MMS OCEAN SCIENCE
VOLUME 2 ISSUE 6
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THE SCIENCE & TECHNOLOGY JOURNAL OF THE MINERALS MANAGEMENT SERVICE

Meeting the Challenge in the Face of Nature's Wrath

A Hurricane on the OCS

Tahiti Field Development

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Effects on Arctic Cisco

Down But Not Out

Powerful New Lessons

NOVEMBER/DECEMBER 2005
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ABOUT THE COVER

Top: *Mars* platform before Hurricane Katrina.

Bottom: *Mars* platform damage after Hurricane Katrina. Photos courtesy Shell Exploration & Production.

All photos courtesy of Minerals Management Service unless otherwise noted.

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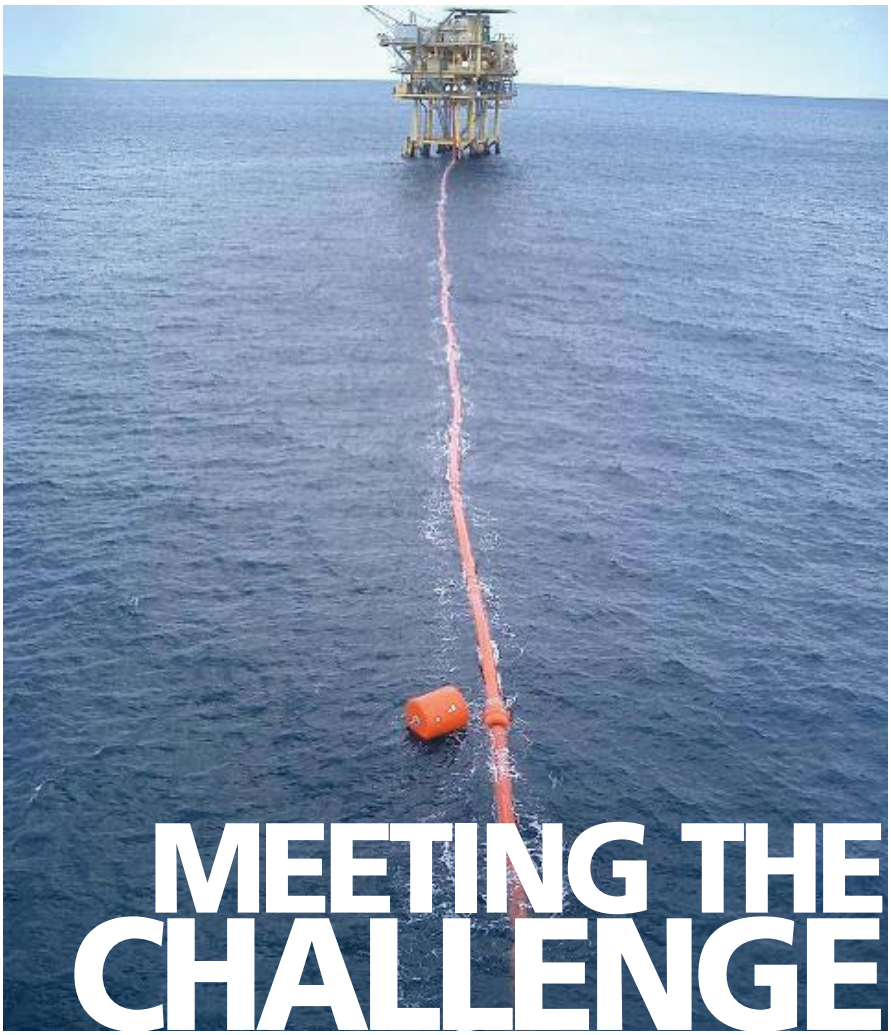


MEETING THE CHALLENGE

Left and Below: Transferring of oil from a platform to a tanker. After the hurricanes, onshore facilities were damaged, making it impossible to transport the oil from the platform to shore through pipelines. Transferring the oil to a tanker allows the product to reach undamaged facilities.

Bottom: Hurricane tracks in the Gulf of Mexico. Red is Rita, yellow is Katrina, green is Ivan, and purple is Dennis.

Extracting oil and gas from geological formations thousands of feet below the ocean's surface without adversely affecting the surrounding ecosystems is difficult at best. The equipment needed to do so is technologically and financially challenging. When that equipment is confronted by the fury of a major hurricane with 145+ miles per hour winds, the results can be disastrous. But when two large storms hit within weeks of each other, the results can be catastrophic. Yet in the aftermath of Hurricanes Katrina and Rita, the damage, while extensive, is not irreparable. This is due in part to the lessons learned from earlier hurricanes and to the cooperative effort of the Minerals Management Service (MMS) and its industry and academic partners.

