IEEE

OCEANIC ENGINEERING SOCIETY

Newsletter

OES

VOLUME XXXIV

NUMBER 2

EDITOR: FREDERICK H. MALTZ | SUMMER 1999 | (USPS 420-910) ISSN 0746-7834

OES Newsletter Going Electronic,

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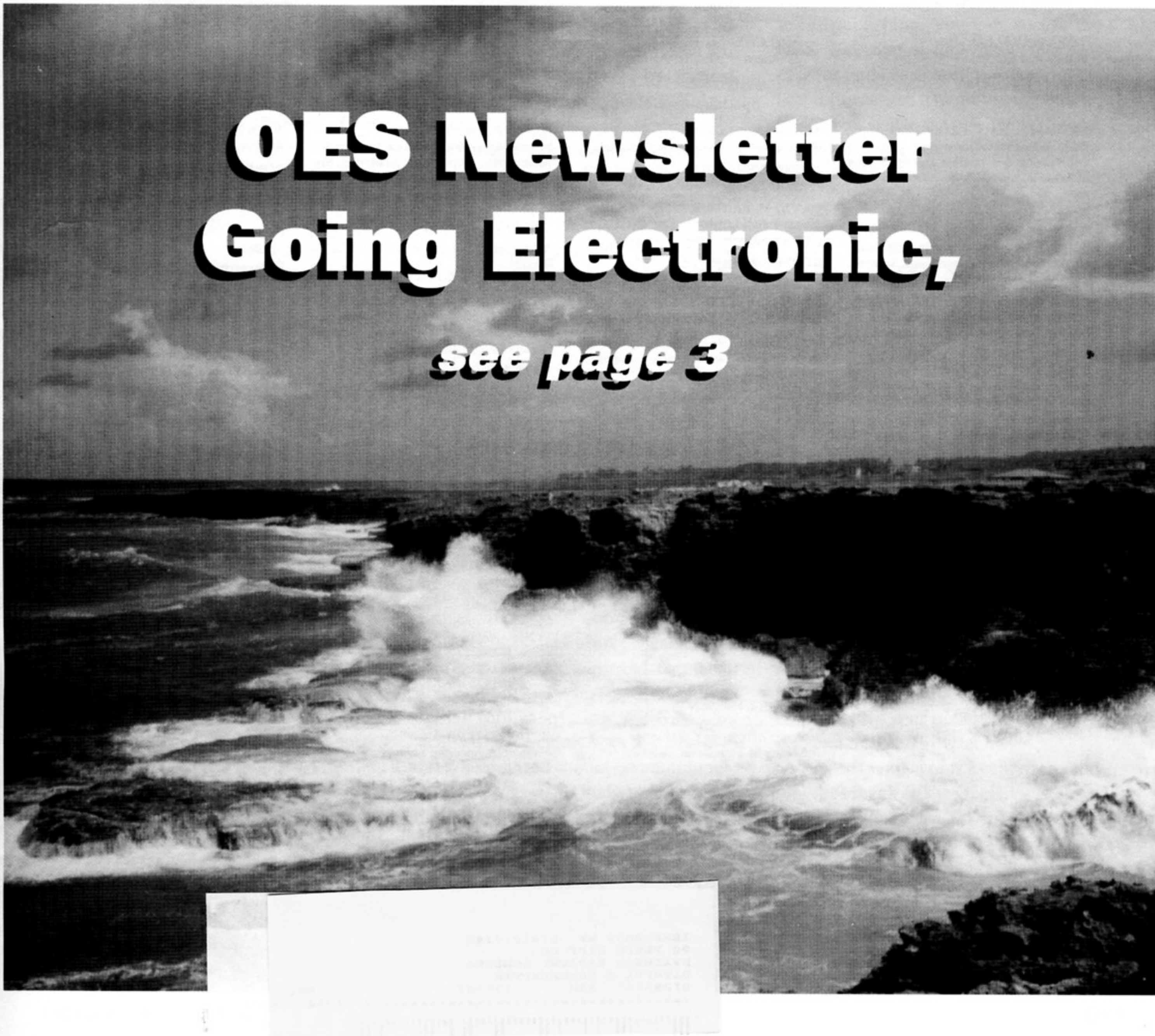
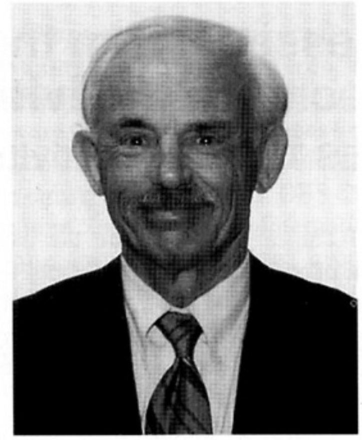


IEEE OCEANIC ENGINEERING SOCIETY

(Continued on back cover)

IEEE Oceanic Engineering Society Newsletter is published quarterly by the Oceanic Engineering Society of the Institute of Electrical and Electronics Engineers, Inc. Headquarters: 3 Park Avenue, 17th Floor, NY 10017-2394. $1.00 per member per year (included in Society fee) for each member of the Oceanic Engineering Society. Printed in U.S.A. Periodicals postage paid at New York, NY and at additional mailing offices. Postmaster: Send address changes to IEEE OCEANIC ENGINEERING SOCIETY NEWSLETTER, IEEE, 445 Hoes Lane, Piscataway, NJ 08854

The OES Newsletter Is Going Electronic



Frederick Maltz

In the Winter '99 issue of the newsletter, Glen Williams stated our goal to take the newsletter totally electronic. Beginning with the Winter 2000 issue, the Oceanic Engineering Society Newsletter will be distributed either via an electronic mail attachment or Internet access. The next two issues of the newsletter, Summer and Fall, will be the last produced in the current hardcopy form.

Initially, we will send an email notice upon availability of each new issue on the Web. We will need your email address as we do not have valid email addresses for many members. Your email should be addressed to:

eric@net.tamu.edu.

In the 'Subject' of your email please place the following:

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For example, if your email is **f.maltz@ieee.org**, the 'Subject' field would be:

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We are going to keep the Web version of the newsletter in both PDF and HTML formats with enhancements. Future PDF versions will include a table of contents, and the HTML version will be expanded to include multimedia and interactive content. Once the bulk of member email addresses have been received and a procedure established, the newsletter will be distributed via an electronic mail attachment along with the Web availability notice. I will keep you posted on future procedures for subscribing and unsubscribing.

At the last Panel of Editor's meeting in Piscataway, New Jersey, Anthony Durniak, presented some ideas about IEEE publishing for the year 2000 and beyond.

Some of the benefits he indicated are faster delivery than print, more rapid publication and frequent updates. In addition, using the new capabilities, it will be possible to search/sort by interest, provide interactive content with links to related documents and multimedia. Other benefits include convenience and cost effectiveness. He also indicated that the IEEE is in the process of building an electronic publishing infrastructure, including a single Web access point for all material published by IEEE. This includes Transactions and Journals, Magazines, Conference Proceedings, and Standards.

To learn more about the future of IEEE publishing, you can access the OES Web Site at *http://auv.tamu.edu/oes/* for updates as well as other important information. The following article, which was sent to me by Glen Williams, describes some other IEEE publishing initiatives that will be taking place very soon.

Frederick Maltz
OES Newsletter Editor

Journal of the Oceanic Engineering Society Goes Electronic

The Oceanic Engineering Society has become a member of the IEEE OpeRA electronic publishing project effective immediately. The 1999 issues of the Journal of Oceanic Engineering have been placed in the OpeRA database for electronic access via the WWWeb to all OES members. In 2000, the IEEE will roll out EPIC, the next generation of its electronic publishing project. EPIC will contain all of the Journals and Transactions of each of the Societies in SGML tagged format at first, with the Conference Proceedings in PDF format to follow. EPIC will basically replace OpeRA, so that access to the OES Journal should be continuous.

The Journals on OpeRA are stored in PDF format, so users must have the Adobe Acrobat Reader integrated with their browser. To get to OpeRA and the electronic Journal of the OES:. Via either the Explorer or Netscape, go to *http://opera.ieee.org*. Register, as necessary, using your IEEE Member number, and Search/Browse.

Please send your evaluation and other feedback on the OpeRA system to me at *g.williams@ieee.org*.

Message from the Vice President, Technical Activities

OES Technical Activities: Semper Fidelis

Joseph R. Vadus

Technical Activities are the backbone of our society, mainly exemplified by the quality and stature of our human resources and the products we produce.The most notable products are our publications and conferences.

Our product-producing human resources include: ExCom/AdCom, technical committees, editors and supporting associate editors, chapters and membership.'

For easy reading, here are some informative 'one-liners'.

Technical Committees: Coordinator of our eleven technical committees, Stan Chamberlain and committee chairs continue to marshal technical expertise in support of Oceans conferences and workshops, and provide sources for journal papers. Environmental technology is new and open for members.

