

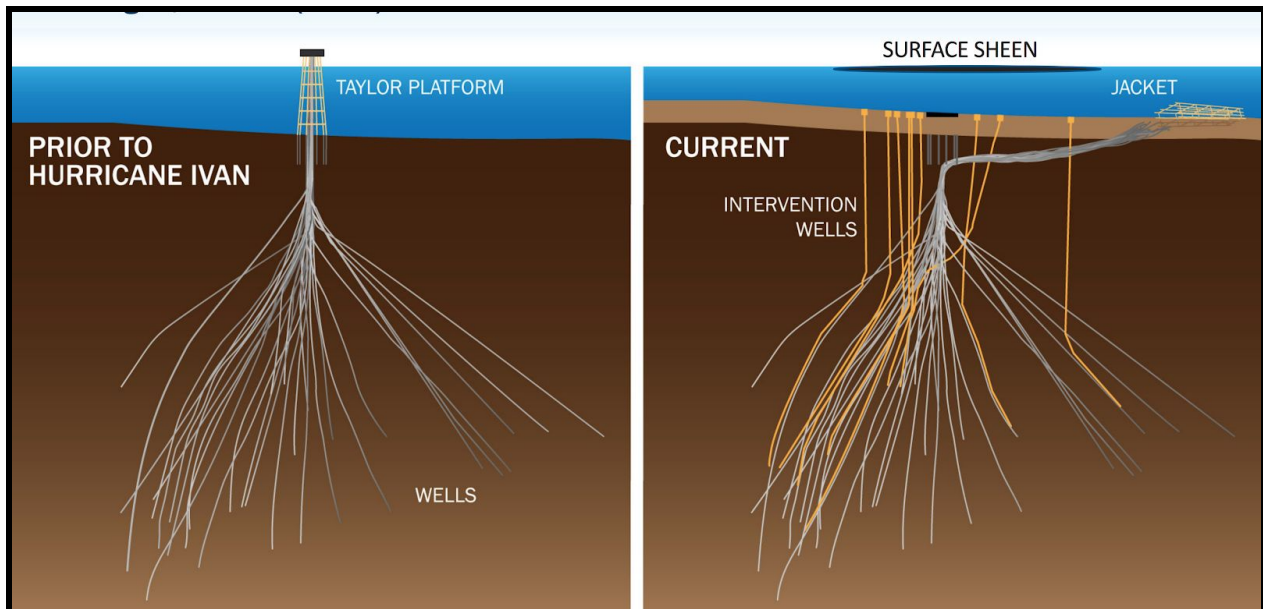
What Can We Learn From MC20: The Longest Offshore Oil Spill in U.S. History

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Destruction of an Oil Platform

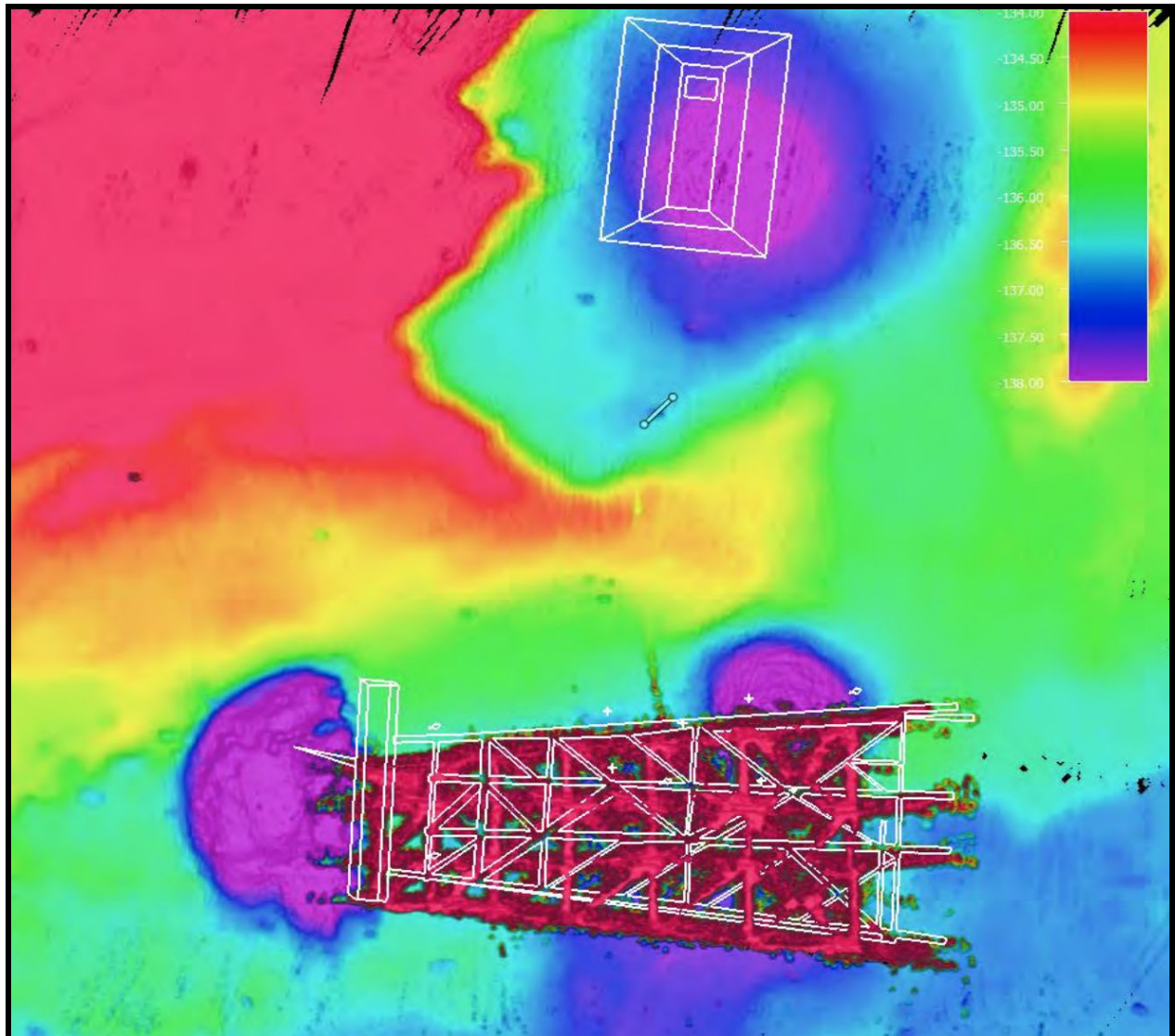
No one witnessed the destruction of the oil production platform designated MC20A on the night of 15 September, 2004, when the eye of Hurricane Ivan passed 36 miles to the east. MC20A sat 80 feet above the water on legs that were cemented to the bottom 470 feet below. A fearsome combination of 120-knot winds and 100-ft waves hammered the platform as Ivan first made its landfall in Alabama, along with a 10-foot storm surge. But Ivan was not finished with MC20A. The storm drove torrential rain and generated over one hundred tornadoes as it moved through the southeast US. Then, amazingly, it emerged into the mid-Atlantic, veered south, turned across Florida, and re-entered the Gulf. [Ivan's final landfall](#) on the southwest coast of Louisiana came late on September 23rd, with yet another storm surge.