IN THE FACE OF NATURE'S WRATH

After Hurricane Ivan in 2004, operators in the Gulf of Mexico, in cooperation with MMS, have reviewed and considered technologies to ensure equipment is stronger, smarter, and better able to withstand the stresses of storms such as Katrina. Studies funded by MMS have helped scientists understand hurricanes and predict their force. And additional studies have been awarded to learn more about Hurricane Ivan – studies that may reduce damage in future hurricanes.

The mission of MMS is to oversee offshore oil and gas exploration and production, safeguard human life, protect the marine environment, and ensure that our Nation receives fair market value for those resources. That mission is made much more difficult by natural disasters such as Katrina and Rita. With the help of its industry and academic partners, MMS is exploring new technologies, researching new frontiers, and formulating new plans of action that will ensure that its mission is successful and America's energy future is always secure.

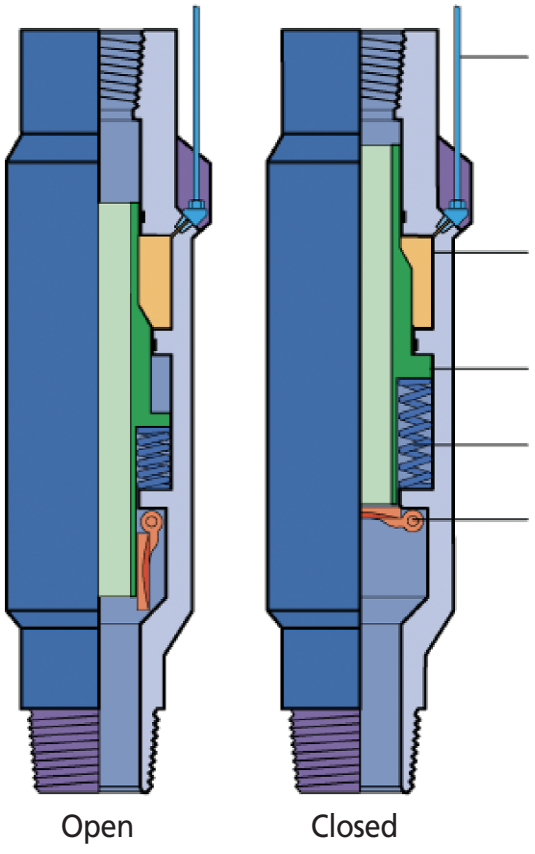
PLANNING FOR THE WORST

A HURRICANE ON THE OCS

An approaching hurricane raises the level of concern for the Minerals Management Service (MMS) and the offshore oil and gas industry long before it reaches the waters of the Gulf of Mexico. The MMS and industry must prepare for the protection of offshore workers, equipment, and the environment. Pre-storm planning is used to outline evacuation methods, shut-in of production, and post-storm start-up procedures.

The monumental job of evacuating the 25,000-30,000 offshore workers begins well in advance of the hurricane. Helicopters and boats take all but those essential employees necessary to "shut-in" the facility. The process of closing down or shutting in the facility may be accomplished either on the platform or, for many new platforms, remotely through the Supervisory Control and Data Acquisition (SCADA) system.

All wells on the Outer Continental Shelf (OCS) must be equipped with downhole safety valves that shut off the flow of oil in the event of an emergency. Should the platform be damaged, these valves "shut-in" production flow to prevent pollution events until the production can be safely reestablished.



The MMS requires all wellbores in the Gulf of Mexico to include a downhole safety valve (DSV) pictured here. A DSV isolates wellbore pressure and fluids in the event of an emergency or failure of surface equipment. In severe hurricanes, closing the DSV eliminates the potential for the escape of any oil, gas, or wellbore fluid into the Gulf. During Hurricanes Katrina and Rita, these devices were 100% successful in preventing an accidental release.

Operators are required to report shut-in production statistics to MMS. These statistics include the platform name, daily oil production, cumulative oil shut-in, daily natural gas production, cumulative natural gas shut-in, anticipated production return time, and the reason production was shut-in. At the height of Hurricane Katrina, 100% of oil production and 94% of gas production on the OCS was shut-in. During Hurricane Rita, the worst storm to affect the offshore industry, again 100% of the oil and 86% of gas production was shut-in.

As the storm abates, operators return to inspect the damage to the platforms, rigs, and equipment. They must inspect for damage above water and underwater. If the initial underwater inspection detects significant structural damage, more detailed underwater inspections must be conducted. A complete inspection of pipelines must also be completed before start-up. A visual inspection is conducted by divers or remotely operated vehicles (ROV's). A check for flow, leaks, or other damage that cannot be readily seen by the initial visual inspection is also required.

Repairs may entail rerouting the flow of oil or gas through other pipelines. For others, repairs may take a year or more and cost millions of dollars. In cases where pipelines will not be available for a long period of time, alternative transportation methods are available, such as where the oil may be transferred to a tanker and taken to shore (see page 3).

When the repairs are finished and inspections completed, production will resume. At each step of the start-up, MMS works with industry operators to allow the production to be resumed as rapidly as possible while still ensuring the protection of human lives and the ocean environment.

