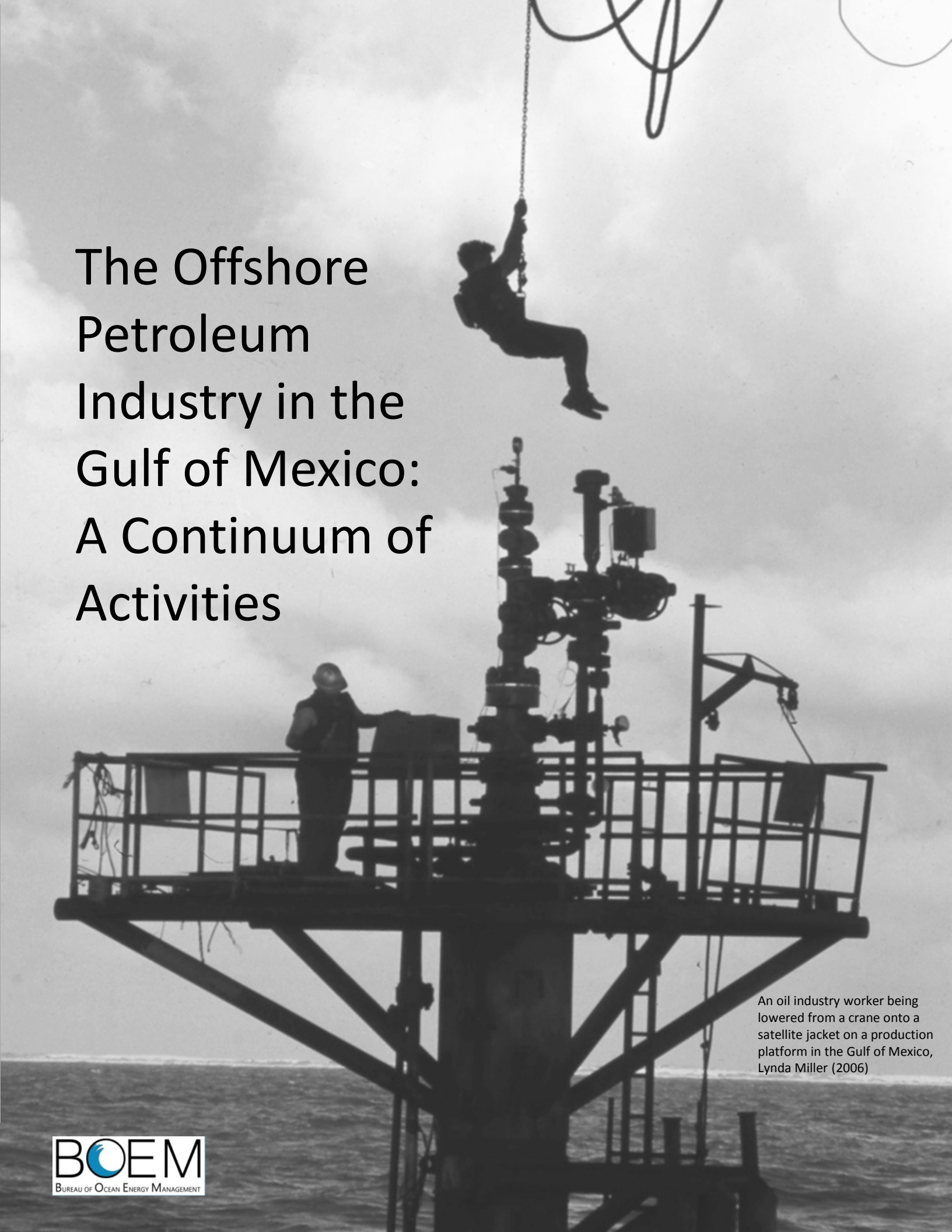
The Offshore Petroleum Industry in the Gulf of Mexico: A Continuum of Activities



An oil industry worker being lowered from a crane onto a satellite jacket on a production platform in the Gulf of Mexico, Lynda Miller (2006)

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This document was inspired by the *Offshore Oil and Gas History Project.* To download a PDF file of the associated Environmental Studies Program final report, go to the U.S. Department of the Interior, Bureau of Ocean Energy Management, Environmental Studies Program Information System website and search on OCS Study BOEM 2008-042.

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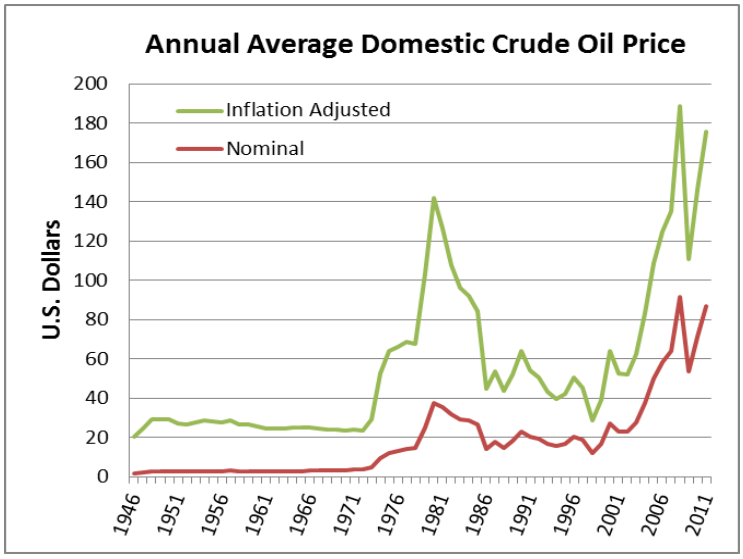
The Offshore Petroleum Industry in the Gulf of Mexico

