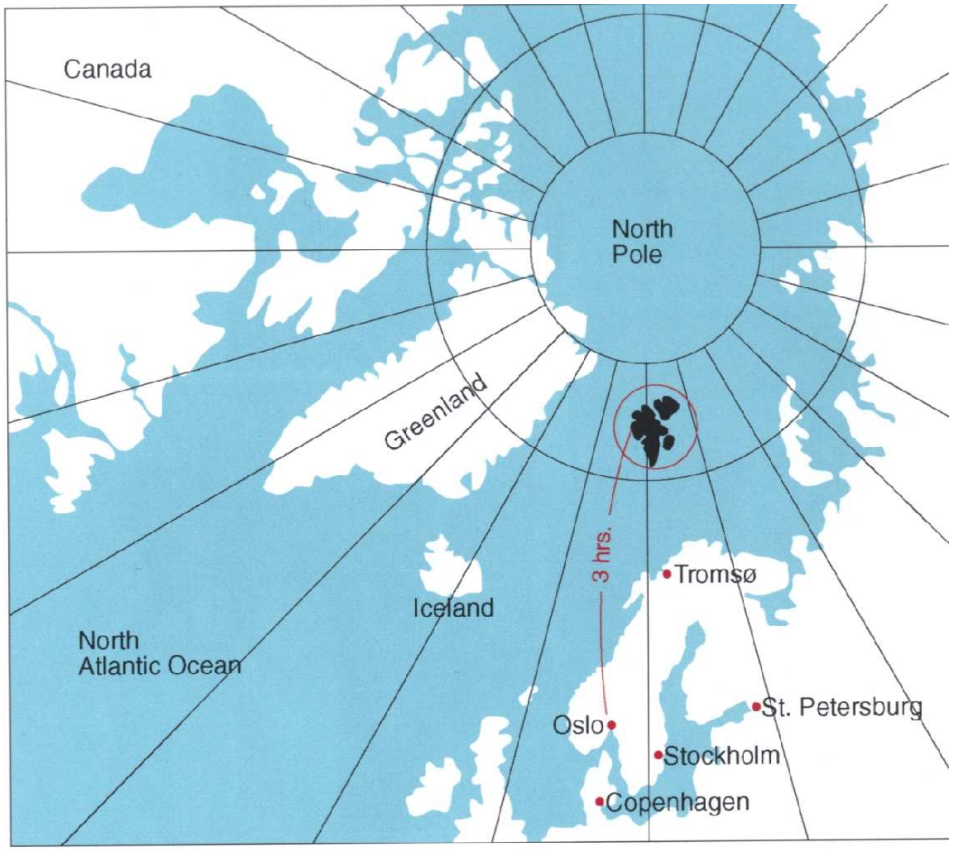
The twentieth International Workshop on Water Waves and Floating Bodies

The University Centre in Svalbard,
Longyearbyen 29 May – 1 June 2005

Dedicated to the co-founder of the Workshops
Professor J. Nicholas Newman
on the occasion of his 70th birthday



Proceedings

Edited by J. Grue

The twentieth International Workshop on
Water Waves and Floating Bodies

Foreword

The twentieth International Workshop on Water Waves and Floating Bodies is dedicated to the co-founder of the Workshops, Professor J. Nicholas Newman on the occasion of his 70th birthday.

The International Workshop on Water Waves and Floating Bodies is an annual meeting of engineers and scientists with special interests in water waves, and the effects of waves on floating or submerged vessels. The Workshop was organized initially by Prof. D.V. Evans, (University of Bristol) and Prof. J.N. Newman (MIT), following informal ad hoc meetings between their research groups in 1984. Initially intended to promote communications between workers in the UK and USA, the interest and participation quickly spread to include other countries. Particular emphasis is given in the organization and conduct of the Workshop to participation by young researchers including post-graduates; inter-disciplinary discussion amongst engineers and scientists; and presentation of preliminary work before it is published elsewhere. Attendance is restricted to the authors of submitted abstracts, which are judged for acceptance by a small committee. The Proceedings for each Workshop includes an extended abstract of each presentation, and recorded discussions. The Proceedings of previous Workshops are available online (www.rina.org.uk) through the cooperation of the Royal Institution of Naval Architects.

