IEEE

OCEANIC ENGINEERING SOCIETY

Newsletter

VOLUME XXXVII

NUMBER 4

EDITOR: FREDERICK H. MALTZ FALL 2002 (USPS 420-910) ISSN 0746-7834

IEEE OCEANIC ENGINEERING SOCIETY

OES Journal Associate Editors

ARTHUR B. BAGGEROER
Arctic/Antarctic Oceanic
Engineering. Information and Processing of Acoustic and Electromagnetic Phenomena

D. RICHARD BLIDBERG
JOHN J. LEONARD
AUV's, ROV's, Autonomous Systems, Unmanned Vehicles, Intelligent Systems, and High Level Control

WILLIAM H. CAREY, *Editor Emeritus*
Acoustic Propagation and Scattering, Signal Processing

CHRISTIAN DE MOUSTIER
Bathymetry. Surveys, Mapping. Remote Sensing, and Sonar Image Processing

GEOFF EDELSON
Signal Processing, Array Processing, Synthetic Aperture Sonar, Acoustic Communications

JOHN E. EHRENBERG
Acoustic Simulation and Sensors.

DAVID M. FARMER
Instrumentation, Acoustical Oceanography. Air-Sea Interaction. Turbulence.

RENE GARELLO
Regional Editor France and Europe

MALCOLM L. HERON
Regional Editor South America, Australia and Africa
Remote Sensing; Radar; Waves; Currents; Air-Sea Interaction

DAVID P. KNOBLES
Seismo Acoustics, Seafloor Geophysics, Seismology, Propagation, Scattering, Signal Processing, Interface Waves

HISAAKI MAEDA
Regional Editor for Japan and Asia
Marine Hydrodynamics, Dynamics of Floating Structures, Underwater Vehicles Ocean Energy Utilization

ARYE NEHORAI
Array Processing; Statistical Analysis; Detection; Estimation

JOHN D. PENROSE
Regional Editor Western Australia

JOHN POTTER
Regional Editor Southeast Asia
Ocean Acoustics, Marine Mammal Acoustics

DANIEL RAMSDALE
Book Reviews

ROBERT C. SPINDEL
PETER DAHL
Acoustic Communication, Navigation and Telemetry; Acoustic Tomography; Acoustic Remote Sensing; Underwater Optics

RICHARD STERN
Engineering Acoustics: Equipment and Devices, Instrumentation, Materials, Measurement Techniques

continued on back cover...

IEEE Oceanic Engineering Society Newsletter (ISSN 0746-7834) 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

OCEANS '02 MTS/IEEE

Marine Frontiers

Reflections of the Past, Visions of the Future

October 28-31 • Biloxi, Mississippi
Mississippi Coast Coliseum and Convention Center

THE INDUSTRY'S PREMIER U.S. CONFERENCE AND EXHIBITION

- More than 150 COMPANIES featuring technologies for solving problems throughout the world's oceans.
- Exhibitor Product Showcase – Exhibitor presentations focus on the LATEST INDUSTRY DEVELOPMENTS and HOTTEST TECHNOLOGIES.
- NETWORK and EXCHANGE IDEAS with more then 2,000 industry professionals from marine-related industries, academic institutions and government agencies.
- KEYNOTE SPEAKERS include top leaders in national ocean policy and homeland defense.
- Local Tours will include visits to the John C. Stennis Space Center, home of some of the world's most advanced technologies for ocean and space exploration.

INNOVATIVE TECHNICAL SESSIONS

More than 300 technical papers will address new technology concepts, developments, and applications that describe advances in science and engineering in the ocean environment. Planned topic areas will include:

- Advanced Marine Technology
- Communications and Navigation
- Ocean Monitoring Systems
- Marine Policy, Education and Business
- Marine Resources
- Underwater Acoustics
- Signal and Information Processing
- Ocean and Coastal Engineering
- Homeland Defense

For details on the exposition, conference, registration and housing please contact:
J. Spargo & Associates, 11212 Waples Mill Road, Suite 104, Fairfax, Virginia 22030
Tel: 800-564-4220 • Fax: 703-818-9177 • Email: Oceans@jspargo.com •
Web site: www.OCEANS2002.COM

Table of Contents

President's Message

Thomas F. Wiener

I can't let September 11 pass without remembering the horror of that day. I remember those who were killed by the terrorist cowards, and I honor those who came to their rescue. I am appalled each time I realize that the best in people is so often called forth by the worst in people. Let us renew our vow and our effort to put an end to all who use terrorism to further their end, and let us redouble our efforts to find peaceful solutions to the problems we face together. Congratulations to Dr. John Potter and the IEEE OES Singapore Chapter. I am delighted that this group of active members has organized itself. I look forward to their activities and to their contributions to the profession. Be sure to review Vice President Joe Vadus's report on our conferences. He is a major reason for our successful conference programs. There you will learn about our progress on Two Oceans, and also about our workshops, These, while not as large as OCEANS Conferences, provide a well-focused opportunity to specialize. Speaking of Conferences, the Joint Oceans Advisory Board (JOAB) is now organizing itself. They had a good meeting this summer, and settled most of the remaining issues. The next step is to fill the offices and prepare a budget. I expect this budget to be part of the report they submit to both societies in Biloxi in October. I am pleased to report that progress is being made in assembling the data on conference attendance and conference finances. For too long, our data collection has been ad hoc and not rationalized. John Irza, Stan Chamberlain, and Claude Brancart are bringing all the data together. They are capturing them in a relational database. When the task is complete, we will be able to do the kinds of analyses that we have always wanted to do, but have been unable to complete. We will have a report at the Administrative Committee meeting in Biloxi. Diane Di Massa and her Dues Committee have issued an Interim Report. There is still some data to be gathered, but they are leaning toward a policy that contains the following elements:

- Unbundled paper version of the Journal of Oceanic Engineering. Members would have access to IEEE *Xplore* and JOE via the World Wide Web. Members who want a paper copy of the JOE would subscribe for the marginal cost of their copy, about $30. This number is being refined.
- Continue to subsidize the cost of Society membership by some amount. This recommendation would result in a dues charge less than the cost of membership, but regularly com-

pared to actual cost. The basis of the subsidy would be some identified element of the cost, such as the newsletter or the administrative costs incurred on our behalf by IEEE Operations Center, such as the cost of conducting our AdCom elections, and the cost of processing our membership renewals.

- Student and other reduced memberships should continue to be half the price of regular membership. The Committee will have its final report to present to the AdCom in Biloxi. At that time, we make a decision. Three conferences, OCEANS '01, Offshore Technology '02, and AUV '02, have closed and have provided a tidy surplus for the Society. Thanks to all who worked to make it happen. In case you haven't seen it, the new Society Web Site is up. Go to *http://www.oceanicengineering.org/* and see it. Thanks to Todd Morrison and his committee for getting it all together. It's growing every day. On a similar note, let me encourage you to get yourself an IEEE mail alias. This will hasten the day when we will have a Members Only part of the OES Web Site. It also provides virus scanning and removal service automatically. And it's free. Go to *http://eleccomm.ieee.org/personal-aliases.shtml*.Our Administrative Committee will meet on Monday, October 28 in Biloxi. In addition to the items mention above, we will hold elections for President and for Vice President for Technical Affairs. I encourage you all to attend and to participate. If you haven't registered for OCEANS '02 in Biloxi, now is the time. Indications are that it will be a useful and important conference, and you can stay a few extra days to enjoy the Mississippi Gulf Coast. And the rooms are filling fast. Where else can you get a room at a First Rate hotel for $86 per night?

Thomas F. Wiener
IEEE/OES President

Message from the Vice President, Professional Activities

On Thursday, August 29, 2002, the Executive Committee held a teleconference to review progress on action items from the Administrative Committee Spring meeting in Houston on May 5, 2002. During the teleconference one of the items for discussion was the election of AdCom members for the 2003-2005 term. It occurred to me that many of our members are not familiar with how the Oceanic Engineering Society is organized and governed. By way of introduction to what your elected officers due during the year, it would be well to explain how the Society operates. Article V, Section 1 of the OES Constitution defines that "The Society shall be managed by an Administrative Committee (AdCom) of no less than ten nor more than thirty Members-at-Large, who shall have voting rights and who shall be elected by vote of the members of the society ... Elected Administrative Committee members shall be at least Member grade. Section 2 of Article V then defines the Officers of the Society and Section 3 defines the election of officers of the Society. The President of the Society appoints the Society Treasurer, who shall be an elected AdCom member, and the Secretary, who does not necessarily need to be an AdCom member.

Norman D. Miller

At the present time the bylaws state that the AdCom shall consist of 18 members-at-large. Each year we have an election to fill six slots on the AdCom. Each year the nominating committee presents a slate of AdCom candidates to the AdCom and after approval the slate is presented to the membership for voting. The term of office for an elected AdCom member is three years. An AdCom member can serve for two consecutive terms and must lay out for a year before being eligible for another term. Each year the nominating committee searches for new candidates for elected AdCom members. If you are interested in serving the Society as an AdCom member or have a recommendation for an AdCom member, you are welcome to advise the President who will pass the name along to the Nominating Committee. AdCom members are expected to work during their term of office and will be assigned duties on one or more of the operating committees of the Society. Members must also plan to attend the two Administrative Committees each year. These are held in the spring at the Offshore Technology Conference (OTC) and in the fall at the annual OCEANS Conference. However, committee work goes on during the periods between AdCom meetings. The officers of the Society all spend much additional time to the duties of the Society and ExCom meetings are held several times during the year.

During the ExCom teleconference we reviewed committee reports. During the Houston AdCom a committee was formed to review our dues structure and to make recommendations for the coming and future years. One of the largest costs of membership to the Society is the publication of the Journal. Another large cost is the IEEE corporate allocation. Our membership dues only cover a small portion of the member cost to the Society. At the Houston AdCom meeting the 2003 Society dues were raised to $19.00. Our estimated membership cost for 2003 are $61.63. Much of this cost differential is paid from the income we receive from the Offshore Technology Conference. The Committee made two policy recommendations that will be acted upon at the Fall AdCom meeting at OCEANS 2002.