The history of the offshore oil and gas industry in the Gulf of Mexico is marked by environmental, social, and political challenges. As an extension of the vast U.S. petroleum industry, the offshore industry was and is influenced by the operational, technological, economic, and political issues that characterize that industry. Once offshore, though, the industry faced new, unique circumstances. The technological challenges of offshore exploration and production are perhaps the most obvious: constructing drilling rigs and platforms that can withstand wave action, developing techniques for cutting and welding metals underwater, and transporting materials and equipment over vast expanses of open water. Yet, the social challenges are equally daunting: attracting and maintaining a workforce able and willing to live on a small metal structure for weeks at a time or to work hundreds and even thousands of feet below the water's surface; organizing a workforce to take action and achieve results quickly and efficiently; and establishing a huge and oftentimes uncertain industry amid isolated rural communities.



During the 1990s and into the next decade, the Bureau of Ocean Energy Management (BOEM; known at that time as the U. S. Minerals Management Service, or MMS) initiated a series of studies on the history of the offshore oil and gas industry in the Gulf of Mexico. The story of this industry in the Gulf is one of hard work, inventiveness, entrepreneurial spirit, and risk-taking that turned relatively isolated coastal communities into significant contributors to U.S. and global efforts to find and produce petroleum from beneath the ocean. The history studies covered a range of topics from the evolution of offshore technology to the industry's effect on local communities, and also examined specific sectors such as fabrication and commercial oilfield diving. At the time the studies began, little had been written about the industry, its complexities, its many economic sectors, or its impacts on families, households, and coastal communities.

The offshore petroleum industry evolved from the onshore industry and moved through wetlands and lakes and then across the outer continental shelf (OCS). The OCS is a legal and political unit that is under federal jurisdiction and generally extends from 3 to 200 nautical miles (230.2 mi) from the U.S. coast. In the Gulf of Mexico, this industry is a vast configuration of structures, vessels, companies, and people responsible for four primary phases of activity: exploration, development (drilling), production, and decommissioning. On the OCS, the process begins when a potential developer identifies where petroleum might be and obtains a lease from the federal government. The developer then drills exploratory wells to try and locate oil or gas. If successful, the well is temporarily sealed while preparations are made to extract the petroleum from below the ocean floor. To produce petroleum from the established well, the developer must have a method to manage the output and a system to transport it back to shore. Lastly, developers must have a plan to shut down operations after extracting as much of the petroleum as possible.

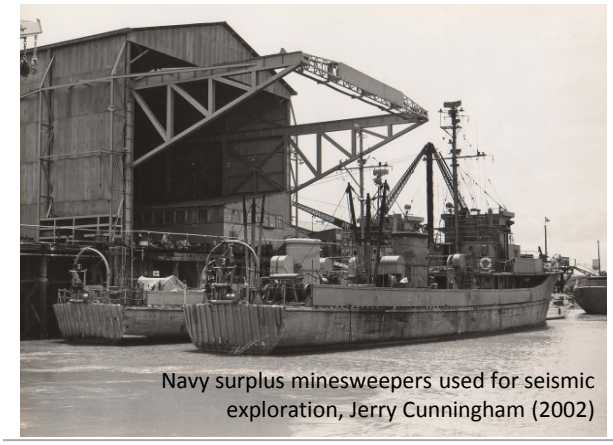
Although offshore petroleum has assumed a high profile in the national development strategies of many countries around the world, the Gulf of Mexico remains the primary laboratory for technological innovation and regulatory practices. Efforts to analyze the political, social, and economic aspects of offshore exploration and development can benefit from an understanding of what has happened there. This document was created to highlight some key findings of the history studies in order to increase that understanding (see the final page for references for the study reports and the location of the project archives). Quotations and photographs were donated by study participants in the years indicated.

Graph: Annual Average Domestic Crude Oil Price based on Illinois Basin Crude Oil Prices, Illinois Oil and Gas Association (online at www.ioga.com/Special/crudeoil_Hist.htm). As you read the timelines on the following pages, keep in mind the fluctuation seen here, and note how these ups and downs affect global, national, and regional trends.

EXPLORATION

The search for oil and gas under the ocean begins when a seismic crew takes a vessel out to sea to scan the ocean floor to examine the rock and sediment formations. Seismic surveyors use sound waves that reflect off the bottom of the ocean floor and the rock layers inside the earth and travel back to recording equipment at the surface. These waves allow scientists to see features below the earth's surface. The information from the seismic survey is fed into a computer and used to create three-dimensional (3-D) models of the earth's characteristics and identify pockets where oil and gas are likely to be found. Once those pockets are located, a mobile drilling platform with an exploratory drilling rig will drill temporary exploratory wells. The wells generally take 60 to 90 days to complete and produce core samples which geologists examine to determine the quality and quantity of petroleum present.

