

# Walter Munk and JASON

by

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Walter Munk Legacy Symposium  
Scripps Institution of Oceanography  
La Jolla, CA

October 17, 2019

I met Walter Munk probably in 1962, when I briefed the JASON group at its second summer study. But our paths had crossed much earlier, anonymously to be sure, when Walter survived the first thermonuclear explosion, on a small raft in the vast Pacific Ocean. This was the 10-megaton MIKE test on Enewetak Atoll, in the Marshall Islands. In a few minutes we'll hear Walter's account of the experience<sup>1</sup>.

I came to know Walter well when I joined JASON in 1966, and I was able to benefit from his insights and experience. Since about 1957 I had worked almost half time with the President's Science Advisor Committee (PSAC), created late that year by President Dwight D. Eisenhower. Although not yet a PSAC member, I had been asked to chair its Military Aircraft Panel and its AntiSubmarine Warfare Panel. It was in that latter context that I appreciated Walter as a scientist—energetic, imaginative, bold, courageous, and thorough. We'll see Walter later in this talk, commenting on JASON, but first I list the JASON reports which he authored, usually with others who drew on and extended Walter's long experience and deep understanding of the oceans and the science and phenomenology involved.

There are too many reports and too much substance even to read the titles, let alone explain the substance and its significance, so I'll spend only a few seconds on each page. ("62-" indicates 1962).

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<sup>1</sup> Early in a 14-minute 2012 interview by Richard Breyer and Anand Kamalakar, posted at <https://repository.aip.org/islandora/object/nbla%3A287202>  
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<b>Yr</b>	<b>Title</b>	<b>Lead author</b>
62-	Report by JASON/Navy visiting group	W. Munk
62-	Report by JASON/Navy visiting group	W. Munk
65-	Letter to M.L. Goldberger commenting on limited NIKE-X deployment propo	J. Bengston
68-	Comments on NRL Meeting, 12-13 March 1968: Nonacoustic antisubmarine	W. Munk
69-	Generation and airborne detection of internal waves from an object moving	Callan
70-	Non-acoustic ASW update	W. Munk
71-	Acoustic backscatter from microstructure	R. Dashen
72-	W. Munk	Munk
72-	Internal-surface wave interactions and related problems	W. Munk
72-	Effect of various arms limitation options on SSBM survivability, Vol II, Appen	Garwin
72-	Effect of various arms limitation options on SSBM survivability, Vol I: Summa	R. Garwin
75-	Sound propagation through a fluctuating stratified ocean: theory and obser	W. Munk
75-	Summary of ocean hearing work	Abarbanel
75-	An interpretation in terms of internal waves and tides of multipath scintillat	F. Dyson
76-	Limits on Coherent Processing Due to Internal Waves	S. Flatte'
76-	Sound Transmission Through a Fluctuating Ocean	S. Flatte'
77-	Scattering of Sound by Internal Waves: The Role of Particle Velocities	W. Munk
77-	Ocean Variability and Acoustic Ranging	W. Munk C. Wunsch
77-	Strategic Implications of a large system of intercorrelated acoustic arrays	S. Flatte