ADDING TO DOMESTIC PRODUCTION

TAHITI FIELD DEVELOPMENT

Chevron USA recently announced the start of construction of the floating production facility for installation in the Tahiti Field. Tahiti is located in Green Canyon Blocks 640, 641, and 596 of the Gulf of Mexico, 190 miles south of New Orleans, and will be developed from two subsea drill centers producing to a floating production facility supported by a truss spar.

The subsea drill centers will be located near the two Tahiti appraisal wells in Green Canyon Blocks 596 and 640 that were completed in 2003. One of the appraisal wells encountered more than 1,000 feet of net pay, one of the most significant net pay accumulations in the history of the deepwater Gulf of Mexico.

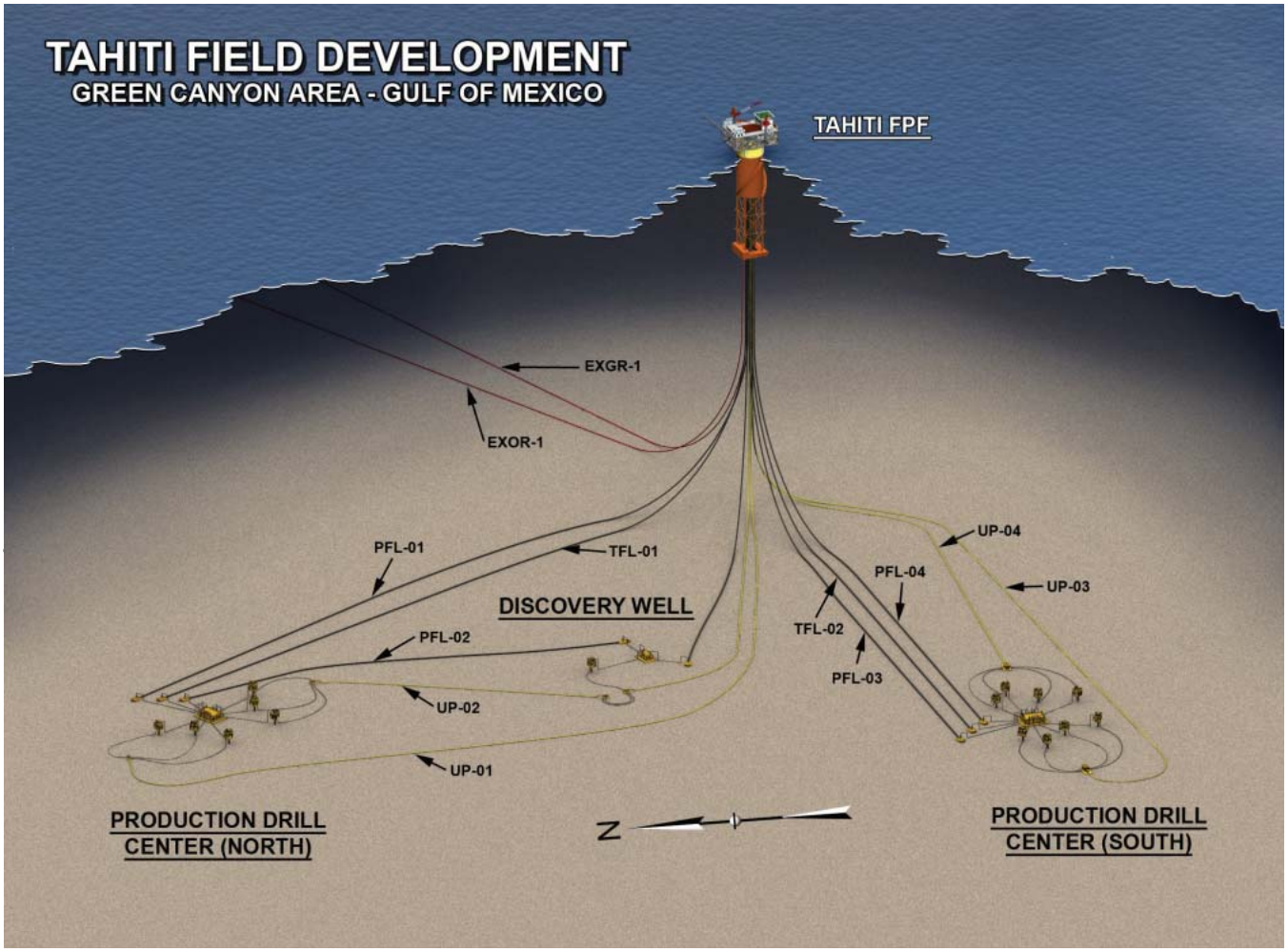
Tahiti is one of the Gulf's largest deepwater discoveries, located in 4,200 feet of water, and is believed to hold 400–500 million barrels of potentially recoverable oil-equivalent.