One of the big discussion items during the teleconference was the planning toward two OCEANS Conferences each year. In the Summer Newsletter Joe Vadus, Vice President for Technical Activities outlined very well our schedule of conferences and workshops for future years. In 2004 we will have a test of this concept with an OCEANS Conference in Kobe, Japan, and one in the USA. The OCEANS Conferences require a lot of planning and the work has been ongoing for the past two years in preparation for this change.

Membership is always an item of concern. It was pleasing to find out in the latest IEEE membership report that OES is no longer the smallest Society in IEEE. We have moved up the ladder and are now the third smallest Society in IEEE! Our membership continues to increase with new members in Region 10 (Asia and the far east). We gained new members in Taiwan and Singapore during the past year. We also received several new member applications in our booth at OTC. We have also gained new Senior Members and we continue to remind members to become Senior Members when they become eligible.

Along with membership gains we have also gained two new Chapters in the past year. Last year we welcomed both the Boston Chapter and the Taiwan Chapter. The Taiwan Chapter was inaugurated this spring when our President Tom Wiener and VP Professional Joe Vadus visited there. In August a new Chapter in Singapore received its charter. We are pleased with the growth of OES in these areas.

One of the activities of the Society that is of great value is our work with students. This year OES provided support for the National Ocean Sciences Bowl, sponsored by CORE (Consortium for Oceanographic Research and Education), held in Providence, RI April 28-29, 2002. Twenty-two High School teams from across the USA participated in the two-day event. Jim Barbera and I attended and it was exciting to watch the four-member teams compete in a "Jeopardy" style competition. It was great to meet the teams and their coaches and find out their interests. The key to the team was a teacher that had the interest and drive to coach the students and get them interested in competing. The students had to do a lot of outside reading to prepare for the competition as the questions ran a full gambit from history, geology, chemistry, physics, math, oceanography, geopolitics, and on and on. You soon identified with a team and were anxious to see them win. OES provided four awards of $500 each to winning teams to buy books and resources for the students. Jim and I were honored to present the certificates to four of the winners. We plan to continue our support for this program.

Human Powered Submarine Races are another area of interest in Student Activities. Once again OES provided support for the Human Powered Submarine Races held in the San Diego area in July. OES provided money for the operating expenses and the San Diego Chapter also provided funds to help in the conduct of the races. Next year the races will be held at the David Taylor Model Basin and OES and the Washington/Northern Virginia Chapter will provide support.

Our major student activity of the year continues to be our support of the Student Poster Session at OCEANS. This year is no exception and we have a fine group of students who have accepted our invitation. We expect 20 posters this year and will have students from Africa, Europe, and Japan along with students from Canada and the USA. The students will get a pre-conference field trip to a swamp while they are in Biloxi!

2002 has been a busy year for OES and we look forward to OCEANS 2002!

Norman D. Miller, P.E.
IEEE/OES
Vice President, Professional Activities

IEEE OES Senior Membership Campaign

In an effort to recognize our members' technical and professional excellence, boost member participation in the OES and local chapters, and promote membership development, the OES has decided to take an active role in the IEEE Senior Membership Initiative. Jim Collins and Bill Terry, Chair - OES Senior Member Promotion Campaign have taken the lead in this effort. OES President, Tom Wiener, has given this his full support and is encouraging each chapter's participation.

The IEEE's Senior Member Program calls on Section and Society members to work together as a group to identify and nominate qualified Members for Senior Member grade. The **Nominate a Senior Member Initiative**, as a part of the Senior Member Program, provides financial incentives to Sections and Societies who nominate qualified members from their respective entities for Senior Member grade.

Becoming an IEEE Senior Member is a major achievement in a member's professional career. Senior Membership offers several benefits to individual members:

- The professional recognition of your peers for technical and professional excellence.
- An attractive fine wood and bronze engraved Senior Member plaque to proudly display.
- Up to $25.00 gift certificate toward one new Society membership.
- A letter of commendation to your employer on the achievement of Senior Member grade (upon the request of the newly elected Senior Member.)
- Announcement of elevation in Section/Society and/or local newsletters, newspapers and notices.
- Eligibility to hold executive IEEE volunteer positions.
- Can serve as Reference for Senior Member applicants.
- Invited to be on the panel to review Senior Member applications.
- Nominations for IEEE fellow require the candidate holds Senior Member grade at the time the nomination is submitted.

The campaign calls for participation at the local chapter level with each chapter starting with the following steps:

- Identify three or more Sr. Members or Fellows in your local chapter who are willing to serve as references and lead your local initiative.
- Announce your local drive at chapter meetings and in chapter websites and newsletters.
- Identify members in your section who should be recognized and nominated for Sr. Membership.
- Nominate these members and work with them to complete the application and get the two added references.

All OES members are encouraged to work with their local chapters in identifying members who should be recognized. Contact your local chapter Chair for further information.

The follow IEEE URLs have further information on the Sr. Membership program.

Nominate a Senior Member Initiative:
http://www.ieee.org/organizations/rab/md/sminitiative.html

Senior Member Program:
http://www.ieee.org/organizations/rab/md/smprogram.html

Senior Member Nomination Letter:
http://www.ieee.org/organizations/rab/md/sm_nom_letter.doc

Senior Member Reference Form:
http://www.ieee.org/organizations/rab/md/smref.htm

Senior Member Application Form:
http://www.ieee.org/organizations/rab/md/smelev.htm

Field Evaluation of Sounding Accuracy in Deep Water Multibeam Swath Bathymetry

Christian de Moustier
Scripps Institution of Oceanography
9500 Gilman Drive, La Jolla, CA 92093-0205, USA

Abstract- A new Kongsberg-Simrad EM120 multibeam echo-sounder has been installed aboard Scripps Institution of Oceanography's Research Vessel Roger Revelle in January 2001. This system can map reliably a 20 km swath of seafloor in 4000 m water depth with 191 soundings per ping. Such a wide swath width demands highly accurate (<0.05° RMS) roll information from a motion sensor, and makes estimating sounding accuracy across the swath an interesting challenge. It is shown that good accuracy estimates can be obtained by collecting data on station under control of the GPS-aided dynamic positioning system usually available on most modern long-range oceanographic vessels. A number of motion sensors, with RMS roll accuracy specifications ranging from 0.05° to 0.01° , were tested with the EM120 sonar on station in 3800 m to 4000 m water depths. Unexpectedly, they yielded roughly the same depth uncertainty as a function of receive beam angle. This result might be explained by synchronization errors between the attitude data and the sonar data leading to beam pointing errors, other types of beam pointing errors, a range of roll accuracy narrower than specified for the motion sensors, or a combination of these factors.

I. INTRODUCTION

In January 2001, the Scripps Institution of Oceanography installed a Kongsberg-Simrad Inc (KSI) EM120 multibeam echo-sounder aboard the newest ship in its fleet, the Research Vessel (R/V) Roger Revelle owned by the US Navy and commissioned in 1996 (AGOR 24).

This sonar system operates at a nominal frequency of 12 kHz, with a 1°x150° overall transmit sector (fore-aft x athwartships) and up to 191 receive beams steered athwartships at regular angular steps across the swath, or at gradually narrower angular steps to achieve uniform horizontal offset between soundings athwartships, or a combination of both. Its flat hydrophone array configuration yields nominal receive beam widths of $2°/\cos(\theta)$ from broadside ($\theta=0°$) to the outer steering angles ($\theta=\pm 75°$). Most importantly, the sonar achieves broad swath widths in deep water (e.g. =20 km at 4km depth) by steering the transmit beam in 9 discrete sectors athwarthships, while compensating for the ship's yaw, pitch, and roll. However, it is necessary to know the ship's roll and pitch to better than 0.05° RMS to achieve KSI's specification for sounding accuracy of 0.2% of water depth across the swath. In fact, since the sea trials at the end of January 2001, an apparent roll artifact has ruffled along-track the outer edges of the bathymetric swath collected aboard R/V R. Revelle. Several tests have been conducted with various motion sensors to try and identify its cause.

With swath widths in excess of 20 km it is difficult to find a seafloor area, with suitably little relief along and across track, on which to conduct sounding accuracy tests. Options include survey techniques developed to resolve biases in swath bathymetry data, such as running a patch test over a known seafloor area [1], or creating a reference surface from a highly redundant set of soundings obtained by running tightly spaced parallel tracks with up to 90% swath overlap between adjacent tracks. Sounding accuracy is then estimated by comparing individual soundings to the reference surface [3]. In all cases, a deep water reference surface is very costly in data acquisition and processing time.

Provided the ship has good dynamic positioning capabilities, a simpler and much cheaper alternative consists in maintaining the ship on station at a constant heading over a relatively flat seafloor area. Ping after ping, the same patch of seaflloor is sampled in a given beam direction and changes in bottom relief along and across track become nearly negligible.

The purpose of this paper is to highlight the effectiveness and potential pitfalls of estimating sounding accuracy from multibeam swath bathymetry data gathered while the ship holds station. EM120 swath bathymetry and associated navigation data collected aboard R/V Roger Revelle are used to illustrate the ship's station keeping requirements in Section II, and the sounding statistics in Section III. In Section IV, a comparison is made between results obtained on station, in 3800m to 4000 m of water depth, with four different motion sensors providing attitude data to the EM120 sonar. Their unexpected similarity is discussed and potential causes are analyzed.

II. SHIP STATION KEEPING REQUIREMENTS

A. Position

At average oceanic depths (4 km), the along and across track extents of the footprint of a 1°x2° specular beam are roughly 70m and 140m, respectively. Adjacent beams on either side athwartships are within 1°, but the angular beam spacing becomes progressively narrower from nadir out when using the sonar's mode that provides equidistant soundings across-track, which is true for all the data presented here. Therefore one needs to maintain the ship's position within a watch circle 10 m in diameter for a given beam direction to sound the same patch of seafloor repeatedly.