The MC20A oilfield before Hurricane Ivan: an array of reservoir completions spread across several square miles of underground territory. (Platform vertical scale is greatly exaggerated; source [Taylor Energy Company documents](#))

As bad as the wind and waves had been, the mud was worse. Giant walls of mud, which washed out of the Delta when the storm surges ebbed, carried the fallen platform 500 feet

downslope from its original location, and buried four of its eight legs under 60 or 70 feet of mud. Tall as MC20 had been when intact, it was just the tip of a vast underground array of wells drilled 4,239, 6,703, 9,833, or 12,202 feet into sedimentary rock. Despite the total destruction of the platform, it was still tethered to the wells and still connected to the oil and gas reservoirs it had been producing.

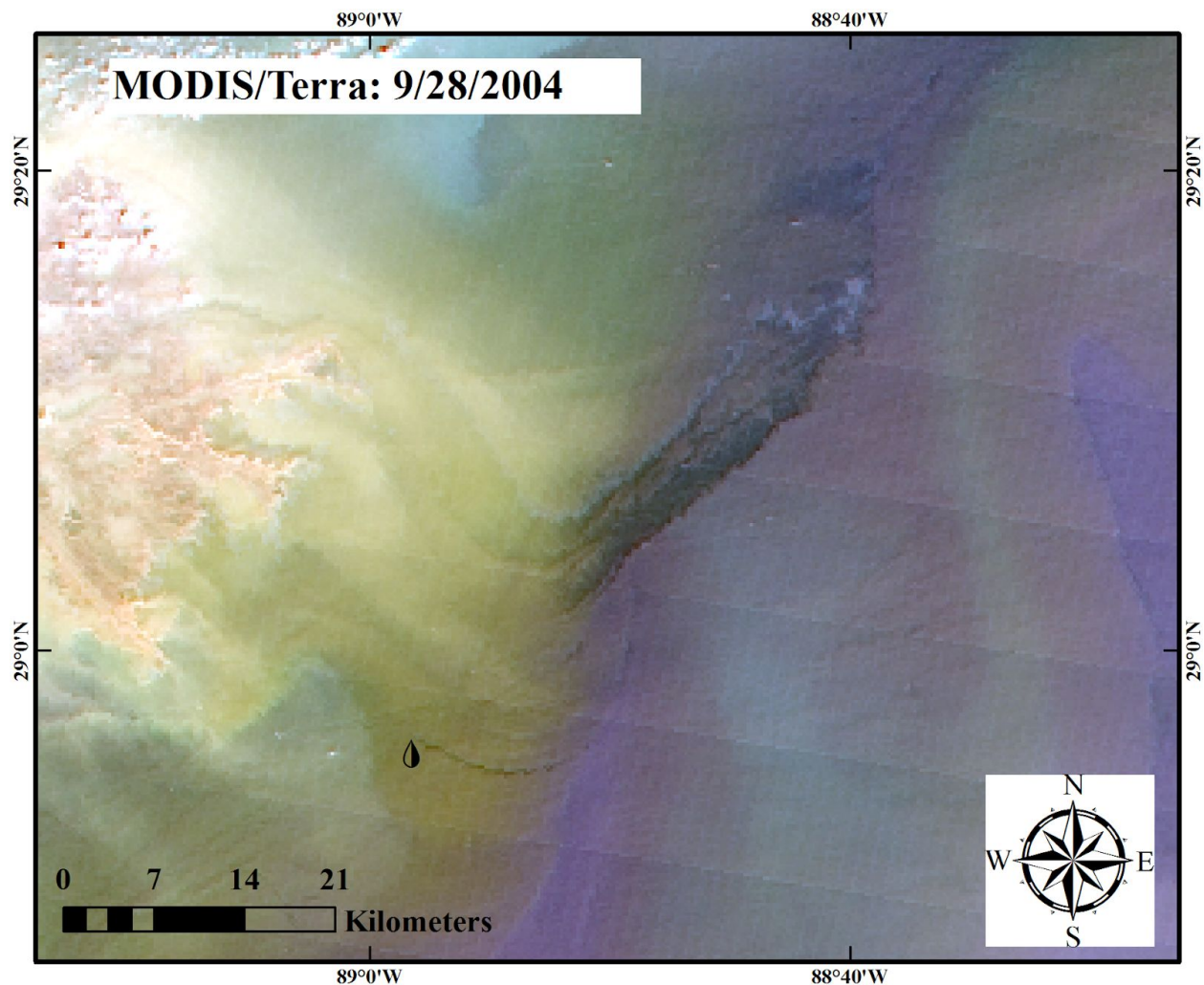


Sonar map of the wreck of MC20A, with line drawings of the rectangular base where it stood (now buried) and its new location. Oil and gas is coming out of the purple crater above the bottom legs of the platform (Source [Taylor Documents](#)).

Ongoing Discharge

On September 28th of 2004, the MODIS satellite collected a cloud-free color image of the Mississippi Delta and the northern Gulf. Normal satellite images of the Delta show filaments of marsh vegetation amid the canals and channels that lead to dark green coastal waters. No vegetation is visible at all in this image, just thick swirls of yellow-brown mud still draining out

into the Gulf. And at a point 12 miles from the battered marshes, a thin black swirl joins the flow. MC20A was leaking oil.



Satellite image showing oil slicks from MC20 after Ivan (Image courtesy Shaojie Sun)

When an oil spill happens, the law designates a *Responsible Party*, which has to work with the Coast Guard and other agencies in a *Unified Command* to respond, stop, and hopefully mitigate the impact of the spill. The Taylor Energy Company owned MC20A and was the responsible party. Its initial surveys of the wreckage found ongoing discharges, but the oil was coming from pipes that were buried under soupy mud. They tried to dredge down to the leaking wells, but the mudflow was just too thick. Of the 25 wells that had been producing, its contractor assessed the need to drill relief wells that would insect the buried wells and plug them to prevent discharge; 13 high priority and 7 medium priority wells were identified.

By 2008, Taylor had plugged 4 wells of high priority, 4 medium and 1 of low priority. Then it ceased drilling operations, declaring that further intervention would actually make the oil discharges worse. The Minerals Management Service issued a "Finding of No Significant

