Committee on Resources

Subcommittee on Energy & Minerals Resources

Witness Statement

Testimony of
The Center for Marine Resources and Environmental Technology
(formerly The Marine Minerals Technology Center)
Continental Shelf Division
Dr. J. Robert Woolsey, Director
The University of Mississippi

Before the
United States House of Representatives
Committee on Resources
Subcommittee on Energy and Mineral Resources

May 25, 1999

This statement is respectfully submitted in support of H.R. 1753 and S. 330, and of the Center for Marine Resources and Environmental Technology, Continental Shelf Division (CMRET / CSD), formerly the Marine Minerals Technology Center, a research center of the Department of Interior, administered by the Minerals Management Service, Office of International Activities and Marine Minerals. H.R. 1753 and S. 330, both titled the Methane Hydrate Research and Development Act of 1999, call for Congress to promote the research, identification, assessment, exploration, and development of methane hydrate resources. For the past two years, the CMRET has been actively pursuing academic, industry, and government collaborations for the study of methane hydrate resources. **Requested funding for the continuation of research on methane hydrates is $10 million per year, for each of the next five years.**

Certainly the topic of methane hydrates has been discussed within industry and academic circles for years, but never so much as in the very recent past. Gas hydrate resource estimates range from 100,000 trillion cubic feet (tcf) to well over 7,000,000 tcf under U.S. jurisdiction alone. If you consider that U.S. consumption of natural gas per year is only 22 tcf, gas hydrates represent a tremendous resource for this country. Their production, however, remains very problematical. Perhaps at this point in time, of more importance is the hazard they represent to the oil and gas industry. Prior to 1985, U.S. industry rarely looked for conventional oil and gas prospects beyond the 1,500 foot bathymetric contour in the Gulf of Mexico. Today, leases have been obtained in 11,000 feet of water, more than 400 miles offshore. The complexity and risk of deepwater oil and gas production are very considerable and must be met with an aggressive program of technological research and development based on sound scientific understanding, all of which translate to higher cost. A typical shallow water well might cost between $100 to $500 million; a deepwater development might be in the range of $1 to $3 billion. It is more critical now than ever before that mistakes not be made.

In the way of emphasizing the importance of hydrate research to the understanding and mitigation of related problems with sea floor stability, a number of recent incidences should be mentioned. At an industry forum held in Houston last June, Michael A. Smith of Minerals Management Service, New Orleans, noted that over the previous 14 years shallow water flows (SWF's) have been reported in about 60 lease blocks in the

Gulf of Mexico. They typically occur in water depths exceeding 1700 feet and originate in sand deposits located 1,000-2,000 feet below the sea floor. It is not a phenomenon peculiar to the Gulf of Mexico. Members of a panel of experts at a deep water workshop organized by the Society of Exploration Geophysicists in New Orleans last fall unanimously declared that shallow water flows presented the greatest obstacle to deep water drilling worldwide. A number of internationally recognized geologists have stated publically that the flows are very possibly associated with the dissociation of gas hydrates that had formed in the pore spaces of the sand bodies. The only way to detect such sand bodies prior to drilling is through detailed geophysical/geotechnical surveys. More research is critical to the development of reliable systems for the accurate identification of both gas hydrate deposits and buried sand bodies that are potential sources of SWF's.

***Current Activities of the Center for Marine Resources and Environmental Technology*:** During the past two years, the CMRET has been working on two pertinent projects: The first, and highest priority, is the development of high resolution survey technologies capable of detecting buried sand bodies and gas hydrate occurrences in offshore Mississippi/Louisiana. The most significant result to date is the conclusion that it is not possible to obtain sufficient seismic resolution by surveying only from the sea surface. A hybrid system is now being developed by which the seismic receiver (hydrophone) will be towed at depth while the seismic source is towed at the surface. The primary advantages of this arrangement are that 1) the hydrophone is deployed in a very quiet environment, away from the noise typically generated at the surface by wave action and the survey ship; 2) the downward-traveling signal received at the hydrophone constitutes a far-field source signature for each shot; and 3) this signature may be used during processing to enhance the resolution of the reflected (upward-traveling) signal and improve the estimates of sediment properties. Future development includes towing a high-resolution impulsive source at depth also.

