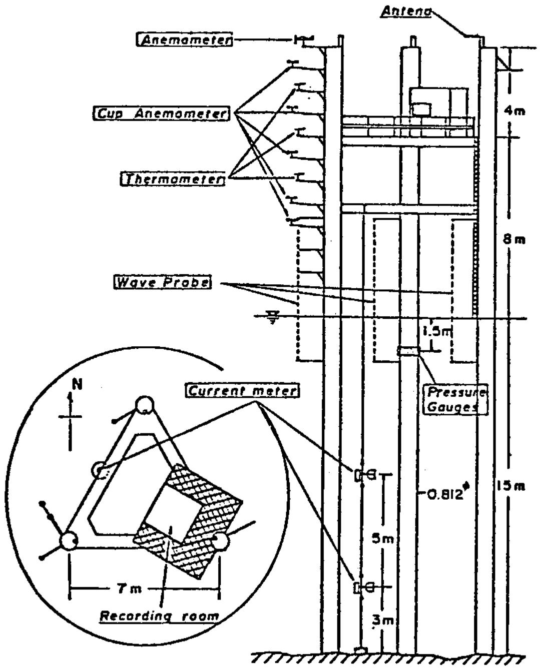


Fig. 1 : Fixed type sea observation platform.

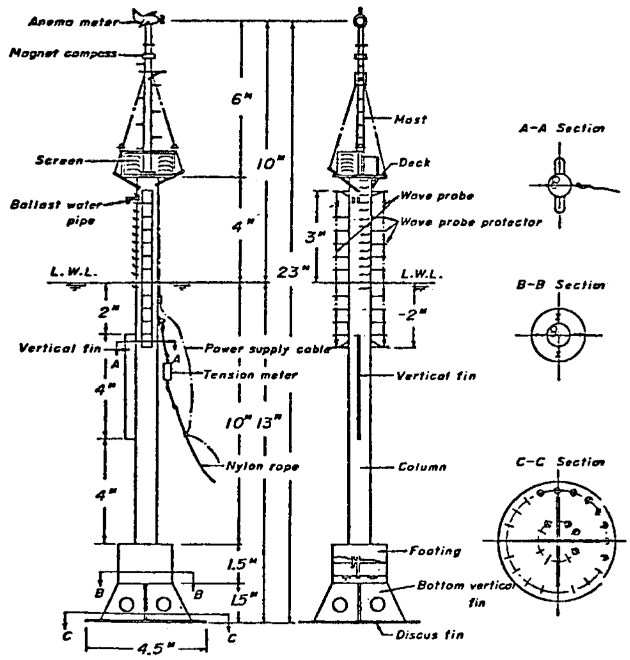


Fig. 2 : Floating station of spar buoy type.

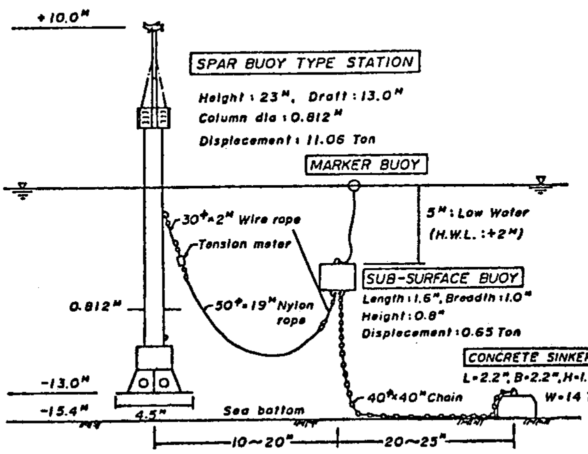


Fig. 3 : Mooring system.

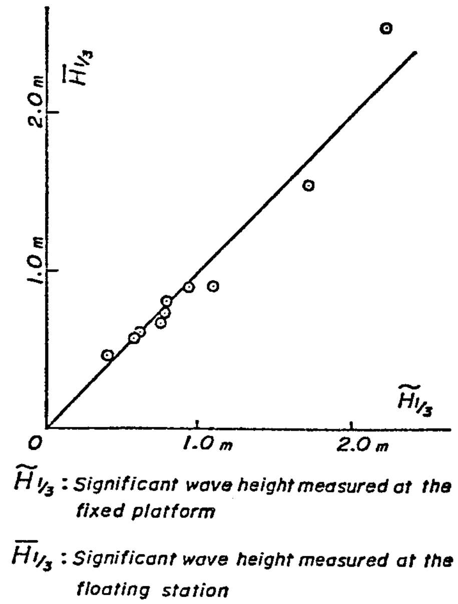


Fig. 4 : Comparison of significant wave height measured at the fixed platform and the floating station.

tained at the both stations is good.