Laying first generation seismic equipment, Houston Lejeune (2004)



Navy surplus minesweepers used for seismic exploration, Jerry Cunningham (2002)

"I worked offshore, ten days on and four days off, for about 15 years. I stayed in exploration. After 23 years I decided I couldn't take my family with me anymore. And I was always jumping from one job to another. So I told [the company] I was gonna leave. And I stayed away for about a year and a half. And they called me back and asked me if I was ready to go back. Which made my wife real happy." – Santo Rousso (2005), Seismic Developer

1930s: First seismic reflection surveys performed in oil exploration to delineate subsurface structure.

1953: Submerged Lands Act granted coastal states exclusive rights to 3 nautical miles from their coastlines.

1983: President Ronald Reagan declared the U.S. Exclusive Economic Zone (EEZ), claiming for the United States rights to all waters up to 200 nautical miles from the coastline.

1987: First three-dimensional (3-D) seismic surveys, a global event that set the stage for seismic surveying.

1999: Cumulative effect of earlier technological changes resulted in estimated 60% decrease in real cost of finding and producing oil compared to 10 years earlier.

Global — World War II — Arab Oil Embargo

1930s-1950s: Near Shore | 1960s-1980s: Deepwater | 1990s-beyond: Ultra Deepwater

Regional — Hurricanes — Hurricanes

Early 1930s: California oil producers applied to the U.S. government for offshore oil and gas leases.

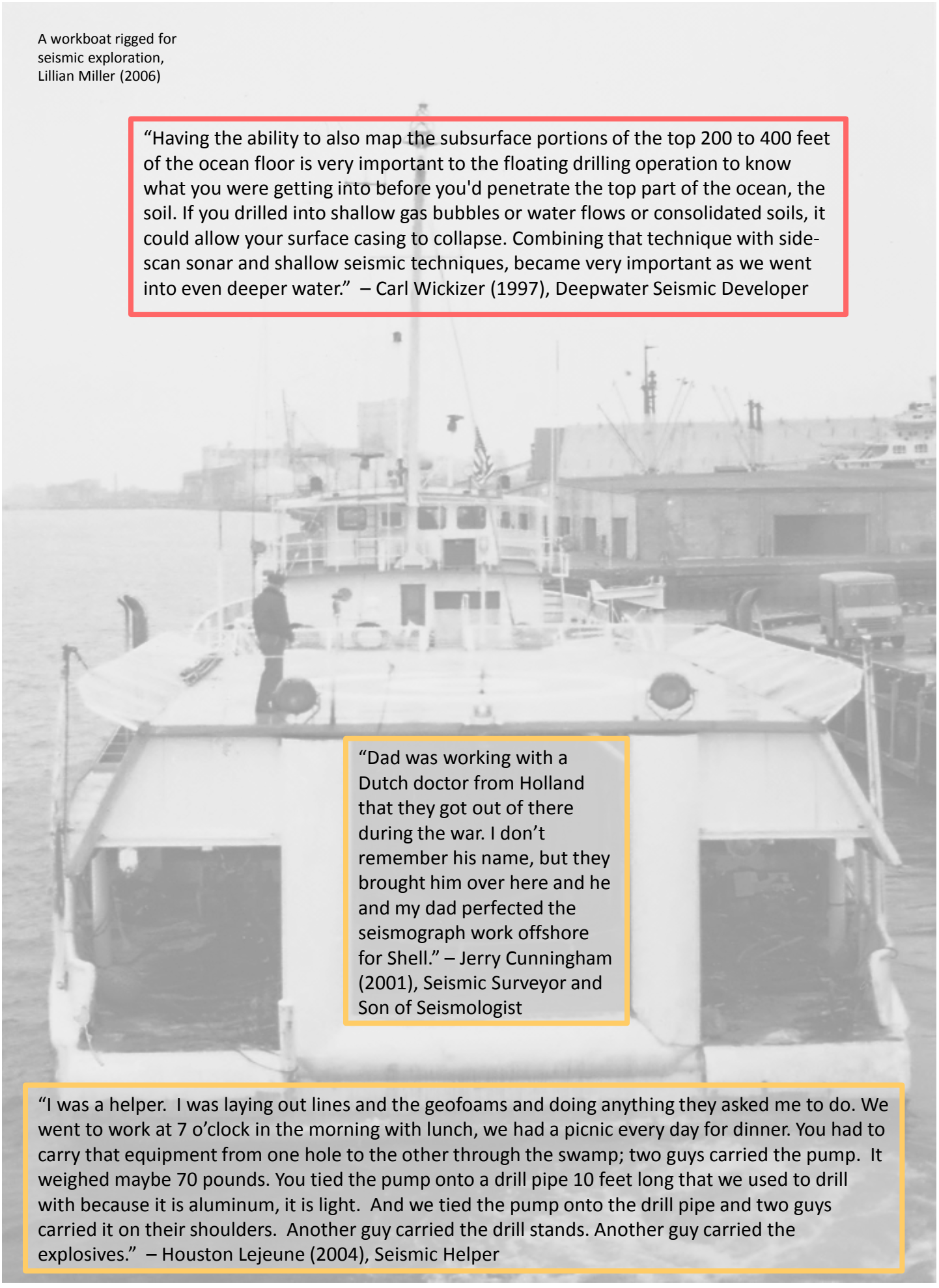
1945: U.S. attorney general challenged California's right to offshore submerged lands and the minerals that they held.