Aboard R/V Roger Revelle, the dynamic positioning system controls two stern Z-drive azimuthal thrusters and a bow thruster. It can maintain the ship's position in a P-Code GPS reference frame in a circle less than 10 m in diameter for the 40 min required to collect 100 pings in 3800 m of water depth, as shown in Fig. 1.

B. Heading

The 1° fore-aft beamwidth of the transmit beams imposes restrictions on the ship's heading variability during a test, before relief variations along and across track can no longer be neglected. As illustrated in Figs. 1-2, experience with R/V R. Revelle shows that the ship can hold station and heading to 0.6° RMS (Fig. 3) in sea states 4 or below. In the foregoing analysis, data with heading variations up to 0.75° RMS have

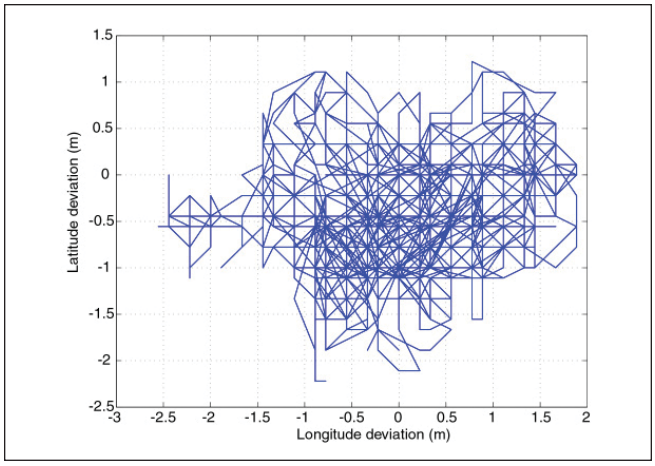


Fig. 1. Variations in the ship's position while on station.

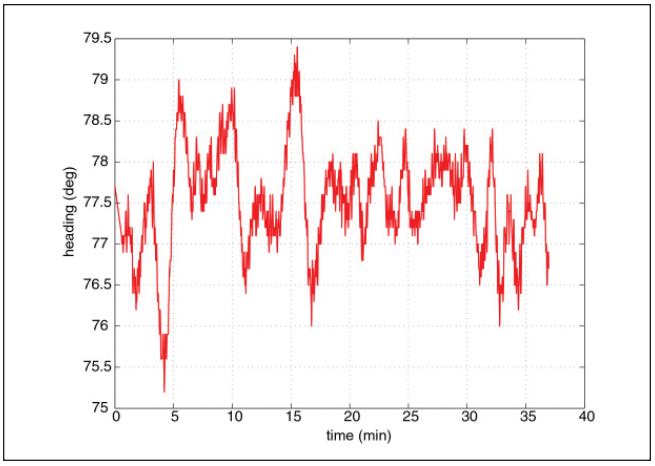


Fig. 2. Variations in the ship's heading while on station.

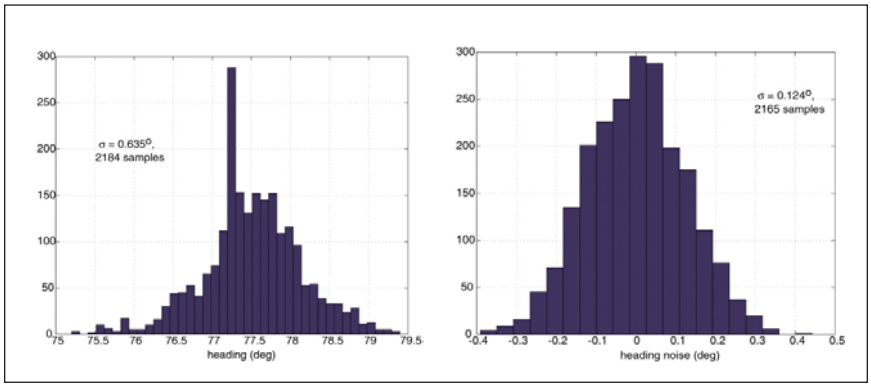


Fig. 3. Histograms of variations in the ship's heading (left) and heading noise (right) while on station.

been used, but they start showing the limitations of the negligible relief assumptions.

Likewise, the noise in the heading data supplied to the EM120 sonar should remain a small fraction of the fore-aft beam width. As a first order verification, Fig. 3 shows a noise histogram drawn from the residuals of detrending and low-pass filtering performed on the heading data of Fig. 2. Although not strictly speaking a noise sequence, the residuals have a mean of zero and a standard deviation of 0.12°, which is within 20% of the 0.1° specified RMS accuracy of the Meridian Gyro used in these tests, and of the accuracy required by the EM120 sonar.

Control of heading variations during a test is achieved by setting a maximum heading deviation in the dynamic positioning system. However, local weather conditions might make such settings moot and it becomes necessary to collect enough pings to be able to select a subset of pings that fall within the desired heading bounds.

III. SOUNDING STATISTICS

A. Depth Profiles

Given proper control of the ship's heading and position during data collection on station, it is straightforward to compile statistics of the soundings as a function of receive beam angles referenced to nadir, hence corrected for the ship's roll and for refraction effects at the face of the array. Here, beam angles are considered in 0.1° increments, but only beam directions reporting data for more than half the total number of pings in the set are used in the statistics.

Stacked profiles of depth vs. received beam angle are shown in Fig. 4, with details in Fig. 5 showing the mean depth (solid line) and the scatter of soundings about the mean. The scatter increases with steering angle, and tighter angular spacing of beams at increasing athwartships angles to achieve equidistant soundings can be seen also in these plots.

Closer inspection of the outer beams from Figs. 4-5 reveals two interesting clues illustrated in Fig. 6, where soundings at ±65° from nadir are plotted as sequences of depth vs. consecutive ping numbers (equivalent to time at ~20 s/ping). These two sequences contain frequent spikes that are for the most part "180° out of phase" between port and starboard, indicating that the athwartships profile rolls with the ship. Second, there is a long term oscillation with a period of about 60 pings (~20 min) that does not seem to be correlated with anything obvious at this point.

B. Depth Uncertainty

The depth accuracy for each sounding is estimated from the data in Figs 4-5, by forming the ratio of the standard deviation of the soundings in each angular bin to their mean. This yields a depth uncertainty in percent of mean water depth.

As shown in Fig. 7-8, uncertainties remain below 0.2% from nadir to about ±60° and climb rapidly thereafter to values in excess of 2% at ±70°.

C. Angular Variations

To first order, the depth uncertainties ΔD vs. receive beam angles θ can be converted to an apparent angular error in beam pointing $\Delta\theta$. This is done by differentiating the conversion of straight path slant-range R to depth D ($D=R\cos\theta$), yielding:

$$\Delta D / D = \Delta R / R - \Delta\theta \tan\theta. \qquad (1)$$

The range uncertainty ΔR of the EM120 is on the order of 37 cm in the deep water mode, hence the ratio of ranges on the

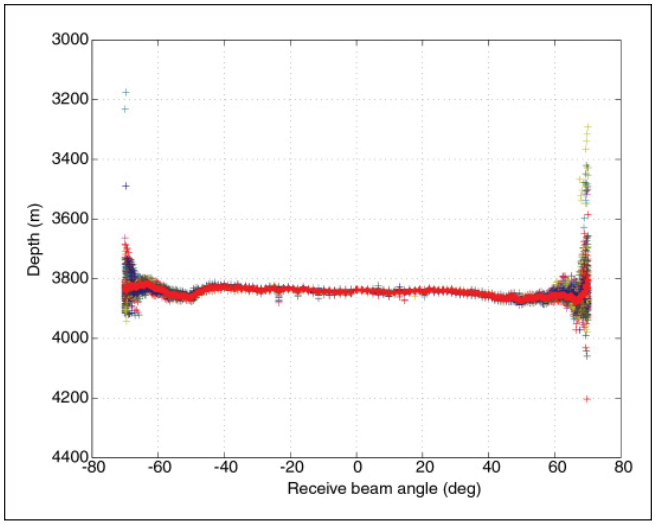


Fig. 4. Stacked instantaneous bottom profiles of depth vs. receive beam angles (port <0, starboard >0) for about 100 pings recorded with the ship on station.

right side of (1) is of order 10^{-4} and is negligible relative to the angular term. The apparent angular error is then:

$$\Delta\theta = -\Delta D / (D \tan\theta). \qquad (2)$$

The apparent angular error associated with the data in Figs. 5-8 is plotted in Fig. 9, along with its mean (zero) and standard deviation (solid line). The standard deviation line remains roughly constant and below 0.08° until ±60° and increases to over 0.2° at ±70°. All else being equal, one would expect the apparent angular error to remain essentially constant across the swath, and the fact that it increases beyond ±60° indicates that beams in the outermost sectors of the 9 sector transmit pattern behave differently than the rest. An obvious culprit is the lower signal-to-noise ratio to be expected on outer beams at that depth, yielding noisier bottom detection results. In addition, higher sensitivity to roll error could be a factor, so could beam pointing errors due to insufficiently accurate sound speed information at the face of the array to correct for refraction effects. The latter is less likely because the ship was on station and sound speed continuously measured at the depth of the array agreed to within 1m/s with the corresponding sound speed in the measured sound speed vs. depth profile entered in the EM120.

IV. COMPARISON OF MOTION SENSORS

The data collection technique described in previous sections was used to test 4 different motion sensors with the EM120 sonar, in an effort to verify whether inaccuracies in roll were mainly responsible for the apparent roll artifact mentioned earlier. The four sensors are a TSS DMS05[4], a Seatex MRU5, a Seatex Seapath200[5], and an Applanix POS-MV320[6], whose relevant characteristics are listed in Table 1.