5. *Concluding remarks*

As described thus far, by utilizing the experimental site where the fixed type sea observation platform has been set, we have succeeded to develop the single point mooring spar buoy type sea observation platform. The motions of the buoy were small and total system operated satisfactory. Thus, it was shown that the buoy so far developed could be used as the platform for oceanographic research such as measuring wind and waves with the high precision.

The floating station was removed from the site in the end of May 1978. Since then many researches on science and technology for ocean exploitation are still conducted at the experimental site.

REFERENCES

Tasai, F. et al.: "A study on a stable platform for oceanographic research (1)", Bulletin of Research Institute for Applied Mechanics, Kyushu University (in Japanese) No. 46, 1977, pp. 17-109.

A.M. FERGUSON - University of Glasgow, Department of Naval Architecture, Glasgow, United Kingdom

"Ocean Engineering Test Facilities"

These comments concern two points raised in the review by Dr. Hogben on modelling sea conditions.
Firstly, regarding the question of how the subject of Ocean Engineering should be accomodated within the ITTC.
I endorse Dr. Hogben's view that this would best be achieved by forming an 8th committee with the title "Ocean Engineering". The subject which is rapidly expanding, covers a wide range of new topics which are not covered adequately, if at all, by the existing seven committees.
My second comment concerns the requirement of new facilities purpose built for ocean engineering experiments.
With regard to the position in the U.K. there are now six manoeuvring basins in existance, none of which were specifically designed for offshore engineering tests. The largest of these basins is that at A.E.W. with the dimensions of 122 m x 61 m at a depth of water of 5.5 m. It is this last figure, the depth of water, which would probably limit the usefulness of even this large tank, when considering ocean engineering tests.
In the writers opinion, the minimum depth of water for any new ocean engineering laboratory, should be 10 m. A depth of 10 m at 1/100 scale, the scale commonly used at present, corresponds to 1 km which is as deep as is likely to be needed and deep to all waves ever recorded in the Atlantic.
At 1/20th scale, 10 m corresponds to the edge of the continental shelf, which is the limit of all North Sea fields.
For the information of the Conference, I can report that, at Glasgow University, a specification is being prepared for a new deep water ocean engineering laboratory which it is hoped, will eventually be funded and built. The new laboratory would have minimum dimensions of 60 m x 25 m and a depth of water of 10 m. The facilities would include equipment for the production of waves, wind and current.

At present ocean engineering research is continuing at Glasgow University using the existing towing tank facilities with particular concentration on Item I (fluid-structure interaction) of the Draft recommendations for the proposed committee on "Ocean Engineering". We are also involved with research on "wave force" reducing devices for surface piercing circular cylinders, as part of a joint programme with N.M.I. and will probably include use of the Christchurch bay facility. It is hoped that the outcome of the research will be offered to the ITTC.

S. SCHUSTER - Versuchsanstalt für Wasserbau und Schiffbau, Berlin, Federal Republic of Germany

There is no question that I may emphasize the necessity of an ITTC Committee on Ocean Engineering, since I stood up for this idea already at the past conference. But it may be allowed that I point to a few dangers when giving a deal along the proposed paragraphs.

1. The spectrum of tasks is too wide. Due to the experience I had in introducing Ocean Engineering into the field of matters of the German Society of Naval Architects I may recommend confining the list of subjects to those which are to be handed by naval architects already now. That means, we should cancel the points 5, 6 and 7.
2. These important subjects should be kept to the Hydraulic Laboratories and the special societies and conferences, respectively.
3. The case that both the disciplines of Hydraulics and Hydrodynamics are living under one roof, as we have in the Berlin Model Basin, and that since 75 years, is profitable, but not the rule; therefore we need in general co-operation with other institutions, and at the level of ITTC with other Conferences. Especially I recommend contacts to ECOR which invited the ITTC already some times a few years ago. Comparable connections should be installed with DIANC, ICCS, and ICCE.
4. The first steps seem to be simple ones. We need one of us to be a kind of link between ITTC and ECOR or the other ones. I would nominate Mr. Hogben and Mr. Yamanouchi, both being members of ECOR.
5. In view of more details demonstrated by the pictures and films of typical tests as well as the recommendation of providing 10 m depth for future basins working in the field of ocean engineering, I may add, that it seems to me more evident to have different kinds of facilities. That are a towing tank of perhaps only 5 m depth but minimum 200 m length, a shallow water tank, a circulating tank and, if possible, some hydraulic channels with flowing water and movable soil.

