TAKING AMERICAN NATIONAL STANDARDS TO THE INTERNATIONAL LEVEL

Michael A. Bahtiarian
Noise Control Engineering
799 Middlesex Turnpike
Billerica, Massachusetts 01821

Once you have led a group of national experts on the creation of the first commercial standard for the measurement of underwater noise from ships, what do you do next? First, you celebrate that you got the job done and make sure everyone knows that it is not just a "commercial standard," but more correctly, the first "voluntary consensus standard."

"Unlike Super Bowl winning teams, standards committees are not offered paid trips to Disney World…"

Until the formation of Working Group 47 under the Acoustical Society of America's (ASA) S12 committee on Noise, no one was talking about standardizing a method for the source level measurement of a ship's underwater noise signature.

It took about four years for the working group's efforts to be realized with the issue of American National Standards Institute/Acoustical Society of America (ANSI/ASA) S12.64-2009/Part 1, *American National Standard, Quantities and Procedures for Description and Measurement of Underwater Sound from Ships- Part 1: General Requirements*. This author was given an opportunity to write about the technical details of the standard in the October 2009 issue of Acoustics Today. Briefly, the standard provides a description of the methodology, instrumentation, and data processing to quantify an "affected source level" measured using

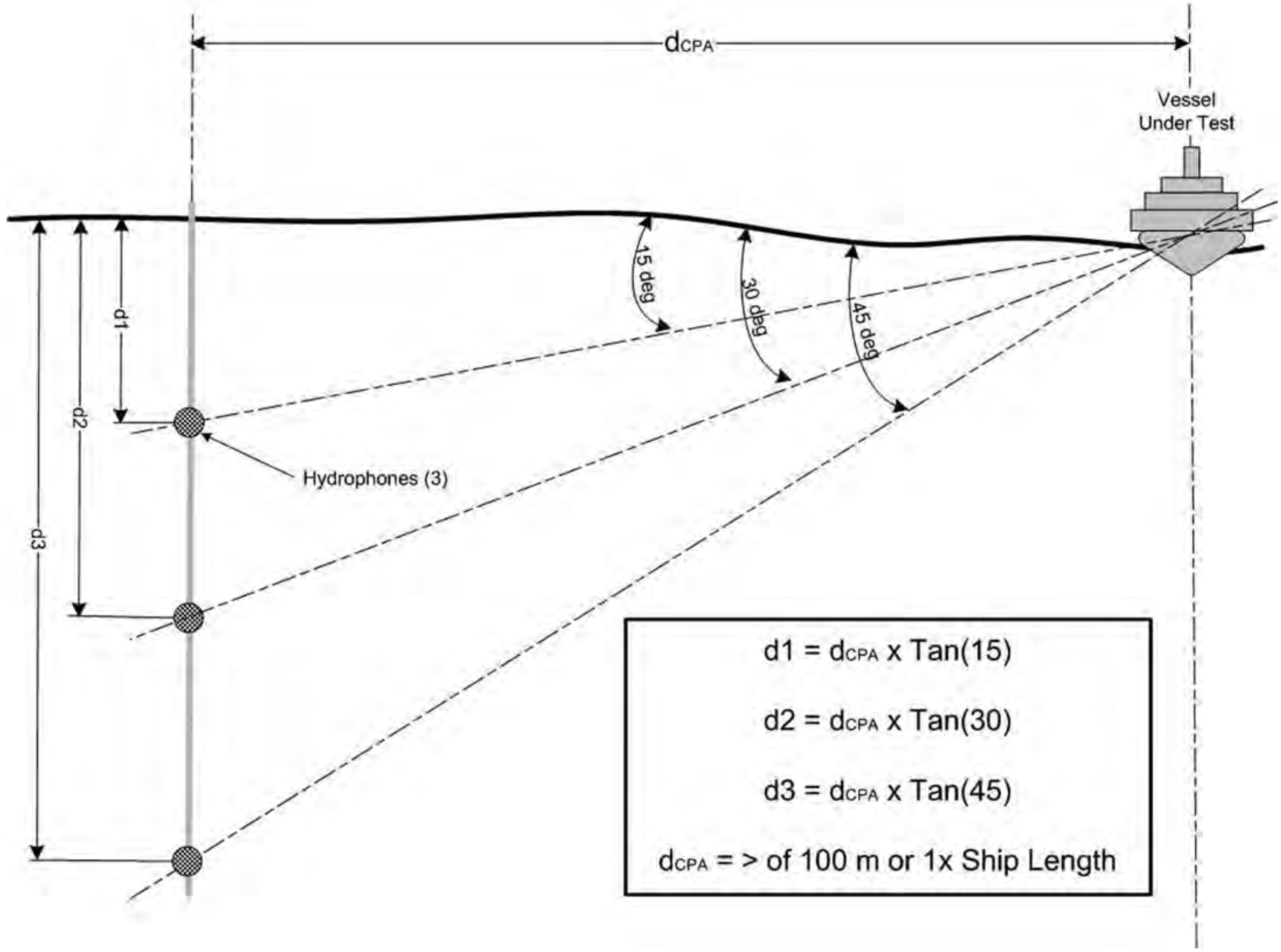

Fig. 1. For reference, this diagram is taken from ANSI/ASA S12.64-2009/Part 1 and shows the hydrophone geometry for Grades A and B. The reader is referred to the October 2009 issue of Acoustics Today for further technical details. Used with permission from the Acoustical Society of America, © Copyright 2009.

Fig. 2. Map of North America showing both U.S. and Canadian underwater noise testing facilities and ranges operated by the U.S. Navy and the Canadian Navy.

hydrophones. The results are reported in sound pressure level (SPL) relative to one micro-Pa, normalized to a distance of one meter in one-third octave bands. The standard provides a description of the measurement process and not a specific tool or device. The standard has three Grades, A, B & C, which are intended for precision, engineering and survey measurements, respectively. Figure 1 shows the configuration of the overall measurement scheme for Grades A and B.