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Cover page

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Nick Newman photographed by Kathy Newman

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Introduction

The success of the International Workshop on Water Waves and Floating Bodies was recognized at the recent International Congress of Theoretical and Applied Mechanics – ICTAM04 – in Warsaw, where I heard it said unofficially that the Workshop community represents the most well functioning subgroup within the field of international theoretical and applied mechanics. It is indeed true that the Workshop series that David Evans and Nick Newman initiated twenty years ago continues to be a stimulating meeting place for the most active scientists within our field. If we count all research groups that once or more have contributed to the Workshops, and include the rather broad collection of scientific issues that have been communicated, it becomes evident that members of the community regularly were updated not only about marine hydrodynamics, but also about the more general field of fluid mechanics. For participants coming from small countries with few representatives in science, it was a luxury to come abroad and discuss recent scientific developments with fellow experts. During the years, many young scientists have sought their scientific identity through the Workshops. This was always important for me. The international network among colleagues continues to be very helpful in daily work and at special occasions.

Needs within the Norwegian offshore industry continue to stimulate research in marine hydrodynamics. Hosting the 20th Workshop in the Arctic environment is very timely in many respects. Polar science is expanding its activity. In direct relation to our branch of science: hydrocarbon resources in the Arctic, marine environment currently receive high attention. Russian companies are about to start regular production of gas in the Barents Sea, and the Norwegian companies Statoil and Hydro are exploring production of reservoirs of gas or perform trial drilling at new locations in the area. Environmentally friendly exploitation of hydrocarbon resources in the Arctic area is a hot political issue in Norway, as well as internationally. Transportation of oil and gas along the Russian and Norwegian coasts is growing. Safety of the operations and transportation in the polar waters will rely on rules that on the bottom line are based on matematical, numerical and experimental modeling of waves and currents that are interacting with marine bodies, which is the expertise of our community.

During the preparations for a Workshop at Spitsbergen it became evident that Nick Newman, the co-founder of the workshops would turn 70 in 2005. His birthday is 10 March. With reference to the much quoted *Newman's approximation* in the analysis of slowly varying drift forces, his text book *Marine hydrodynamics* and the wave analysis code *WAMIT*, and much more, he is the international front figure in the field of marine hydrodynamics during more than a generation. Last October I had the chance to ask Nick if we could celebrate him at the forthcoming Workshop. I was delighted when he accepted my proposal. A small group including myself, Maurizio Landrini, Maureen and Phil McIver had two years ago made some initial plans for a potential celebration of Nick. Another co-conspirator was David Evans who has suggested we use the wording: the twentieth International Workshop on Water Wates and Floating Bodies is dedicated to the co-founder of the Workshops, Professor J. Nicholas Newman, on the occasion of his 70th birthday. In turn others were consulted. Everybody were very positive to the plan that the Workshop family celebrates Nick at this annual gathering. I have invited three very close colleagues of Nick to write short contributions as an introduction to the celebration. These are included in the introductory part of the Workshop proceedings. Please read the words prepared by Fritz Ursell, David Evans and Finn Gunnar Nielsen on the forthcoming pages.

John Grue, Chairman of IWWWFB20

A Note for the Newman Celebration, Svalbard 2005

by F. Ursell

During World War II I had worked on the propagation of ocean waves where theory had played an essential part, and soon after the war I had found a method of calculating the virtual mass and damping of a half-immersed circular cylinder. This work had applications in engineering hydrodynamics and had been computed by using the electromechanical calculating machines of the time. My work had been noted by Art Ippen, the Head of the MIT Hydro Lab, I had talked to him at international conferences, and in 1957 I was invited to spend a year with him as a visiting lecturer on leave from Cambridge University. The Hydro Lab at that time was part of Civil and Sanitary Engineering. I first met Nick soon after I arrived.

In those days the theoretical aspect of Aerodynamics was well developed, but Engineering Hydrodynamics or Hydraulics had to rely largely on model experiments and dynamical similarity. Even where mathematical solutions were available they were not useful in practice because numerical computations were painfully slow. By 1957 there were changes. Leading universities like Cambridge, Manchester and MIT had mainframe computers, but their use was subject to restrictions. It was a condition at MIT that a part of every problem had to be computed by hand. (I did not get involved in that.) Nick did not belong to the Hydro Lab, he was a graduate student in Naval Architecture. My lectures at MIT were on aspects of theoretical fluid mechanics, another visitor from England, my friend Michael Longuet-Higgins, was lecturing on related topics in MIT Mathematics. We drew up a joint programme. Nick was interested in these lectures and accompanying seminars and took a lively part in the discussions. He obtained permission to spend 1958-59 with me at Cambridge University where there was a lively group associated with Sir Geoffrey Taylor, the leader on the experimental side was Alan Townsend, and the leader on the theoretical side was George Batchelor. The graduate students were housed in some big rooms and they educated each other. At that time graduate students in Cambridge worked towards a thesis, and they also attended lecture courses of their choice but were not examined on them. I cannot now remember in detail what help Nick received from me. On his return to the United States he joined the David Taylor Model Basin where he worked with Francis Ogilvie and, subsequently, Ernie Tuck (another of my students at Cambridge). Their group was generously supported by Bill Cummins.