All the tests reported here were conducted in sea state 3. Tests with the DMS05 and the MRU5 were conducted at the same location in 3800 m of water depth within one hour of each other, hence conditions can be deemed identical. Tests with the Seapath200 were conducted in 4000 m of water depth, and tests with the POS-MV320 were conducted on a gentle slope (3750

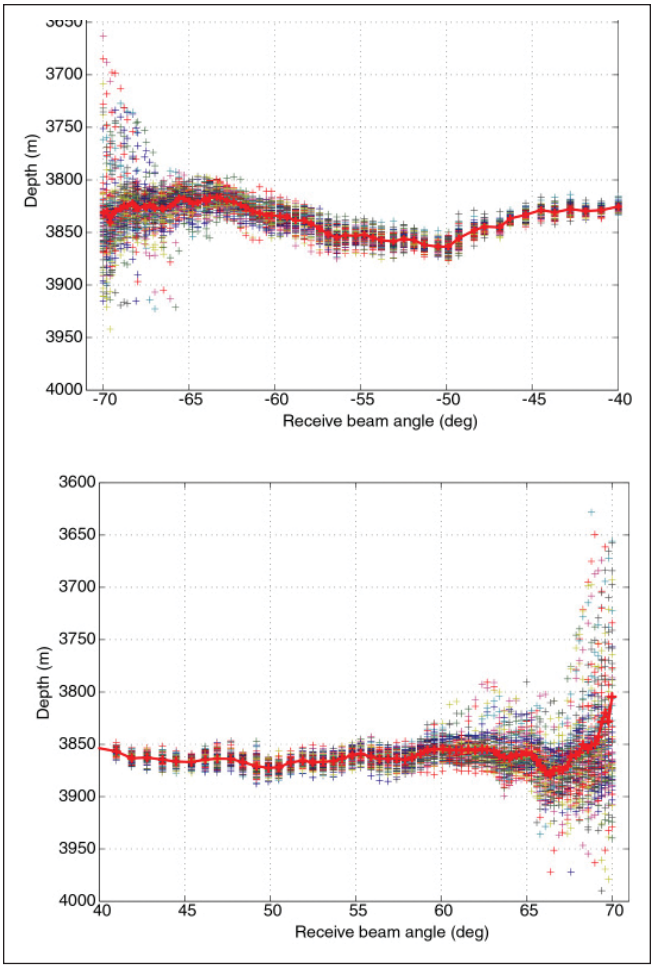


Fig. 5. Details of the port and starboard beam soundings (+) from Fig. 4 with the mean profile drawn as a solid line.

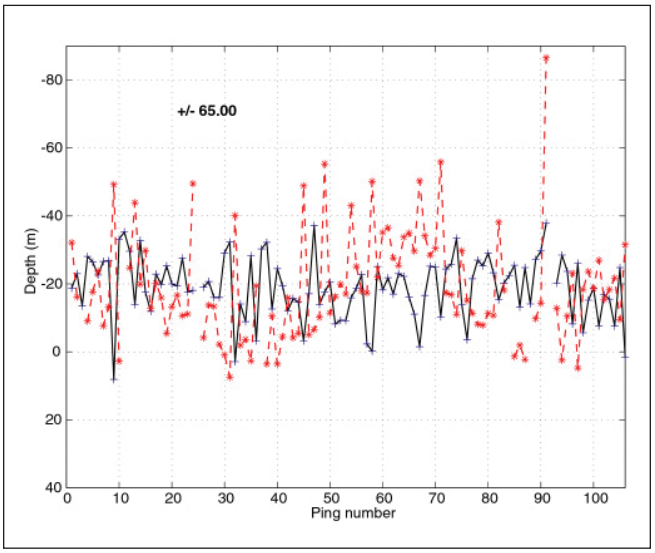


Fig. 6. Evolution of soundings in time for two beams at ±65° from vertical for the data shown in Figs. 4-5. Solid line port, dashed line starboard.

m to 3900 m over 21 km) with the swath parallel to the slope. A summary of the test conditions is given in Table 2.

Results of the four tests are compared by plotting the respective depth uncertainties on the same graph (Figs. 10-11). Fig. 10

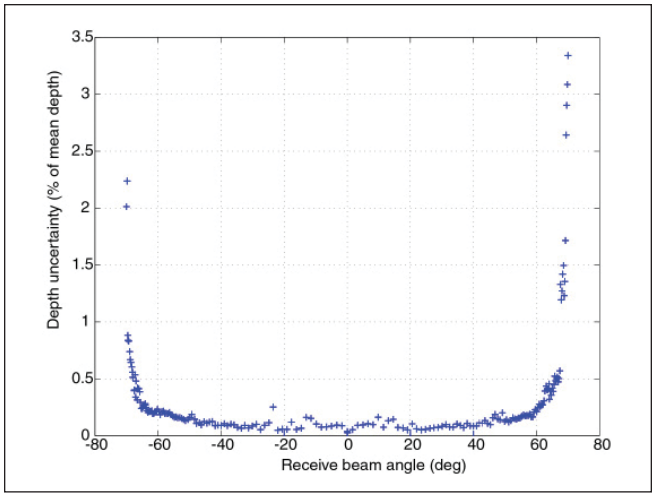


Fig. 7 Depth uncertainty (standard deviation/mean) of soundings in Figs 4-5 for each beam direction referenced to vertical.

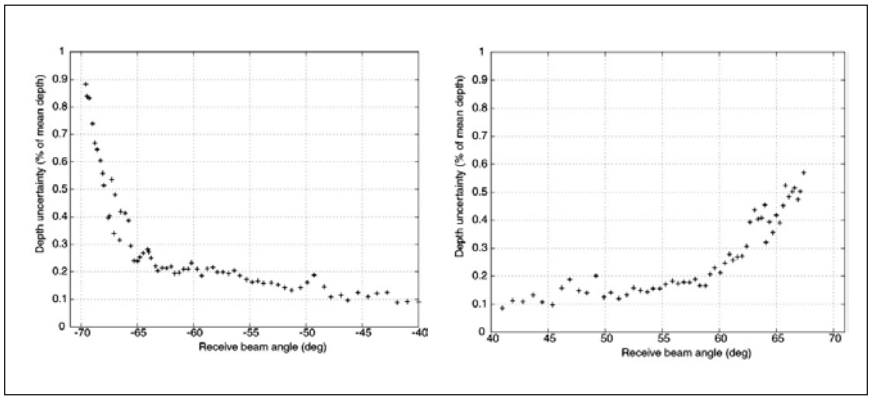


Fig. 8. Details of the depth uncertainty (Fig. 7) measured on the outer beams for soundings in Figs. 4-5.

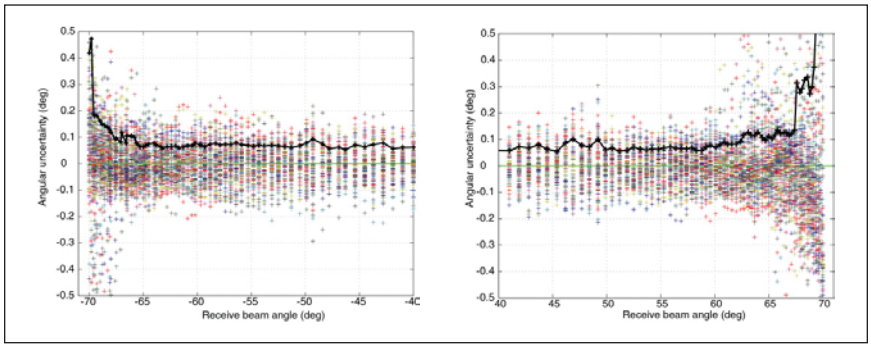


Fig. 9. Apparent angular error (2) associated with the depth uncertainties in Fig. 7-8, showing the scatter of individual points, their standard deviation (solid line), and their mean (zero center line).

provides the comparison results, and Fig 11 illustrates the limitation of the method as will be explained shortly. In spite of a factor of 5 difference in specified RMS roll accuracy between the POS-MV320 and the DMS05, there are surprisingly small differences in Fig. 10 between the depth uncertainties obtained with the four motion sensors from nadir to ±60°. As expected, data gathered with the POS-MV320 has a somewhat lower depth uncertainty overall, but the improvement is not commensurate with the specified RMS roll accuracy.

Results with the Seapath200 were obtained after the ship's roll compensation tank had been emptied to provide a nearly sinusoidal roll motion. With the roll tank in operation, the ship's roll departs noticeably from a simple harmonic modulation, and results with the Seapath200 were noisier than those shown here.

The smaller than expected differences in depth uncertainties between motion sensors could be explained by a narrower range of RMS roll accuracy than specified in Table 1. Nonetheless, the apparent roll artifact is present at the edges of the swath with all four sensors, indicating that factors other than inaccuracies in roll are involved as well.

Except for data obtained with the POS-MV320, depth uncertainties exceed 0.2% of water depth beyond 60°, and climb above 1% by 70° for the MRU5 and the DMS05. These much larger uncertainties are most likely due to bottom detection errors on the outerbeams causing a few outliers to skew the results. Ping by ping outlier removal will probably be necessary to obtain a picture of depth uncertainty vs. receive beam angle that remains consistent over several tests, and from which more definitive depth accuracy estimates can be derived.

The requirement for careful data editing prior to assessing depth accuracies is illustrated in Fig. 11 where results obtained with the POS-MV320 have larger uncertainties than with the other sensors. Yet this plot corresponds to the port half of the data shown in Fig. 10. In this case, the higher depth uncertainties are due to larger bottom detection scatter upslope, which is most likely caused by local relief and the somewhat higher standard deviation of the ship's heading (0.71°). Once again, careful data editing will be required to obtain a consistent picture because the uncertainties reported for POS-MV320 data are not representative of the actual depth accuracy capabilities of the sonar system. The other curves are more consistent and therefore closer to the actual accuracy.