1968: Two-dimensional (2-D) seismic surveys utilizing airguns began in the Gulf of Mexico.

1978: The United States and Mexico signed the Treaty on Maritime Boundaries to define the boundaries between the two countries in the Gulf of Mexico (Mexico ratified the treaty in 1979; the U.S. in 1997).

1993: First 3-D seismic survey in the Gulf of Mexico.

A workboat rigged for seismic exploration, Lillian Miller (2006)



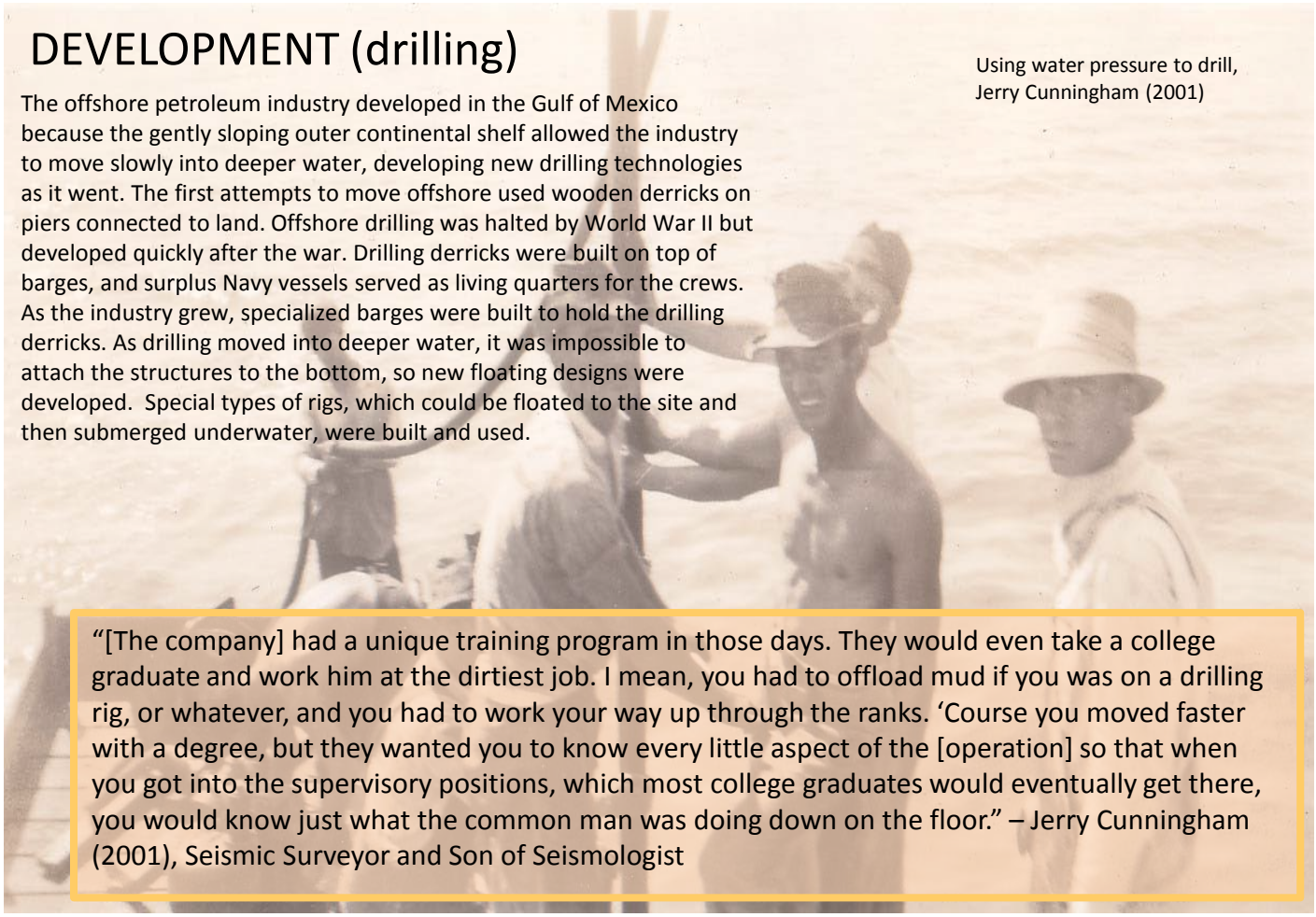
"Having the ability to also map the subsurface portions of the top 200 to 400 feet of the ocean floor is very important to the floating drilling operation to know what you were getting into before you'd penetrate the top part of the ocean, the soil. If you drilled into shallow gas bubbles or water flows or consolidated soils, it could allow your surface casing to collapse. Combining that technique with side-scan sonar and shallow seismic techniques, became very important as we went into even deeper water." – Carl Wickizer (1997), Deepwater Seismic Developer