Impact,” essentially saying that the ongoing sightings of oil slicks over MC20 posed no danger to the environment. The Coast Guard concurred, but ordered Taylor to make frequent overflights to assess the floating oil and to install containment domes--huge funnels designed to sit on the bottom and collect the oil before it entered the ocean. The sanctioned overflights began and, true to Taylor’s predictions, asserted that “sheens” appearing over MC20 were the result of less than a gallon a day leaking into the Gulf.

MC20 from Above

The problem was that the oil kept leaking, even though there was scant public awareness of the ongoing issue. The BP blowout changed that. SkyTruth analysts monitoring the slicks spreading from Deepwater Horizon [noticed a persistent source](#) of surface slicks that seemed unrelated to the bigger threat. SkyTruth president John Amos contacted me to ask whether there were any natural seeps in the area, but I knew of none. Research quickly uncovered the history of MC20A, but at the time, all eyes were on the unfolding catastrophe spreading from the Macondo blowout.

In 2012, I began active research sampling at the site, assisted by physicist and pilot Bonny Schumaker with her [On Wings of Care](#) operation and with funding by the [ECOGIG-2](#) consortium. My students and I routinely found oil slicks that were [10 miles or longer flowing from MC20](#), all on days when Taylor was reporting to the Coast Guard that a few gallons or less of oil had been released. By then, Taylor had commissioned surveys and analyses, including contributions from top oil-spill experts based at the Woods Hole Oceanographic Institution. They developed a hypothesis that they referred to as the “[Rum Punch Scenario](#)” whereby oil and gas eruptions following the hurricane had excavated craters near the base of the fallen platform. Remnant oil from the storm’s immediate aftermath was, purportedly, becoming more concentrated in the craters much like “a bowl filled with fruit punch [that] was repeatedly spiked with rum, and . . . over time the composition of the rum punch would trend toward consistently increasing rum content.” According to this theory, the oil discharge rate cannot exceed 10.7 gallons/day.

This has been the [position of Taylor](#) ever since. In 2008, the company had been forced to create a trust of \$666 million to be used for mitigation and clean up. After spending over \$230 million, in 2016 the company began to assert that its efforts to mitigate an “Act of God” should be at an end, and the unspent portion of the trust should be refunded. Taylor subsequently took the government to court to enforce the refund. By then, however, the Coast Guard and the Bureau of Safety and Environmental Enforcement (BSEE), had had enough of the rum punch and were insisting on more stringent study.

The oil slicks on the surface over MC20 became well known to oceanographers and [remote sensing experts](#). So much so that NASA began to fly missions over the site to test oil-spill detection methods. A number of remote-sensing experts began to develop independent estimates.