III. CONCLUSIONS

The sounding accuracy of a deep water multibeam swath bathymetry sonar can be assessed from data collected while the ship holds station, maintaining position and heading to tolerances set by the fore-aft beam width of the transmit beam, and by the nominal footprint of the intersection of the transmit beam and the narrowest receive beam. However examples provided in previous sections show that careful data editing is required to obtain reliable estimates.

Comparisons of sounding accuracies obtained with 4 different motion sensors yielded smaller than expected differences given the factor of 5 difference in RMS roll accuracy among the sensors. Likely explanations include incorrect specification of RMS roll accuracy for the motion sensors,

Table 1. Motion Sensors Accuracy Specifications		
SENSORS	RMS Roll/Pitch Accuracy (deg)	Heave accuracy (cm)
DMS05	0.05	5
MRU5	0.03	5
Seapath200	0.03	5
POS-MV320	0.01	5

Table 2. Test Conditions			
	Heading Standard Deviation (deg)	Position Variations (m x m)	Bottom Slope (deg)
DMS05	0.64	3x4.5	0.11
MRU5	0.57	5x5	0.11
SEAPATH200	0.750	8x6	0.13
POS-MV320	0.71	9x4	0.4

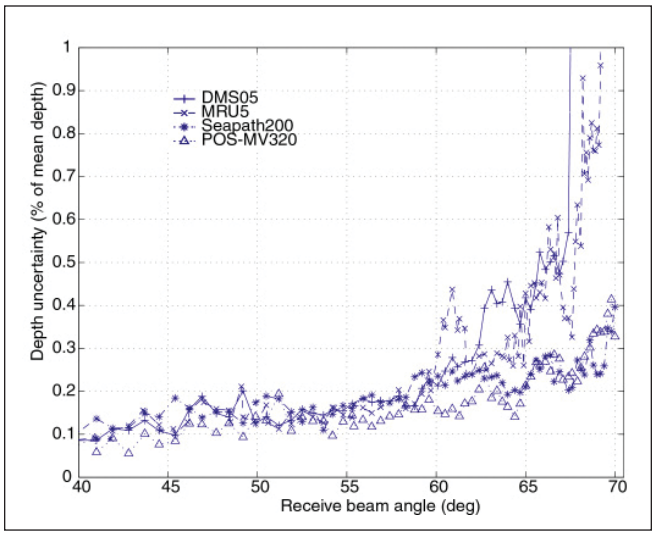


Fig. 10. Depth uncertainties vs. starboard beam angles referenced to vertical for 4 different motion sensors.

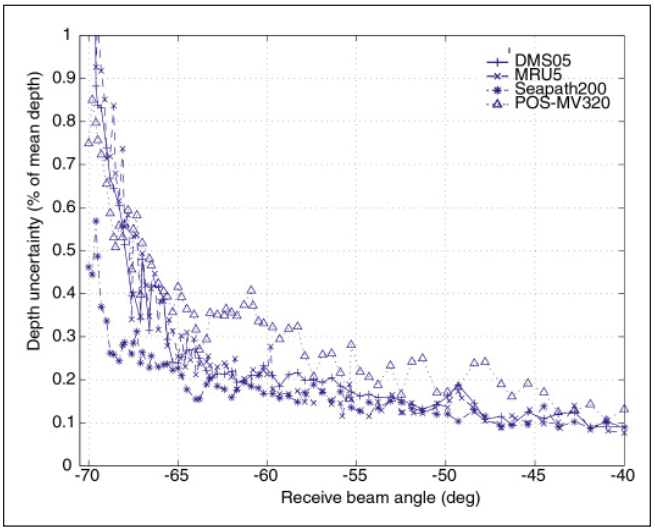


Fig. 11. Depth uncertainties vs. port beam angles referenced to vertical for 4 different motion sensors.

beam steering errors on the outermost sectors (beyond ±58°) of the EM120 sonar, and misregistration between the roll time series and the sonar data. The last two explanations are the most probable given the evidence of apparent roll errors found at the edges of the swath (Fig.6).

ACKNOWLEDGMENTS

This work would not have been possible without the generous contributions of Duane Fotheringham (KSI), Michael Mathewson (Seatex), Peter Stewart (Applanix) who loaned us the various vertical reference units used in the tests described here. Many thanks are due to the captain and the crew of R/V Roger Revelle who provided the necessary precision ship handling, and to John Chatwood, Jim Charters and Dan Jacobson who helped with EM120 data acquisition. Purchase and installation of the EM120 system were funded in part by the US Navy under a DURIP grant, by the National Science Foundation and by UC ship funds.

REFERENCES

[1] Kongsberg-Simrad Inc, EM120 product description, 27-4-1999

[2] D.R. Herlihy, B.F. Hillard, and T.D. Rolon, "NOAA Sea Beam system patch test," Int. Hydr. Rev., vol. 66, 119-139, 1989.

[3] J.A. Hammack, D.H. Fabre, J.E. Hughes Clarke, and B. Reed, "Hydrographic multibeam processing system (HMPS) swath alignment tool," Proc. Canadian Hydrographic Conf., 157-167, 1998.

[4] TSS, www.tss-realworld.com

[5] Seatex, www.seatex.no

[6] Applanix, www.applanix.com

Christian De Moustier (M'86) received the Ph.D. in Oceanography (Applied Ocean Science) at the University of California, San Diego in 1985. Between 1985 and 2001, he has worked at the Marine Physical Laboratory, Scripps Institution of Oceanography (SIO), conducting research in signal and image processing techniques applied to sonar data, and in underwater acoustics with emphasis on physics of bottom-interacting sound and sound reverberation in the ocean. He served as Academic Administrator for SIO's Ship Operations and Marine Technical Support, providing scientific direction and specifying engineering solutions for shipboard instrumentation needs (computers, sonars, underway sensors) and software programming requirements. In January 2002, he will join the faculty of the Electrical Engineering Department and the Center for Coastal

and Ocean Mapping at the University of New Hampshire in Durham. He has been serving as Associate Editor for the IEEE Journal of Oceanic Engineering since 1990, for topics related to seafloor acoustic remote sensing, bathymetry mapping and surveying, and sonar image and signal processing applications. He served three terms on the Administrative Committee of the Oceanic Engineering Society (1990-1993, 1995-1997, 1998-2000). He is a member of the IEEE OES, and the American Geophysical Union. He is a Fellow of the Acoustical Society of America.

Upcoming Conferences and Meetings

Oceans 2002 Conference & Exhibition
October 29-31, 2002
Mississippi Coast Coliseum & Convention Center
Biloxi, Mississippi
http://www.OCEANS2002.com

TECHNO-OCEAN 2002, 9th Techno-Ocean International Symposium and International Exhibition/Research Organizations Exhibition
November 20-22, 2002
Kobe International Exhibition Hall
Kobe Port Island, Japan
http://www.techno-ocean.com

Undersea Defense Technology Conference & Exhibition
October 8-10, 2002
Korea, Nexus Communication
www.udtnef.com/korea

14th Deep Ocean Technology Conference & Exhibition
November 13-15, 2002
New Orleans, Penwell
www.deepoffshoretechnology.com

Ocean Optics XVI Conference and Exhitition
November 18-22, 2002
Santa Fe, New Mexico
Office of Naval Research, NASA, The Oceanographic Society
oceanopticxvi@aibs.org

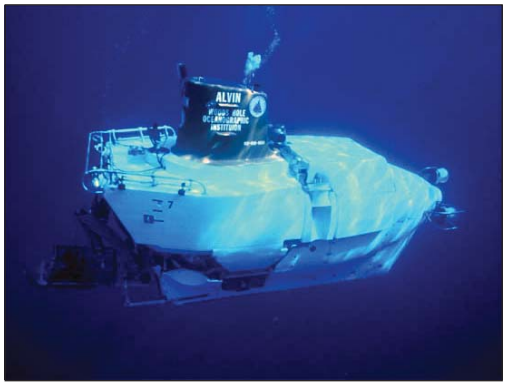
Oceans 2003
September 22-26, 2003
San Diego, CA
http://www.oceans2003.org

Soundings

Welcome to the latest installment of "*Soundings*", a column that reports on a broad spectrum of news items from the mainstream media as they relate to Ocean Engineering technologies. The purpose of this column is to inform the ocean engineering community of our industry's visibility in the media and how the general public perceives our efforts.

Alvin to Retire?

Probably one of the most recognized public symbols of ocean exploration, the submersible Alvin turned 35 this year. Ocean scientists are starting to contemplate a replacement but the exact definition of "replacement" has yet to be determined. It seems everyone is weighing-in with their comments, from members of Congress, a White House oceans panel, and a National Academy of Sciences group. In spite of the impressive advances in ROV technology and related sensor/handling systems in recent years, there is still no substitute for a human set of eyes "on the spot." It is not a question of "if" but rather a question of "when" we see the "son of Alvin" take to the seas. http://www.oceanexplorer.noaa.gov/technology/subs/alvin/alvin.html



NOAA Takes Lead Raising Awareness and Artifacts.

The U.S. Government's National Oceanic and Atmospheric Administration (NOAA) has taken a lead role in raising the public's awareness of the oceans through its program to locate and retrieve submerged cultural artifacts. Prominent among this program's activity has been the recovery of the USS Monitor. (http://oceanexplorer.noaa.gov/explorations/02monitor/monitor.html)

However, in late August, news of a new discovery surfaced when officials at the National Oceanic and Atmospheric Administration and the National Undersea Research Center (NURC) at the University of Connecticut announced they positively identified the wreck of the "Portland" in Stellwagen Bank National Marine Sanctuary, off of Cape Cod Massachusetts.

The Portland, one of the first luxury steamships using side paddlewheels, sank in Massachusetts Bay in 1898, killing all 192 people aboard. The sinking has been widely referred to as ''New England's Titanic.'' The wreck was initially discovered by Arne Carr and John Fish, local marine explorers. NURC conducted further at-sea exploration at the behest of NOAA and produced video footage of the ship's rudder and other identifying marks that gave ''solid'' evidence that the wreck is indeed the Portland. The cause of the ships demise was the coalescing of two winter storms that produced 90 mile-per-hour winds. A triple storm convergence off the New England coast in 1991 resulted in serious loss of life offshore and formed the basis for Sebastian Junger's book "The Perfect Storm."