Publications: Jim Lynch, Editor of our Journal of Oceanic Engineering, with his supporting associate editors, continue to produce a first class journal recognized world-wide for high quality. Fred Maltz, Editor of the OES Newsletter does a great job in keeping us all well informed. After the fall issue, the newsletter will appear exclusively on the internet. The journal and newsletter have also proven invaluable for promoting OES conferences.

Ocean Oriented Conferences: Their numbers continue to proliferate worldwide and tend to dilute attendance spread over many conferences, and reduce availability of good papers and exhibitors. There is an apparent need for more inter society collaboration. I'll try harder for out years.

The MTS-IEEE/OES Coordinating Committee has completed the n th iteration of the relatively new conference guidelines due out before the new millennium. While procrastination continues, we have sent out draft guidelines to Oceans-99-00-01-02-03.

After serious deliberation, J.Spargo Associates of Fairfax , VA was selected as the conference support contractor:to handle administrative and operational functions in support of conference committees for oceans conferences in 2000, 2001 and 2002. IEEE s ITCMS will complete their contract after 1999.

OCEANS 98: Once again (after OCEANS 94), the French Chapter and strong committees proved that going abroad can be successful and serve our international membership. The great success of the 98 endeavor has been greatly appreciated and well reported.

All Conferences: 1999-2003 will be titled OCEANS XX MTS/IEEE.

OCEANS 99: In Seattle, September 13-16. A great venue and shaping up nicely with Chair Bob Spindel and co chair Ted Brockett at the helm and Norm Miller, OES liaison.

A sizable technical program of over 325 papers being structured by co chairs Jack Jaeger and Alan Beam. A record of 28 countries participating. For excitement you can catch a 25 pound salmon at Pikes Market. Check the internet at *http://www.cms.udel.edu/mts/oceans99/oceans99.html*

Underwater Technology 2000: May 23-26, In Tokyo again to repeat a universally acclaimed successful symposium run by the Japan Chapter, OES's newest and largest active chapter. Sponsors are OES, ONR and the University of Tokyo. The ExCom includes OES's: Hisaaki Maeda, Joe Vadus, Tamaki Ura, Bob Wernli, and Dick Root & Hassan Ali of ONR. Five star accommodations and registration package provide unbeatable value for Tokyo. A sure sellout. Check us out on the internet: *http://underwater.iis.u-tokyo.ac.jp/ut00/.*

AUV 2000: In Cambridge, MA being planned for summer 2002 under the perennial guiding hand of Claude Brancart. The new format focuses on subsystems. Hear the best and leave with the latest. Details will be made available soon. For immediate information, and expression of interest contact Claude at *c.brancart@ieee.org*.

OCEANS 2000: In Providence R.I. on Narragansett Bay, September 11-14, is shaping up under Chair John Sirmalis, Naval Undersea Warfare Center with Claude Brancart, providing OES Liaison, with support from many Y2K embedded New Englanders. The OES Directory lists more OES members in the Providence Chapter than any other city in the U.S. Check us out on the internet. We are Y2K certified.

OCEANS 2001 or OCEAN Space Odyssey 2001: In Honolulu, November 4-8 at the Hilton Hawaiian Village, a one stop paradise for papers, pools and pu-pu s. A great venue. If you were there for OCEANS 91, you ll likely be there again. Plans are being coordinated by Craig MacDonald and Liz Corbin, State of Hawaii, Department of Business Economic Development and Tourism (DBEDT). The Director of DBEDT, Seiji Naya is Honorary Conference Chair. Honorary Chairs to be invited at the opening event are the Governor and the Navy Commander Pacific Fleet. MTS Vice President, Michael Cruickshank of the University of Hawaii provides oversight at the local level. OES members Kiman Wong and Oscar Libed, with their great experience running 0'91, are lending their support.

OCEANS 2002: October 28-31 in Biloxi, Mississippi. About one hour from New Orleans and from Stennis Space Center, with a large contingent of Navy, NOAA and NASA, and their supporting contractors. Navy Rear Admiral K. Barbor, Commander of the Navy Meteorology and Oceanography Command will Chair, with a strong team of committee chairs. The Five-Star Beau Rivage Resort Hotel on the beach, just completed for $ 600 Million, and the nearby convention center amidst many resort hotels along the beach, provide the local venue. Lloyd Breslau, of the OES AdCom, is a member of the committee.

OCEANS 2003: In San Diego, September 21-26, at the pleasant Town & Country Resort & Convention Center. A proposal is in the works for 2003, but out of cycle with past 75, 85, 95 conferences in San Diego, because of a great opportunity — The University of California-Scripps would like to celebrate it s centennial anniversary September 26 during the OCEANS 2003 MTS/IEEE Conference. Bob Wernli (former Chairman of OCEANS '95 in San Diego) has agreed to Co-Chair the conference with the Director of Scripps. They will be collaborating with Kevin Hardy of Scripps in preparing a conference plan, and expect to launch the conference committee later this year — 4 years in advance. Many Scripps Alumni and the popularity of Oceans in San Diego should make it a formidable event.

OCEANS 2004: OES ExCom has prompted me to look offshore in 04 . So, now there are strong possibilities for a venue in Norway. I started with Norway Chapter Chair Thor Fossen, Professor of Engineering Cybernetics at the Norwegian University of Science & Technology in Trondheim, and then contacted my good friend Jens Balchen, Professor Emeritus of Engineering Cybernetics at the University. With their help, we were fortunate to identify a Chairman, past Director of Marintek/SINTEF, Arnold Hansen, another good friend dating back to a U.S.-Norway Workshop on AUV's, to help organize and explore the possibilities.The Norway Defense Research Establishment's Underwater Division has also expressed interest via Jerry Carroll of the U.S. Navy Meteorology & Oceanography Command, and one of the 02 prime movers.Stan Chamberlain has supplied conference guidelines and is willing to co chair the technical program. Thor Fossen also chairs the IEEE Control Systems Society Chapter in Norway, which may add support. Marine and control systems are inter related at the University. We will explore other possible partners such as the bi annual Underwater Technology Conference (UTC) sponsors. Meetings to begin organizing, identifying participants , preliminary plans and venue will be attended in July.

Ideally, we should consider late August or early September for the 04 conference dates.

Engineering Tomorrow: The title of IEEE s new hardbound, limited edition book to be sent out postmarked 1 January 2000. Its description and ordering forms appear in the centerfold of The Institute. Fifty contributors, drawn from IEEE s diverse societies, were interviewed to project their ideas on some technology directions in the 21st Century. I was invited for a telephone interview which lasted 90 minutes. I covered a spectrum of topics related to OES interests, including earlier OES inputs for the new technology directives survey. The IEEE Editors, chose about 15 percent of what I said and wove it into one of the 12 chapters called Exploration, which included inputs from three space technology experts and Sylvia Earle. Fortunately, I was able to laud the future of ROV s and AUV s, but very little detail was wanted. They were also intrigued by floating cities and Navy MOBS, waste disposal, and ocean resource exploration, as related to that chapter. It was mainly the editor/writers choice on all content to portray a uniform total.

Also, they did not permit corporate review of the interviewee s remarks; I guess to encourage imagination.

Chapters and Membership: In planning for future conferences, I learned quickly how important chapters are for hosting conferences in major coastal cities. To my knowledge, the only really active U.S. OES Chapter is in Seattle. On the International scene, we have active, conference-supporting chapters: Victoria, Canada and Canadian Atlantic, France, Japan, and now Norway stepping up to meet the challenge.

I believe membership is more attractive if a member could be allied with an active local chapter to enjoy camaraderie, networking and technology exchange. A local Chapter needs strong leadership and a local program to remain active, and, in some cases meeting jointly with MTS. One way to get started in revitalizing dormant chapters may be to try partially subsidized OES renewal luncheons and speaker program, with occasional imported speakers to provide topical diversity. I believe an investment in OES human resources is a better return on investment than sending money to other entities. In earlier Newsletters, Jim Collins presented some good ideas on increasing membership and Jim Glynn described his plans for chapter revitalization. We hope for good progress to build up our regional network of chapters and membership that are so vital for sustainable development of OES.

Potpourri of Activity: You are cordially invited to volunteer to help support one or more of the above functions. Your participation is appreciated, and you can enjoy the camaraderie of a cooperative effort. OES needs a few more good men and women. We need you. Your ideas and suggestions are welcome. Contact me at *jvadus@erols.com.*

Joseph R. Vadus
Vice-President, IEEE/OES
Technical Activities President,
Global Ocean Inc.
—International Consultants

UNDERWATER TECHNOLOGY 2000

Underwater Technology 2000

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IEEE — OES — SEIKEN SYMPOSIUM

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DEADLINE FOR SUBMISSION: NOVEMBER 19, 1999

NOTE: PREFERRED ABSTRACT SUBMISSION IS BY E-MAIL TO:

Prof. Tamaki Ura
E-Mail: ura@iis.u-tokyo.ac.jp

Institute of Industrial Science,
University of Tokyo
7-22-1 Roppongi Minato-ku Tokyo, 106,
JAPAN
Phone: +81-3-3402-6231 ext. 2280
Fax: +81-3-3401-6259

OR

Mr. Robert L. Wernli
E-Mail: wernli@nosc.mil

SSC San Diego
c/o 11775 La Colina Rd.
San Diego, CA 92131-1413
USA
Phone: +1-619-553-1948
Fax: +1-619-553-1915

CALL FOR PAPERS

IEEE Millenium Medals To Be Awarded

The IEEE will award Millenium Medals to individuals to be recognized for their contributions to any of the IEEE entities, e.g., a Technical Society, a Region/Section, etc. These individuals are to be nominated by that entity.