My estimate, as reported in 2018 to the Gulf of Mexico Oil Spill and Ecosystem Science (GOMOSSES-18), was [96 barrels per day](#). My former PhD student, Oscar Garcia, using different analytical techniques, reached a higher estimate, which the *Washington Post* [breathlessly reported](#) as amounting to enough “to overtake BP’s Deepwater Horizon disaster as the largest ever.” This is almost certainly untrue in the near term, because it extrapolates from Garcia’s most extreme observations, and misleading, because the slow but continuous discharge at MC20 presents an entirely different set of circumstances and risks from those posed by the BP spill. However, unless the discharge is stopped, there is no indication that the source is running dry. So, over time--decades--the total discharge could surpass the BP spill of between 3.6 and 4.3 million barrels.

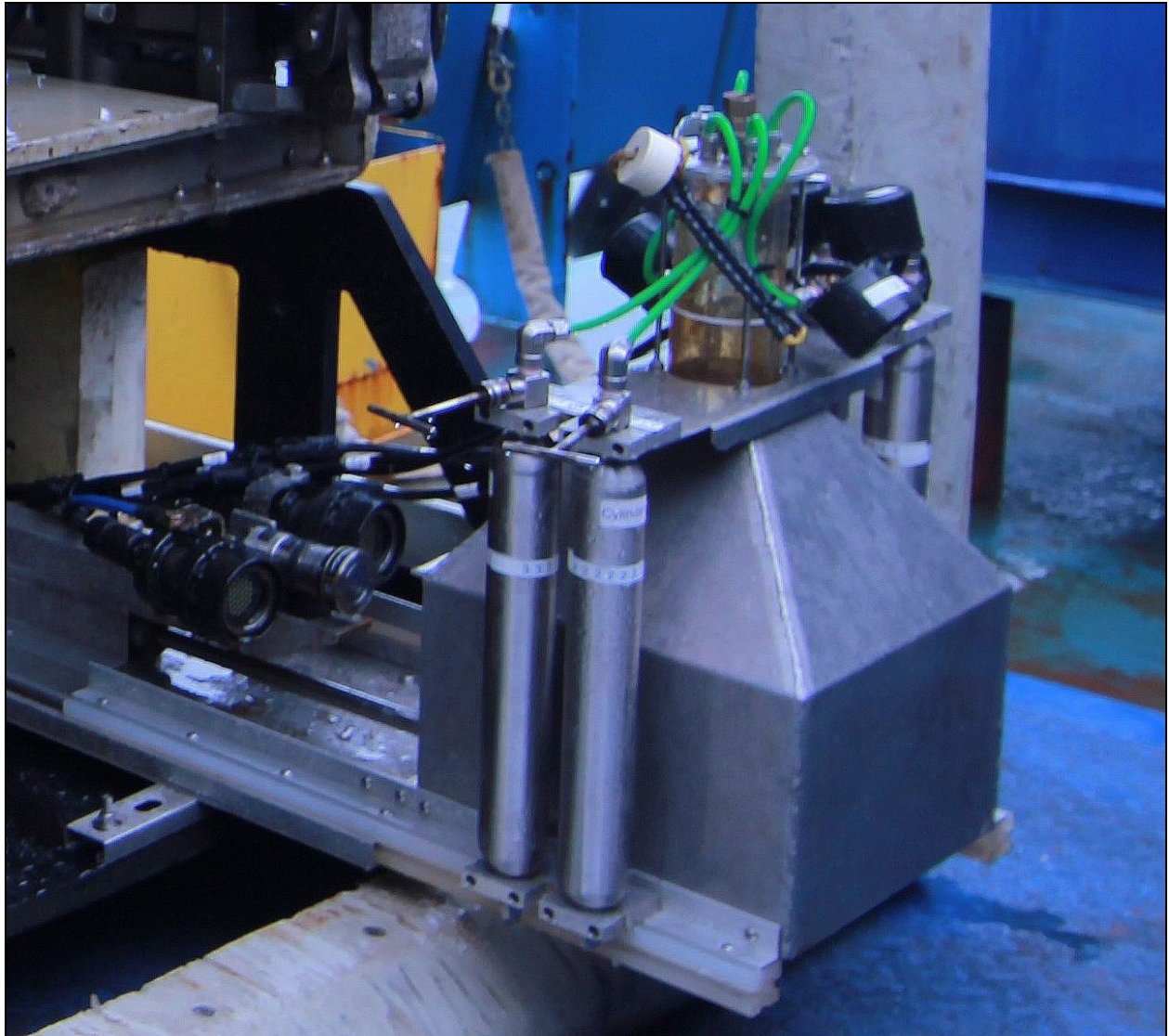
A major, unanswered question was how oil was reaching the surface from the platform wreckage. Sonar surveys of the site consistently showed a large plume rising from the crater at the northwest corner of the platform legs. Taylor’s own experts have long conceded that the [plumes exist](#), but contend that what the sonar is seeing is “dry” gas that is occasionally “sparging” drops of remnant oil. In other words, there’s no new oil or gas coming up through the damaged wells, just a form of swamp gas kicking loose a few drops left over from the accident.

At Sea with the MC20 project

Faced with scientific articles, stories in the press, and the ongoing court case brought by Taylor, the leadership of BSEE finally had had enough and demanded that its own experts should go offshore and find out what was in the plume.

The agency teamed with NOAA to charter a research vessel and organize an intense effort to sample the oil and gas while it was still rising through water and track it back to its source on the seabed. I was asked to join because of my previous experience collecting oil and gas samples from natural seeps. The project came together in record time with NOAA experts assembling sonar equipment and other sampling gear.