M.S. CHISLETT - Danish Ship Research Laboratory, Lyngby, Denmark

Wind Simulation using reaction fans

The generation of waves in model scale has been the subject of extensive research and development for many years and has reached a high degree of sophistication.

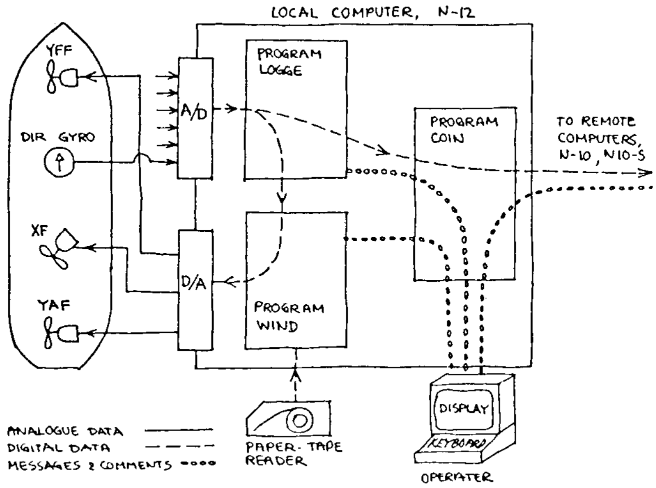
Modelling of winds and currents has, on the other hand, received less attention and they are at best generated using arrays of fans and pumps together with guide vanes. The main disadvantage of this rather unwieldy approach is the poor control over the wind and current fields, whic moreover are tedious and time consuming to check and adjust. The instrumentation and cabling etc. unavoidably aggravate the situation.

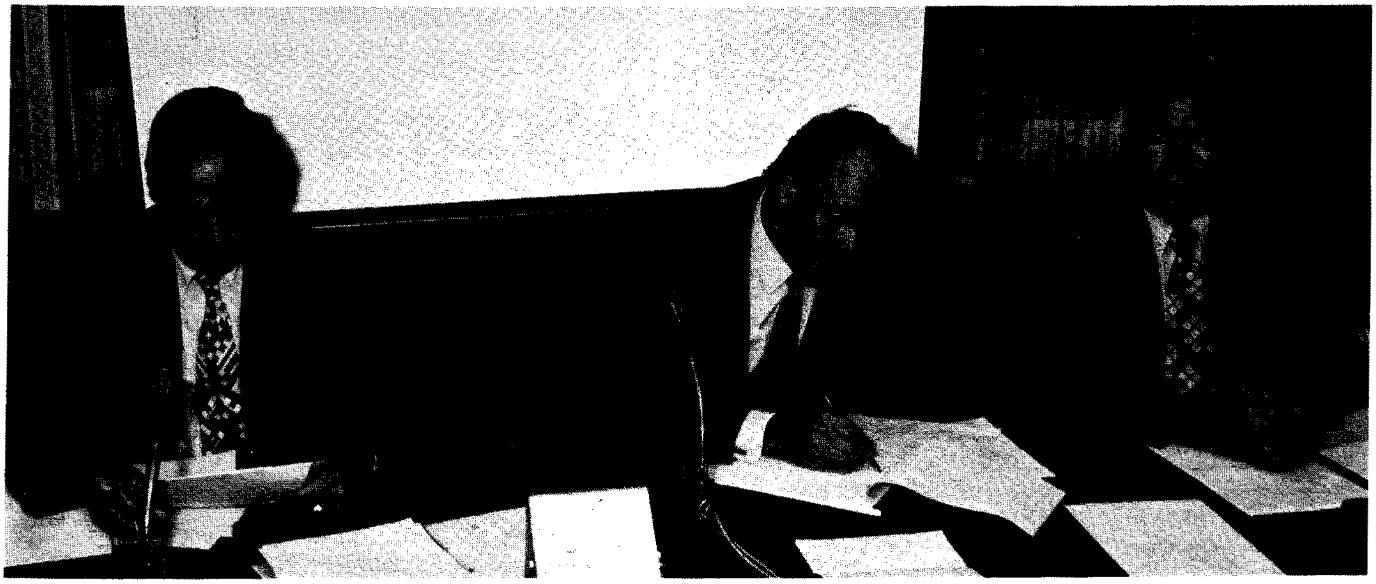
The new system recently developed at DSRL short circuits these problems by impressing the ship and other offshore models directly with the FORCES arising from wind and currents. These forces are generated by mounting small powerful air propellers on the models. The propeller motors are controlled by an on-line digital computer which calculates the command revolutions on the basis of tables of wind tunnel data stored within the computer, together with the attitude of the model (relative to the assumed wind direction) which is sensed continuously.