Fortunately, this article is not about the technical details of how to measure underwater noise from ships, but it is about the standardization process. More specifically, it is about what can happen after the development of an American National Standard. Unlike Super Bowl winning teams, standard's committees are not offered paid trips to Disney World upon the completion of their work. The chair is given a very nice plaque to signify the hard work, even though he could not do it without a dedicated committee of experts from the private sector, government agencies and academia. For example, the members of the ANSI/ASA S12/WG 47 that created ANSI/ASA S12.64/Part 1 came from the Naval Sea Systems Command (NAVSEA), Naval Surface Warfare Center (NSWC) and National Oceanic and Atmospheric Administration (NOAA); academia including members from University of Delaware, Lamont-Doherty Earth Observatory, Florida Atlantic University, University of Rhode Island and University of New Hampshire; and industry including private consultants to Fortune-500 companies. The topic was of such interest that there was international participation, from Canada, United Kingdom, the Netherlands and Australia.

Back to the question—after developing an ANSI accredited standard what do you do for an encore? The only logical follow-up is to bring the standard to the International Standards Organization (ISO) and that is just what was done with the encouragement and help of the ASA standards office. This office, with limited staff, manages standards development, maintenance, sales and distribution for all topics in acoustics, noise, vibration, bioacoustics and now underwater noise. This includes such differing topics such as sound power from computer equipment to classroom acoustics, and now underwater noise from ships.

This author assumes that standards move from the national arena to the international stage all the time. Likewise ASA receives international standards (from ISO) and then adopts them as ANSI/ASA standards. Even without creating new methodology, the process of adopting standards nationally and internationally requires a significant amount of paperwork, technical review and member balloting. All of this work is managed by the ASA standards office. The toughest part of their job is keeping all the volunteer participants (the author) engaged in their standards work without the military's practice of promoting, the private sector's cash/stock bonuses, or academia's practice of bestowing tenure.

By now the reader may wonder why bother with all this effort? Why do we even need ANSI or ISO standards? That question is answered by just a couple of simple examples. Just recently, the author found great difficulty attaching a box-type ski rack to second vehicle without the use of a pricey adaptor. This lack of car rack standardization brings to mind, a similar difficulty replacing a car's windshield wiper. Remember Beta and VHS video tapes? The ASA Standards office mentioned, that the Beta/VHS "issue was really one of competing standards. They were both heavily standardized and it was a matter of which one won out in the marketplace." Actually, the Beta format was better than the VHS, the winner.