The Tahiti Field is designed to have a daily production capacity of 125,000 barrels of oil, 70 million cubic feet of natural gas, and treatment capability for 120,000 barrels of produced water. The field will be developed in phases. Chevron holds a 58% majority share in the joint venture Tahiti project with Statoil ASA holding 25% of the project and Shell Exploration and Production Co. a 17% share. Chevron, as majority participant, will serve as the operator of the field. Total capital costs for the project are anticipated to be approximately $3.5 billion, including the first phase cost of $1.8 billion. The first phase is expected to achieve production by mid-2008.

The deepwater spar hull will be 558 feet (170 meters) long and 128 feet (39 meters) in diameter and have a steel weight of 24,000 metric tons. Delivery of the hull and topside modules is set for mid-2007.

The Tahiti Field, when fully developed, is expected to add significantly to the production of domestic oil and gas, having a positive impact on the Nation's reliance on imported oil and gas.

Diagram of the planned Tahiti project showing the truss spar floating production facility (FPF) and the tie-backs from several wells. Diagram courtesy of Chevron.



IVAN THE TERRIBLE

TAKING ANOTHER LOOK

While damage to oil and gas production in the Gulf of Mexico (GOM) from Hurricanes Katrina and Rita continues to be assessed, a study of the lessons learned from last year's Hurricane Ivan may help operators in the GOM better prepare for the next Katrina.

Hurricane Ivan hit the GOM with 140+ mile-per-hour winds. Although 150 platforms and 10,000 miles of pipelines were directly in the path of Ivan, there was no loss of life and no significant pollution. Thirty-one platforms were seriously damaged or destroyed and 10% of the GOM production was interrupted for over four months.

Facilities that were damaged by Ivan include mobile drilling rigs, offshore platforms, producing wells, topside systems including wellheads and production and processing equipment, risers, and pipeline systems that transport oil and gas ashore from offshore facilities.

Last year, the Minerals Management Service (MMS) awarded contracts to study the impact of Ivan on offshore oil and gas structures in the Gulf. One study explores information from wave gauges deployed by the Naval Research Laboratory on the Outer Continental Shelf (OCS). Preliminary findings suggest that wave heights were over 69 feet and that maximum crest-to-trough heights of individual waves exceeded 132 feet near the eyewall.

Other studies will assess the consequential damage to structures and pipelines, determine the effectiveness of current design standards and pollution-prevention systems, and develop recommendations for changes, if needed, to industry standards and MMS regulations.

For more information:

Subject: Hurricane Ivan Research

Website: www.mms.gov/tarprojectcategories/HurricaneIvan.htm

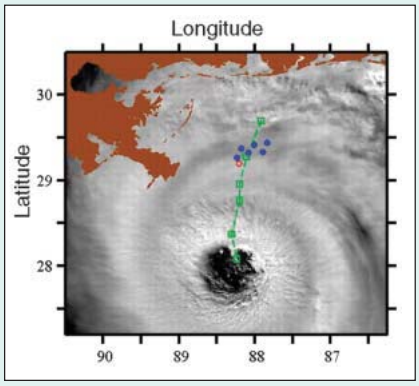
Subject: Hurricane Ivan Information

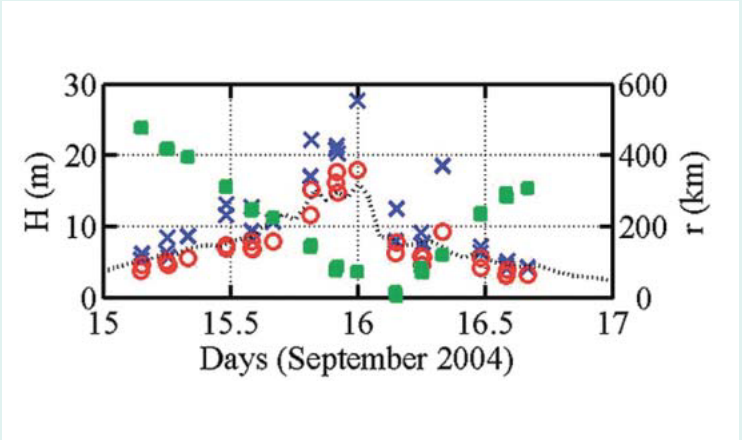
Website: www.gomr.mms.gov/homepg/whatsnew/hurricane/ivan.html

Extreme Waves Under Hurricane Ivan

On September 15, 2004, the center of Hurricane Ivan passed directly over six wave-tide gauges deployed by the Naval Research Laboratory (NRL), at depths of 60 and 90 meters (197 and 295 feet), on the outer continental shelf in the northeastern Gulf of Mexico, allowing measurement of the extreme waves directly under this Category 4 hurricane.

