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U.S. and Japan Team on Cooperative Research Projects

By Mary Zoccola

The Ship Survivability, Materials and Structure Directorate (60) technical personnel have been working on a cooperative research project with the Japanese called Advanced Steel Technology. The Beginning In late 1990, there was a call for cooperative programs from the Office of Naval Research.

The Carderock Division Code 60 proposal was approved in 1991. However, the Memorandum of Understanding (MOU) wasn't signed until the fall of 1995, which allowed the program to actually begin. "Since then, it has been a full-blown program with regular meetings in the United States and Japan," said Paul Holsberg (61). "It is a $35 million program with each side contributing about one-half of the funding."

Five years of negotiations ensued between when the idea that the Japanese and the Americans could collaborate surfaced and when the work actually began. Five years elapsed, in part, because the Americans needed to determine the research in which both they and the Japanese were interested. Most of the negotiations were with the Japanese Technical Research and Development Institute (TRDI), the organization that supplies most of the technical leadership for the Japanese participants. The TRDI is the sole organization of the Japan

Defense Agency which conducts research, development, test and evaluation of military systems and equipment, such as fighting vehicles, ships, aircraft and guided weapons for the Ground, Maritime, and Air Self Defense Forces. Additionally, the MOU took a long time to clear both the American and Japanese sides of the project. "In our case not only did it have to go through the Defense Department, but it also had to go through the State Department and the Department of Commerce and get their approval as well," explained Holsberg. "There was a lot of word smithing during the program, especially when you are dealing with another language; the translations are not always the same." Also, the Department of Defense designed the Advanced Steel Technology MOU as a model for other international programs. "They may have inserted other requirements that may not have been specific to our program, but would be useful for other follow-on programs," said Holsberg. Currently, the Advanced Steel Technology program is the Navy's, if not the Department of Defense's, number one program in this area. At the very top of the MOU is the Joint Steering Committee. The two co-chairs of the committee are Rear Admiral Michael T. Coyle (NAVSEA 03) and Dr. Takao Sasajima (Director, First Research Center, TRDI). Both have overall responsibility for the whole program. The American project sponsor at SEA 03M2 is Charles Null. Holsberg is the American project manager. Michio Nishida (Director, 4th Division, 1st Research Center, TRDI) is the Japanese project officer. The Chair of the Joint Working Group for the Americans is: Tom Montemarano (614); and for the Japanese: Kazuhisa Kuda (Chief, 1st Ship Structure Research, 4th Div., 1st Research Center, TRDI).

The success of the project really lies with the efforts of Montemarano who spearheaded the work and made the entire MOU happen. The program started in his branch where they were required to engineer the proposal back in 1991. Also, Montemarano was the general developer of the program at Office of the Secretary of Defense and the Navy. He also served as the technical negotiator on the U.S. side. Additional people in working groups include: Gene Franke (615), Ernie Czyryca (614), Philip Dudt (672), Joan Carlberg (654), Dan Davis (613), Jeff Mercier (614), Nash Gifford (653), Bob Krezel (662), Ben Whang (retired from 671) and Allen Manuel (NAVSEA 03P4). "We work very closely with the Navy International Program Office (NIPO)," explained Holsberg. "We also have close ties with the Mutual Defense Assistance Office (MDAO)--a branch of our embassy in Japan that coordinates American visits to Japan."

The Program

The program is aimed at using structures fabricated from a weld metal that is not as strong as the plate that it welds together. Typically, U.S. Navy welds are always as strong, if not stronger, than the plate they weld together. This "undermatched" welding approach will be a departure from typical Navy practice. The U.S. Navy wants to apply this technology to the HY 100 steels used in submarines. HSLA 100 steel (having a yield strength of 100 kpsi) is approved for non-pressure hulls in submarines. For undermatched applications it would be fabricated with weld metal having a yield strength of approximately 80K PSI, which is about 20% undermatched. The Japanese steel is a 160 kpsi steel, normally welded using Gas Tungsten Arc Welding (GTAW). This is a welding process which is often not used for production in the United States. It is a very high quality process, but it is very slow and therefore, expensive. The Japanese want to be able to fabricate components which do not have the access required for the GTAW process. They want to use stick electrode welding (known as Shielded Metal Arc Welding), but can only use electrodes with a yield strength of 140K PSI, a 13% undermatched condition.