Imagine all the extra work and money that goes into creating multiple adaptors, windshield wipers, and two different video tape formats. It is unfortunate that standards groups were not started when the world became electrified. If so, we would all have one type of electrical socket. The only negative is that travel stores would not be able to sell power adaptors/convertors when landing abroad without ability to recharge your electronic devices.

If global uniformity did not occur for power outlets, automobiles, or the early digital entertainment industry, why is it necessary for sound and vibration? Why is it so important for underwater noise? Since electrification (1920's) and establishment of home entertainment (1970's), the world has gotten to be a lot smaller place in which we can interact with people in any corner of the world. Today we still have failure of standardization— PC vs. Mac. Even the core of our technical world, the units system, is not unified. How many feet is one meter?

Certainly, we could live without a standard method for measuring ship noise, but wouldn't uniformity be better? For the case of the first ANSI/ASA working group on underwater noise, the need for such a standard came from the author's involvement in design, construction and testing of quiet research vessels starting around 2001. Europe had been building such quiet ships since 1995. Efforts got started in the U.S. with the design and construction of a new class of quiet fisheries research vessels for the U.S. Department of the Interior, National Oceanic and Atmospheric Administration (NOAA). The first of the Class, the *OSCAR DYSON* was put into service around 2004. Since then three more vessels were put into service with many more quiet ships on the way.

Without a standard, the only way to get an accurate measure of a ship's underwater noise was to go to a naval facility. Since World War II the field of underwater acoustics has been the sole concern of the navies of the world, who have used this special knowledge to hide their submarines while in the hunt for enemy combatants. In the United States, this need resulted in the establishment of numerous ocean range facilities for measurement of underwater noise. Unfortunately, both U.S. and Canadian facilities are located in the corners of North America. Figure 2 shows the location of the major U.S. and Canadian facilities for measurement of underwater noise. These facilities are available for "private party" work, but at significant cost for facility usage and travel expenses for both fuel and manpower to crew ships to travel to one of the four corners. This works for the Navy, but it is not economically feasible for industry. Hopefully, the ANSI standard solved this problem by offering uniform methodology that did not require a "fixed range facility."

In the author's opinion the rest of the world has the same problem. The first underwater noise Working Group within the ASA had a large international participation, mostly from Europe. Low-noise ships are being designed and built in many of the continents, particularly Europe, Asia, North America, and Australia. Balloting of the proposed work to create an ISO standard was met with broad interest. To be approved, the proposal must be accepted by a simple majority of the voters of the committee and only five member bodies (i.e., countries) need to agree to participate in the development of a new standard. Nine countries elected to participate in this one, with two additional countries signing on after work had commenced.

The ISO version of an underwater noise standard began at a meeting in London in April 2011. The first meeting was attended by nine participants representing Germany, the Netherlands, Denmark, Norway, United Kingdom and the USA. Thus, Working Group 55 under Sub-Committee 1 (noise) which is part of Technical Committee 43 (acoustics) was formed. The shorthand designation is TC 43/SC 1/WG 55. Since the first meeting, WG 55 has become a "United Nations" representation with members from Australia, Canada, Denmark, Germany, Japan, Mexico, Netherlands, Norway, Russia, United Kingdom, and the USA. There are twenty-one people on the working group representing those 11 national member bodies. This is quite a large committee for a standards working group.

This is an excellent place to compare one of the major differences about operating under the national ANSI guidelines versus the ISO guidelines—membership. Working under ANSI, anyone can become a member of the standards working group, but within ISO you must be nominated by your country's member body. In the U.S., the member body is ANSI, American National Standards Institute, which works through the ASA for topics related to acoustics and vibration. Other member bodies are British Standards Institute (BSI) in the UK; Deutsches Institut für Normung (DIN) in Germany; and Standards Council of Canada (SCC) in Canada.

A pleasant surprise working within ISO is that the organization provides a set of web tools for the chair and the committee. The most useful is the availability of a web meeting account. This is very helpful in keeping the committee efforts moving forward. ANSI does not provide such support unless funding is provided by private parties. For ISO Working Group 55, the web meeting has become an indispensable tool. It allows telephone connection of everyone by land line or voice over internet protocol (VOIP). It allows display of the agenda and other relevant visual information on the user's computer screen. With this group, we have had as many as ten committee members on a web meeting at once.