Via this short message, I would like to invite your nominations for the IEEE Millenium Medals to be awarded by the Oceanic Engineering Society, in recognition of that individual's service to the OES. (Service is defined here as any mode of contribution to the Society, either technical, administrative or other.) Just send me an email (*g.williams@ieee.org*) by August 31, 1999, with the nominee's name, contact information and a 25 word (max) description of the individual's contribution to the OES. Multiple nominees may be submitted. The OES Millenium Medal nominees to be forwarded to the IEEE will be determined by your elected Administrative Committee, with the award recipients listed in this Newsletter after they are announced by the IEEE.

Award presentations will take place at OCEANS'00 if possible, or another OES function where appropriate.

Modeling and Simulating the Influence of the Ocean: A Role for the Oceanic Engineering Society

By
Edward C. Gough, Jr.

Introduction:

Modeling and simulation are familiar tools to members of the IEEE Oceanic Engineering Society (OES). For the past forty years or so, since computers began to be available at government laboratories and academic institutions, the idea of using formal, abstract mathematical models solved numerically in digital computers on a domain of parameters to study aspects of the ocean has been widely accepted. Over this period the technical use of the word *model* has changed from designating a physically scaled object in kind, such as a model ship or a model harbor, hydrodynamically scaled for tow tests or sedimentation studies, to now mean a code for numerically solving the abstract model. Such codes may even be named, and treated as trade brands conveying utility or validity to potential users. This shift in focus has had a profound effect on research, education, and the practice of engineering in the ocean, and the evidence so far suggests that the tools and practice are far from maturity.

These changes have coincided with the revolutionary advances of processor and memory technology, and the collapse of the costs of a computing cycle, as contrasted with the escalating costs of going to sea. A few years ago it was common to hear apparently sober technologists, enthusiasts of modeling and simulation, argue that the expenses of sea-based expeditionary ocean studies could be successfully avoided by implementing complex, interdisciplinary numerical models. These would be essentially cascades of purely disciplinary models, that is, a meteorological model might produce wind stresses and rainfall that would drive a stratified ocean circulation model, perhaps perturbed by tidal forces and with a detailed bathymetry. Perhaps the hydrodynamic modeling would be faithful enough that internal waves would emerge in the interior and solitons be generated in packets on the modeled continental slopes in ways numerically indistinguishable from careful observations. These numerical solutions would be virtual oceans created inside inexpensive computers that could be exercised in every way the real ocean would, and more. Such synthetic environments would allow repeatable, controlled experiments that could not otherwise be accomplished in a real ocean. Other models, acoustic propagation models or ship navigation models, or fishery models for example, could be coupled to these with the benefit of rarely needing to go to sea.

Technologists were not the only ones to be tempted by the promise of modeling and simulation. Models, by there very nature, are dispassionate and quantitative. They do not "care" about their outcomes, do not make subtle adjustments as they run in order to achieve a desired result, they are repeatable and can be audited to assure their results. To an outsider they simply codify a set of knowledge, crafted by experts, and they provide reliable quantitative predictions for hypothetical circumstances. As such they are perfect tools for policy and decision-makers. In a complex, democratic society there are many conflicting interests competing for finite resources. Many social and governmental institutions are organized around the principle that these conflicts should be adjudicated according to objective measures not dominated by any interest. Quantitative methods have been developed extensively over the past two hundred years to meet these needs, often led by the engineering profession. Computerized models and simulations are at the apex of this sort of public analysis, and are often seen as being even more fair and more objective than other techniques by virtue of the fact that they can be run without intervention.

Such benefits, obviously worthwhile, remain a goal for modeling and simulation supporting engineering in the ocean, but the sea has so far resisted being so easily understood. Unfortunately, as these synthetic oceans have been created and tried there is a growing realization that many of the formal approximations that were useful to achieve simple, instructive, closed-form or manual numeric solutions, have shortcomings when applied to more complete simulations. The ocean is exceedingly complex. There are often seams between the models that hinder a simple cascade. There are problems of scale, bandwidth, and sampling that only submit to careful restrictions of the domain. There is coupling in the real ocean that is often ignored at our peril, but is not understood well enough to accurately model.

As we have attempted to achieve greater fidelity in numerical models we have continually been confronted by our mistaken ideas about the ocean. Non- linearities inserted into numerical codes were discovered to create extreme sensitivity to initial conditions, even in dynamical system with low dimensionality, an outcome anticipated by few in 1960 or even 1990. This sensitivity turns out to be a physical property long observed, but largely unrecognized until recent work in non-linear dynamics. Likewise, coupling between terms caused by variable and underdetermined boundary conditions, anisotropy, and lateral inhomogeneities have bedeviled many attempts to reconcile observed conditions in the real ocean to the models and simulations meant to represent them. The message of these failures is unmistakable, we have not yet achieved the sophistication needed to create seamless synthetic oceans, and will not except through continued heroic effort. Models, so far, are not substitutes for the real thing.

To make this thought more clear, and as a prototype for thinking about modeling and simulation, consider the example from another field, the *orrery*. In the eighteenth century an Englishman, probably George Graham, invented a clockwork mechanism that emulates the timing and phase of a Copernican solar system. Each of the major planets and each of their major satellites are represented by a ball, and are driven by a set of gears that moves each planet around the fixed sun. In order to run the model and simulate the motion of the planets one literally turns a crank to move the planets around the sun. The timing of this motion may be quite precise, but the finite size of the orrery is obviously not to scale in either the size of the planets or their relative distances. The model enjoys the distinction that although a considerable expertise is required to design and build the model, anyone can turn the crank and simulate the motion of the solar system. Likewise, innovations in the motion of the planets, such as reversing their direction, can be studied with the model.

This device was once called a planetarium, but that name is now applied to a different modeling and simulation environment where the positions of stars and planets are projected as points of light onto a darkened interior dome. The mechanical model of the solar system is named after Charles Boyle, the fourth Earl of Orrery, the project's patron.

The model makes explicit the idea that the universe is a clockwork. There is no place in the expression of the abstract, and far more useful, formal Newtonian model of universal gravitation where mass and distance account for the observed motions rather than gear ratios. Although the orrery may be validated against an ephemeris, it cannot be verified against the Newtonian model. There is no way to add another planet or perturb an orbit to study sensitivities to small deviations. The model is rigid.

This paper reviews the interests of OES in modeling and simulation as indicated by publications since 1976 and conference presentations made since 1996. The paper proposes a framework for discussing modeling and simulation that separates the elements from the specific technical area supported by the modeling and simulation, and raises a concern about the universal need for verification and validation. Finally, there is a discussion of the importance of modeling and simulation to national policy debate and decisions, which is rarely the subject of OES technical journals.

Elements of Modeling and Simulation

Modeling and simulation are at the heart of modern engineering practice. Whether an electrical engineer uses Ohms Law or SPICE in designing and analyzing a circuit for an undersea current meter, or a mechanical engineer applies Newton's Laws of Motion and the Navier-Stokes equation while devising a control system for an autonomous underwater vehicle, or a radar engineer assumes Bragg scattering while seeking to understand the performance of a synthetic aperture radar from above the sea, the construction and application of formal models, sometimes through simulation, is a critical professional activity for engineers. Regardless of division by academic discipline engineers face complex problems that require objective, quantitative analyses to facilitate design and policy decisions. Models, which are formal analogs of phenomena and systems, are the fundamental entities that allow these analyses.

Among highly interdisciplinary activities, such as those represented by the Oceanic Engineering Society, the objects of modeling may be diverse indeed. All of the physical properties and constraints of the ocean and its behavior apply, as do the phenomena of energy propagation and the dynamics of objects suspended in the ocean. Instrumentation and measurement of ocean properties, both directly and by remote observation, telemetry and communication within the ocean, control of ocean vehicles, organization of data archives for retrieval, analysis and display are only a few topics to which modeling and simulation apply within the scope of interests of OES.

When we refer to models we now most often mean a formal, mathematical structure that relates a mapping from a set of circumstances onto a set of consequences or outcomes. The idea is that there are casual relationships that can be represented by formal mathematical constructions such as maps or functions. By imposing other formal conditions, which often seem very well justified, such as measures and other properties of vector spaces, formal models can be manipulated by formal rules. These manipulations, while not saying anything explicitly truthful about the phenomena being modeled, have proven surprisingly robust in practice. This quality is the basis for mathematical physics, applied mathematics, and much of the formal, academic engineering represented in technical publications and societies such as OES.

Formal systems that are used in modeling are usually mathematical. Algebra, differential equations, integral equations, probability, the calculus of variations, dimensional analysis, are all traditional formal systems.

