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WESTERN HEMISPHERE SECURITY ANALYSIS CENTER

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Independent Monitoring the Cuban Economic Zone Oil Development

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EXECUTIVE SUMMARY

The extensive impact and consequences of the 2010 Deep Water Horizon oil drilling rig failure in the Gulf of Mexico, together with expanding drilling activities in the Cuban Exclusive Economic zone, have cast a spotlight on Cuban oil development. The threat of a drilling rig failure has evolved from being only hypothetical to a potential reality with the commencement of active drilling in Cuban waters.

The disastrous consequences of a drilling rig failure in Cuban waters will spread over a number of vital interests of the US and of nations in the Caribbean in the general environs of Cuba. The US fishing and tourist industries will take major blows from a significant oil spill in Cuban waters. Substantial ecological damage and damage to beaches could occur for the US, Mexico, Haiti and other counties as well.

The need exists for the US to have the ability to independently monitor the reality of Cuban oceanic oil development. The advantages of having an independent US early warning system providing essentially real-time data on the possible failure of a drilling rig in Cuban waters are numerous. An ideal early warning system would timely inform the US that an event has occurred or is likely to occur in, essentially, real-time.

Presently operating monitoring systems that could provide early warning information are satellite–based. Such systems can indicate the locations of both drilling rigs and operational drilling platforms. The system discussed/proposed in this paper relies upon low-frequency underwater sound. The proposed system can complement existing monitoring systems, which offer ocean-surface information, by providing sub-ocean surface, near-real time, information. This “integrated system” utilizes and combines (integrates) many different forms of information, some gathered through sub-ocean surface systems, and some through electromagnetic-based remote sensing (satellites, aircraft, unmanned arial vehicles), and other methods as well. Although the proposed integrated system is in the developmental stage, it is based upon well-established technologies.

INTRODUCTION

Numerous articles and opinion pieces suggest increasing cooperation with Cuba in environmental areas to deal with oil spills irrespective of whether those spills originate in the US Exclusive Economic Zone or the Cuban Exclusive Economic Zone. The risk of oil spills off Cuban coasts has been used by some in support of political views. For some, it serves to explain why it is important to weaken or remove the long-standing US embargo of Cuba. Others argue that the US is losing out by not having US oil companies involved in oil drilling in Cuban waters. [1] It is often further argued that the US has the capabilities to deal effectively with major oceanic drilling ring failures and any attendant oil spills.

The US and Cuba have reached agreements in the past on several issues. It is possible that cooperation may also develop in environmentally protective activities. Yet, cooperation in oil drilling and production activities may or may not be reached.

A central question in Cuban drilling activities will be quality control of the oil drilling and production equipment, quality of methods utilized, and quality and level of training of personnel. Much of the drilling equipment to be used is reputed to be of Chinese manufacture. The equipment will likely be operated by personnel from a number of countries (presently with US personnel excluded). Will any sort of emergency standby plan be developed for use in the event of a Cuban drilling rig failure? Will the rigs be constructed as to withstand major natural events such as hurricanes?

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[1] For example, see the recent piece by J. Pinion and R. L. Muse, "Coping with the Next Oil Spill: Why U.S.-Cuba Environmental Cooperation is Critical," Brookings Institute, Issue Brief No. 2, May 2010.

The need exists for the US to have the ability to independently monitor the reality of Cuban oceanic oil development. An optimum circumstance would be one in which the US has the ability to monitor drilling activities at a distance in real time. In particular, it would be very valuable to have real time information on the occurrence of a drilling rig or other failure in oceanic oil activities. This paper proposes a non-invasive "integrated system" that utilizes many different forms of information, some gathered through oceanic "in situ" systems, some through electromagnetic-based remote sensing as well as other in order to monitor drilling activities.

OIL SPILL RISKS OFF CUBAN COASTS

In recent decades, discoveries of potentially significant oceanic sub-bottom surface oil and gas deposits in the Cuban Exclusive Economic Zone (EEZ) have taken place. Projections of the amount of oil contained may have significant errors, but estimates on the order of 4-6 billion gallons of oil have been made by the US Geological survey.[2] The writer is unaware of any oil production presently ongoing in the Cuban EEZ.

Several international entities are engaged in Cuban oil-related activities. Among them: the Spanish Corporation Repsol YPF, (which found light oil in Cuban deep waters in 2004); and oil companies of Norway, Brazil, Malaysia, Vietnam, Venezuela and China. In June 2010, the Russian state oil enterprise, JSC Zarubezhneft, opened an office in Havana to increase cooperation with Cuba in this sector.[3]

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[2] USGS-ERP 2004.