I took on the task of getting quantifiable samples from the plume and invented a gadget that I’m calling the *bubblometer*. This is a square funnel open on the bottom and the back that can be extended from the front of an ROV. A calibrated video camera records the oil and gas passing through the funnel, while pressure flasks are able to collect discrete samples of the hydrocarbons. In early September of 2018, the RV Brooks McCall sailed for MC20 loaded up with instruments, and experts.

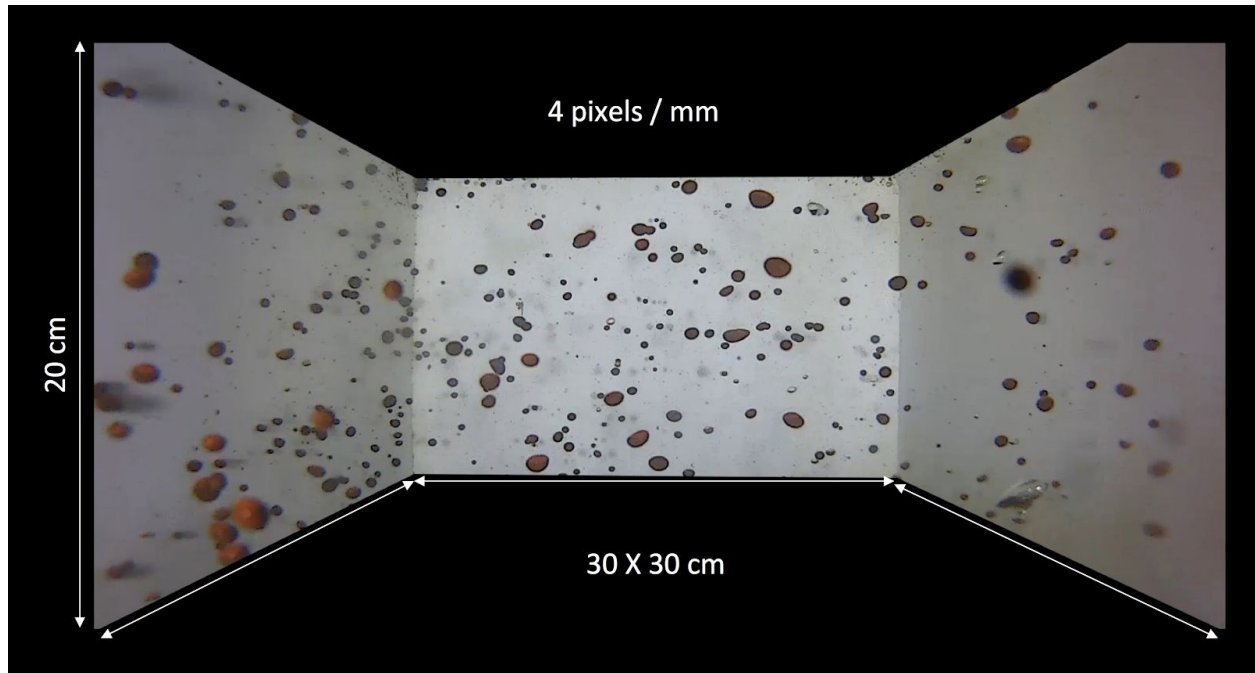


The FSU bubblometer: digital video records bubbles of oil and gas passing through the chamber, while discrete samples can be collected into the pressure flasks. (Source [I.R. MacDonald](#)).

When the ship held position over the downed MC20A platform in calm seas, it soon became surrounded by an [undulating film of rainbow- and metallic-colored oil](#), with gas bubbles swelling and bursting through in small patches and an unending stream of new oil drops rising to the surface. The film drifted downwind, forming the long, ribbonous oil slicks that are so evident from airplanes and satellites. To track the oil to its source, the ROV Comanche followed the oil down toward the crater at the base of the platform. Operating several feet above the bottom to avoid any disturbance, the vehicle approached the crater through murky water and encountered a copious flow of bubbles.

It extended the [bubblometer into the flow](#) and recorded hundreds of large and small oil bubbles per minute passing through its calibrated chamber. The funnel gathered the oil and gas into a cylinder on top of the device; it was then collected by opening valves connected to evacuated

