

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

PETROLEUM GEO-SERVICES INC.,
Petitioner

v.

WESTERNGECO LLC
Patent Owner

Cases

IPR2014-01475 (U.S. Patent No. 7,162,967)

IPR2014-01477 (U.S. Patent No. 7,080,607)

IPR2014-01478 (U.S. Patent No. 7,293,520)

DECLARATION OF MICHAEL S. TRIANTAFYLLOU

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I, Dr. Michael S. Triantafyllou, hereby state the following:

I. INTRODUCTION

1. I have over 40 years of research and development experience in the dynamics and control of marine vehicles and structures. I specialize in two fields: (1) control theory; and (2) the interactions between fluids and structures, including fluid mechanics and structural dynamics. A copy of my *curriculum vitae*, including a list of the publications I have authored within the last 10 years, is attached hereto as Exhibit A. I have provided testimony at a deposition and at trial in the past 4 years. These engagements are listed in Exhibit B. I am being compensated at a rate of \$350 per hour for the time I devote to this matter. I have no financial interest in the outcome of this litigation. The information I considered in forming my opinions is attached hereto as Exhibit C.
2. I earned a bachelor's degree in Naval Architecture and Marine Engineering in 1974 from the National Technical University of Athens in Athens, Greece. I have also earned the degrees of Masters of Science in Mechanical Engineering, and Masters of Science in Ocean Engineering, both awarded in 1977 from the Massachusetts Institute of Technology ("MIT"). In 1979, I earned a Doctorate of Science in Ocean Engineering from MIT. During the course of my doctorate studies, I conducted research on the dynamics and control of ships and positioning structures for the oil industry.
3. Since 1979, I have been a faculty member first in MIT's Ocean Engineering department and then in MIT's Mechanical Engineering department. I was an Assistant Professor from 1979 to 1983, and Associate Professor without tenure from 1983 to 1986. Much of my research during this time focused on cable mechanics, and specifically on the design of marine cable

lines subject to large forces, such as ocean currents. Many of the principles of cable mechanics are equally applicable to streamers used in marine seismic surveys. In addition to my research, I taught courses in the design of floating structures and the dynamics of ocean structures.

4. I earned permanent tenure status in 1986. I continued my research on cable mechanics, focusing specifically on towed cables, including streamers and towed arrays. In conjunction with the United States Navy, I studied the fluid mechanics of towed arrays for use behind submarines for the detection of other vessels. Though the precise nature of my work for the Navy remains confidential, it involved the development of the boundary layer theory around towed cables, as well as their hydrodynamics and maneuverability.
5. In 1990, I earned the title of Professor. I continued to work on the development of cables and towed arrays for the United States Navy, specifically focusing on conducting modeling studies for the hydrodynamics of marine cables.
6. Since 2004, I have served as the Director of the Center for Ocean Engineering at MIT. In 2008, I was named Associate Department Head of the Mechanical Engineering Department, and I currently serve as the William I. Koch Chair in Marine Technology. During 2007-2014, I conducted research focused on developing steering capabilities for the Navy's acoustic towed arrays. The technology is similar to the steerable streamer concepts employed by the oil exploration industry. Part of my research focused on simulating the overall performance of underwater arrays towed by helicopter at high speed for underwater detection. Arrays towed by helicopter present many of the same challenges as arrays towed by marine seismic vessels, but also present many additional challenges. For example,

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