[3] EFE, "Firma petrolera rusa abre una oficina de operaciones en Cuba," *El Nuevo Herald* (Miami, FL: 26 June, 2010) http://www.elnuevoherald.com/2010/06/26/752528/firma-petrolera-rusa-abre-una.html#ixzz0s9cMuVk5.

The bottom topography of portions of the Caribbean and Gulf of Mexico are shown in Figures 1 and 2.

Figure 1 shows the general bathymetric features of the Caribbean and Gulf and includes the names of some prominent bathymetric features.

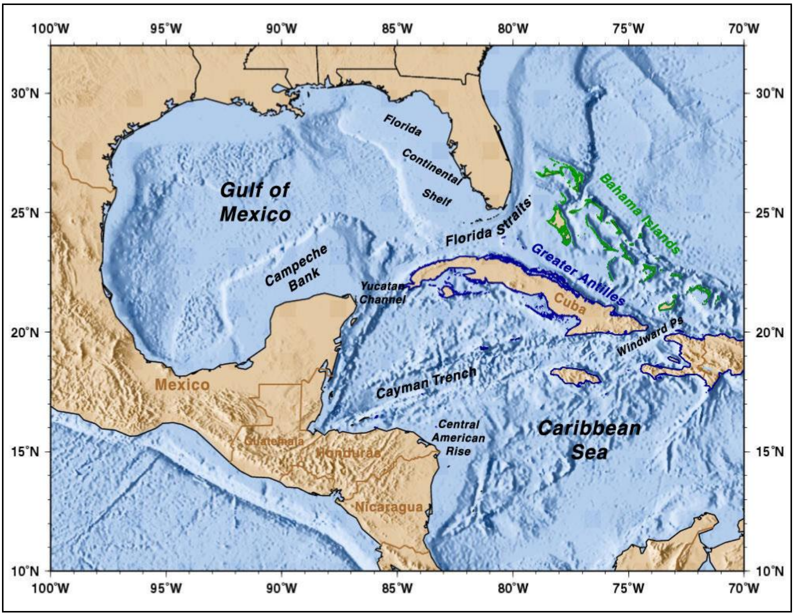

Figure 1. *Bathymetric features of the Caribbean Sea and Gulf of Mexico*[4]

Figure 2 shows a smaller region of the Caribbean and the Gulf and includes some bottom depth contours. Note that bottom depths north-northwest of Havana Cuba reach 2,000 meters (about 6,000 feet) and beyond.

[4] http://oceancurrents.rsmas.miami.edu/atlantic/img_topo1/loop-current2.jpg visited 06-07-2010.

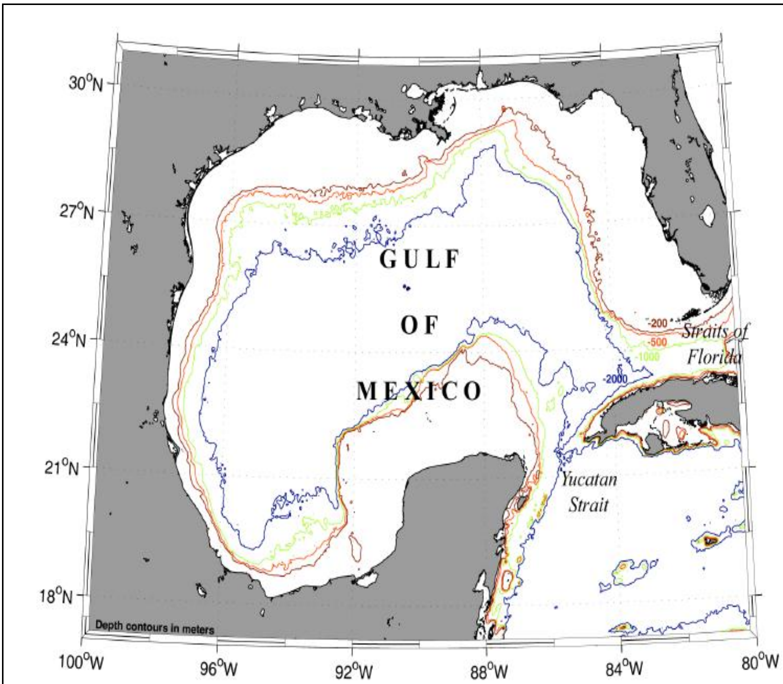

Figure 2. *Bathymetry of the Gulf of Mexico*[5] .