Over the past few decades they have been joined by game theory, linear programming, Monte Carlo techniques, fuzzy logic, neural networks, synthetic annealing, genetic algorithms and non-linear dynamics. In fact theoretical advances in non linear differential equations have produced formal results that explain solitons, intermittency, bifurcations of solutions, and a host of other results that mathematics simply could not accommodate fifty years ago.

These advances have the effect of moving constraints that existed before. Without changing the underlying requirement of the problem, now opportunities for a better understanding become available simply through advances in the underlying formal structure.

Formal modeling, the act of deciding on and imposing a mathematical form that is meant to represent a physical event or phenomenon, is a creative act of the imagination. Some models have enjoyed a long run a success when used to explain or predict events, Newton's Second Law of motion comes to mind as the prototype of the effective formal model that is repeatedly reused to solve physical problems involving both static and dynamic loads and their consequences.

Because building models is an act of discretion intangible elements are part of the ultimate success of the model. Education is obviously critical. If the modeler is unaware of formal results that may be applied the problem he will be unable to exploit them. Experience is similarly critical. The nature of the phenomena being modeled, its domain and range and behavior are all clues to which models will be most effective. Beyond these there are matters of taste and talent. Because we like to think of models as objective conveyers of collective knowledge the role of intangibles such as these are seldom mentioned, yet the evidence of models suggests that it is not an activity done equally well by all practitioners. Despite the fact that some modelers may contribute more than others, modeling and simulation remains a field that is advanced by consensus. Models, no matter how brilliant, that fail to be adopted, simply fail. The formal model is the communication of an idea that has the property of being verifiable and testable. It predicts an outcome based on a circumstance.

Formal models may have an impact on knowledge by being run in two ways, the inverse and the forward problem. In the inverse problem a model is proposed with some form and some perhaps unknown parameters. Data is collected and the parameters are estimated to be most consistent with the data. The properties of the solution, as well as the most appropriate methods to find a solution, depend on the nature of the data themselves. This area of modeling and model application is well studied in some fields such as geophysical prospecting, medical and ocean tomography, for example. In its simplest form it is merely curve fitting, but it is also the basis for filling data bases and seeking automatic, adaptive systems and solutions.

Returning briefly to celestial mechanics for a clarifying example, the inverse problem is Kepler fitting ellipses under a Copernican, heliocentric solar system to Tyco Brahe's observational data of planetary motion. Once in place the orbital parameters were solved allowing the model to be run *forward* to predict the future positions of the planets with respect to the fixed stars. One might say that inverse problems are fundamental to science, as we know it. The power of such models can be seen by noting the consequences of Newton's question: "why ellipses?"

The forward problem is solved to find a value corresponding to an input. In this way the model is simply a function or a mapping of the domain onto a range. A single trajectory or sequence of points in the range that are a consequence of running the model iteratively on an independent variable, such as time, or according to contingent conditions, either stochastic or by the intervention of an outside agent, is what we mean by *simulation*.

Simulations are especially useful ways to explore the possibilities of models when the model is well known. This allows training simulators, hardware-in-the-loop stimulators, mission planning and rehearsal, and many other useful applications of models. Simulations may even exhibit *emergent behaviors*, that is show effects that were not explicitly programmed, for example in non-linear models, or cellular automata. In such cases it is insufficient to validate only the underlying models and databases of parameters, but the simulation's dynamics must also be examined.

Modeling and Simulation and the Oceanic Engineering Society

Modeling and simulation are well represented in the publications and activities of the OES. A survey of the INSPEC data base over the past thirty years or so, searching on the key phrase*: (modeling or simulation) and ocean*, reveals an exponential growth in publications from five in 1968 and two in 1969, to three-hundred-sixty-six in 1998, roughly doubling every two to five years. A similar search *on IEEE Journal of Oceanic Engineering and (modeling or simulation)* yielded 157 records the earliest of which were in 1976, J-OE volume 1, number 2. The growth in J-OE papers, while not as dramatic as in the literature as a whole, still reflects a steady increase: ten papers in the seventies; thirty-seven papers in the eighties; and one-hundred-four papers in the nineties. As is fitting for tools that are so integrated into practice, almost all of these papers focus on analysis or design topics related to a particular engineering problem or area of technical application, rather than issues common to modeling and simulation. An informal survey of the J-OE papers of the nineties selected in the INSPEC search suggests that signal processing, autonomous vehicle and ship control and propulsion, and ocean acoustics are the technical areas of interest that now receive the most attention in the J-OE.

An attempt to validate the impression created by the INSPEC search by actually inspecting the papers published in J-OE over the past three years was revealing, if not surprising. I failed to find a single paper that did not include an abstract, formal model of the matter under study. Formal modeling is central to the professional activities chronicled by this Society, and along with the unifying theme of the ocean, is the common element among the technical discourse of the Society.

In addition to the J-OE, OES sponsors an annual conference called OCEANS, often jointly with the Marine Technology Society. These conferences bring together many with common technical and policy issues around the ocean, and feature short technical presentations of papers on topics of current interest. Like J-OE, a survey of these conferences reinforces the theme that modeling and simulation are ubiquitous tools in practice. There are, however, special sessions regularly devoted to topics of interest to the M&S craft. Emerging issues such as data base organization, for example according to the principles of Geographical Information Systems, data visualization and display as ways to communicate numerical results to decision makers, the impact of new computing or data architectures, open standards, etc. In addition, there are papers on applications of new techniques, such as cellular automata, or genetic algorithms.

There is, however, little discussion of the impact of modeling and simulation as practiced by ocean science and engineering professionals on the quality of modeling and simulation practiced by public policy decision- makers. Although few are in a better position to examine and comment these uses of technical tools, OES has not engaged this aspect of M&S as a Society. Whether we should is an open question.

An Example of Modeling and Simulation in Public Policy: The U.S. Department of Defense Modeling and Simulation Master Plan

On January 4, 1994 the Department of Defense issued a directive, number 5000.59 entitled "DoD Modeling and Simulation (M&S) Management." This directive superseded the M&S management plan dated June 21, 1991, and a former directive establishing a Defense Modeling and Simulation Office (DMSO), while establishing a new Executive Council, and reestablishing DMSO. The directive established DoD policy that:

> Investments shall promote the enhancements of DoD M&S technologies in support of operational needs and the acquisition process; develop common tools, methodologies, and databases; and establish standards and protocols promoting the internetting, data exchange, open system architecture, and software reusability of M&S applications. Those standards shall be consistent with current national, Federal, DoD-wide and, where practicable, international standards for open systems.

Furthermore, the Executive Council's published vision for DoD M&S states that:

> Defense modeling and simulation will provide readily available, operationally valid environments for use by DoD components:
> - To train jointly, develop doctrine and tactics, formulate operational plans, and assess warfighting situations
> - To support technology assessment, system upgrade, prototype and full-scale development, and force structuring.
>
> Furthermore, common use of these environments will promote a closer interaction between the operations and acquisition communities -in carrying out their respective responsibilities.

The Navy, as a DoD component responsible for the representing the Ocean as well as naval interests, provides an additional vision:

> In the 21st century, the United States Navy will use Modeling and Simulation to make better analytical decisions, improve warfighting skills, and develop superior systems to maintain the world's most powerful maritime forces for the joint force commanders. Analysts will construct force structures; warfighters will train and prepare for war; and system designers and engineers will develop new systems and platforms, all through modeling and simulation in a synthetic battlespace credibly replicating the real world.

It all sounds so easy when *they* say it. Apparently there is little room left for hubris in the Pentagon.

These ambitions are built on the notion that this approach will save vast sums of money by avoiding the need to develop and test systems in the actual environment where they are to be used in situations that mean not only life or death for sailors, but perhaps life or death for a nation or an alliance. Does the state of the practice of modeling and simulation of the ocean environment, and systems that operate in the ocean justify this approach?

This question does not only apply to the U.S. Navy, but to all other policy makers with responsibilities that include environmental and climate health, public safety, fisheries management, and a host of other issues. Whether or not they have had the foresight to write down what they need from models of the ocean, the implications are clear for those who fund technological development and for technologists. We are going to need many verified, validated, correct models of the ocean to meet not only our own needs as we design and analyze systems for the ocean, but also high quality models and simulations to support serious policy questions. We must be cautious to not let important decisions be made on the basis of an Ocean Orrery, or if we do, to be alert to the consequencees.

Summary

Modeling and simulation are powerful tools for understanding and explaining the world around us. When used with discretion, modeling is a way of organizing knowledge accumulated through observation or deduced from underlying principles. Modeling is a way of enforcing constraints on otherwise wishful thinking. It is a powerful tool for explaining the physical, economic and practical world, and a synthetic measurement process that allows us to explore conditions that may otherwise be inaccessible. Modeling is a creative act of imagination, serving as a collective memory for organizing and storing what we know about physics, geometry and dynamics. Because modeling is a creative act it must be tempered by the discipline of verification for internal consistency, as well as validated against independent observation. Only when models replicate, in some way, outcomes in the real-world corresponding to similar entering conditions can we say the models are satisfactory.