The satellite image (right) shows the eye of Hurricane Ivan just southeast of the boot of Louisiana on September 15, 2004 (provided by NRL's Ocean Optics Group). The NRL moorings are shown as blue dots. A National Data Buoy Center (NDBC) buoy is shown as a red circle and the track of Hurricane Ivan is shown in green with the squares marking the hurricane's center every three hours.





The chart (left) indicates the wave height (H) in meters for significant wave height (circles) and maximum wave height (crosses) for the six moorings and wave height for the NDBC buoy (dotted line) over time (days). The radial distance of Hurricane Ivan's center from the buoys is shown as green squares. Waves were observed with significant wave heights reaching 17.9 meters (59 feet) and maximum crest-to-trough individual wave heights of 27.7 meters (91 feet). Analysis suggests that significant wave heights likely surpassed 21 meters (69 feet) and that maximum crest-to-trough individual wave heights exceeded 40 meters (132 feet) near the eyewall.

WORKSHOP CONVENES TO DISCUSS FACTORS

EFFECTS ON ARCTIC CISCO

Falling catches of Arctic cisco in recent years and the possible correlations with offshore development are of great concern to residents of the North Slope Borough. The Minerals Management Service (MMS) convened a workshop on the variability of Arctic cisco (Qaaktaq) in the Colville River and brought together local experts from Nuiqsut, Kaktovik, and Barrow, Alaska, and Tuktoyaktuk, Canada, as well as scientists from the United States and Canada. Collectively they represented a wealth of expertise and experience.

The primary goals were to share their knowledge of the Arctic cisco, to identify important questions and to consider how those questions might be answered in the future.

Commercial catches within the Colville Delta have been monitored since 1967, and subsistence catches since 1985. Reported catches have been variable over time, with a series of declining catches from 1997 to 2002, which has caused community concern.

A panel of community elders and local experts recounted to fellow workshop participants their personal observations of historical catches of Arctic cisco and events associated with the rise and fall of the catches or availability of the fish. Some of these observations were before 1940. The changes most emphasized in the presentations were the decreases in subsistence catches from nets set under the ice of the Colville River during the 1970's, with many examples of catches dropping from hundreds of fish per day to tens of fish or less per day. Residents reported Arctic cisco have also decreased in size, now requiring the use of smaller mesh nets. Concerns and possible correlations with oil development include both onshore and offshore activities. Additional presentations of Arctic cisco ecology, oceanography, genetics techniques, and fisheries modeling continued with discussions of issues and information needs.

The workshop participants prioritized the topics of most concern, which were

1. Effects of development and human activities
2. Review previously collected Canadian and Alaskan data, including Elders' information
3. Arctic cisco life history
4. Migration of young of the year from Mackenzie River
5. Water quality, contaminants
6. Genetics, source stocks
7. Colville river dynamics
8. Ice roads and bridges
9. Seismic, noise
10. Climate change
11. Socioeconomics

There was a consensus among participants that initial efforts should be made to collect and synthesize available information. There are very good catch statistics for the commercial fishery since 1967 and the subsistence fishery since 1985. There are relevant data on the fisheries, fishes, oceanography, weather, water quality, and land use.

Participants identified potential State, Federal, and international agencies or organizations that may be approached for joint efforts or possible funding for this project. Particular importance was given to the potential for a cooperative or collaborative effort between the Canadian and Alaskan communities. For some concerns such as water quality, groundwater contamination, and measurements of body burden levels of possible contaminants in subsistence foods, there are existing programs in which the community can ask for assistance or participation.

FOR MORE INFORMATION:

Proceedings of a Workshop on the Variability of Arctic Cisco (Qaaktaq) in the Colville River

Website: www.mms.gov/Alaska/reports/2004Reports/2004_033.pdf

Top: Nuiqsut resident clearing ice to access his fish net in the Colville River on a relatively warm day (above 0° F) at sunset (about 2 P.M.).

Middle: Harvesting Arctic cisco (Qaaktaq) after the other end of the net is pulled up through another ice hole.

Bottom: The Arctic cisco (Qaaktaq) is a crucial subsistence food resource for residents of Nuiqsut on the northern coast of Alaska.

DOWN BUT NOT OUT

Courtesy CIMMS/SSEC and Rick Kohrs/UW-SSEC

MMS SOLDIERS ON IN AFTERMATH OF HURRICANES KATRINA, RITA

The one-two punch of Hurricanes Katrina and Rita had a catastrophic impact on MMS employees in the New Orleans office and other locations.

In New Orleans, with about 500 MMS employees, the impacts have been devastating on both personal and professional fronts. Many employees have lost their homes and all are dealing with the impacts. The MMS office building was damaged but escaped the destruction that so much of the city has experienced. Repairs have begun.

Fortunately, the MMS workforce knows how to land on its feet. A temporary office was established in Houston by the Gulf of Mexico Region Continuity of Operations Team before Katrina hit and quickly expanded in the storm's wake. This temporary office is a new work home for 150 employees. Crisis counseling is being made available to all MMS employees affected by the storms.