In the 1960's Naval Architecture and Ship Hydrodynamics were beginning to change radically. During the war there had been important theoretical contributions (e.g. at the Courant Institute at New York University which I often visited during my stay at MIT, and of course in Great Britain). And then there was the computer, a mainframe computer in a central location. Theoretical results could be computed more and more easily, and experimental measurements began to lose their central position in engineering. As we all know, Nick in due course became a leader in many aspects of ship hydrodynamics, including computational and mathematical aspects. I am not qualified to describe these in detail, he wrote many papers. We often met but we never formally collaborated until I had retired, when we wrote a paper on water waves on finite depth due to an impulse (with J.-M. Clarisse), published in 1995. In this paper there was a great deal of very technical mathematics, in which Nick was very much involved.

My first encounter with Nick was in the academic year 1957-58, at MIT. At that time Nick was a graduate student in Naval Architecture, and I was a visitor in the Hydro Lab lecturing on various aspects of fluid mechanics, particularly waves. (At the same time Michael Longuet-Higgins was visiting MIT Mathematics. I knew him well, and we agreed on the topics which each of us was to cover.) I had been invited by the Director of the Hydro Lab, Art Ippen, a pioneer

of Engineering Science. At that time no British Engineering Department would have invited a mathematician to spend time with them. Theoretical Ship Hydrodynamics barely existed as a useful subject, there were results such as the infinitely thin Michell ship but they were difficult to compute numerically. Havelock was the acknowledged expert. The basic experimental tool was the Towing Tank. This state of affairs was frustrating to Nick who wished to understand the problems on which he was working.

Art Ippen assigned two excellent graduate students to work with me on some experiments, R.G. Dean and Y.S. Yu. Would I suggest an experiment on which we might work? I suggested an accurate test of Havelock's wavemaker theory: a wavemaker oscillating at one end of a wave tank generates a regular wavetrain, would its amplitude agree with Havelock? The difficulty was the wave reflection from the far end, of the order of 10 per cent, this could not be suppressed but I had reason to believe that it could be analysed away.

I remember a seminar in which Nick took a prominent part, and I believe that it was his scheme of analysis that we adopted. Nick decided to work with me at Cambridge University for one year (1958-59). I cannot remember that I did anything for him there, I cannot even remember the problem on which he was working, but the graduate students in fluid mechanics were an outstanding group and supervised each other. Somehow his life's work was decided during these years, and in 1959 he moved to the David Taylor Model Basin where he was associated with his contemporaries Francis Ogilvie and Ernie Tuck.

Nick and the Workshop: how it all began

It was at the ONR Symposium in Hamburg in 1984 that the first idea for the Workshop emerged. Both Nick and I had a small group of RAs and research students with us, including in my case Phil McIver and Chris Linton and in Nick's, Paul Sclavounos and Dick Yue (although I am ready to be corrected over the names after all this time) and we set up a joint informal session in one corner of the lounge area of the large expensive hotel where the Symposium was being held. We both felt that the format of the Symposium was intimidating for younger people, being a succession of papers from the great and the good with little opportunity for stimulating discussion. At the end of our informal session one or other of us, I can't remember which, suggested we should do this more often, and the seed was sown.

The following summer (or maybe autumn, but Nick will know as he had just sailed crossed the Atlantic in his yacht) Nick suggested I join him on his boat berthed near Southampton, to discuss how to take the idea forward. A promise of a trip on his boat led my wife Janet and me to drive our three excited children the three-hour journey to the coast from Bristol only to find that in the meantime Nick had damaged his back and the sailing was off. It is not easy to keep occupied three teenagers on a boat that is going nowhere and it is a tribute to both Kathy and Janet that they kept them at bay long enough for us to make progress on the aims, format and title of the Workshop. The first two were relatively easy but the last caused considerable difficulty from the outset. We had originally thought in terms of an annual meeting crossing the Atlantic between the UK and the US, the first being at MIT for which Nick had already secured informal promises of support, and the second being in Bristol. But it soon became clear as we talked that we needed to widen the scope and the word International crept in to our thinking. We were determined that all attendees should be required to participate fully and attend all sessions so the word Workshop emerged. As for the subject area, it was the interaction between waves and bodies that was crucial to our mutual interests. Hence the cumbersome title which have prompted the uninitiated to liken it to a meeting of police forensic experts!