Figure 3 shows the boundary line of the US and Cuban EEZs. Figure 3 also shows some of the bottom tracts that Cuba is either leasing or proposes to lease to foreign oil drilling entities.

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[5] Smith, W. H. F., and D. T. Sandwell, 1997; Global seafloor topography from satellite altimetry and ship depth soundings, *Science*, v. 277, 1957-1962.

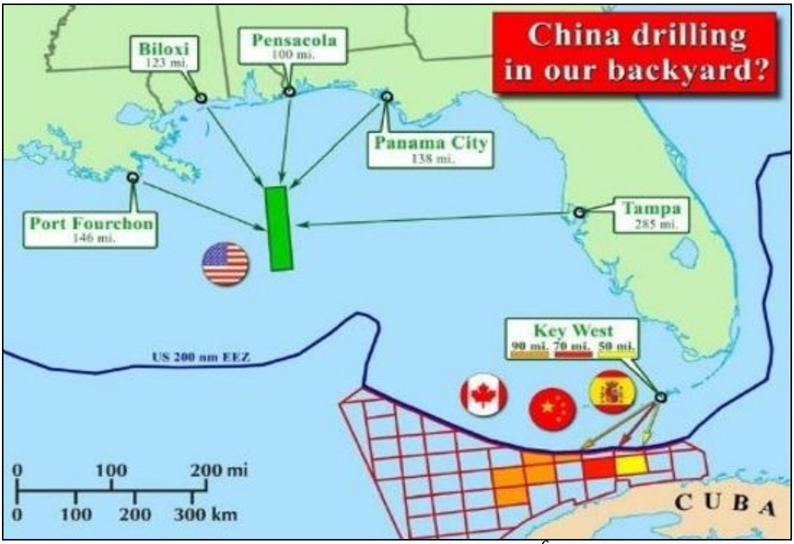

Figure 3 *Drilling activities in the Gulf of Mexico* [6]

From the figures above and from the oil-related activities being conducted, several observations are possible:

1. The quality of drilling rig equipment (reputedly being primarily manufactured in China) is largely unknown and may be difficult to determine;

2. The activities will be under foreign control, including Cuban control;

3. Drilling will be occurring in waters including depths in excess of 500 meters; and

4. There is no a priori need by exploiters of Cuban oil for US participation.

After the Deep Water Horizon, the Obama administration

[6] http://i27.tinypic.com/28klxds.jpg.

reversed previous decisions on authorizing trips to Cuba on oil-related issues. It licensed a US Houston-based oil drilling group to visit Cuba to start cooperation on safety and environmental practices. Also in May 2010, the International Association of Drilling Contractors (IADC) received permission to travel to Cuba to discuss safety and environmental practices.

The ambient ocean currents in the Cuban EEZ are complex. However, a clearly important feature is the Gulfstream, which passes between Florida and Cuba. The Gulf of Mexico is linked with the Atlantic Ocean through the Strait of Florida and to the Caribbean Sea through the Yucatan Channel. The Gulfstream forms the "loop current" in the Gulf of Mexico for portions of the year (see figure 4). This current is likely to transport oil spilled in the Cuban EEZ to Florida and to the Eastern United States. Through this current and other possible currents north of Cuba the potential of the transport of Cuban oil to Haiti, Mexico and other Caribbean nations exists. An important point to note is that an oil spill in the Cuban Exclusive Economic zone (Figure 3) is likely to reach Florida and the eastern US in a far shorter period of time than water from the Deep Water Horizon (DWH) oil spill. This implies that oil reaching US waters will be far less weathered than oil from the DWH, and thus the potential of thick patches of oil reaching Florida exists.