"Dad was working with a Dutch doctor from Holland that they got out of there during the war. I don't remember his name, but they brought him over here and he and my dad perfected the seismograph work offshore for Shell." – Jerry Cunningham (2001), Seismic Surveyor and Son of Seismologist

"I was a helper. I was laying out lines and the geofoams and doing anything they asked me to do. We went to work at 7 o'clock in the morning with lunch, we had a picnic every day for dinner. You had to carry that equipment from one hole to the other through the swamp; two guys carried the pump. It weighed maybe 70 pounds. You tied the pump onto a drill pipe 10 feet long that we used to drill with because it is aluminum, it is light. And we tied the pump onto the drill pipe and two guys carried it on their shoulders. Another guy carried the drill stands. Another guy carried the explosives." – Houston Lejeune (2004), Seismic Helper

DEVELOPMENT (drilling)

The offshore petroleum industry developed in the Gulf of Mexico because the gently sloping outer continental shelf allowed the industry to move slowly into deeper water, developing new drilling technologies as it went. The first attempts to move offshore used wooden derricks on piers connected to land. Offshore drilling was halted by World War II but developed quickly after the war. Drilling derricks were built on top of barges, and surplus Navy vessels served as living quarters for the crews. As the industry grew, specialized barges were built to hold the drilling derricks. As drilling moved into deeper water, it was impossible to attach the structures to the bottom, so new floating designs were developed. Special types of rigs, which could be floated to the site and then submerged underwater, were built and used.



Using water pressure to drill, Jerry Cunningham (2001)

"[The company] had a unique training program in those days. They would even take a college graduate and work him at the dirtiest job. I mean, you had to offload mud if you was on a drilling rig, or whatever, and you had to work your way up through the ranks. 'Course you moved faster with a degree, but they wanted you to know every little aspect of the [operation] so that when you got into the supervisory positions, which most college graduates would eventually get there, you would know just what the common man was doing down on the floor." – Jerry Cunningham (2001), Seismic Surveyor and Son of Seismologist

1947: The first out-of-sight-of-land well was completed in the Gulf of Mexico in 14 feet of water.

Late 1970s – Early 1980s: Oil companies saw enormous capital expenditures financed largely though banks with credit, based on future assets in the ground.

1987: Spar technology for combined deepwater drilling and production platforms was patented; and the first logging while drilling tool was introduced.

1995-1996: New drilling and development technologies enabled easier re-entries, multilateral completions, extended reach drilling, reliable subsea completions, and floating production facilities.

2000-2001: Offshore well was drilled in over 9,000 feet of water, utilizing subsea mudlift (riserless) drilling and other deepwater technologies. Huge cost saving opportunities led to drilling in deeper water with greater production flow rates.

Global: World War II | Arab Oil Embargo

1930s-1950s: Near Shore | 1960s-1980s: Deepwater | 1990s-beyond: Ultra Deepwater

Regional: Hurricanes | Hurricanes

1947-1950: Tidelands Cases decided by the U.S. Supreme Court granted the Federal government rights over all U.S. offshore lands.

1961: First dynamically-positioned drillship, with a computer-controlled system to automatically maintain the vessel's position and heading using its own propellers and thrusters.

Early 1960s: Development of ship-shaped rigs and semi-submersibles extended the offshore industry's water depth drilling capability to nearly 1,000 ft.

1996: First spar platform was installed in 1,930 feet of water in the Gulf of Mexico.

A crew boat heading to a drilling rig, Roy Smith (2002)

"There was always an effort to try and keep what we were doing either covered by patents, or by a secret, if something was different. We got up there with Auger in 2,863 feet of water, well in advance of anybody else in that depth of water in the Gulf of Mexico or anywhere else. From the standpoint of both the technical aspects of it, as well as the project management organization, how do you get a million parts all together at the right time and the right place and make it work? That was a major feat also. It involved slews of people doing that." – Lee Brasted (1997), Civil Engineer and Floating Systems Manager

"From the early to mid '70s to when the bottom fell out, you had growth that was just unbelievable. And they had people comin' here from all over the country, because this is where the boomtown was." – Tim Creswell (2002), Production Foreman

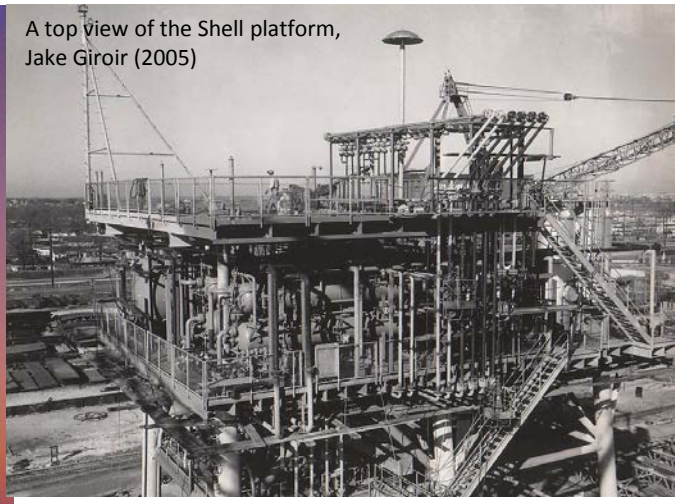
Platform with a drilling rig and a well, James "Cecil" Broussard (2002)