The identification of the wreck is part of an ongoing effort by NOAA to scour Stellwagen Bank and other marine sanctuaries for archeological and cultural finds. NOAA is also conducting similar archeological research in the Great Lakes. "Our announcement [of the Portland] is the result of an increased emphasis on submerged cultural resources," said Dan Basta, director of the National Marine Sanctuary Program in NOAA. "You can't [always] get people excited over squid," said Basta. "Our drive is to use maritime heritage to demonstrate... our relationship to the sea."

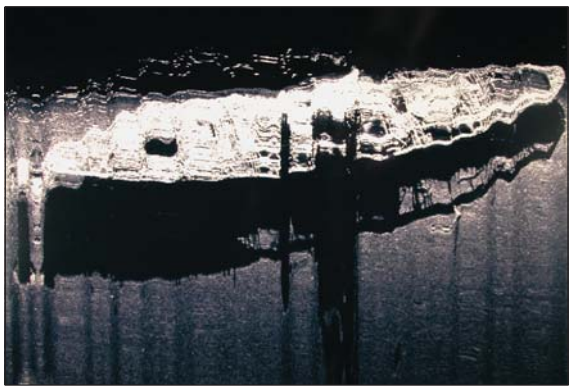


PHOTO COURTESY OF NOAA

If you see an article (whether in print or in electronic form) that you would like to see mentioned in this column, please let me know by email, fax, phone, or regular mail. Email contributions can be sent to a special address: Soundings@Sygnus.Com. Information for phone, fax, and regular correspondence can be found in the back of newsletter where I am listed in the AdCom section.

by John Irza

The Search for the World War II Japanese Midget Submarine Sunk off Pearl Harbor, Dec. 7, 1941

John C. Wiltshire,
Hawaii Undersea Research Laboratory
School of Ocean and Earth Sciences and Technology
University of Hawaii, Honolulu

Introduction

At 12.20 p.m. on August 28, 2002, the Pisces IV and Pisces V, two deep diving submersibles operated by the Hawaii Undersea Research Laboratory (HURL), found the Japanese midget submarine which was the first vessel sunk in the attack on Pearl Harbor, December 7th, 1941. HURL is one of six national laboratories comprising NOAA's National Undersea Research Program. It is located at the University of Hawaii's School of Ocean and Earth Sciences and Technology. The sunken midget sub was located during the last of a series of test and training dives conducted annually in the military debris fields off Pearl Harbor. HURL is now undertaking its regular four to five month dive season of scientific and engineering dives focusing on fisheries enhancement , coral reef habitats, undersea volcanism, landslide monitoring, acoustic identification of fish and their habitats and other engineering and oceanographic studies.

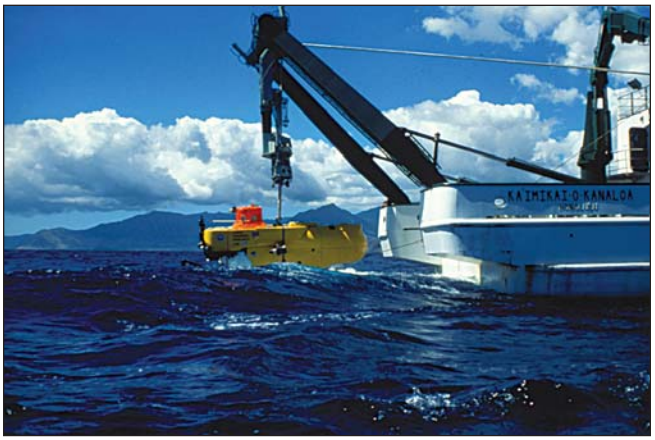
This midget sub find has been described as the most significant modern marine archeological find ever in the Pacific, second only to the finding of the Titanic in the Atlantic. The Japanese midget sub was one of five attached to five I-class mother submarines and brought from Japan to be launched 5-6 hours before the aerial attack, within a few miles of Pearl Harbor. Each had a crew of two. The subs were battery powered , 78 feet long , 6 feet in diameter and weighed 46 tons. They carried two torpedoes and a scuttling charge to avoid capture. Although experimental in design, they were very advanced for the time. For short periods, they could run at 20 knots. These midget submarines were completed only months before the attack allowing little time for the crews to train. All of the five submarines comprising the advanced attack force were sunk or captured. The type A midget submarines had a series of basic design problems including trim and ballast control and problems both with battery life and battery monitoring. Later redesign, as five man midget submarines of the Koryu class, addressed but did not solve these problems. The Japanese midget submarines although believed at the time to be a potent secret weapon, in actual fact, were never highly effective. So far four of the five original midget submarines attacking Pearl Harbor have been found.

History

The discovery of the midget submarine confirms the account radioed to naval command at Pearl Harbor at 6:45 am on Dec. 7, 1941 . A Japanese submarine was shot through the conning tower and then depth charged trying to enter Pearl Harbor behind a cargo ship. The crew of the attacking USS Ward , an older style four stack destroyer, saw the midget sub lifted out of the water by depth charges after firing the fatal shot from its four inch side gun. The Ward's crew were Naval reservists from Minneapolis, MN. Unfortunately, Naval command in Pearl Harbor ignored the Ward's report and the aerial attack began at 8 am. At the Pearl Harbor investigation, some question was made of the accuracy of the Ward's report. The Ward is now vindicated. The Ward itself was later targeted by the Japanese and sunk in a kamikaze attack, ironically on Dec. 7, 1944, in the Philippines.

Search

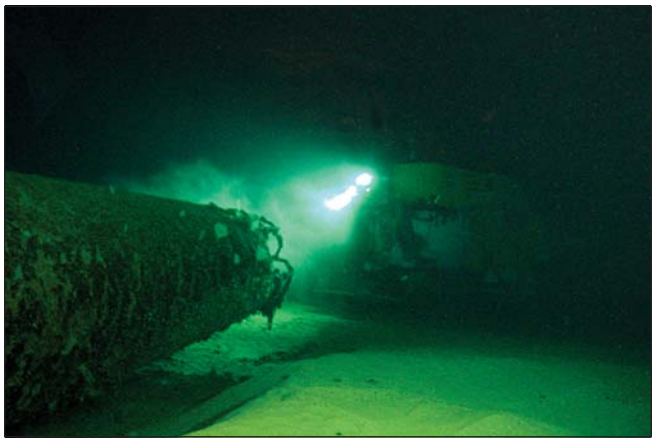
The search for the Japanese midget sub has been ongoing for 61 years since it was first sunk. In its latest phase, the Hawaii Undersea Research Lab has conducted towed side scan sonar surveys of the debris fields off Pearl Harbor. At the end of World War II, obsolete war materiel was dumped in 1,000-3,000 feet of water several miles off Pearl Harbor. This included: landing craft, tanks, old aircraft, trucks, barges, small ships, fuel tanks etc. There are on the order of 1,000 significant sonar targets in the area. Sorting through these various targets to identify the most promising ones to dive on as a submersible pilot training exercise has been the work of many years. The Japanese midget submarine although giving a very

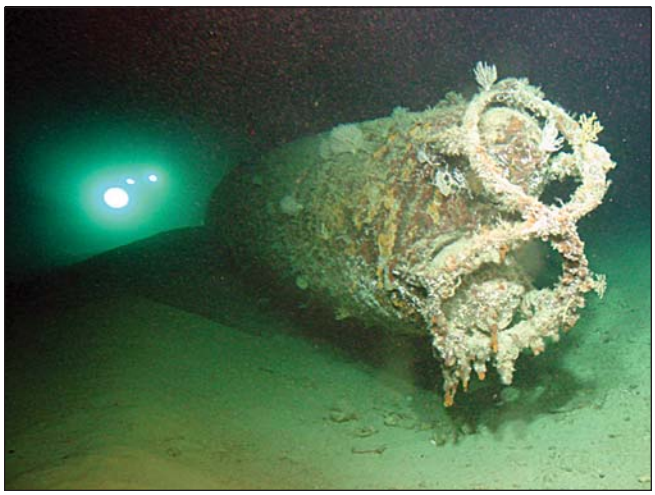


clear return on the side scan survey was interspersed with other debris on the bottom complicating the search efforts.

Findings

The Japanese midget submarine was found in 400 m of water about five miles off the mouth of Pearl Harbor. As it is classed as a military grave site, its exact location is being held by the U.S. State Department. The submarine sits upright on the bottom and is in amazingly good condition as shown in the photos. Both torpedoes are still in place. The submarine has no apparent depth charge damage but does have shell damage on both sides of the conning tower. The port side of the conning tower exhibits what one analyst has identified as shrapnel holes. This would presumably have come from the first shell fired by the USS Ward which exploded near the submarine but did not directly hit it. The starboard side of the conning tower shows a hole from the 4 inch shell fired by the side gun on the Ward as the ship steamed past. Apparently, this shell did not explode on impact as the midget sub conning tower is clearly still in place. While four depth charges were dropped directly on the midget as the Ward passed by, the charges were set to go off at a depth of 100 feet and the submarine was at the surface. The pressure wave created by the 4 depth charges was sufficient to fully lift the 46 ton, 78 foot midget out of the water, but apparently did no visually apparent structural damage. The midget sub sank from flooding through the four inch shell hole.





Questions

A number of questions still remain over this submarine, which was the first casualty in the war between the U.S. and Japan. Can and should it ever be raised, perhaps to join the USS Missouri forming the bookends for the Pacific war, that is, the first shot and the final surrender? Why did the Naval command at Pearl Harbor apparently ignore a confirmed enemy sinking right off its harbor mouth? Why did the Japanese put so much faith in the five midget submarines that they were allowed to lead the Pearl Harbor attack ? After all five of the attacking midget submarines were lost in their first engagement and shown to be ineffective, why did the Japanese Imperial Navy go on to build hundreds of midget submarines most of which were never used?

