

Model-Based Synthetic Aperture Acoustic Array



Edmund J. Sullivan

Many people have tried to exploit the fact that the towed array is moving in the ocean. That is, since the length of the array, called its aperture, plays a critically important part in its performance, it would seem that by using the *dynamic* aperture, that is, the aperture traced out over time, the performance could be significantly improved. It is well known that *active* synthetic aperture can provide improved acoustic imaging algorithms in ocean acoustics as well as nondestructive evaluation (e.g. laser ultrasound). Analogously, can a *passive* synthetic aperture be successfully created? This issue has been a controversial subject in the U. S. Navy for several years, and it is still a matter of controversy.

This talk will present a history of this controversy and show that much of the confusion has arisen through the appearance of faulty “proofs” purporting to show that it could *not* be done. The flaws in these proofs will be discussed and further, it will be shown that by using a model-based approach, the angle dependent Doppler associated with the array motion can be exploited to achieve a significant improvement in performance. This will be shown by several examples, using both simulated and real experimental data.

Biography of Edmund J. Sullivan

EDUCATION: Ph.D. Physics/1970/ University of Rhode Island
M.S. Electrical Engineering/1967/ University of Rhode Island
B.S. Electrical Engineering/1965/ University of Rhode Island

Clearance: Secret

Edmund J. Sullivan earned the bachelors and masters degrees in Electrical Engineering in 1965 and 1967, respectively, from the University of Rhode Island. In 1970 he received the Ph.D. in Nuclear Physics, also from the University of Rhode Island. Dr Sullivan served on the research and technology staff of the Naval

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Underwater Systems Center (NUSC) until February of 1985 when he was appointed head of the Signal Processing Group at the SACLANT Undersea Research Centre in La Spezia Italy, where he performed both theoretical and experimental research in matched-field processing, bispectral analysis of radiated noise, and passive synthetic aperture processing.

He held this post until July of 1988. For the two years previous to the SACLANT appointment, he was the Acoustic Signal Processing editor for the Journal of the Acoustical Society of America. He was an associate editor for the IEEE Journal of Oceanic Engineering for nine years, his tenure ending in 1999. He was reappointed as the Acoustic Signal Processing editor for the Journal of the Acoustical Society of America in 2003. Previous to his retirement he was a staff scientist for the Physics and Technology Division at the Naval Undersea Warfare Center (NUWC). He is the holder of several patents in the areas of underwater acoustics and array processing. His present interests are in Inverse Scattering, Model-Based signal processing, and Passive Synthetic-Aperture array processing. He is a fellow of both The Acoustical Society of America and the IEEE. He is a member of Tau Beta Pi and Sigma Pi Sigma.

Dr. Sullivan has published numerous journal articles, 1 book, 2 encyclopedia articles, 6 book chapters, and several NATO and Government reports covering the subjects of Underwater Acoustics, Signal Processing, Nuclear Physics, and Electromagnetics. This year (2015) he published a monograph entitled "Model-Based Processing for Underwater Acoustic Arrays." This is a joint publication of the ASA Press and Springer Publications.

Among the awards he has received are the IEEE OCEANS 94/OSATES Distinguished Technical Achievement Award, The Acoustical Society of America Silver Medal in Signal Processing in 2010 and the NUWC Excellence in Science Award, both in 1978 and 1991.

IEEE / OEB SP Chapter will provide Togo's sandwiches, snacks and other refreshments for this event – come early before they disappear! This event is "no charge".