"We know many of our staff face very tough times in the wake of Hurricane Katrina," MMS Director Johnnie Burton told employees in the aftermath of Hurricane Katrina. "I know that all the members of the MMS family wish to send our thoughts and prayers to our co-workers and their families," she said. "While we need to restore the operational capabilities of the MMS Gulf region, we are concerned first about the safety of all our staff. I am humbled by the dedication already demonstrated by many of our staff and want to thank everyone for their continued support. As the President has said, right now we face very tough times but as a Nation we will recover and we will be stronger. A million thanks to everyone."

On September 13, Secretary Norton and MMS Director Johnnie Burton met with MMS employees who relocated their regional headquarters from New Orleans and commended them for their outstanding dedication and effort. Despite their personal losses, these professionals continue to work with energy companies to help restore Gulf oil and gas production shut down by the storms.

Norton thanked Interior employees for their commitment and efforts. "More than 1,400 Interior employees are working with local and State agencies to rescue residents trapped by the storm, provide food, water and shelter, and help with recovery efforts throughout the region," Norton said. "MMS employees, many of whom lost their homes and possessions, have been especially dedicated, carrying on their public service under the most difficult conditions."

Immediately after the storm, the primary focus for MMS was humanitarian aid to those persons devastated by Hurricane Katrina. The MMS released 10 of its contracted helicopters for search-and-rescue missions. Several oil and gas companies also donated their helicopters and boats for this purpose.

The MMS has now located and accounted for all the members of our

"…My thoughts are with you and your families as we work toward rebuilding our lives, our homes, and the Gulf of Mexico Regional Office. I appreciate your support, cooperation, and willingness to pitch in and do what it takes to get this massive job done."

Chris Oynes, Gulf of Mexico Regional Director, September 14, 2005

New Orleans office displaced by the storm. The Continuity of Operations team relocated to Houston as Katrina approached New Orleans. Within a few days, a heroic group of around 20 individuals gathered and have worked tirelessly through some very long hours every day since Katrina, gathering and assessing data on the status of operations in the Gulf.

The Gulf of Mexico is of vital importance to American citizens, supplying 29 percent of the Nation's domestic oil supply and 19 percent of the gas produced domestically. For this reason, within hours after Katrina moved through, the complex process of energy restoration began in the Gulf.

The first step was aerial overflights by the industry to conduct initial damage assessments. Then, personnel boarded the facilities and checked structural components, production equipment, and pipelines for damage.

As Hurricane Rita bore down on the Gulf, the process began again, working to shut down, secure, and evacuate rigs and platforms before the storm hit, and then surveying the damage afterward. The complex process of restoring energy production in the offshore region began anew and continues.

"I cannot find words to sufficiently praise the dedication of these MMS employees in the Gulf Coast Region – many of whom had their homes destroyed or severely damaged. Yet they have devoted every waking hour to helping restore energy for America," MMS Director Burton said.

Hurricane Oil Spill Response

For the last 30 years, there has been a steady decrease of the Outer Continental Shelf (OCS) oil spill rate. In fact, the spill rate has decreased almost 67%. The progress is due to a diligent commitment to environmental safety. Although the total volume of oil spilled on the OCS has declined each decade since 1970, a Category 4 or 5 Hurricane like Ivan, Katrina, or Rita brings the possibility of damage to pipelines and platforms that could result in an oil spill.

To increase safety and environmental stewardship of OCS operations, Minerals Management Service (MMS) requires advanced training for offshore personnel in production safety and well control techniques. In addition, all exploration, development, and production plans submitted by operators in the Gulf must include up-to-date oil spill contingency plans and environmental reports.

The MMS manages a comprehensive safety inspection program dedicated to safe exploration, development, and production operations on the OCS. A full-time staff conducts almost 25,000 inspections of offshore facilities each year – up 60% since 1999. Should a mishap occur, MMS makes use of its comprehensive accident inspection program to identify and address any issue.

As part of its mission to keep offshore development safe and environmentally sound, MMS has funded research over the last 25 years to learn more about the behavior of potential spills and methods of containment. At the National Oil Spill Response Test Facility (Ohmsett), industry and academic scientists are testing and documenting the behavior of hundreds of types of crude oils and refined products. Methods of containing each of these oil types in differing weather conditions and diverse locations have been and are being developed.