"Oil companies had to wait for the technology. They could see [the oil reserves] with seismic, but didn't really have the right kind of drill ships or semi[submersibles] to get to the depths they needed. When they finally got the deepwater vessels, they started to drill and confirm all their 3-D, 4-D seismic. An oil company back [before the early 1980s] was finding reserves worth $5 to 10 million or even $1 to 10 billion dollars; that was a big oil company. Today that value of reserves is what makes up a small independent, and big oil companies are finding these reserves that are worth $100 to 400 billion." – Bill Jackson (2006), Regional Sales Manager

PRODUCTION

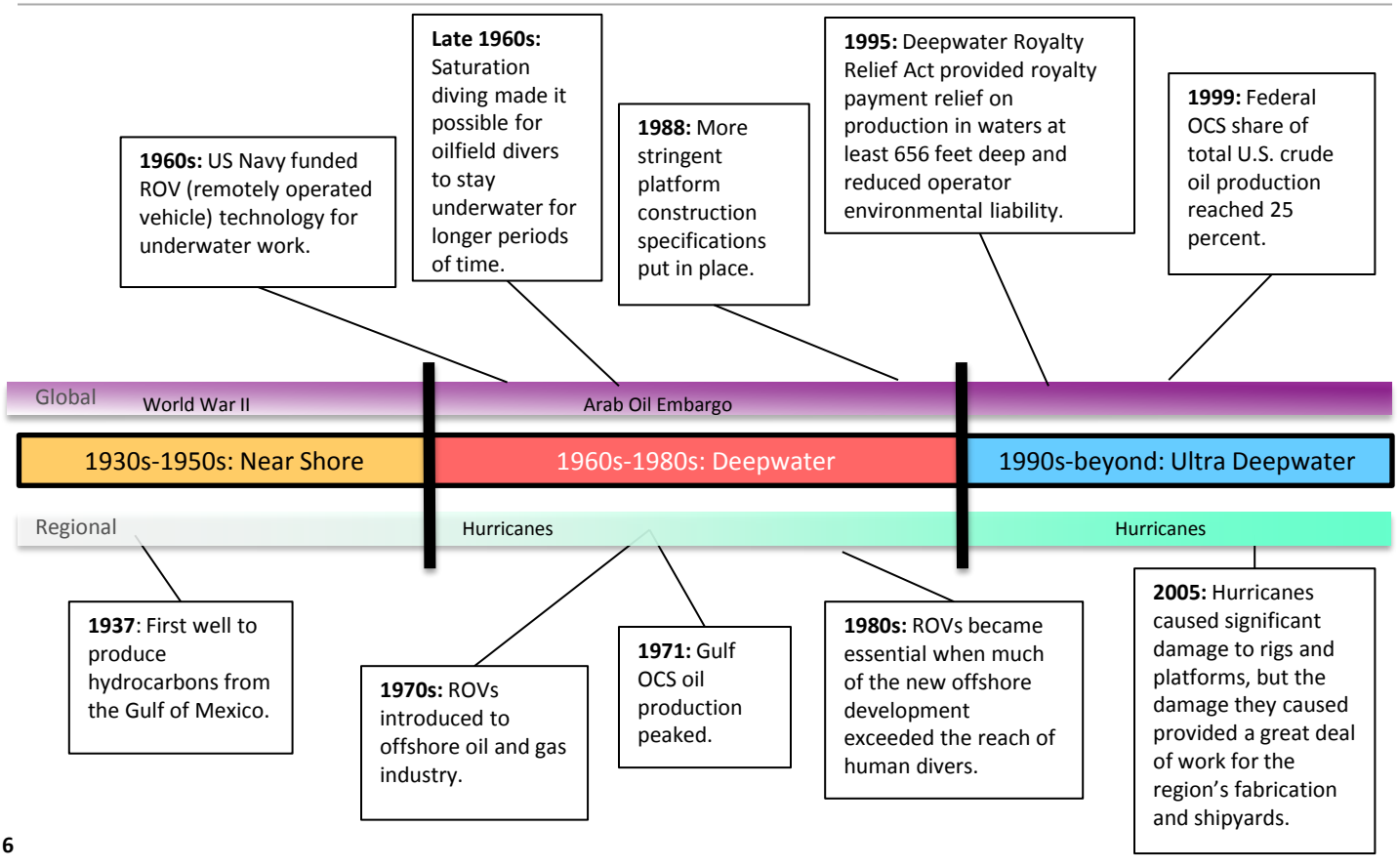
Mr. Gus platform at sunset, Lynda Miller (2006)