Raising the Midget Sub

It is unclear if the submarine will be raised or if its resting site will become a marine sanctuary. Discussions are ongoing between the United States and Japanese governments. It would be technically feasible, although difficult and expensive, to raise the submarine. Recent efforts have raised the sunken Russian submarine Kursk in arctic waters off northern Russia as well as the partial raising of the sunken Japanese fisheries training vessel Ehime Maru off Hawaii. Both of these efforts were more complicated and involved larger vessels than the Japanese midget submarine. The Kursk effort involved a nuclear reactor and live and damaged torpedoes.

Complications involved in raising this Japanese midget sub include the two torpedoes and the scuttling charge as well as the necessity of maintaining structural integrity on a possibly damaged hull. Initial speculation on a salvage plan has focused on making the midget sub close to neutrally buoyant. This might be done either by pumping compressed air or foam into the hull through the shot hole. The midget sub could then be gently nudged onto a 90 foot long pallet and secured. The pallet would then be gently lifted and towed to shallower, protected waters where divers could arrange
a lift to the surface under optimal conditions.

Future

Long before any decision or plans could be formulated to raise the midget submarine, the site will need to be thoroughly photographed and surveyed. There is some possibility that an underwater endoscope such as that used to explore the interior of the submerged wreck of the USS Arizona at Pearl Harbor might be deployed from the Pisces submersibles to explore the interior of the Japanese midget submarine through the shell hole. As the shell hole is quite small, this may prove to be operationally impossible.

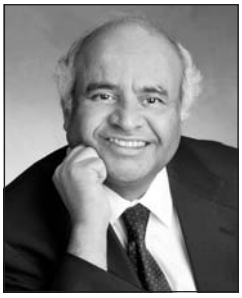
Further research at the site will certainly clarify the subs condition and provide valuable information for future groups contemplating raising the midget submarine In all cases, future exploration must proceed with the greatest respect and care for this submerged wreck, recognizing it as a war grave site likely containing the remains of the two Japanese crew , the first casualties in the Pearl Harbor attack.

Student Members Retention, Staff and Volunteer Synergy Are Discussed at Debate

By Kathy Kowalenko
Editor, The Institute

PHILADELPHIA, USA – The three candidates running to succeed Mike Adler as president in 2004 faced-off in a debate at the University of Pennsylvania Faculty Club on 18 June. Hosted for the fourteenth year by the IEEE Philadelphia Section, the debate was coordinated by Fulvio E. Oliverto and moderated by Tasos Malapetsas, the Section's chair.

Vijay Bhargava of Victoria, British Columbia, Canada; Luis Gandia of Puerto Rico, USA, and Arthur Winston of Boston, USA, answered questions from The Institute and the audience.



Vijay Bhargava

The following are excerpts of the candidates' responses to selected questions. Read all the questions and responses at "http://www.spectrum.ieee.org/INST/ti.html".

What can the IEEE do to remain a leader in publishing technical articles?

Bhargava: It is well known that the IEEE is often slow to respond with visible presence in an area. An example is when it took us so long to start the IEEE Wireless Transaction after a commercial for-profit publisher had already came out with that topic. Part of it might be that our Societies occasionally are hampered by a so-called "silo" mentality. There is no doubt that we have to develop a strategy to handle not only competition from outside, but from within. We have to examine direct publishing on the Internet, something the IEEE does not do. We recognize that the younger people are often more comfortable going to the Internet as an information source. While our peer-review system and branding is a big consideration, people want to reference material that is readily available.

What I mean by competition from within is we now have IEEE Xplore™ subscriptions with major libraries and corporations. If you assume that members join the IEEE for the publications, conferences and conference proceedings, then you have to make sure these are available in a customized way and in a user-friendly manner. To what extent should the IEEE turn the Web site into a portal for all related technical literature? Do we broker a cooperative arrangement with other publishers, co-branding like IEEE Press did with John Wiley and Sons, Inc.?

Luis Gandia

Certainly, the need for customization, personalization and focus on service and delivery is a must. We also need to encourage people to start writing papers focusing on the reader rather than the author. In other words, we would like these articles to be more readily available. The IEEE Member Digital Library is a neat idea because often a publication will appear in transactions you do not subscribe to, and it would be nice to have a member version of IEEE Xplore granting access to all the publications.

Given our market share, our peer-review system and with some of the initiaves on Internet publishing, we will continue to be authors' first choice for publishing.

Gandia: I'm not an expert in publications but I can tell you what I read about IEEE publications. We have heavy competition in publishing from Elsevier, Scientific American, MIT Technology Review and many others. Most of these have a lot of money. Most can do whatever they want to make their publication the best in the world.

We have one thing that most of them don't have. We have the authors who write for the IEEE, and we have the reviewers who review those articles. Those articles are not printed or published until they are reviewed by our authors. That's one thing that some of these other companies don't have. People prefer to read IEEE publications because they know the articles are being reviewed. They know that they contain the latest technology. We can work it out, we can meet that competition if we really want to do it, if we really fight for it. But it is not going to be easy. It is going to be very hard, but I know we can do it.

Winston: At Tufts University, I heard the chair of the electrical engineering/computer science department tell a student, "Before you get your Ph.D, I want you to have published at least three articles in a peer-reviewed journal, namely the IEEE." So that definitely is a strength.

I've worked with the IEEE's major competitors through the Reed part of Elsevier in terms of conferences, and they are very aggressive. One thing they've done that will take a lot of work — but perhaps IEEE should consider — is that they are constantly bringing themselves to your attention. For example, they put out a daily highlights-type document. That takes a lot of work but it keeps you constantly acquainted and refreshed with what Elsevier is doing. Perhaps new articles, news releases or things like that could be put out so that people can keep this constant reminder and contact with the IEEE.

Another potential problem area is that I've heard some students ask, "Sure we like the publications but why do we need to become part of the IEEE when we can get them through our school?" We have to convince younger people who might have access that there are advantages to the IEEE like having their own material, their own copies and other benefits from the organization.

In your opinion, why does the IEEE lose so many of its younger members — college graduates and young engineers — and how would you change this?

Bhargava: During my tenure as Regional Activities vice president, we thought about this problem and provided strong support for the Student Activities Committee chair to come up with programs such as Graduates of the Last Decade (GOLD). The big difference in that program and several other ongoing initiatives always has been that students are the seed corn for the future of the IEEE.

There are various things we can do to harvest this IEEE seed corn, perhaps inviting them to your local Section meeting, making a special effort or taking a new hire at your company to a Section meeting and helping him or her with IEEE networking. Also perhaps Section Chairs could write a letter reminding them that they are welcome as full-fledged IEEE members and to participate in Section activities.

The GOLD program is making a concerted effort to ensure that students remain IEEE members within a certain period of years of graduating. It is very important that we get them there. GOLD and other initiatives such as providing them with e-mail aliases, ways to be in touch with the members, and encouraging all Societies and Sections to develop products to address the specific needs of a young engineer are also helpful programs.

Arthur Winston

Gandia: Believe it or not, every year we lose 50,000 members. Just to break even, we need to recruit 50,000 new members. It has been proven that the majority of these 50,000 people who leave the IEEE are student members and recent graduates.

Why do they leave? That is a very important question. Why do students join the IEEE? Mostly because they need the IEEE, especially graduate students, to feed them information and to get information out of our Societies. They join the IEEE so that when they graduate, they can put on their curriculum vitae that they are an IEEE member to help them get a job.

So, what happened? Even with the GOLD program, why do they leave the IEEE? "I'm an engineer already, I don't need the IEEE. I have it made, I'm making $40,000 to $50,000 a year." How wrong they are. I've been telling students every time I talk to them that after graduation is when they need the IEEE the most. Now you are a professional, and the IEEE can help you in that. Some of them understand, but unfortunately, the great majority don't. I think the GOLD program is an excellent program but its effectiveness still has to be proven.

Winston: The answer is simple, but the implementation is not. The main reason students join is for social purposes. Also related to that is how effective the Branch Counselor is. That's been demonstrated.

Those who have dealt with fundraising for your school know you have the same kind of phenomenon. People move, and contact is broken. Or even if they haven't moved, in the case of the IEEE, they have lost the understanding or maybe they never did understand how important professional networking is, how important professional information is, the obligation of supporting your professional society. They don't know this.

The implementation can only be done by personal contact, keeping people involved. If they are involved, they are going to stay and contribute. You have to find a way to keep them involved, and it takes more than just the school or the Branch Counselor. You have to fall back on the Section. It is a lot of work. I don't know of any good way of attracting student members without getting them involved. It's important that something be done because we really are subsidizing the whole student effort. It's important but on the other hand, we are not getting that return. They are not becoming full-fledged members and paying their dues. It is an important thing, and personal contact and involvement is the key.

Is the IEEE a volunteer society served by Headquarters or the reverse?

Winston: I happen to be on record of asking that very question. One reason why I'm involved with the IEEE is because of the volunteer activities. It's one of the few organizations that you can get involved with, gain from and contribute to. The staff has to get a little more sensitive to things, and there has to be better synergy between the staff and volunteers. I think that's starting to change, but I did see an effort over the last couple of years — if we weren't careful — of the emphasis going toward staff directing and volunteers following rather than the reverse.

I learned from my business experience that dealing with lawyers is still one area in which we have to be careful. The only way I was successful with lawyers and working with other parties was to come out with a memorandum of understanding or at least to discuss what we wanted to do and tell the lawyers to implement it. What has happened to the IEEE is that we get legal advice and don't necessarily tell the lawyers what we want to accomplish.

Gandia: What we must remember is that IEEE staff and volunteers are a team. We must find a happy median for volunteers and staff to be able to work together. Staff exists to serve volunteers.