For more information:

Subject: Gulf of Mexico Region Home Page

Website: www.gomr.mms.gov

Subject: Hurricane Information

Website: www.gomr.mms.gov/homepg/whatsnew/hurricane/index.html

POWERFUL NEW LESSONS

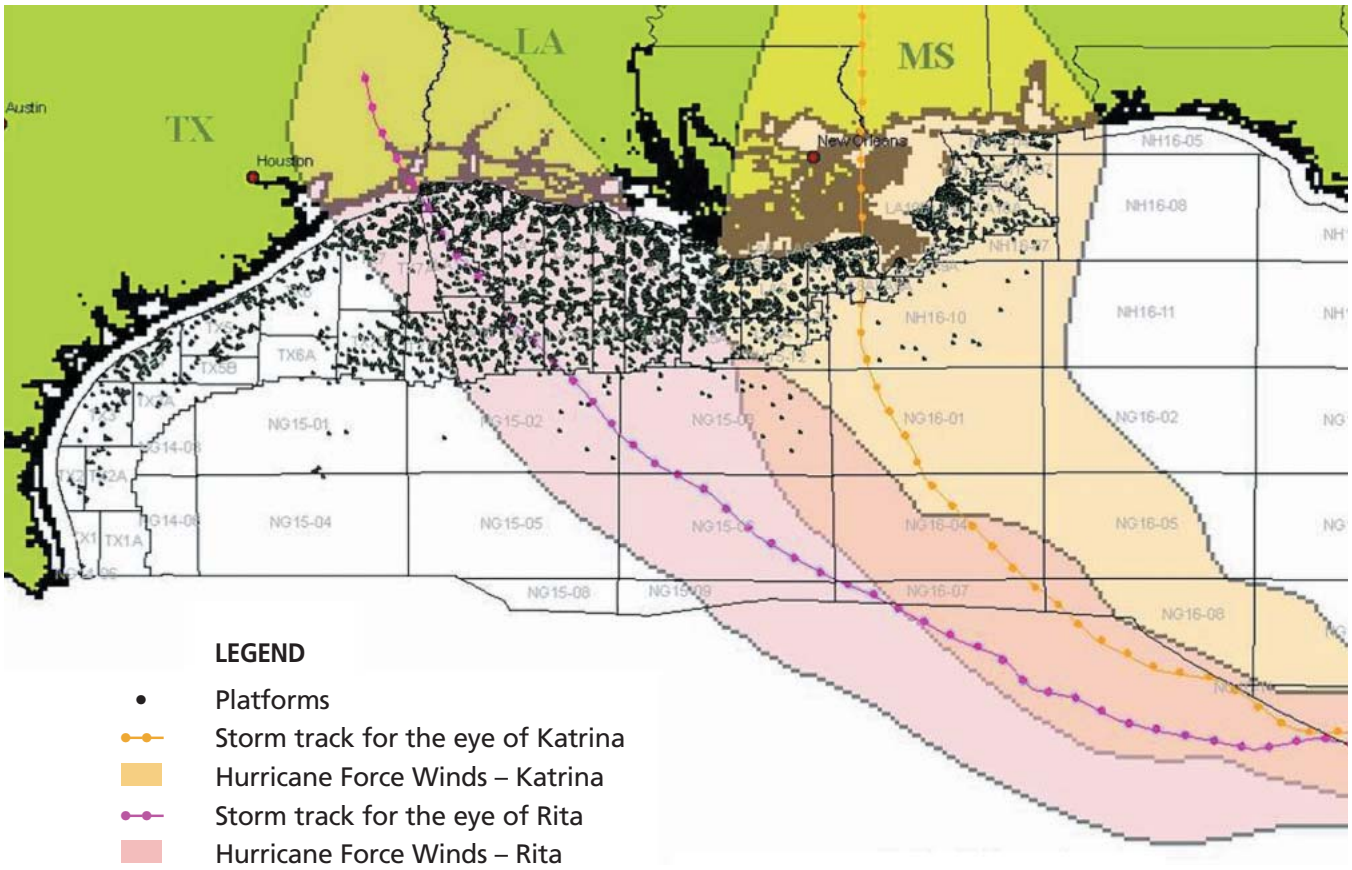
Whether deep or shallow, fixed or floating, pipeline or platform, oil and gas production structures on the Outer Continental Shelf (OCS) must withstand incredible stresses – water pressure, ocean currents, and the powerful forces of fierce hurricanes. The engineering goals for each of these structures is that there will be no loss of life and no environmental damage, and no long-term disruption of oil and gas production in the event of a hurricane or other catastrophic event. The Minerals Management Service (MMS) is responsible for ensuring that these goals are met.

This past summer, Hurricanes Katrina and Rita combined to severely test OCS engineering criteria. Fortunately, there was no loss of life or significant environmental damage on the OCS from production structures and equipment. But a total of 160 platforms and rigs were damaged or destroyed, the majority of which were older and low-producing structures that were built before 1988, when more stringent engineering standards were adopted. However, Shell's $550 million Mars facility, a deepwater tension leg platform (TLP), sustained major damage.

One engineering issue that has been identified from experiences with hurricanes is the design of mooring anchors. Nineteen Mobile Offshore Drilling Units (MODU's) were torn from their moorings and were found adrift after Hurricanes Katrina and Rita. To address this issue, Secretary of the Interior Gale Norton called for a conference of industry leaders and associations with regulators to discuss and recommend changes that might prevent mooring failure in the future.