The second project began as a collaboration among the CMRET, the U.S. Naval Research Laboratory (NRL) at Stennis Space Center and the U.S. Geological Survey (USGS) at Woods Hole, Massachusetts, and now involves an international team of scientists (see attached list) with the NRL and the USGS acting in an advisory capacity. The object of the project is to install a multisensor monitoring station on the sea floor in the northern Gulf of Mexico. The purpose of the station is to remotely observe physical and chemical changes of the water column and sea floor sediments in the vicinity of a gas hydrate mound. These mounds form along the intersections of faults with the sea floor. They are edifices constructed of water from the sea and hydrocarbon gases that have migrated up the faults from buried reservoirs. In addition to hydrates, they usually incorporate various minerals deposited by bacteria feeding on the hydrocarbons. The mounds are ephemeral, capable of changing greatly within a matter of days. Formation or dissociation of the hydrate constituents are dictated by pressure, temperature, gas chemistry and rate of gas flow. Variations in these can be triggered by water currents and seismic activity. Variations in sediment stability can also occur and be indicated by changes in the speeds at which compressional (P) and shear (S) waves propagate through sediments below the sea floor. The monitoring station would be capable of monitoring all these parameters, as well as some others such as heat flow and electrical conductivity, on a more-or-less continuous basis over an extended period of time. Members of the offshore petroleum industry have expressed interest and are expected to play a supportive role in making the station a reality. Conoco has offered access to their subsea facilities in the Mississippi Canyon area which will greatly reduce our cost, particularly with regard to power supplies and communication links.

Attached with this testimony are three relevant abstracts which have been submitted for publication or have been published.

The Gulf of Mexico Hydrate Research Consortium (GMHRC): In its 1997 report to the President, the

Panel on Energy Research and Development of the President's Committee of Advisors on Science and Technology recommended that the Department of Energy (DOE) develop a science-based program with industry, federal agencies, and the U.S. Navy to understand the potential of methane hydrates worldwide, with a recommended funding level of $45 million over a period of 5 years, beginning in FY 1999. It is our understanding that recommendations for the funding level have since been substantially expanded upwards to $150-200 million for a 10-year period. Senate Bill S. 330 and H.R. 1753 would authorize such a program. In response to this directive, the CMRET formed the Gulf of Mexico Hydrate Research Consortium (GMHRC) in March, 1998. The GMHRC is comprised of a group of researchers from academia, federal research institutions, and the U.S. Navy with varying but compatible interests in gas hydrates research. Under the management of the CMRET, the Consortium was formed for the purpose of promoting communication, coordination, and cooperation among interested researchers. The research mission of the Consortium will be primarily focused on the chemical and physical characterization of gas hydrate deposits, development and improvement of technologies for their recognition and mapping, assessment of sediment mechanics, sea floor instability as related to natural and anthropogenic events/activities of hydrate dissociation, engineering solutions for prevention/avoidance of instability and failure, investigation and monitoring of gas discharges to the water column and atmosphere, and scientific and technical research leading to the eventual production of methane hydrates.

The GMHRC would provide the DOE with a network of established, experienced, qualified researchers who could provide the best and most efficient means through which to approach scientific and engineering problems relating to gas hydrates (specifically those occurring within the Gulf of Mexico region). Maximum cost efficiency for the research dollar would be attained through the pooling of facilities, equipment and expertise. Ideally, the GMHRC will be guided by two Boards, an Industry Review Board and a Scientific Advisory Board, which will collectively be responsible for identifying and prioritizing research interests, and for issuing Requests for Proposals (RFP's), reviewing research proposals, and finally, for recommending funding. The CMRET, as head of the GMHRC, would be responsible for program administration, acting as liaison between the Boards and the consortium members, and for coordinating educational activities, data management and dissemination, and appropriate workshops, seminars, and annual research reviews.