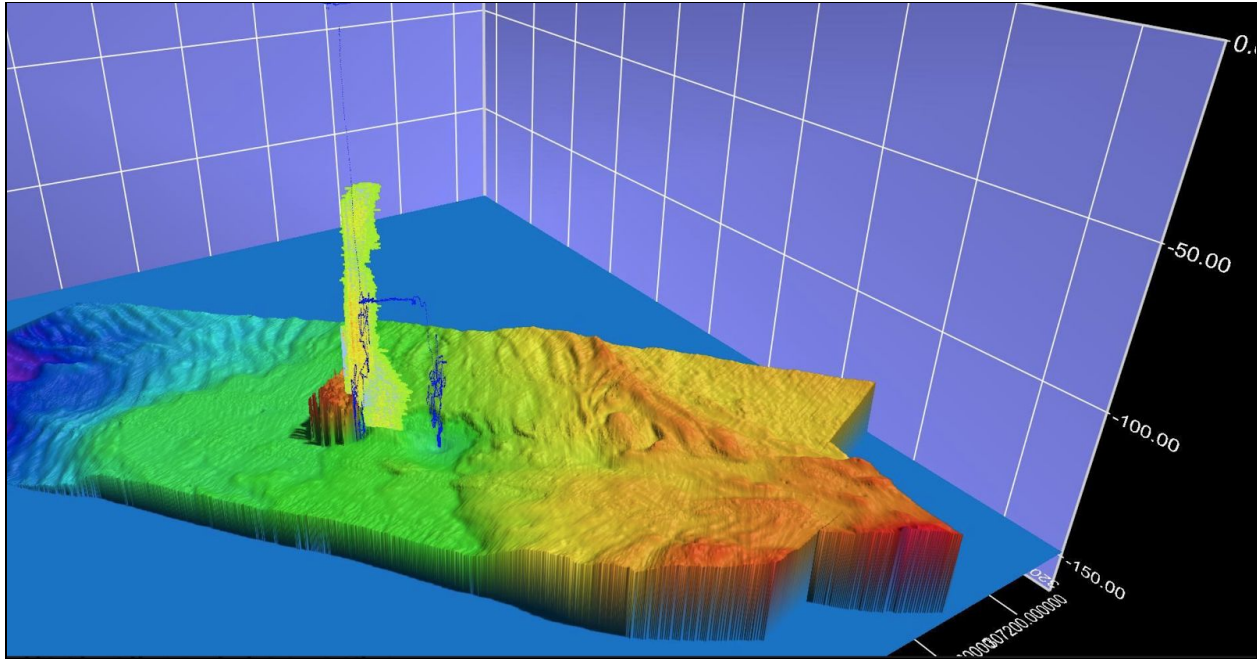
pressure flasks. The process was repeated at multiple depths within the plume. Simultaneously, acoustic instruments on the ship were recording the large outline of the plume as it followed a curving path to the surface, partially deflected by currents in mid-water. Importantly, the rising bubbles were seen near the bottom and as much as 50 feet above the bottom, which demonstrates that the hydrocarbons were rising steadily, not lingering in the “punch bowl.”



Frame-grab of digital video from bubblometer camera showing oil bubbles in the calibrated volume of the visualization chamber. (Source [I.R. MacDonald](#))

At present, results of the MC20 project are under rigorous analysis by the government’s team. The agencies place a premium on accuracy and verification and will not make any estimates regarding the rate of the MC20 discharge until the data are fully analyzed.

Preliminary results from the team were presented at the [GOMOSES-19 conference](#) (New Orleans, 2-4 February). These findings, which I have partially excerpted for this article, do offer persuasive evidence to refute the “rum punch scenario.” The plume of oil and gas is dense and voluminous, with a vigorous upward flow. The plume was continuously detected throughout the five operational days of the MC20 field effort. Its origin is entirely within the crater at the base of the MC20A wreck, where the buried bundle of wells is still attached to the platform. The concentration of methane in the air above the wreck was as much as five times higher than normal. Preliminary chemical analysis of the oil and gas confirms that this material is being discharged from the underground reservoirs that were tapped by the MC20A wells.



South-looking sonar visualization of MC20A site showing fallen platform with an acoustic slice through the plume of oil and gas rising from the crater. The blue track of the ROV documents its path through the plume collecting images and samples (Source [I.R. MacDonald](#)).

Taken together, these findings are entirely inconsistent with incidental release of oil left over from the 2004 accident and loosely suspended in the crater and surface sediments, amounting to no more than 10 gallons per day. Nothing in the new data would lead me to believe that my 2018 estimate of [96 barrels per day](#) was too high.

Containment?

Armed with these findings and concerned by the public attention resulting from media coverage, the Coast Guard changed course in September, 2018, and contracted a response effort independent of the Taylor Energy Company. Although the company could still be liable for the cost, an outside company has been contracted to engineer and install a temporary cap, called a containment dome, which will prevent oil from getting into the ocean after it discharges through the crater. This would be only a temporary fix. A permanent solution may require additional plug-and-abandonment drilling in the years to come. This long oil spill will take even longer to really kill.

The engineering challenges are high. Although the MC20 project benefited from relatively favorable conditions, ocean currents at the site can be very strong. The plan is to attach the dome to the platform legs instead of placing it on the bottom and to install a collector that will separate the oil so it can be recovered. As of 13 March, when I was offshore with a [CBS camera crew](#), the chartered work vessel was anchored over the wreck site while teams of divers and engineers continued the installation.