When validated the model provides a synthetic, surrogate world that can be systematically explored without the inconvenience or risks normally associated with exploratory expeditions, although it is not clear that this approach actually saves money.

There is a core of work that is purely technical, and there is also an element of our work that is applied to decisions that have ramifications beyond the immediate technical concerns. These are essentially the decisions of when, whether and to what degree to commit public and private resources to a course of action. To participate in these decisions implies that we are able to coax special insights from our special understanding of

- not only the pertinent physical phenomena but also their complex interaction and way they fit into a larger context. To do so is to make a bold claim about the nature of our knowledge - and to be modest regarding how much we really know.

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Edward C. Gough Jr.
Principal Engineer, Applied Physics Laboratory
University of Washington

E. C. Gough Jr. is a Principal Engineer at the Applied Physics Laboratory, The University of Washington where he leads research projects related to sonar and the ocean environment.

Mr. Gough has been at the University of Washington since 1989, when he joined as head of the Signals and Systems Department, and later served as head of the Environmental and Tactical Systems Department. There he led research projects in Arctic environmental acoustics, including studies of propagation and ambient noise. During this time Mr. Gough advised Submarine Development Squadron Twelve on applications of oceanography and environmental acoustics to anti submarine tactics. The department also conducted research and exploratory development in non-linear signal processing, time series analysis, environmental acoustics, and tactical oceanography.

From October 1996 through September 1998 Mr. Gough served as Technical Advisor to OPNAV N84, the ASW Requirements and Assessments Division of the Chief of Naval Operations Staff. He held this position as an IPA, on assignment from the University of Washington Applied Physics Laboratory.

From September 1993 through August 1995 Mr. Gough was Science Advisor to the Commander, U.S. Navy Sixth Fleet in the Mediterranean Sea, where he was responsible for developing and resolving the list of Command Technology Issues. While there his effort focused on C4I issues related to the Commander, Joint Task Force Afloat role of the flagship. The Navy Science Assistance Program of the Office of Naval Research sponsored this assignment.

Prior to joining the University of Washington, Mr. Gough was a Principal Scientist at Planning Systems Incorporated for twelve years. While there Mr. Gough led research projects, including field efforts, in Arctic environmental acoustics, low-frequency acoustics, signal processing and sonar engineering. From 1974 through 1976 Mr. Gough was an Engineer at Sperry Marine Systems in the Advanced Products Group.

Mr. Gough earned a Master of Applied Mathematics degree from the University of Virginia in 1977 and a B.Sc. Ocean Engineering degree, with Honors, from Florida Atlantic University in 1973. He was a cooperative education student at Woods Hole Oceanographic Institution in 1972 and 1973, and at the Smithsonian Institution's Harbor Branch facility in 1971.

Mr. Gough's honors include the Superior Civilian Service medal for his work at OPNAV N84, awarded by the Chief of Naval Operations in 1999. Mr. Gough is Chair of the IEEE Oceanic Engineering Society, and a member of the AdCom. He is also a member of the Society of Industrial and Applied Mathematicians.

Finance Committee for the Oceanic Engineering Society

OES Finances

The Oceanic Engineering Society is a substantial business entity, with an annual budget of about $450,000. Our reserves amount to almost $400,000. Our Society has four major sources of income: OES singularly and jointly sponsored conferences, symposia and workshops, Journal page charges, and Society dues. Major categories of expense are OES publications, Society committee expenses, and IEEE Headquarters administrative expenses.

Conference income is the primary determinant of the Society¡s financial health. The Society's net surplus or loss each year closely parallels the surplus or loss of our conferences.

During the recent Technical Activities Board 5-year review of the Society, we reached the conclusion that we need to improve the management of our resources. That is, we need to identify society objectives more clearly, and we need to expend our resources more precisely to achieve these objectives. Also, because of the importance of conference income to our financial health, we need to take a stronger hand in helping the local Conference Committee spend conference funds wisely, limit conference expenses prudently, and be more proactive in working with local Conference Committees toward continuously responsible conference resource allocation.

Some of the expenses are absolutely under our control. For example, we decide to spend a certain amount of the Society's funds by having an Administrative Committee meeting at each OCEANS conference. Some expenses are very little under our control. For example, when we have an Administrative Committee election, the IEEE charges us an amount to prepare and mail the ballots and to receive and tabulate the returns. These two examples are a small sample of what we need to understand and manage to get the most for our membership from our financial resources.

The foregoing should not be misunderstood. The Society is in excellent financial health. Even though our membership is smaller than any other technical society in the IEEE, our expenses and financial reserves place us well into the middle of the pack, and reflect our conservative approach to our fiscal responsibilities.

Accounting System

As the Society's Treasurer, I am responsible for preparing the annual budget, and for monitoring our financial health. The IEEE Technical Activities staff in Piscataway does our accounting and receives and disburses our funds. One of the first things I discovered when I assumed my duties in 1997 was that the IEEE accounting system was complicated, opaque, and not at all suited to our way of managing our finances. Step One was to figure out how it all worked, and how we could relate the IEEE accounting system to our activities and purposes. After about a year of work, I sorted out the purposes and organization of the IEEE system.

Following another year of work, I have now related the system to our organization and purposes. We are now in a position to manage our finances more effectively.

Thomas F. Weiner

The IEEE system is designed to help the IEEE Technical Activities Board (TAB) and the Operations Center Staff keep track of TAB finances. We, on the other hand, have an organization (headed by a President and Three Vice Presidents, together with the Editor of the Journal of Oceanic Engineering) with somewhat different needs. These five leaders are what I term 'Claimants' for the Society's resources. They use those OES resources to accomplish the Society's purposes. They also have responsibility for ensuring that our income appears as planned. For example, the Vice President - Technical is responsible for conferences, so it is to him we look to assure our conferences are profitable. Because the IEEE accounting system is unwieldy for our purposes, I have rearranged the accounts into Claimant Groups. They include income and expense accounts. These accounts include those controlled by the IEEE and those controlled directly by us.

OES Finance Committee

As Treasurer of the Oceanic Engineering Society, I am forming a Finance Committee to help manage the Society¡s finances more effectively. The Finance Committee¡s Charter is as follows:

Oceanic Engineering Society Finance Committee Charter

Purpose

To assist the Officers and Administrative Committee of the Oceanic Engineering Society in defining Oceanic Engineering Society objectives and applying resources to achieve them.

Membership

The Finance Committee shall consist of the Treasurer as Chair and four other members of the Administrative Committee

Functions

Support financial aspects of OES management
Develop Financial Goals for OES
Develop Financial Calendar for OES
Develop standard Financial Reports for OES
Assist Claimants in preparing budgets
Provide Claimants with financial information to support their activities
Support financial management of OES Conferences
Assist in establishing the conference budget

Assist in obtaining approval of the budget from the conference sponsors
Assist in establishing a conference financial tracking system
Assist in preparing conference financial reports
Support financial management of OES Publications
Assist in establishing budgets for the publications
Assist in establishing a publications financial tracking system
Assist in obtaining publications financial reports from the IEEE and other organizations
Assist in preparing financial reports for the publications

As you can see from the charter, helping to establish and support Society goals is the number one function of the Finance Committee. The other two major issues for the Society that the Finance Committee will deal with are conference finances and publication costs. The latter includes the costs for electronic publication of our Journal and Newsletter and the best way of achieving this goal. We need to understand whether we can realize a cost saving by 'going electronic'. If so, are there alternative ways to do this that incur different costs? In any case, can we identify identify, and quantify and justify the benefits to the OES membership for such a step?

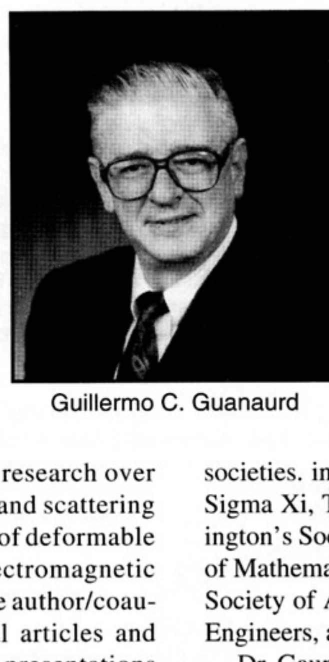
Given the amount of work necessary to manage the Society's finances, we need a Finance Committee. None of us has enough time to do the whole job, but five of us can put together enough time to do it well. Also, Society financial management should not be a one-man show. I am sure that many of you have more good ideas and more experience than I in this area.

Therefore, I invite members of the Administrative Committee to join the Finance Committee. Via this Newsletter, I also invite members of the OES to volunteer for service on the OES Administrative Committee. Please send me your name, address, eddress (I communicate much better by email), and telephone numbers. We'll have our first face-to-face meeting in Seattle during OCEANS '99. This will be preceded by a couple of telephone conferences. I appreciate your help.