Our implicit intention was that it should be held out of the usual conference season and that the venue should not be particularly attractive to hangers-on or even spouses, who would distract participants from their work! (We decided that the issuing of hair shirts would be a step too far).

The first Workshop was held in February 1986 at MIT and those who attended, and who remember slithering in the ice and snow back and forth across the Charles river after the evening sessions before disappearing into our hotel in Boston until the following morning, will attest that our intentions were well and truly met. For the second Workshop in Bristol, we decided to keep everyone together for both social and work activities and this ethos has prevailed since. The next few years were critical for the Workshop which would have folded had not Nick come to the rescue by hosting it in Woods Hole on two separate occasions. It is fitting that a key player at that time was John Grue who with Enok Palm and Even Mehlum, offered the delightful setting of the Hardangerfjord Hotel, Øystese in Norway for the fourth Workshop.

That set the standard for the future and ever more attractive venues have been chosen at warmer times of the year. This in turn has led to an increasing attendance by 'accompanying persons' which, far from distracting the participants, have lent the occasion something of a family flavour which I (and I'm sure Nick also) welcome despite my early youthful puritanism. Since that time its future has been secured with offers of venues stretching ahead up to three or more years. Long may it continue.

David Evans, Bristol April 2005

Nick Newman and offshore engineering

Most offshore engineers working within marine hydrodynamics have at least three associations to Nick Newman: His 1977 book *Marine Hydrodynamics*, the *Newman's approximation* and the computer code *WAMIT*. *Marine Hydrodynamics* has been textbook for many advanced courses in marine hydrodynamics and still serves as a key reference book almost thirty years after it was issued.

The *Newman's approximation* from 1974 on *Second-order, slowly-varying forces on vessels in irregular waves*, has become a classical concept. Here he shows how the mean drift forces and moments, as derived in his 1967 paper on mean wave drift forces, can be used to estimate the slow drift motions of a floating body in irregular waves. Offshore engineers have used these relations for more than thirty years to estimate slow drift resonant response of floating structures. The position of the approximation in the industry has been so firm that sometimes it is hard to convince people that it really is an approximation.

In the work on the slow-drift problem Nick demonstrated his capability of addressing practical problems in an analytical elegant manner. His exceptional skills in this field has been further demonstrated and implemented during almost 20 years of development of the computer program WAMIT. The program has become a world industrial standard for computing wave loads and motions of large volume structures in waves. As far as I have experienced, the work started back in 1981 in Trondheim with a discussion on how to reduce the speed of computing the free surface Green's function. Having developed a fast and accurate routine the work on a complete boundary element code was initiated. The development took place in close cooperation with industry and involved a large number of doctoral students. Nick and his staff implemented among others removal of irregular frequencies, interaction between multiple bodies, generalized modes, second order capabilities and higher order geometry definition. All these features had the solution of practical problems as starting point, but he has not been compromising on the theoretical foundation and accuracy of results. Nick's sense for practical solutions has also been demonstrated in his eager to make the code available on state of art PCs. I cannot imagine that any other code has been as important as WAMIT in the analysis of floating offshore structures. It gave a boost to the understanding of local wave diffraction phenomena around platform legs, important in the evaluation of deck clearance. It has been essential to understand the wave interaction phenomena for offshore loading, moonpool dynamics and other sheltering effects. The second order capabilities have been essential to the analysis of most TLPs designs.

Many other important contributions could be mentioned, as his investigation on the ringing problem, analysing of wave power utilization, hydro-elastic structures and a lot more, not mentioning his vast number of publications within ship hydrodynamics. We still hope for many important contributions in the years to follow.

Nick has attracted a large number of visitors and students to MIT. We have all experienced the kindness and open attitude of Nick. He assisted with cultural as well as personal and practical related issues, always with the same caring attitude. Maybe the respect and tolerance he taught is as important to us as marine hydrodynamics? It is the kind of attitude the international industry and research community needs.

Finn Gunnar Nielsen, Bergen April 2005