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CECIL H. AND IDA M. GREEN
INSTITUTE OF GEOPHYSICS AND PLANETARY PHYSICS
SCRIPPS INSTITUTION OF OCEANOGRAPHY (0225)

LA JOLLA, CALIFORNIA 92093-0225

20 September 2014

RADM Matthew Klunder
Chief of Naval Research
800 North Quincy
Arlington, Virginia 22217-5000

Dear Admiral Klunder,

I wish to report on my activities from 1 October 2013 to 31 December 2014 as Secretary of the Navy Chair of Oceanography. This is in continuation of the Secretary of the Navy Chair in Oceanography 1985-90, and follows the same informal letter format designated by Admiral Brad Mooney and continued under Admirals Wilson, Miller, Palaez, Gaffney, Cohen, Landay, and Carr.

My 2013-14 research has again been divided between acoustics and physical oceanography.

The oceans respond to various forces: wind, buoyancy, tides, ... ; without these forces the ocean would be a stagnant pool. Winds are the most important. We can identify three wind regimes and associated wave conditions: 1. Very weak winds that transfer momentum by surface wind shear; 2. Moderate winds and low waves, with momentum transferred by higher pressure on the upwind wave slopes; 3. Strong winds with wave breaking and possible contributions from parasitic capillaries. There was a lot of research on these fundamental issues fifty years ago with significant progress, and not much since.

Different components of the wave spectrum play a leading role. In either case, the winds need to exceed the wave velocity at some critical elevation. For the low frequency gravity waves, the winds at relatively high elevation have to exceed a rapid phase velocity; for the high frequency ultra-gravity (ug) waves, the winds at low elevation have to exceed a relatively slow phase velocity. The so-called "wind-noise" problem may differ radically in these two regimes, with potentially important ASW implications. I am working on these issues now and will devote my terminal appointment to these questions.

The above wave research is closely related to the low frequency acoustic field in the deep ocean. Farrell and I have completed our analysis of three years of excellent hydrophone and geophone recordings transmitted from an abandoned ATT cable at 5 ½ km depth (beneath conjugate depth) in the mid-Pacific, midway between Hawaii and California. Worcester and Berger have assembled a network of deep stations between the surface and bottom; I plan to continue to participate in the analysis of the depth dependence of the acoustic field.

A handwritten signature in cursive script that reads "Walter Munk".

Walter Munk
Secretary of the Navy Chair in Oceanography



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HONORS, AWARDS & INVITED TALKS 1 October 2013 – 31 December 2014

HONORS & AWARDS:

University of California, San Diego 2013 Roger Revelle Award “in honor of his achievements and impact advancing the UC San Diego mission,” (Presented by Pradeep Khoulsu, Chancellor of UCSD at the UC San Diego’s Founders’ Celebration, November 16, 2013)

Explorers Club 2014 Medalist “for his extraordinary contributions to oceanography, pioneering marine science, and more specifically to our understanding of the inner workings of the Earth’s oceans,” (Presented by the Explorers Club at their Annual Meeting, March 15, 2014).

Bruno Frachon, Director General Service Hydrographique et Océanographique de la Marine (SHOM), presented Professor Munk with the Medal of Honor of the French Navy, in honor of his service during World War II. (Paris, France, June 2014)

The Ralph B. White Memorial Award “in recognition for unique contributions to Oceanographic Exploration and the Conservation of the Seas” (Presented by the Southern California Chapter of the Explorers Club June 14, 2014).

INVITED TALKS & MEETINGS ATTENDED:

The Atlantic Meets the Pacific Conference (La Jolla, CA) October 3-5, 2013. “*Antartic Talk*” (3 October 2013)

10th annual Austrian Science Talk in Santa Monica on 12 October 2013, hosted by the Federal Ministry for Transport, Innovation, and Technology and OSTA Washington. Annenberg Community Beach House (Santa Monica, CA). *Invited Talk* (12 October 2013)

Guest Speaker for Professor Larry Armi’s SIO Class (19 November 2013)

Meeting with Admiral Harriss, Mesom Building, SIO, La Jolla, CA (9 January, 2014)

ONR Arctic Meeting in Washington, D.C. (14-15 January 2014)

Joint Symposium Pontifical Academy of Sciences and the Pontifical Academy of Social Sciences: Sustainable Humanity, Sustainable Nature: Our Responsibility (Vatican City, Italy, 2-6 May 2014)
Invited Talk: “*An Oceanographic Perspective*” (5 May 2014)

Explorers Club (New York, N.Y.) Invited Talk: “*Antipodal Obsessions*” (15 March 2014)

Meeting with Commander Feldmeier (La Jolla, CA, 1 April 2014)

Scripps Sea Level Rise Workshop RE: Sunnylands (La Jolla, CA, 7-8 May 2014) Invited Talk: (8 May 2014)

Norwegian Scientific Academy for Polar Research Arctic Symposium (Bergen, Norway, 27-29 May 2014). Invited Talk: "*Waves and the Normandy Landing in 1944*" (May 28, 2014)

JASON (18 June – 3 August 2014)

Measurements of Earth Data for Environmental Analysis (MEDEA) Meeting at National Academy of Sciences, Washington, D. C. (23 July 2014)

Scripps Institution of Oceanography (La Jolla, CA) "*Gift of Seiche*" (31 July 2014)

Scripps Institution of Oceanography, Charlie Fest Symposium (La Jolla, CA) Invited Talk: "*To Charlie Kennel on his 75th Birthday*" (August 28, 2014)

ESOMM - 5th International Meeting on the Effects of Sound in the Ocean on Marine Mammals 2014 (Amsterdam, Holland 5-7 September 2014) Invited Talk: "Sound and Marine Animals" (5 September 2014)

ESOMM – 2 days of informal meetings with students (Island of Texel, Netherlands) Invited Talk: "Global Ocean Warming" (6 September, 2014)

Sunnylands Prince Albert Conference on Climate Change (Palm Desert 11-12 October 2014)

ONR Navy Chairs Meeting with Admiral Klunder in Washington, D.C. (21-22 October 2014)

DARPA Meeting RE: Arctic Watch in Washington, D.C. (23 October 2014)

Scripps Institution of Oceanography Retreat (October 2014). Remarks by Walter Munk (October 19 2014)

Meeting with Admiral Johnathan White at Scripps Institution of Oceanography, La Jolla, CA (31 October 2014)

REFERENCES and PUBLICATIONS

Peter N. Mikhalevsky*, Hanne Sagen, Peter F. Worcester, Arthur B. Baggeroer, Sue E. Moore, Craig M. Lee, Kathleen J. Vigness-Raposa, Lee Freitag, Agnieszka Beszczynska-Moeller, Olaf Boebel, Timothy F. Duda, Brian D. Dushaw, Jean Claude Gascard, Alexander N. Gavrilov, David K. Mellinger, Andrey K. Morozov, Walter H. Munk, Michel Rixen, Stein Sandven, Emmanuel Skarsoulis, Kathleen M. Stafford, Elling Tveit: *MULTIPURPOSE ACOUSTIC NETWORKS IN THE INTEGRATED ARCTIC OCEAN OBSERVING SYSTEM* Community White paper for the Arctic Observing Summit

Usama Kadri, William Farrell, Walter Munk (in Press), *Acoustic-gravity Waves, Theory and Applications*, Journal of Geophysic Research, To be presented by Usama Kadri at European Union of Geophysics (EUG) 2015

Munk, W. (2014) The Perfect Storm, Richard A.F. Penrose Memorial Lecture. *Proceedings of the American Philosophical Society* 157, no. 4 (forthcoming December 2014).