Another potential design issue highlighted initially by Hurricane Ivan last year and then by Katrina and Rita is the deck height – the space between the ocean and the lower deck of an oil and gas platform. Wave-tide gauges set up by the Naval Research Laboratory to study waves in the Gulf recorded individual wave heights reaching an amazing 91 to 132 feet – heights that put platforms and equipment at risk. New regulations for deck height are being assessed and may need to be implemented to prevent further damage. The MMS and its industry partners will work together to apply any new information to create a safer operating environment.

Pipelines have a proven track record of reliability on the OCS; however, they can still be affected by powerful



Hurricanes Rita and Katrina paths, August and September 2005. Gold area indicates Hurricane Katrina's path/hurricane force winds. Pink area indicates Hurricane Rita's path/hurricane force winds.

On this diagram of a platform, the deck height is the distance from the sea surface to the base of the lower deck. The deck height can vary from 42 to 53.5 feet, depending on the water depth, for new installations and between 24 and 48 feet for existing platforms, depending on the type of structure and water depth. Artist's rendition courtesy of BP Exploration and Production.

hurricanes on the OCS. While the effects of Katrina and Rita on the pipeline system are still being evaluated, the damage during Hurricane Ivan (approximately 100 pipelines) proved they are not completely safe from the effects of a hurricane. While these represent a small part of the 33,000 miles of pipeline currently on the OCS, improvements in the system – such as re-routing the pipelines out of mudslide areas – are being explored to provide additional security to the environment and to the flow of the Nation's energy supply.

To obtain valuable data about the effects of Hurricanes Katrina and Rita on the Gulf itself, MMS is funding an exploration cruise to collect oceanographic information along the hurricanes' paths. Shortly before Katrina hit, an MMS-funded observational study was completed in the area of the storm's path. Scientists will be able to compare the two studies to assess the changes in the Gulf and learn more about the effects of powerful hurricanes on Gulf ecosystems.

While Hurricanes Ivan, Katrina, and Rita have caused tragic losses, scientists, operators, engineers, and regulators have a chance to learn from the damage experienced in these powerful storms and improve the safety of both production and transportation in the future.

Of the 4,000 platforms that MMS regulates, 3,050 platforms were in the path of Hurricanes Katrina and Rita. The preliminary damage assessment indicated that 112 of the older "end of life" facilities built prior to MMS's upgraded design standards were destroyed.

Major new facilities withstood the storms better, with only one major facility destroyed and four receiving significant damage. Repairs are already underway on the damaged facilities, but a substantial portion of production is expected to remain shut-in until the hurricane season next year.

The MMS has taken a number of actions to facilitate the process of returning energy resources to America, consistent with the need for safety. These measures include expediting review of requests for temporary barging of oil or flaring of small amounts of natural gas; expediting the approval process for pipeline repairs; waiving of cost recovery fees until January 2006; and maintaining continuous operations in the Gulf area despite evacuation and relocation of the MMS New Orleans office and damage to district offices.

MMS – A Leader in Securing the Nation's Domestic Energy Supply

Sun sets behind platform in the Gulf of Mexico.
Photo courtesy of Gregory S. Boland

NEW WAVES

Late-breaking News & Information

MMS Regional Office Operations Return to New Orleans and Commits to Staying in the Area

The Department of the Interior's Minerals Management Service reopened its Gulf of Mexico Regional Office at 1201 Elmwood Park Boulevard in New Orleans. "After two months of operating with a reduced staff in Houston, we are happy to have all our employees back at work, and the majority back in the Elmwood space," stated MMS Director Johnnie Burton. "Despite the temporary loss of offices housing more than 600 employees, we moved aggressively to resume full operations."

Because of the extensive damage sustained by the regional office during Hurricane Katrina, employees were prevented from returning to work. A temporary office with a contingency of employees was established in Houston.

Director Burton noted that "MMS is committed to stay in the New Orleans area and contribute to the economic revival of the area. We are working to secure a new 10-year lease for the Elmwood building and are working with the property owner to update the building as part of the repairs."

As of October 28th, all employees reported for duty, with about 350 occupying the first five floors of the Elmwood Towers and a small contingent in a neighboring building; and about another 150 remaining in Houston until the other five, more heavily damaged, floors are repaired. About 100 district employees have continued to work in the district offices along the Gulf Coast despite Hurricanes Katrina and Rita. The Lake Charles district office was temporarily closed because of Hurricane Rita but reopened with full operations on October 24th.

The MMS Gulf of Mexico Regional Office has been located in the New Orleans metropolitan area since the agency was created in 1982, and has been housed at the Elmwood Towers building since 1986. "The return of the Gulf of Mexico Regional Office to New Orleans is a clear indication of the Federal Government's commitment to the rebuilding of the metropolitan area," said Director Burton.

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