This system enables the model to be impressed with precisely controlled (and continuously documented) wind and/or current loadings, the flexibility of which is limited only by the imagination of the test engineer. It is for example a simple matter to programme a veering/backing wind having increasing/decreasing velocity, including natural gustiness and the lee effects of one structure on another. Corrections for differences between model and full-scale vertical wind gradients and Reynolds Number drag effects can be conveniently included.

Current forces can be treated in the same way, if necessary using water propellers instead of air propellers. In this case it is of course necessary to include a feed-back correction to account for the relative water speed due to the model's motion.

The system consists essentially of an interactive real-time marriage of a physical model in the water and a mathematical model in the computer. The success of the union results from the matching of the two partners' characteristics in such a manner that the strength of the one compensate for the weakness of the other.





Dr.M.W.C. Oosterveld
Secretary 15th ITTC

Dr.W.B.Cummins
Chairman Advisory Council

Prof.Dr.J.D.van Manen
President 15th ITTC

MEETINGS OF ADVISORY COUNCIL

Various meetings of the Advisory Council took place during the Conference and the Executive Committee was able to take note of the deliberations.

In particular the Advisory Council gave thought to the Recommendations of the Executive Committee and could in general support these Recommendations.

In the opinion of the Advisory Council the existing Technical Committees should, as much as possible, cover the topics of the 16th ITTC. The Advisory Council supported the suggestion of the Executive Committee to establish new committees on PERFORMANCE IN ICE and on OCEAN ENGINEERING and to establish a Panel on HIGH SPEED MARINE VEHICLES. It was recommended that this High-Speed Marine Vehicles Panel should operate in the same way as the Panel on Testing in Ice had operated for the 15th ITTC.

It was the opinion of the Advisory Council that the program of the Conference must not become too condensed. Each Technical Committee (except the Information Committee due to the nature of its work) should be allowed at least three hours for the presentation and discussion of the Report and Recommendations of the Committee. In addition, enough time during the Conference must be left for informal communications.

The Advisory Council endorsed Recommendations 8, 9 en 10 of the Executive Committee with respect to an improvement of the exchange of information. It was recommended that this exchange should include news about the organization of the forthcoming Conference and of the progress of the work of the Technical Committees and the Panel. The edition of a kind of Newsletter was also considered to be advisable. Symposia on topics which are important to the ITTC may also be announced in this Newsletter.

The Advisory Council understood to a certain extent the wish of the Executive Committee to make delegate representation more compatible with the size and scope of each establishment. It was established that in certain cases, the Advisory Council would not object against a member sending two representatives. However, it was not considered advisable to make fixed rules in this respect. If for some reason a member organization wishes to send two delegates, a request can be made to the Executive Committee.

Prior to the 2nd meeting of the General Session the proposed final recommendations of each Technical Committee were discussed, allowing time for reconsideration by each Committee before presentation to the Conference.

On request of the Executive Committee, names of potential candidates for the different Technical Committees were put forward by the Advisory Council.

Dr. W.E. Cummins, who had been the Chairman of the Advisory Council since its foundation, reclined Chairmanship of the Council for another period.
The Advisory Council elected
Prof.Dr. J.D. van Manen as Chairman and
Dr. H. Edstrand as Vice Chairman of the Council.

EXECUTIVE COMMITTEE

EXECUTIVE COMMITTEE PRESIDING