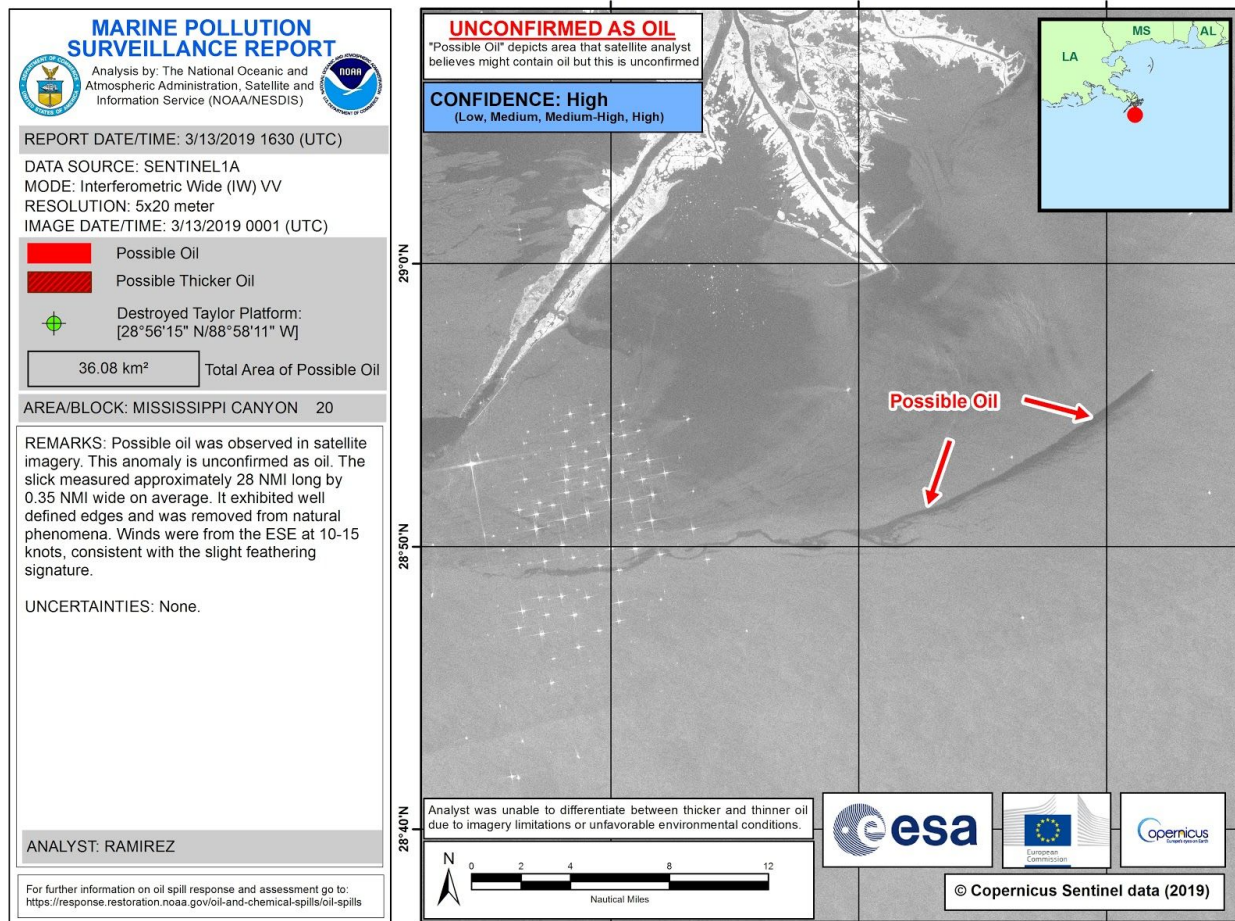


Work boat anchored over the Taylor Energy Company platform site on 13 March 2019 (source I.R. MacDonald).

Containment domes have been tried before, and catching oil plumes 400 feet underwater is no simple feat. Satellite images from the site still show a miles-long oil slick drifting away from the wreck site. Hopefully, the dome will work and this will end or be reduced. After fifteen years, however, it's fair to ask what lessons have been learned. The platforms and pipelines that surround the Mississippi Delta and dot the Gulf's deeper waters are [vulnerable to mudslides](#) triggered by hurricanes or earthquakes, as I discuss in a separate article. If such an accident happens again, do we have the best policies and scientific methods in place so that it doesn't take another fifteen years to tackle the problem with full force?

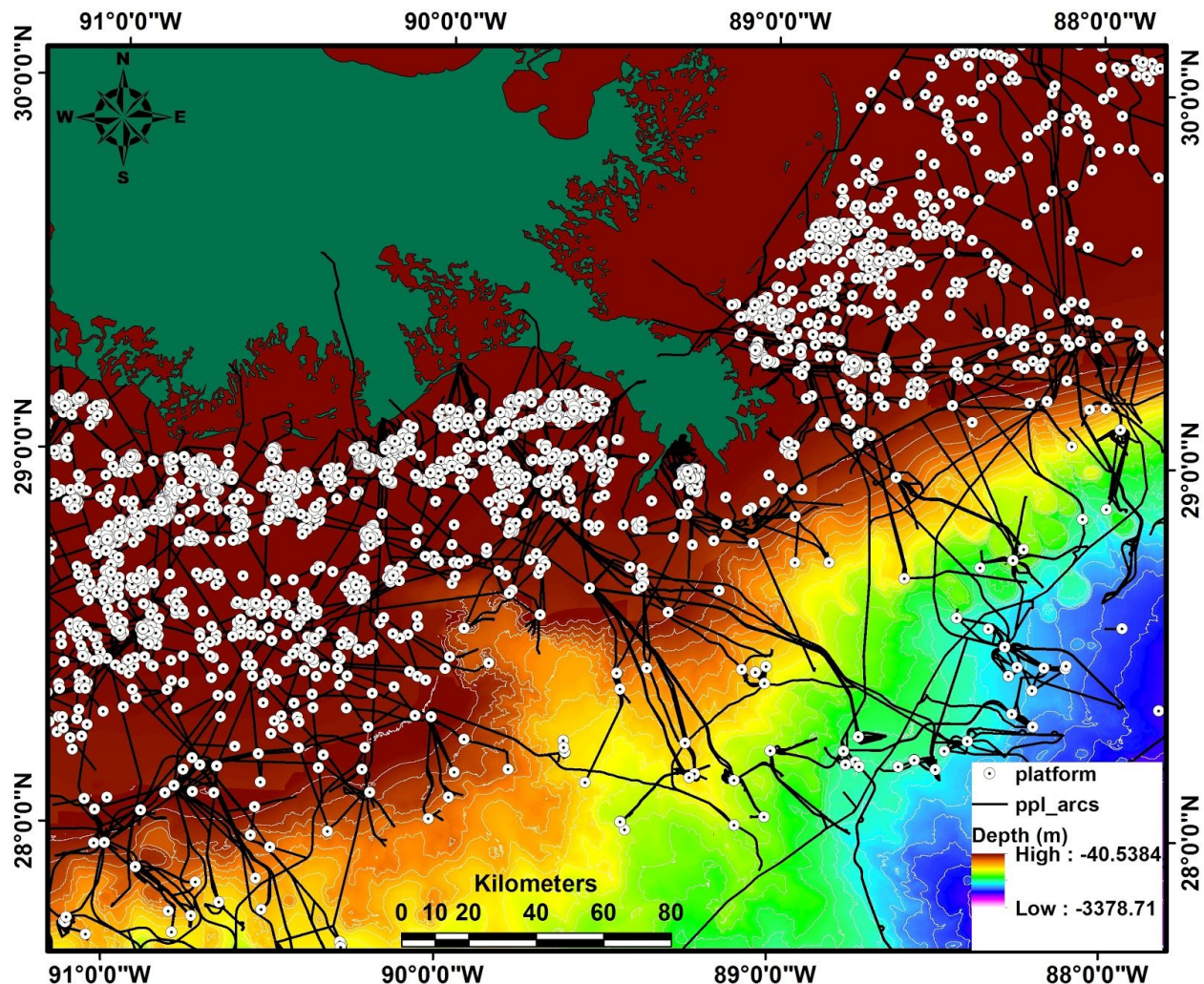
Lessons learned and future research?