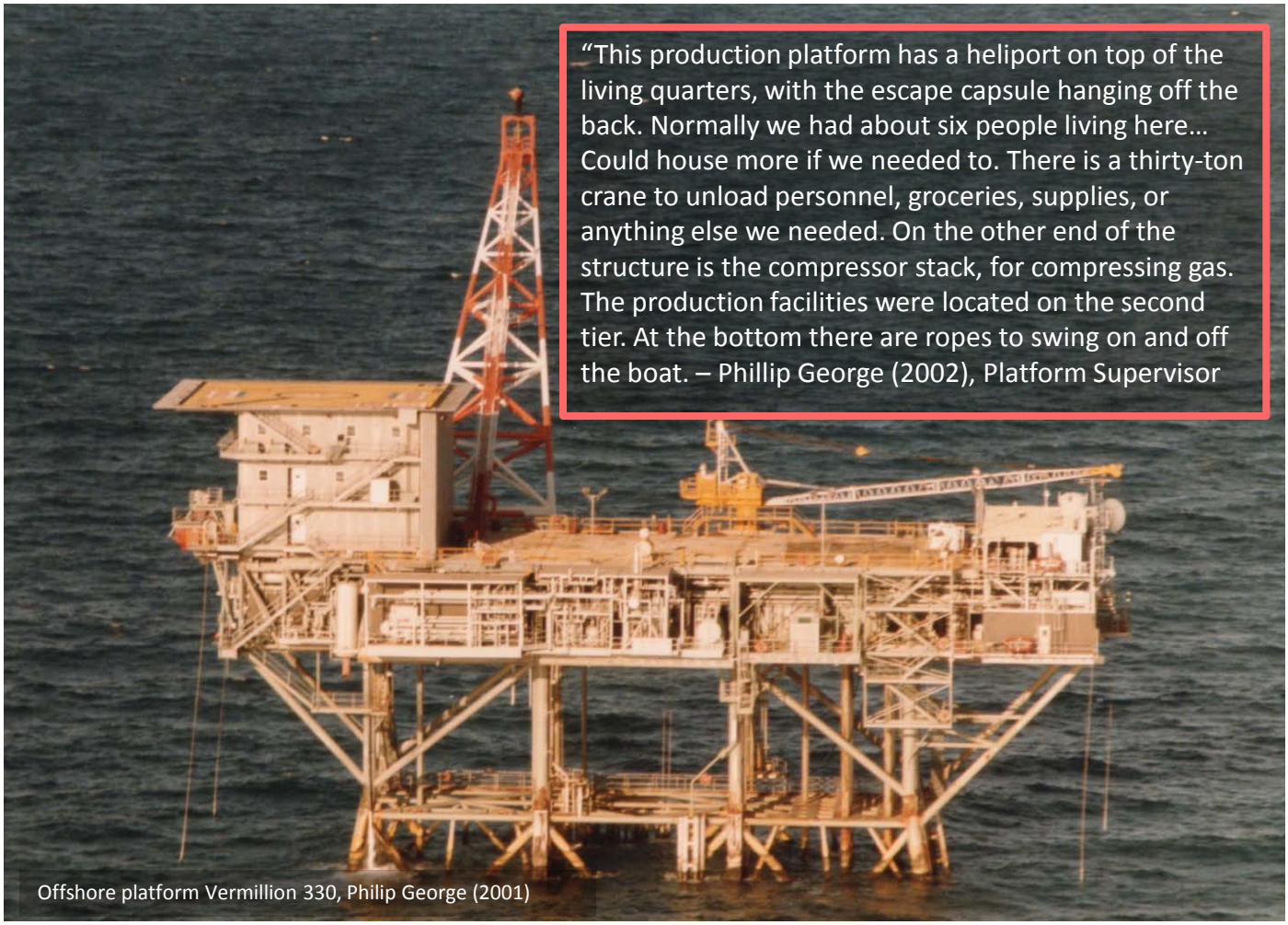
Once oil has been found, the well is completed and petroleum flows up from the ocean floor through metal tubing to a production platform. Oil and natural gas in the Gulf of Mexico are under pressure, so workers on the platform must control that pressure to prevent a blowout. Special equipment is used to detect changes in pressure within pipes and automatically seal them off if necessary. In the early years, platform workers used gauges to measure and manage flow. By the 21st century, many old platforms and all new ones were being managed by computers which provide continuous information to the production crews.



A top view of the Shell platform, Jake Giroir (2005)

"We were using helicopters mostly for personnel, and utility boats for equipment. When it got real rough, foggy, and the helicopters couldn't fly, we'd put personnel on a utility boat. It took a little longer to get in. When we started in 1967, we were using B47As – the little dragonfly-looking helicopter with the bubble. Offshore, that was our workhorse going from platform to platform. The 204 model Huey helicopters came out of Vietnam." – E.J. Aucoin (2009), Offshore Production and Transportation Superintendent





"This production platform has a heliport on top of the living quarters, with the escape capsule hanging off the back. Normally we had about six people living here… Could house more if we needed to. There is a thirty-ton crane to unload personnel, groceries, supplies, or anything else we needed. On the other end of the structure is the compressor stack, for compressing gas. The production facilities were located on the second tier. At the bottom there are ropes to swing on and off the boat. – Phillip George (2002), Platform Supervisor

Offshore platform Vermillion 330, Philip George (2001)

During the 1950s and early '60s, we had what they called depth bracket allowables. You could produce as much gas as you wanted to, but your oil was restricted because they were trying to keep the price up [because] if you produced too much oil the price would drop down and everybody would lose money. After the early 1980s, the U.S. produced maybe 500 or 1,000 barrels a day from a well. Other countries like Saudi Arabia, Mexico and Venezuela produced 10,000 barrels a day from a well. There was a drop in oil prices and a lot of people were laid off during that time, a lot of rigs stacked. –Kenneth Kaigler (2002), Drilling Engineer