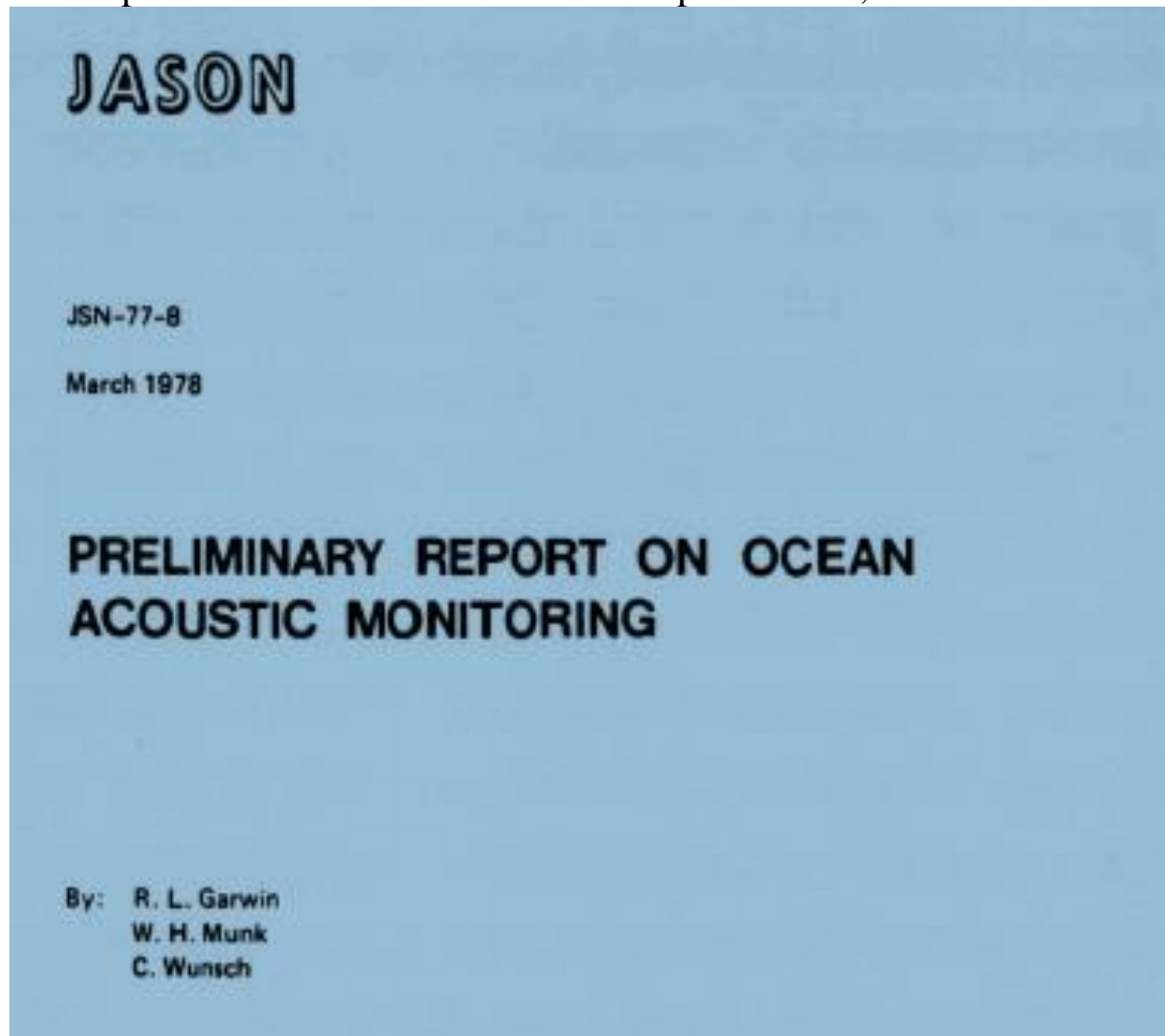
<b>Yr</b>	<b>Title</b>	<b>Lead author</b>
77-	Preliminary Report on Ocean Acoustic Monitoring	W. Munk
78-	SH 1978	E. Frieman
78-	The Long Term Impact of Atmospheric Carbon Dioxide on Climate	G. MacDonald
78-	Ltr to Dr. Høglund re NORDA Document Review	
79-	The Long term impacts of increasing atmospheric carbon dioxide levels	G. MacDonald
79-	Non Acoustic ASW	E. Frieman
80-	Letter to A. Andreassen: Hydrodynamics Work	W. Munk
80-	Letter to E. Harper: Hydrodynamics Work	W. Munk
80-	Hydrodynamics 1980	
81-	Technical Assessment of the Soviet ALFA Class Submarine	
81-	Child's Guide	W. Munk
81-	Active Acoustics with an Emphasis on an Arctic Environment	
81-	Unmanned Submersible Probe	
81-	Comments on the Tactical Oceanographic Working Group	
82-	SEASAT Progress Report	
82-	Arctic	
83-	Active Acoustic Sources	W. Munk
83-	Letter to Andreassen and Harper	R. Dashen
83-	AUV	
83-	SEASAT Report	K. Case

<b>Yr</b>	<b>Title</b>	<b>Lead author</b>
83-	Bispectra	
83-	Undersea Bioluminescence	
84-	Index of Refraction Effects in the VAS	
84-	Seismic Discrimination	S. Flatte'
84-	SEASAT III and IV	C. Callan
85-	Ltr to RADM Mooney Re: SAR Image of the Ocean Surface	W. Munk
85-	Submarine Detection: Acoustic Contrast Versus Acoustic Glow	S. Flatte'
85-	Ltr to RADM Mooney Re: SAR Image of the Ocean Surface	W. Munk
85-	Ltr to Ed Harper Re: Detection of Internal Wave Wakes by Airborne SARs	Dashen
85-	Ocean Science and Technology Planning	Abarbanel
86-	Sea Surface Films	R. Davis
86-	Ships from Space	W. Munk
86-	Note Concerning: Turbulent and Vortex Wakes of Ships OR Ltr to P. Selwyn F	K. Watson
87-	Ocean Backscatter	W. Munk
87-	Super Gain Arrays/Tomography	R. Dashen
89-	A Model of Ocean Noise	W. Munk
91-	Acoustic Warfare	D. Nelson
92-	Non Acoustics ASW in Regional Conflict	F. Zachariasen
92-	Ltr Rpt: San Martin - 60 Hz EMF	S. Koonin
95-	Acoustic ASW	H. Levine