Thomas Freud Wiener, Sc. D.
Treasurer, Oceanic Engineering Society
2403 Lisbon Lane
Alexandria VA 22306
t.wiener@ieee.org
703-768-9522 (H)
703-516-7363 (V)
703-516-7360 (F)

Who's Who in the OES

GUILLERMO C. GAUNAURD (M'82- SM'83) received the B.A. (mathematics), B.S.M.E, M.S., and Ph.D. (physics/acoustics) degrees from Catholic University, Washington, DC, in 1964, 1966, 1967, and 1971, respectively.


Guillermo C. Guanaurd

He is a Senior Research Physicist at the Carderock Division of the Naval Surface Warfare Center (N.S.W.C.), Bethesda, MD, where he is currently a Group Leader in the Weapons Materials Department. He has been with N.S.W.C. since 1971, specializing on the scattering interaction of acoustic, electromagnetic, and elastic waves with materials and structures. His research over the years has mainly dealt with radiation and scattering problems of classical physics, mechanics of deformable media, fluid-structure interactions, electromagnetic theory, and applied mathematics. He is the author/coauthor of more than 120 scientific journal articles and more than 300 other publications and/or presentations at professional societies, congresses, symposia, and government reports. He has delivered scores of invited papers/keynote lecturers at scientific meetings and universities. He has organized/chaired dozens of special technical sessions and entire scientific conferences. He lectured intermittently (part time) at the Engineering School of the University of Maryland, College Park. He holds four patents.

Dr. Gaunaurd has won a number of awards including the Washington Academy of Sciences "Scientific Achievement Award" (1989), the Nadonal Defense Preparedness Society Bronze Medal (1991), and others within N.S.W.C. His professional biography is listed in *American Men of Science, Who's Who in America,* and a dozen other such books. He has been a Guest Editor of the *IEEE Journal Of Oceanic Engineering* and since 1992 has been an Associate Editor of the *IEEE Transactions On Ultrasonics, Ferroelectrics And Frequency Control*. He is a member of several scientific societies. including the New York Academy of Sciences, Sigma Xi, The American Academy of Mechanics, Washington's Society of Engineers, and the International Union of Mathematical Physics. He is a Fellow of the Acoustical Society of America, the American Society of Mechanical Engineers, and the Washington Academy of Sciences.

Dr. Gaunaurd is an active contributor to the journals and activities of three IEEE. Societies, namely, the Oceanic Engineering Society, the Antennas and Propagation Society and the Ultrasonics, Ferroelectrics and Frequency Control Society. For these and other contributions he was elevated to the rank of Fellow of the IEEE. on November 1998. The citation chosen for this honor was: "For contributions to the direct and inverse scattering interaction of Acoustic, Elastic and Electromagnetic waves with matter".

OTC 2000

ABSTRACT SUBMISSION FORM
1–4 MAY 2000 • HOUSTON, TEXAS, USA
DEADLINE FOR SUBMISSION • 15 SEPTEMBER 1999

WORLDWIDE RESOURCES - TECHNOLOGY FOR THE 21ST CENTURY

Dear Colleague:

This is our first step toward the Offshore Technology Conference 2000, scheduled for 1–4 May 2000, which will provide industry professionals with ways to stretch their thinking, challenge their careers and encourage productive debate and roundtable discussions. With our theme, "Worldwide Resources – Technology for the 21st Century," we are offering you the opportunity to contribute your ideas to be shared with professionals from around the world and from every discipline. By submitting an abstract, you can help us begin the process of what we hope will be a productive exchange.

OTC invites you to submit an abstract of a proposed paper in your area of expertise related to the offshore industry. The success of the technical program at OTC 2000 depends upon your participation. The technical themes are listed in more detail on the following pages. We encourage you to think how you can contribute and also to contact your colleagues whom you believe have something special to offer to this event.

We would like the program at OTC 2000 to include a wider mix than ever of stimulating topic presentations. In addition to cutting-edge technical reports, we want to know how you are meeting and responding to other areas challenging the oil and gas industry — such as the impact of state-of-the-art technology, the best practices in contracting or operations, the expanding roles and new demands of petroleum engineers, organizational culture changes, and the shifting industry dynamics.

Abstracts will be carefully reviewed by the 2000 Conference Program Committee, which includes representatives from the 12 sponsoring organizations. Relevance, timeliness and quality are the key factors for reviewing proposed papers.

Attached is an abstract form for OTC 2000. Abstracts are due by 15 September 1999. Authors will be notified of their status by November 1999. Completed manuscripts for selected abstracts are due by 8 February 2000.

We look forward to your abstracts. Whether they address a broad managerial theme, an exploration innovation or a new technology, we need you to take up this challenge.

Yours sincerely,

Mike Williams
2000 Program Chairperson

SPONSORING ORGANIZATIONS
- American Association of Petroleum Geologists
- American Institute of Chemical Engineers
- American Institute of Mining, Metallurgical, and Petroleum Engineers
- American Society of Civil Engineers
- American Society of Mechanical Engineers—Petroleum Division
- Institute of Electrical and Electronics Engineers—Oceanic Engineering Society
- Marine Technology Society
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- Society for Mining, Metallurgy, and Exploration Inc.
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- The Minerals, Metals and Materials Society

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- Petroleum Equipment Suppliers Association

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- National Ocean Industries Association
- UK Offshore Operators Association
- International Association of Geophysical Contractors

INVITED ORGANIZATION
- American Geophysical Union

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Deadline for Abstract Submission—15 September 1999

GUIDELINES FOR AUTHORS

The Abstract Form

A proper review of your abstract requires that it contain adequate information on which to make a judgement. The suggested limit of 200–300 words should not be constraining if the abstract is limited to the following factual highlights:

- **Description of the Proposed Paper:** Outline the scope and nature of the work upon which the paper is based (e.g., field data, laboratory data, original analysis, or computer work). If the paper is a review paper, carefully state the extent of the coverage.
- **Application:** Describe the possible applications of the information provided in the paper.
- **Results, Observations, and Conclusions:** Summarize the results and major conclusions to be presented in the paper and state how these differ from previous work on the same subject. State whether new information will be revealed and whether the data from field, laboratory,or computer work will be included.
- **Significance of Subject Matter:** Describe the significance of the proposed paper by listing up to three technical contributions or additions to the technical knowledge base of the petroleum industry.

Selection Criteria

The Program Committee will observe the following criteria when selecting papers for the conference.

- The paper must not have had prior publication or circulation.
- The paper should contain significant new knowledge or experience in some field of offshore exploration and production.
- The paper must be technically correct and should be of interest to a reasonable number of people working in the field of offshore operations. It may be theoretical or present the results of laboratory studies, and it may state or analyze a problem. The paper may also be a review paper, but must be of significant value to the technical field.
- The paper may present information about equipment and tools to be used in exploration and production. Such papers must show the definite applications and limitations of such equipment and avoid commercialism and the extensive use of trade names.
- The abstract should have necessary clearance before submittal to OTC. Prospective authors should advise of any clearance problems when the abstract is submitted.

Preparation of Manuscripts

A manuscript will be required for each paper selected for the conference. Manuscripts will be included in the conference *Proceedings,* to be available to registrants at the meeting. The maximum length for any paper is 7,000 words.

- Complete instructions on preparation of manuscripts and slides will be sent to authors of accepted proposals.
- All papers presented at the conference will be copyrighted by OTC.
- Do not use trade names, company names, or language that is **commercial** in tone in the paper title, text, figures, and presentation materials. **Commercialism** in papers submitted for the *Proceedings* may be cause for removal of the paper from the program.
- The paper must be written in English.

When faxing or sending abstract via Internet, **DO NOT** duplicate by sending original via post (mail). Please include complete information requested on this form as these data will be published in the registration brochure. If available, please include your business card and a copy of your organization's/company's letterhead when submitting your abstract by post (mail).

Send completed abstract form to: Technical Program Unit, Offshore Technology Conference

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SUBJECT CATAGORIES ARE LISTED BELOW. PLEASE INDICATE BY NUMBER THE MOST APPROPRIATE PRIMARY CATEGORY DESIGNATION ON THE ABSTRACT FORM WHERE INDICATED. A SECONDARY CATEGORY IS OPTIONAL.