This unprecedented accident and its long aftermath raise many concerns regarding how to measure oil spills at sea and who should be consulted or believed when uncertainties inevitably arise. The upside is that we can learn a great deal from what has already been done and could learn much more if research is supported in the future.



Satellite image report showing oil slick covering nearly 14 square miles and originating from the Taylor Energy Company site on March 13, 2019. Presence of surface oil was confirmed by a CBS News crew (Source [NESDIS Pollution Reports](#)).

An overarching question concerns the vulnerability of a large and aging network of pipelines and platforms that surround the Mississippi Delta and the growing array of extreme deep-water structures that are now being installed. [Mudslides](#) are an intrinsic part of the Gulf's geology--and that of coastal regions presently considered for expanded oil drilling and production. The Delta is a particular area of concern because [massive wetland losses](#) over the past 50+ years have greatly increased the [load of sediments](#) that is hanging on the sloping seafloor, some of which will inevitably slip. Much of the infrastructure was installed before this risk was well understood. Detailed surveys to assess this risk are urgently needed and should employ the most up-to-date sonar and mapping techniques. Costs of this work are considerable, but so is the potential risk--especially as it seems that the frequency of intense hurricanes is on the rise.



Map showing platforms and pipelines surrounding the Mississippi Delta (Source [Bureau of Ocean Energy Management](#)).

Specific to the MC20 locality and circumstances, fifteen years of contamination present scientists with a natural laboratory for studying the [long term impact](#) of oil pollution in the ocean. When containment succeeds and the litigation concludes, hopefully soon, the National Resource Damage Assessment process should be initiated to document how the seafloor around the platform site has been transformed by the oil and by all the activity needed to stem the flow. Efforts should be made to track the potential oil impact in the wider marine and coastal ecosystem along the Louisiana coast.

The natural laboratory concept applies to developing better tools to assess release of oil from a submerged source, which happened at MC20 and the Deepwater Horizon, and how it spreads on the surface. Satellite and aerial remote sensing data have been available to authorities since the earliest days of the spill. Due to limits in techniques, there is uncertainty about the exact magnitudes of oil observed, and the rate of flow. These techniques could be improved—including by [ongoing study](#) of the oil still flowing in MC20. But every indication is that

the discharge rate is orders of magnitude greater than what the Taylor Energy company's contractors asserted. Why did the Coast Guard continue to believe an interested party when independent scientists were pointing to a much more serious problem? Does the unified command structure that the Coast Guard follows need to be reconsidered, given the failures of the process at MC20?

There are many other possible topics for research at MC20, but I will conclude with the problem of oil pollution rising through the water--sometimes very deep water--which recurs often when wells fail or ships sink. During the Deepwater Horizon response, activity at the site kept researchers away from the plume that was carrying all the oil up to the surface, where it did the most damage. Consequently, there remain many questions about the physics of oil plumes and oil slicks in the ocean that can't be properly addressed in laboratory studies. The MC20 site is close to land, and the water is deep enough to generate complex behavior in the plume, but shallow enough to make it accessible. We all want the oil flow to stop, but in the medium term, the containment dome will need to be periodically removed for maintenance. When this happens, the plume will rise again, offering the opportunity for modelers and remote sensors to develop and refine new techniques.

I would hope that this kind of knowledge could shorten the path to recognizing a serious situation such as occurred after Hurricane Ivan destroyed MC20A. But it will only happen if independent and academic scientists are invited to the table and supported in their research. In all the remaining uncertainty surrounding MC20, this issue needs higher priority.