Bhargava: The IEEE works best when there is synergy between staff and volunteers. The division is reasonably straightforward. Volunteers set the policy, and staff takes it to completion. There should be a volunteer oversight for most activities, but we should be careful not to interfere too much with our staff. They are fairly competent. But sometimes we lose that oversight element. One example of that might be the enormous growth of the information technology-related staff. As far as I know, for a number of years there was no volunteer oversight of that area. Some would argue that might be part of the reason why we are in such a financial mess.

I'm slightly disturbed that by taking into consideration perceived problems with accounting and legal, all sorts of rules and regulations are coming in that really do not help volunteers. I think if you go to the lawyers and ask, "This is what our volunteers do, what is your interpretation of the law?" that will help them, as opposed to the other way and taking the extreme view.

We need to work as a team. But volunteers set policy, the staff implements it and tries to get interpretation for legal and accounting problems that will facilitate the volunteers' job.

OCEANS 2002 MTS/IEEE Conference and Exhibition

OCEANS 2002 will be held in Biloxi, Mississippi, October 29-31, 2002. The conference is expected to attract more than 2000 attendees from across the United States, Canada, Japan and other counties around the world.

Conference co-participants are the American Geophysical Union; the American Meteorology Society; the Society of Naval Architects and Marine Engineers; the Hydrographic Society of America; the Society of Exploration Geophysicists; the Oceanography Society; the Minerals, Metals, and Materials Society and the American Fisheries Society.

Technical Sessions and Tutorials

OCEANS 2002, the most significant conference for ocean science and technology, will provide forums to discuss applications and developments. Over 500 presentations will encompass ocean observation and data collection, modeling, data management, engineering, fisheries, and the role of the ocean in homeland defense. The regional presence of large federal agencies for ocean measurement will result in a wide range of presentations on high technology applications and developments of the Navy, NOAA, NASA, and numerous supporting industries.

On October 28 ten technology tutorials will be conducted at the Marine Education Center of the University of Southern Mississippi.

Exhibits

Approximately 175 exhibitors from commercial, government and academic marine product and service providers will display their latest developments and capabilities. There will also be an exhibitor's showcase to allow demonstration of new products. Additionally, there will be an opportunity for attendees to tour industry, Navy and NOAA ocean survey ships and receive updates on ship instrumentation and capabilities.

Preliminary Program

The opening ceremonies of the conference will be held on Tuesday, October 29. Introductory plenary speakers will address the future of U. S. ocean policy. Afterwards, there will be a grand opening of the Exhibit Hall, followed by the beginning technical sessions. Wednesday will begin with a plenary session on Homeland Defense, with talks by leaders of ocean agencies. Technical sessions will continue Wednesday and Thursday.

Other Activities

On Friday November 1 tours will be available to view the advanced technologies at the John C. Stennis Space Center, home of the US Naval Meteorology and Oceanography Command, US Naval Oceanographic Office, National Data Buoy Center, Naval Research Laboratory, Department of Defense High Performance Computing Center, US Geological Survey Hydrology Laboratory, NASA Earth Research Center and NASA Propulsion Testing Center.

Additional Information

Technical activities will be held at the Mississippi Coast Coliseum and convention Center along the beachfront of Biloxi, Mississippi. Blocks of rooms are reserved at the Beau Rivage Resort and Casino. Room reservations are handled by J. Spargo and Associates, (800) 564-4220 or (703) 631-6200.

Registration Information

Registration is mandatory for participation in conference activities. Prospective exhibitors should contact J. Spargo and Associates. More information is available on the conference web site: www.oceans2002.com.

ELECTED ADMINISTRATIVE COMMITTEE

DANIEL L. ALSPACH
ORINCON Corp.
9363 Towne Center Drive
San Diego, CA 92121
+1 858 455 5530
+1 858 452 4258 (Fax)
alspach@snap.org

NORMAN D. MILLER
(see Vice President)

JOSEPH R. VADUS
(see Vice President, Technical Activities)

MICHAEL INGRAM
14 Monument Street, #3
Charlestown, MA 02129
617 258 3279
617 258 3858 (Fax)
ingram@ieee.org

JOHN W. IRZA
(see Chapter Chair)

ARCHIE TODD MORRISON III
McLane Research Laboratories, Inc.
Falmouth Technology Park
121 Bernard E. St. Jean Drive
East Falmouth, MA 02536
508 495 4000
508 495 3333 (Fax)
atmorrison@mclanelabs.com

ROBERT T. BANNON, President
Bannon International Consulting
301 Willow Run
East Stroudsburg, PA 18301-8591
rtbannon@csrlink.net
570 619 5430
570 619 5107 (Fax)

CLAUDE P. BRANCART
(see Ex-Officio)

JOSEPH CZIKA, JR.
T.A.S.C., Inc.
13605 Dulles Technology Drive
Herndon, VA 20171-4603
j.czika@ieee.org
703 793 3708
703 561 0800 (Fax)

STEPHEN M. HOLT
(see Secretary)

PAMELA J. HURST
General Dynamics Advanced
Technology Systems
67 Whippany Road, Rm. 15G-417
Whippany, NJ 07981
973 463 4475 (Phone)
973 463 4988 (Fax)
pjh47@excite.com

WILLIAM M. CAREY
(see Journal Associate Editor)

CHRISTIAN DE MOUSTIER
(see Journal Associate Editor)

PROF. DIANE E. DIMASSA
U Mass Dartmouth
Mechanical Engineering II-116
285 Old Westport Rd.
North Dartmouth MA, 02747
508-910-6606
ddimassa@umassd.edu

FERIAL EL-HAWARY
(see Chapter Chairmen)

THOMAS WIENER
(see President)

FREDERICK H. MALTZ
(see Newsletter Editor)

EX-OFFICIO

Jr. Past President
GLEN N. WILLIAMS
Engineering Program Office
Texas A&M University
College Station, TX 77843-3112
979 845 5485
g.williams@ieee.org

Sr. Past President
CLAUDE P. BRANCART
18 Juniper Road
Brunswick, ME 04011-3414
207 729 7873
monkfish@blazenetme.net
c.brancart@ieee.org

Membership Development
JAMES S. COLLINS
Dept. of Elec. & Comp. Engineering
University of Victoria
P.O. Box 3055
Victoria, B.C. CANADA V8W 3P6
+1 250 595 6928;
+1 250 595 6908 (Fax)
j.s.collins@ieee.org

Nominations
CLAUDE P. BRANCART

Chapters
NORMAN MILLER

Journal Editor
JAMES F. LYNCH

Awards and Fellows
DAVID WEISSMAN
Dept. of Engineering
104 Weed Hall
Hofstra University
Hempstead, N.Y. 11549
516 463 5546
516 463 4939 (Fax)
eggdew@hofstra.edu

Publications Review Board
GLEN N. WILLIAMS

Newsletter Editor
FREDERICK H. MALTZ

Pace
NORMAN D. MILLER

TAB Engineering Research and Development Policy Committee
JOSEPH R. VADUS

CHAPTER CHAIRMEN

Boston
John W. Irza
Sygnus Technology Inc.
Arlington, MA
781 648 2144
781 641 9974 (Fax)
jirza@sygnus.com

Canadian Atlantic
FERIAL EL-HAWARY
61 Bay View Road
Halifax Nova Scotia
Canada B3M 1N8
902 443 2400
902 445 5110 (Fax)

France
RENE M. GARELLO
Telecom Bretagne
Dept. Image Et Traitemt de l'Infromation
Technopole Brest Cedex
29285 Brest Cedex, France
(33) 98 00 13 71
(33) 98 00 10 98 (Fax)
r.garello@ieee.org

Houston/Galveston Bay
AL WILLIAMS
FSSL Inc.
525 Julie Drive
Sugar Land, TX 77478
713 240 1122 ext 214
713 240 0951 (Fax)

Hawaii
BOBBIN TALBALNO
94-792 Nolupe Street
Waithu, HI 96797
808 608 3200
808 668 3780 (Fax)

Japan
Junzo Kasahara
Earthquake Research Institute
University of Tokyo
1-1-1, Yayoi, Bunkyo
Tokyo 113-0032 Japan
+81 3 5841 5713
+81 3 5689 7234 (Fax)
kasa2@eri.u-tokyo.ac.jp

Norway
DR. THOR I. FOSSEN
Professor of Guidance and Control
Dept. of Engineering Cybernetics
University of Trondheim, N-8034
Trondheim, Norway
47 73594361
47 73594399 (Fax)

San Diego
BRETT CASTILE
Orincon Corporation
9363 Towne Center Drive
San Diego, CA 92121
619 455 5530 X212
619 453 9297 (Fax)

Seattle
SHERI L. REES
Enginuity Development Networks, Inc.
116 NW 130th
Seattle, WA 98177
206 440 1455
206 440 1438 (Fax)
s.l.rees@ieee.org

Victoria
James S. Collins
(See Elected Administrative Committee)

Washington D.C./No. Virginia
JAMES BARBERA
13513 Crispin Way
Rockville, MD 20853
301 460 4347
301 871 3907 (Fax)

IEEE OCEANIC ENGINEERING SOCIETY TECHNOLOGY COMMITTEE CHAIRS

Modeling, Simulation & Visualization, ED GOUGH

Marine Communication Navigation & Positioning, DAVID CHADWELL

Oceanographic Instrumentation, MR. KENNETH FERER

Current Measurements, DR. ALBERT (SANDY) J. WILLIAMS 3RD

Underwater Acoustics, DR. KENNETH G. FOOTE

Unmanned Underwater Vehicles, CLAUDE P. BRANCART

Air/Space Remote Ocean Sensing, DR. DAVID E. WEISSMAN

Sonar Signal & Image Processing, DR. JAMES CANDY

Non-Acoustic Image Processing, DR. FRANK M. CAIMI

Neural Networks and Information Processing, V. WILLIAM (BILL) PORTO

Environmental Technology, JAMES T. BARBERA, SR.

Technology Committees Coordinator, DR. STANLEY G. CHAMBERLAIN

Submarine Cable Technology, ROBERT T. BANNON & PAMELA J. HURST