<b>Yr</b>	<b>Title</b>	<b>Lead author</b>	
95-	Mission to Planet Earth	T. Prince	
96-	Navy Topic: Quick Look Response	C. Callan	
98-	Ltr Rpt: M. McDonald - ONR Grand Challenges: A Quick-Look Report	C. Callan	
98-	Ltr Rpt: Ari Patrinos - Global Climate Modeling (Advanced Climate Prediction	S. Koonin	
04-	Tracking, Tagging and Location	E. Williams	
00-	Nuclear Test Ban Verification	R. Schwitters	
01-	Intelligence Missions of Future Submarines	J. Goodman	
01-	ASW Signal Processing	H. Levine	
01-	New Sources and Methods	J. Kimble	
03-	Active Sonar Waveform	H. Levine	
05-	Ltr Rpt: Bobby Junker - Surface Ship Tracking (Maritime Domain Awareness	J. Goodman C. Callan	
05-	Ship Tracking for Maritime Domain Awareness	J. Goodman	
07-	Navy Ship Underwater Shock Prediction and Testing Capability Study	M Brenner G. Candler	
08-	S&T for National Security	S. Koonin	
09-	Multistatic Non-Acoustic ASW	J. Goodman	
11-	Ltr Rpt: Basic Research Workshop	R. Jeanloz H. Abarbanel	
13-	Acoustic Communications	M. Gregg J. Goodman	
14-	Acoustic Communications II	M. Gregg H. Stone	
17-	Project R	M. Gregg W. Plant (Consu	

Some 78 papers for JASON sponsors—primarily the U.S. Navy in Walter’s case—over a span of 56 years. But Walter’s impact extended far beyond the written word.

I turn now to scientific substance. Carl Wunsch and Robert Spindel have already spoken on this topic, but I'd like to show the JASON report that led to the Munk/Wunsch publication,



## CONTENTS

I	INTRODUCTION . . . . .	1
II	THE MESOSCALE PERTURBATIONS . . . . .	3
III	MOORING MOTION . . . . .	5
IV	PULSE TIME PRECISION . . . . .	6
V	THE OCEAN INTEGRATION TIME AND BAND WIDTH . . . . .	7
VI	INTERNAL WAVE SPREAD AND WANDER . . . . .	9
VII	INVERSE PROBLEM . . . . .	13
	A. The Moore-Penrose (M-P) Solution . . . . .	14
	B. Singular Value Decomposition and Resolution . . . . .	20
	C. Noise . . . . .	26
	D. Specific Examples . . . . .	27
	REFERENCES . . . . .	30



Walter was gregarious and insightful. Near the beginning of our 1977 JASON summer study thinking together on Ocean Acoustic Monitoring he asked whether I would object to his sitting quietly in the corner of my office at the Bishop's School here in La Jolla, where we held our 6-week summer study for several years. He said he wanted to see how I worked. I'm sure he was disappointed with what he saw me do-- reading a couple of articles, making a few notes, and thinking.

In 1977 we mostly had paper journal articles, bound volumes of back issues, and books, and I was probably thinking as much about the other two studies to which I contributed or led that summer, "Heavy-ion Driven Inertial Fusion," and "Magnetic-gun Igniter for Controlled Thermonuclear Fusion."

As our Ocean Acoustic Monitoring report evolved, I felt I wasn't pulling my weight in preparing the paper for journal publication, in view of my other, especially non-JASON obligations with the U.S. Government, so I did not further work on the topic—except perhaps to name it in a letter of 11/16/1977 to Walter and Carl, in which I wrote, "It occurred to me that there is a strong resemblance of the problem of determining mesoscale parameters from sound travel times (on the one hand) to the problem of computed tomography ("CT"), on the other." I won't detail here the correspondence of variables between the two fields.

In preparing this talk, I spent a few minutes on learning a bit about the status of Ocean Acoustic Tomography and the resolution of some of the questions that occurred to us, such as the up-down ambiguity between sound velocities above and below deep-sound-channel and the like. I can see why these fascinating problems have attracted two of my physicist colleagues (JASON members) to serve as SIO Director!

Now I show Walter in most of a 14-minute video interview<sup>1</sup> from 2012 about his experience with MIKE in 1952, a bit about Ocean Acoustic Tomography, global warming, and a good deal about JASON.