One important issue for international web meetings is selecting a time during which most committee members can "attend" the meeting. The best time to include the East and

West coasts of the United States and Europe is 10 to 11 am (EST) To the far west, this is 7 to 8 am (PST) which is a reasonable time to be awake. To the east, in continental Europe this is 4 to 5 pm local time. Obviously, this is not the entire planet. Each committee may have different members in different geographic locations, and will have to adjust the meeting times accordingly.

This author thinks that the web service works best once the committee members have gotten to know each other and can recognize voices and understand accents. This brings up the issue of language. ISO standards are printed in English and French. In ISO/TC 43, ISO meetings and business are typically conducted in English, lucky for those of us in English-speaking countries (U.S., UK, and Australia). Most of the participants speak excellent English which makes for fairly easy communication. The author believes that it is a good practice not to assume all committee members can follow every discussion at the same speed. This author gives everyone more than one chance to ask questions and make position statements.

Email is also possible for some limited "discussions" between the committee. However, there are a couple of problems—losing track of the thought-train, especially when a committee member responds late or out of sequence of "the discussion." It is helpful when the chair poses questions for members to provide opinion without introducing new discussion topics.

As for physical meetings, it is probably obvious that these are much easier to schedule when everyone is coming from the same country. ISO meetings can be scheduled anytime and any place, but out of courtesy to the worldwide membership, 4 months' advance notice is usually given. Also, it is a good practice to keep meeting locations close to major airports.

What else keeps ISO as well as ANSI standards committees operating? Most important is people. Standards committees need people, people, and people. This activity cannot and should not be done by one or two experts. This is even more important in the case of an international arena. As with anything, financial resources are also helpful. However, if the author was offered twenty people or twenty thousand dollars, he would take the twenty people. On the other hand, standards committees can certainly get too large. A good size is between 10 to 15 people with no greater than 25 members.

It is the chairman's, or in the case of ISO convener's job to keep the group on track during committee meetings. The interesting issue with ship noise measurements was that every aspect was related to every other aspect. For example, a discussion of instrument bandwidth eventually leads to discussion of Doppler shift error and ship speed. It is helpful to keep the committee focused on the first topic. It is also important for the convener to delegate work and not take on all efforts. This author has followed the rule that if you suggest the idea, you must work on the idea. As with any volunteer effort it is important to thank everyone regularly!

With that said, this author thanks all the committee members of the Working Group 47 under the ANSI/ASA S12 committee on noise. The author also thanks the current ISO Working Group 55 for their continued efforts.**AT**

The author with his two daughters, "in-command" of the USS ALBACORE, a pre-nuclear era submarine now located in Portsmouth, New Hampshire. It was the first navy-designed vessel with a true submarine (teardrop) hull form. The ALBACORE was used as a test-bed for many technologies including many quieting techniques used by the author on the design of quiet research vessels. In was commissioned in 1953 and designated a mechanical engineering landmark in 2000 by the American Society of Mechanical Engineers (ASME).

Michael Bahtiarian has worked in the field of marine noise control for most of his 26-year career which started at General Dynamics Electric Boat Division. He is currently the Vice President of Noise Control Engineering, Inc. in Billerica, Massachuetts, which specializes in shipboard noise and vibration control. Michael is also a Board Certified member of the Institute of Noise Control Engineering (INCE) and holds a B.S. in Mechanical Engineering from Penn State University and a M.S. in Mechanical Engineering from Rensselaer Polytechnic Institute. Michael is the chairman of the Acoustical Society of America (ASA) Working Group 47 which produced American National Standards Institute/Acoustical Society of America (ANSI/ASA) S12.64/Part 1. He is now the convener of Technical Committee 43/sub-committee 1/ Working Group 55 (TC 43/SC 1/WG 55). He has completed numerous shipboard noise control projects most notably the National Oceanic and Atmospheric Administration (NOAA) Fisheries Research Vessel (FRV-40) and the *R/V HUGH R. SHARP*, a quiet research vessel for the University of Delaware. He is currently involved in other quiet-ship designs including the Ocean Class AGOR Oceanographic Research Vessel and the Arctic Region Research Vessel (ARRV) for the University of Alaska at Fairbanks.