40306	Marine Geology and Chemistry
20407	Exploration and Production Geology
20403	Geophysical Data Interpretation
50209	Seafloor Surveying and Mapping
20403	Site Geotechnical Surveys and Foundation Engineering
30503	Met-Ocean Description and Environmental Loading
20110	System Concepts, Field Development Evaluation Selection
30102	Design and Analysis of Bottom-Founded Systems
30102	Design and Analysis of Floating Systems and Marine Risers
30105	Construction, Installation, Support
10103	Drilling Technology and Equipment
30101	Well-Completion Technology and Equipment
30405	Processing Technology and Production Equipment
30607	Subsea Production, Processing, Multiphase Pumping
30104	Offshore Pipelines and Subsea Flowlines
50107	Marine Terminals and Transportation
40207	Ocean Energy, Minerals, and Mining Technology
30102	Mobile Offshore Drilling Units
50212	Reclassification, Inspection, Maintenance, Repair, Decommissioning, and Salvage
50206	Health, Safety, and Environment Quality
30204	Materials, Welding, and Corrosion Engineering for Offshore Applications
30103	Mooring and Station Keeping
30608	Instrumentation and Control
40402	Project Management and Economics

Offshore Technology Conference
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Abstract	Paper	Session Assigned

Abstract Deadline—15 September 1999

If abstract is selected for the program, the information submitted on this form will be published in the registration brochure. Please type or print the following information. List authors in the order they should be printed in the program. SPE will communicate with the **corresponding author** on all matters. **Check box to indicate corresponding author. In order for authors' names to appear in the conference brochures, all contact information must be completed.**

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If yes, indicate place and date. ______

Will your company allow you to present and/or publish all of the information described in your abstract? ❑ Yes ❑ No ❑ Not Sure

Preferred Presentation Media ❑ Slide ❑ Video ❑ Computer

All information requested on this document must be provided in full and in the order requested.

Abstract Deadline—15 September 1999

Offshore Technology Conference
1–4 May 2000 • Houston, Texas, U.S.A.

Abstract Form

- Maximum 300 words
- All abstracts must use following outline:

Paper Title ______________________________

Corresponding Author ______________________________

Company ______________________________

Subject Categories: Indicate the subject categories that most directly apply to your abstract. Categories are listed inside this form.

❑ Primary ________________ ❑ Secondary ________________

- **Description of the Proposed Paper:**

- **Application:**

- **Results, Observations, and Conclusions:**

- **Significance of Subject Matter:**

Abstract Deadline—15 September 1999

Incomplete abstracts will be returned for resubmittal.

Tutorials To Be Presented At Oceans '99 In Seattle

T1. Adaptive Equalization for High Speed Underwater Data Communications

Presenters: Dr. Milica Stojanovic, Northeastern University, and Lee Freitag, Woods Hole Oceanographic Institution

This tutorial is intended for the audience of researchers, engineers and students interested in the area of underwater acoustic communications. Familiarity with the basic mathematical tools used in communications engineering is assumed, but no advanced knowledge of digital communications or underwater acoustics is necessary.

Signal processing methods based on adaptive equalization and spatial signal combining, which are capable of compensating for the induced signal distortions, are the focus of this tutorial. The tutorial is organized in three parts. The first part focuses on the theory of signal processing in the presence of intersymbol interference and noise. The second part of the presentation focuses on adaptive filtering methods used in equalization and spatial signal combining. The third part is devoted to demonstrating the concepts taught in the first two parts using examples of real underwater acoustic data.

In conclusion, current research efforts, which focus on reduced-complexity adaptive signal processing are outlined, and open problems in the field are summarized.

T2. Principles and Applications of Synthetic Aperture Radar (SAR)

Presenter: Dr. Barton Huxtable, President, User Systems, Inc.

This tutorial is the first half of a pair of coordinated tutorials, with the second half on marine applications offered in the afternoon session. This session provides an introduction to the operating principles of SAR, addresses those issues in SAR technology of special interest to marine applications, and makes use of SAR imagery available from several spacecraft and aircraft platforms. The material is designed for the non-specialist who would like to understand and use SAR imagery of the marine environment without having to become a sensor specialist.

Lecture notes and examples will be distributed.

T3. Re-Engineering University-Level Marine Science Education

Presenter: Dr. Frank Hughes, The Boeing Company

This tutorial is intended for attendees from all of the following sectors, academic, commercial, and governmental. It focuses on identifying what all three sectors should be expecting and demanding of program graduates and on providing specific recommendations and strategies for meeting these increased expectations and demands.

The capability and quality of graduates from marine science education programs is important because ocean issues are of widespread national and societal interest and concern. Producing graduates who have the proper capability and quality requires the reengineering of the current contents of marine science education programs. Graduates must possess the proper set of attributes to be able to satisfy the requirements of jobs in the marine workplace.

Graduates must also be prepared for continuing, lifelong learning. To meet these needs requires changes not only in the contents of the curriculum but in the educational delivery system itself.

Specific recommendations and strategies for reengineering marine science education programs will be presented. These will build from and capitalize on the existing strengths of our educational enterprise. The consequences of failing to change will also be discussed.

T4. Computational Intelligence: Theory and Applications in Ocean Surveillance

Presenter: Bill Porto, Natural Selection, Inc.

Evolutionary computation (EC) techniques are well suited to solving many inherently difficult or time consuming problems since they provide an efficient, robust method for searching large, complex solution spaces. These algorithms can be applied to a wide variety of problem domains and are directly applicable to signal processing, pattern recognition, automatic control, and other aspects of ocean engineering.

This tutorial presents an introduction to EC, including genetic algorithms (Gas), genetic programming (GP), evolution strategies (ES), and evolutionary programming (EP) as they pertain to the ocean sciences. Similarities and differences between EC and traditional computation methods will be discussed, as well as their relative strengths and weaknesses in different problem domains.

Applications and examples within several areas of ocean sciences such as signal processing, detection, optimal surveillance methodologies, and autonomous underwater vehicle (AUV) path planning will be presented. Attendees will gain knowledge in how to choose and implement an appropriate algorithm for their own problems. Software code suitable for execution on desktop computers will also be distributed to attendees.

T5. Introduction to Technological Forecasting and Competitive Technology Intelligence

Presenter: Dr. Richard Mignogna, Technology/Engineering Management, Inc.

Articulating the present state of the art, assessing competitor's technological capabilities, and forecasting the direction and rate of technological advance are critical elements of competitive technology intelligence (CTI). This tutorial, which is offered in two parts, focuses on the application of technological forecasting and competitive technology intelligence in strategic technology planning. In achieving this goal, it covers both quantitative and qualitative analytical techniques for assessing the technical capability of your competitors and for predicting future directions and likely developments in a given technology. The emphasis is on exposing participants to the broad range of techniques available to them.

This session begins with an introduction to technological forecasting and competitive technology intelligence and their role in strategic planning for the enterprise. This is followed by a discussion of technology life cycles and the underlying dynamics of technological advance. Surveillance techniques are then presented, followed by a comprehensive review of the most valuable sources of technology intelligence data. This first part concludes with an overview of technology forecasting methodologies that aid in technology intelligence analysis.

T6. Optimization of Space-Time Signal Processing for Moving Antennas

Presenter: Dr. Igor Gorban, Institute of Mathematical Machines and Systems, Kiev, Ukraine

The tutorial is oriented to scientists and engineers interested in the problem of space-time signal processing. The course is self-contained, however, a general knowledge of space-time signal processing is desirable.

This tutorial has three objectives. These are: 1) the presentation of the basis of modern space-time processing for moving antennas; 2) a description of the new principles of fast multichannel space-time signal processing with minimum calculations; and 3) a discussion of the advantages of using the new approaches in optimization for the new hydroacoustic technique.

A lot of underwater acoustic space-time signal processing (STSP) systems are exploited in complicated dynamic conditions. Because of the streams, pitching, rolling, and other destabilized factors there are antenna motions changing the location of the antenna, its orientation in space, and sometimes even changing its form. The tutorial presents new approaches in complex optimization of STSP. Two aspects of the problem will be discussed. The first aspect is the development of optimum and near optimum STSP methods that take into consideration complicated antenna motion, noises, and medium together. The second aspect is realization of the complicated STSP in millions of channels with minimum computational effort. The advantages of using the new approaches in hydroacoustic technique will be discussed.

T7. Understanding and Using SAR Imagery of the Marine Environment

Presenter: Dr. John Apel, President, Global Ocean Associates

This tutorial is the second half of a pair of coordinated tutorials, with the first half on synthetic aperture radar (SAR) principles offered in the morning session. This session provides an overview of the kinds of information available from SAR images in marine and ocean applications. Intended for the non-specialist, it addresses interpretation of SAR imagery of sea and lake surfaces, the extraction of quantitative information from imagery, and the utilization of images in coordination with insitu measurements, other remotely sensed data, and theoretical/analytical models. Lecture notes will be distributed, and extensive use will be made of the graduate-level textbook, Principles of Ocean Physics, by J.R. Apel (Academic Press, 4th printing, 1995).

T8. Onboard Acoustic Sensors

Presenter: Frederick Maltz, Consultant

This tutorial focuses on the simulation of onboard Autonomous Underwater Vehicle (AUV) sonar returns in shallow water. In particular, statistical models and algorithms are discussed for targets and reverberation from rough sea surfaces and rough bottoms. Sea surface heights are modeled as a Markov Random Field (MRF) followed by a nonlinear transformation. The bottom terrain heights are also represented as a plasma fractal field. The student will be introduced to the statistical methods for generating MRF's and plasma fractals. He will also be given the tools to enable him to synthesize a variety of random fields with specified spectral characteristics in three dimensions and simulate the high frequency acoustic scattering of energy therefrom.