Tests Conducted

In many cases, the program involves making welds to be cut into specimens or tested in plates. Another welding project was actually fabricating a fatigue test box--a 3 foot cube--and welding it together using Japanese specs but American materials. The Japanese have run tests on American materials to see how it works and so that we can compare their fatigue test data with ours. Another test is a HTE, Hull Test Element Plate--a Carderock-developed explosion test conducted near Bldg. 19. We will be testing six Japanese fabricated HTE weldments this winter and spring comparing them with dynamic fracture toughness tests conducted on their undermatched welds. Still another example were Japanese UNDEX models tested at Carderock in October 1996. The Japanese built their models and installed strain gauges in Japan. The completed models and Japanese instrumentation was then shipped to Carderock. The United States instrumentation was coordinated with the Japanese systems and tests run under the direction of Carderock personnel (Phil Dudt, Jim Craig and Jim Matheny among others). To view details of the

explosion and the interaction of the explosion with the models, Carderock video equipment and photographers were used. American technicians and engineers worked side by side with Japanese engineers and technicians very efficiently.

Obviously the major problem which could have occurred was not understanding critical instructions due to the different languages. The MDAO representative, Terumi Laskowsky played an extremely important role as technical translator during the testing. Frequently, the Americans and Japanese would share their ideas on various procedures. For example, Americans at Carderock have usually conducted UNDEX testing with the associated instrumentation cabling sunk, while the Japanese have operated with their cabling floating. After discussing the position of the cable with the Japanese, the Carderock researchers have seen some advantages and will many times now probably keep their instrumentation cable floating. "We had a representative from the Office of the Under Secretary of Defense for International Programs come and observe the test," explained Holsberg. "He was ecstatic because he wants to see the international cooperation succeed." One strength of the program is that personnel at the working level are able to communicate with one another. Holsberg also says that there haven't been any more problems dealing with the Japanese than dealing with an American company. Of course, as in any project, a few problems have occurred. One major problem has been the distance, but using e-mail, fax and making calls at odd hours have helped to compensate. Also, the fact that exchanges occur nation to nation, making changes in the MOU can be a long and slow process.

Finally, fluctuating exchange rates have been an issue. However, none of the issues have been insurmountable to the process. Sharing data The idea is that the United States and Japan are sharing all of the data developed in the program. Much background sharing of information has already occurred, such as model tests and other things conducted in the past. The Japanese have shared hydrostatic models and other technology with the United States. To fully utilize all the information needed from the research, each side conducts their own research on the other side's material. For example, the Americans are conducting HTE and specialized fatigue tests with Japanese materials. In turn, the Japanese are testing American materials using their fatigue, explosive, and stress corrosion tests. In this way both sides obtain a broader range of technical information about their materials, while learning new concepts and

methods. Japanese interaction "Working with the Japanese has gone really well," says Holsberg, adding that since the Japanese and the Americans both work in the technical arena there were similarities which facilitated interaction. "As engineers, we look for the same sorts of things in the same sorts of ways." Also, many of the Japanese were educated in America. Kuda was educated at Georgia Tech; Nishida at Massachusetts Institute of Technology. Sasajima spent a summer working at Carderock. The future of international programs One of the program's benefits is that it involves many Code 60 people; Code 61 is the focus of the program, but Codes 65 and 67 are major players as well. Additionally, the program deepened relations with NAVSEA and the NIPO. Ten years ago, there was little international work at the Carderock Division. Now, there are many international programs. That was due, in part, to the fact that NAVSEA gave up a lot of functions that were primarily international and asked the Carderock Division to take the lead. The Carderock Division is now an active player in the international arena. Three members of Code 61 recently traveled to India to deliver invited papers at a welding symposium. The Dutch recently visited Carderock where a composites program with Jeff Beach's Code 65 team is underway. Code 61 also participates in the Technical Coordinating Program (TTCP), which is a technical exchange between the U.S., U.K., Canada, Australia and New Zealand. "What is prompting the mushrooming of international work is that a lot of countries have found they can't afford to perform research on their own anymore," Holsberg said. "(The attitude is) If somebody has already done the work, let's benefit from it."

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