MONITORING STATION DEVELOPMENT ROSTER AS OF 20 MAY 1999

Director:Bob Woolsey, Center for Marine Resources and Environmental

Technology (CMRET), The University of Mississippi

Technical Advisor:Paul Higley (Specialty Devices Inc., Plano, Texas)

Site Selection:Tom McGee (CMRET)

Harry Roberts (Coastal Studies Inst., LSU, Baton Rouge)

Pete Simpkin (IKB Technologies Limited, Nova Scotia)

Vaughn Goebel (Lookout Geophysical Co., Dillon, Colorado)

Ian Dinwoodie (Math. Dept., Tulane University, New Orleans)

Acoustics:Ross Chapman (School of Earth and Ocean Sci., U. of Victoria, B.C.)

Ralph Goodman (Applied Research Lab, Pennsylvania State Univ.)

Mary Rowe (High Tech, Inc., Gulfport, Mississippi)

Seismics:Ingo Pecher (Institute for Geophysics, Univ. of Texas, Austin)

Angela Davis (School of Ocean Sci., U.of North Wales, Bangor)

Geoelectrics:Rob Evans (Woods Hole Oceanographic Institute)

Lawrie Law (Consultant, Sidney, B.C.)

Spectroscopy:John Noakes (Center for Applied Isotope Studies, U. of Georgia)

John Pope (Blue Sky Batteries Inc., Laramie, Wyoming)

Valdislov Pustovoit (Cen. Design Bur. for Unique Inst., Moscow)

unnamed postdoc (Detection Limit Inc., Laramie, Wyoming)

Pore Water:Jeff Chanton (Department of Oceanography, Florida State University,

Tallahassee, Florida.)

Heat Flow: Earl Davis (Geological Survey of Canada, Sidney, B.C.)

Russian Collab.:Lev Utyakov (P. P. Shirshov Institute of Oceanology, Moscow)

SUPPLEMENT TO
Testimony of
The Center for Marine Resources and Environmental Technology
(formerly The Marine Minerals Technology Center)
Continental Shelf Division

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Long term monitoring of gas hydrates in the Northern Gulf of Mexico:

1. Objective

> Establish an integrated multisensor monitoring station on the continental slope of the Northern Gulf of Mexico.

2. Mission

a. Long term monitoring and comprehensive investigation of gas hydrates and their possible effects on seafloor stability, global environment, and their potential as a next generation major energy resource.

b. Investigation of the utilization of sound from proximal vessels as a more or less continuous acoustic source for long term monitoring of the water column and seafloor processes.

3. Design and Function

a. Net of four vertical arrays augmented by four-component horizontal arrays -- monitoring P waves in water column to determine local physical changes and P and S waves in seafloor sediment hosting gas hydrates (hydrate stability zone-HSZ) to monitor sound speed changes associated with phase changes, as well as seismic events.

b. Broad band ambient noise arrays -- acoustic monitoring of gas bubbles for seepage rate/gas volume estimates.

c. Geoelectric-electromagnetic instruments -- monitor permeability and conductivity in HSZ locations.

d. Heat flow sensors, seafloor and substrates -- monitor heat flow change.

e. Gas sensors/analyzers (for free and soluble gases) -- monitor changes in carbon gas chemistry.

f. Sediment pore-fluid sensors/analyzers -- monitor salinity changes in pore and bottom water.

g. AUV, multisensor equipped, station docked.

Note: Sensor systems (a) through (f) are designed for monitoring of gas hydrates (condition) on a continuous long term basis, as well as monitoring of natural and anthropogenic influences that may effect their formation/dissociation.

Sensor system (g) is an autonomous underwater vehicle (AUV) equipped with certain geophysical/geochemical sensors for the purpose of extending the radius of data acquisition. The AUV will be docked at an underwater facility near the monitoring station. The purpose of the vehicle is to launch on remote command, at periodic intervals and at special times, i.e. thermal events, etc., visit programmed locations, record pertinent data, return to dock and download acquired data, via platform mounted up-link thence via satellite to command center.

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