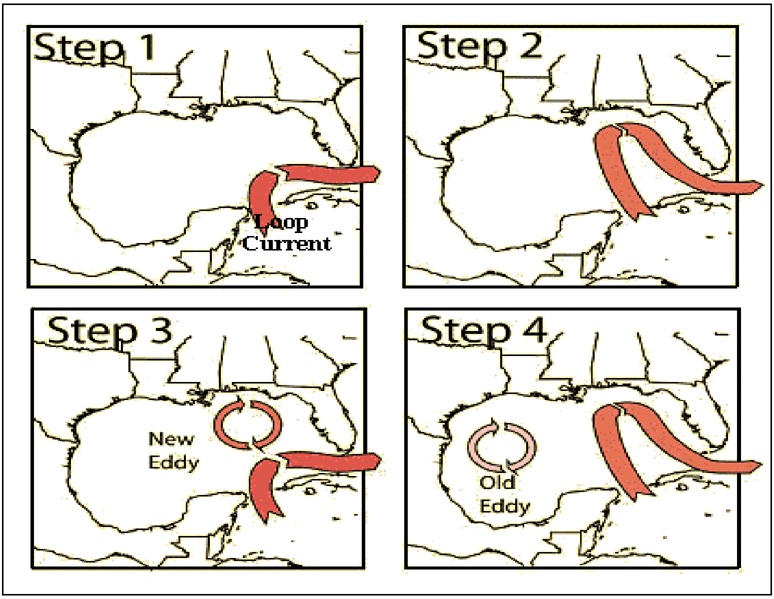

Figure 4 *A schematic of the Loop Current flow northwards into the Gulf of Mexico* [7]

At present it appears that only minor spills from tankers have occurred in the Cuban EEZ so that no effects from spills in the Cuban EEZ have ben documented. Beyond the more widely recognized possible impacts of oil spills, there is also the potential fisheries impact due to fishes and other organisms spending portions of their life cycles in Cuban and American waters.

INTEGRATED MONITORING SYSTEMS

Monitoring systems can utilize multiple forms of information and thus, be comprised of multiple different sensor systems. Over the last several decades satellites have proven to be very effective components of an integrated monitoring system. The applications of satellites to monitoring Soviet missile activity in Cuba during the Cold War are well

[7] turkish.wunderground.com/.../loopcurrent.asp.

recognized. The sensor suites mounted on satellite platforms have included both passive and active electromagnetic and optical systems. (Passive systems only record information generated by objects of interest, while active systems send information gathering signals or emissions reflected from objects of interest). Passive systems are, of course, generally far less easy for the target/object of interest to detect.

Satellite-based monitoring systems have some limitations. A basic limitation is the time period during which a section of the ocean's surface is overflown by a given satellite. Some satellites are effective during daylight hours only. Others have fields of resolution which are not adequate to address the problem at hand. Of course, the basic limitation is obtaining ocean surface data only; penetration of the ocean surface by satellite borne sensor systems is highly restricted.

The new component of an integrated monitoring system for oil drilling monitoring is based on underwater sound. Underwater sound information is gathered from within the body of the ocean and thereby significantly overcomes the ocean surface penetration restriction encountered by satellite systems. Furthermore said underwater sound system can operate 24 hours per day with little nighttime restriction. Additionally said system provides essentially real-time data, another significant advantage.

Another sensor system carrying platform, which came into use in the last few decades have been unmanned drones or unmanned aerial vehicles (UAV). These vehicles have carried both passive and active sensor systems. Surface ships, submarines, and buoys have also been used as components of a monitoring system. Also coming into greater use more recently have been autonomous underwater vehicles (AUV) on which both active and passive sensors have been mounted. Active sensor systems are "intrusive systems" in the sense that some energy has been sent into a region where permission to enter is generally not available. Even more intrusive are incursions made by the platforms on which the sensor systems are mounted into regions where permission to enter is not granted. An ideal monitoring system may have both intrusive and non-intrusive components. For present considerations a non-intrusive passive system is of principal interest. Present monitoring systems which have active components are intrusive and have the possibility of being detected. The proposed new system is passive in nature with very little prospect of being detected.

NEW MONITORING SYSTEM FOR CUBAN OIL DRILLING

A new passive and non-intrusive monitoring system is here proposed for Cuban oil drilling. The new system being considered herein has so far focused on the drilling aspect of oil production. An important question is can the system provide information during the production phase of the oil activity? There are many aspects of the oil production phase, for example ship activity, which should be successfully monitored using underwater sound. The ability of the contemplated new system to monitor other aspects of the oil production process besides the drilling phase, such as operation of the oil platform, and catastropihic failures of the oil flow process, will depend upon the degree to which these processes effectively create underwater sound. Indeed a first phase of the evaluation of the proposed new system design would be the monitoring of certain existing oil production platforms to determine the generated underwater sound levels.

The new proposed system is, essentially, a real-time system that can be located totally in US waters or in US waters and “friendly” waters. It utilizes time-tested methods developed in the course of the anti-submarine warfare programs of the

Cold War. Verbal reports of the inadvertent detection of oil rigs have existed in the underwater sound community for some years.