The tutorial includes an introduction to the fundamentals of high frequency sonar in addition to acoustic scattering from rough surfaces. Side Look Sonar for object search and Forward Look Sonar for obstacle avoidance are discussed in the context of signal generation, beamforming, and high frequency ray acoustics. The sonar equation is discussed in detail for his application. In addition to rough surface scattering, absorption of sound is a significant factor at these high frequencies. The student will be shown how to account for absorption effects in system performance prediction using the sonar equation. He will also be introduced to the basic methods of receiver design to accommodate the high sound absorption levels.

The tutorial includes an overview of computer graphics modeling principles used to visualize the physical environment. Computer simulation examples are used to demonstrate the use of the POV-Ray scene description language and accompanying raytracing software. This software is available for both the PC and the Macintosh. Computer graphics techniques for demonstrating the interaction of the sea surface dynamics with the scattered acoustic field are illustrated in the classroom using an animation player.

T9. Understanding Technological Forecasting and Competitive Technology Intelligence Methods

Presenter: Dr. Richard Mignogna, Technology/Engineering Management, Inc.

This is the second part of a two-part tutorial and delves deeper into the techniques for performing technological forecasting and analyzing technology intelligence data. This session begins with techniques for analyzing and extrapolating technology trends based on the well-known technology s-curve and will teach you how these techniques are applied to 1) assess the present state of the art and competitor capabilities, 2) analyze trends in technological capabilities and performance, and 3) predict the substitution of a new technology, innovation, or product for an existing one. Because the diffusion of technology is obviously more than a simple curve-fitting exercise, the session will next examine how the attributes of an innovation impact its diffusion in the marketplace and how these attributes may be used to assess the acceptance of new product introductions - yours or your competitors.

This session will also present judgmental and expert opinion-based techniques for the development of technology intelligence. Participants will learn how to use the Delphi technique, nominal group technique, morphological analysis and impact wheels for eliciting expert opinion.

Throughout this session of the tutorial, we will refer back to an integrative case study to illustrate how the respective technology forecasting techniques may be applied in real world situations.

IEEE-USA Salary Survey Shows Strong Income Growth

Overall, Pay is Way Up, but Some Younger Professionals Still Lag

WASHINGTON, May 18, 1999 — Primary incomes of electrical and electronic engineers are up 13.9 percent since 1997, according to the IEEE-USA SALARY AND FRINGE BENEFIT SURVEY, 1999-2000 edition. "This confirms what our members have been telling us all along," IEEE-USA Survey Committe Chair Robert Nash said. "The overall picture is good, reflecting the critical role experienced engineers play in sustaining these good economic times. But there are some groups falling behind."

According to IEEE-USA s definitive biannual survey, the January 1999 median primary income from base salaries, self-employment, commissions and bonuses for IEEE members in the U.S. was $82,000, a substantial increase from the comparable 1997 figure of $72,000. This pace exceeds inflation by more than 10 percent, and the gains for the most flexible and entrepreneurial engineers — the full-time self-employed — are even better: an average 19.4 percent increase over two years.

"Encouraging as these statistics are, they are partially offset by a continuing lag for those who entered the workforce in the early 1990s," explained Nash. "While recent graduates and the most experienced are doing better than ever, those with two to six years experience are well below where they should be. The salaries which younger individuals make earlier in their career are a key incentive for attracting talented, future-oriented people into professional engineering — and those incentives are not keeping pace."

"IEEE-USA has continued to refine the Salary Survey to make it even more helpful to mid-career and entry-level engineers who are considering their options," Nash said. "We think they will find the 1999

Survey's details about pay distinctions extremely useful."

The 1999 Survey includes an upgraded regression model for calculating income estimates for thousands of combinations of skills, experience, levels of responsibility, degrees, speciality, type of employer, and other factors, including new details on computer hardware and software and network administration. This model provides the basis for the Salary Survey's upcoming companion volume, SALARY BENCHMARKS: A PERSONAL WORKBOOK, which provides for ranges of pay to allow engineers to consider personal circumstances for their career planning, including the possible effects location will have for 17 major metropolitan areas, as well as other parts of each U.S. region.

THE IEEE-USA SALARY & FRINGE BENEFIT SURVEY, 1999- 2000 Edition, can be obtained by calling 1-800-678-IEEE and asking for product no. UH2981. The cost is $74.95 for members and $149.95 for nonmembers.

For more information on the survey, see *http://www.ieeeusa.org/CATALOG/99salary.html.*

IEEE Completes Sloan Project, Produces Multimedia Career Resources

PISCATAWAY, NJ, 14 May 1999 - Many students are so immersed with technical subject matter that they often overlook what is needed for success in the "real world." To provide students with the necessary information to plan for their careers, the IEEE has produced the following multimedia resources that take an in-depth look at careers for electrical engineers and computer scientists:

The IEEE Student Career Web site at *http:// www.ieee.org/organizations/eab/sloancareers/sloancareers.htm*. The CD-ROM, Careers for Electrical Engineers and Computer Scientists ú And two videos, What's Out There and Getting Ready

"Although aimed at the college student, these materials are also helpful to high school students who are contemplating technical careers," said Peter Wiesner, director of continuing education for IEEE Educational Activities. "We want to encourage students to think about careers early, and provide them with the appropriate resources to do so."

The IEEE was one of eleven professional associations to receive funding from The Alfred P. Sloan Foundation to create products that explore the various career opportunities open to scientists, engineers, and mathematicians. To obtain information about the other participating associations, visit the Sloan Web site at *www.careercornerstone.org*.

The CD-ROM and videos are available for purchase from the IEEE Customer Service Department, 445 Hoes Lane, PO Box 1331, Piscataway, NJ, 08855-1331; E-mail: *customer-service@ieee.org*; Phone - 1.732.981.0060

To order the CD-ROM—$29.95 list and $19.95 for IEEE members-use code EC100-QVE; to order the What's Out There video—$24.95 list and $19.95 for IEEE members-use code EV5526-QVE; to order the Getting Ready video—$24.95 list and 19.95 for IEEE members-use code EV5522-QVE. For more information on any of these products, visit IEEE Web address *www.ieee.org/organizations/eab/careeresource.htm*.

UPCOMING CONFERENCES

1999 IEEE Pacific Rim Conference on Communications, Computers and Signal Processing (PACRIM '99)

August 23-25, 1999

Victoria, B.C., Canada

11th International Symposium on Umanned Untethered Submersible Technology

August 22-25, 1999

Durham, New Hampshire.

Information: Linda Carter, Autonomous Undersea Systems Institute, 86 Old Concord Turnpike,
Lee, NH 03824
Telephone: (603) 868-3221
E-mail carter@ausi.org
WWW: http://www.uust.org

Second International Conference

September 7-9, 1999

Shallow Water Fisheries Sonar
Seattle, Washington

Offshore Europe 99

September 7-10, 1999

Aberdeen, Scotland
Information: D.C.C. Stott, The Offshore Europe Partnership, Spearhead Exhibitions Ltd.,
Ocean House, 50 Kingston Rd.,
New Malden, Surrey, KT3 3LZ, U.K.;
Telephone: +44 (181) 949-9222
E-mail: oe99@spearhead.co.uk
WWW: http://www.offshore-europe.co.uk

2nd International Shallow Water Fisheries Sonar Conference

September 7-9, 1999

Seatlle, Washington

Information: Melanie Milnes, 4027 leary Way NW,
Seattle, WA 98107
Telephone: (206) 782-2211
WWW: http://www.swfc.org

OCEANS '99 MTS/IEEE

September 13-16, 1999

Seattle, Washington

Information: Marine Technology Society,
1828 L St. NW, Suite 906, Washington, DC 20036
Telephone: (202) 775-5966
E-mail: frank.w.hughes@boeing.com or
oceans99@ieee.org

SIP '99 IASTED - International Conference on Signal and Image Processing

October 18-21, 1999

Nassau, Bahamas

Contact: IASTED Secretariat SIP '99,
1811 West Katella Avenue, Suite 101,
Anaheim, CA 92084 USA
E-mail: iasted@iasted.com
WWW: http://www.iasted.com

SEG International Exposition & 69th Annual Meeting

October 24-28, 1999

Houston, Texas

Information: Society of Exploration Geophysicists,
8801 S. Yale, Tulsa, OK 74317

Telephone: (918) 497-5500

Underwater Technology 2000 UT '00

May 23-26, 2000

The New Sanno Hotel Tokyo, Japan

OTC2000 - Offshore Technology Conference

May 1-4, 2000

Houston, Texas

5TH European Conference on Underwater Acoustics ESCPE

July 10-13, 2000

Lyon, France

OCEANS 2000 MTS/IEEE Conference & Exhibition

September 11-14, 2000

Providence, Rhode Island

Oceanology International 99 Pacific Rim Exhibition & Conference

27-29 April 1999

World Trade Centre, Singapore

Contact: Versha Carter - Spearhead Exhibitions Ltd,
Ocean House, 50 Kingston Road, New Malden,
Surrey KT3 3LZ, UK
Telephone: +44 (0) 181 949 9222
Facsimile: +44 (0) 181 949 8186/8193
E-mail: oi99@spearhead.co.uk
WWW: http://www.spearhead.co.uk