The proposed system consists of a set of passive underwater sound sensors. The sensor systems will operate in a frequency range selected so as to capture the full spectrum of underwater sounds emitted by a drilling system operated in Cuban waters. It is based on the notion that a drilling operation creates a series of well-defined sounds as the rig machinery operates, which includes sounds associated with movement of the drill stem. It is anticipated that, at least, certain components of the oil production activity may be monitored by the proposed new system. The extent to which oil production (or production halts) may be monitored by the new system will depend upon the level of underwater sound produced by the different activities associated with production. The sensor systems are either hard wired to shore or use remote data transmission methods.

The systems can operate 24 hours every day of the year. It would provide measurements every few seconds, so that if the drilling operations were to halt for any reason, this would be known within a few seconds. The system can be designed to monitor more than one drilling rig at a time and thus can separate "rig-local" events from multiple rig concurrent events.

Building such a system would require a series of steps/tests/research in order to validate the concept and demonstrate that it is possible to have it constructed and perform as desired. The system can either function entirely on its own or can be integrated with other monitoring systems, such as satellites.

The system that is being proposed can yield information on the performance of a drilling rig before and after passage of a hurricane or other natural phenomenon, e.g. an earthquake. Passive underwater sound systems have reputedly been operated in the past in the Gulf of Mexico and thus could provide useful background information for the new system design. Data from the new system could be integrated with satellite systems as well.

As secondary products, the system could provide information on ships and whales in the vicinity of the rigs. The impact of drilling rigs on whales is a subject of interest in the marine mammal community.

The proposed new system is presently under discussion. These will include definition of costs, development steps, and a time line for development and deployment.

CONCLUSION

The prospect of extensive oil drilling and production in the Cuban EEZ has become a reality. Concurrently the prospect of a major oil spill in Cuban waters wreaking havoc on US coastal and economic interests has also become a reality. Accordingly, the US must be in a position to gain reliable, independent information on the occurrence of a major spill event at the earliest possible moment. The proposed new system provides this opportunity.

Environmental and drilling rig safety cooperation between the US and Cuba, if this were to be developed, would still not guarantee transparency of Cuban drilling rig operations nor the swift communication of drill rig failures. Only a reliable US operated monitoring system will do this. To quote President Ronald Regan "*Trust but verify.*"

WORKS CITED

EFE, "Firma petrolera rusa abre una oficina de operaciones en Cuba," *El Nuevo Herald* (Miami, FL: 26 June, 2010). http://www.elnuevoherald.com/2010/06/26/752528/firma-petrolera-rusa-abre-una.html#ixzz0s9cMuVk5.

http://i27.tinypic.com/28klxds.jpg. visited 06-07-2010.

http://oceancurrents.rsmas.miami.edu/atlantic/img_topo1/loop-current2.jpg. Visited 06-07-2010.

http://oceancurrents.rsmas.miami.edu/atlantic/img_topo1/loop-current2.jpg. Visited 06-07-2010.

Pinion, J. and Muse R.L. "Coping with the Next Oil Spill: Why U.S.-Cuba Environmental Cooperation is Critical" Brookings Institute, Issue Brief No.2, May 2010.

Smith, W. H. F., and D. T. Sandwell, 1997; "Global seafloor topography from satellite altimetry and ship depth soundings" *Science*, v. 2**77**, 1957-1962.

turkish.wunderground.com/.../loopcurrent.asp USGS-ERP 2004.

ABOUT THE AUTHOR

Dr. John R. Proni is the Executive Director of the Applied Research Center (ARC) at Florida International University (FIU). Prior to joining ARC in 2009, Dr. Proni spent more than 36 years with the National Oceanic and Atmospheric Administration (NOAA). In his last position with NOAA, Dr. Proni served as the Director of the Ocean Chemistry Division (OCD) of the Atlantic Oceanographic and Meteorological Laboratory (AOML) in Miami. He was also as Director of the Ocean Acoustics Division and principal investigator, conducting research in energy production, satellite observations of oceanic features and the use of acoustics in pollution studies.

Dr. Proni has been developing innovative concepts with Federal agencies and private industry to help provide improves technological and scientific understanding to better position the United States in the future. He has written and presented more than 100 papers in scientific journals and at scientific meetings. He received the Distinguished Authorship Award from the U.S. Department of Commerce twice for his work on satellite and acoustical observations. Most recently, he received a U.S. Department of commerce Bronze Medal for his role in the study of coral reefs. Dr. Proni earned his Ph.D. in physics at North Carolina State University.

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