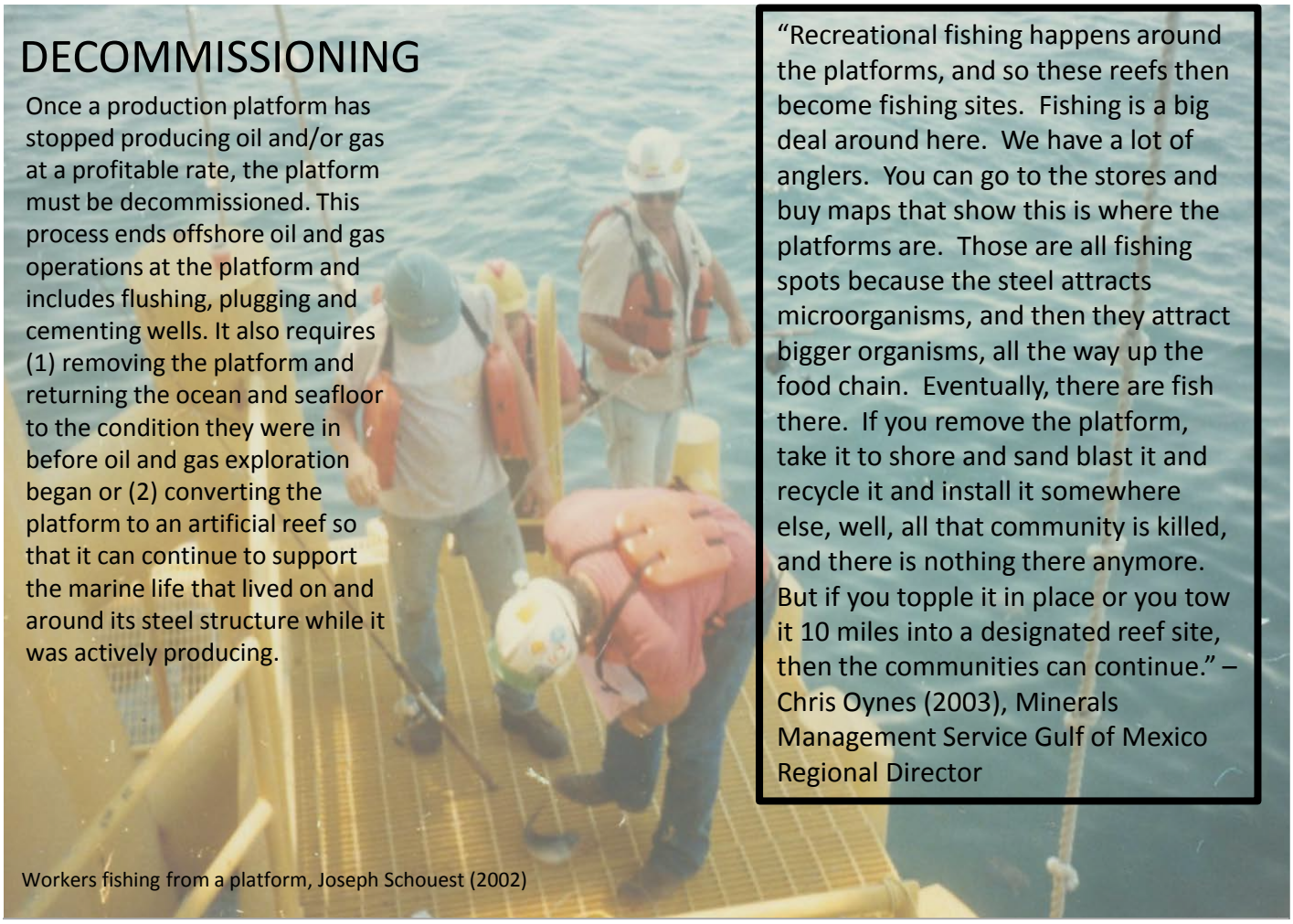
Two divers completing an underwater welding job on a platform, Whitey Grubbs (2002)

I enjoyed working in the oilfield. It was good work. We had about 21 producing oil wells and gas wells. When the wells were in really good condition, a gas well would have 3,500 pounds of tubing pressure and oil wells would be over 1,000 pounds of tubing pressure and no water. But as you produce 'em they start making water. And if you try to pull them too hard they will make water real fast. The company that produced wells slowly...rarely saw the water coming real fast. – Sam Pizzolato (2002), Production Foreman

DECOMMISSIONING

Once a production platform has stopped producing oil and/or gas at a profitable rate, the platform must be decommissioned. This process ends offshore oil and gas operations at the platform and includes flushing, plugging and cementing wells. It also requires (1) removing the platform and returning the ocean and seafloor to the condition they were in before oil and gas exploration began or (2) converting the platform to an artificial reef so that it can continue to support the marine life that lived on and around its steel structure while it was actively producing.

"Recreational fishing happens around the platforms, and so these reefs then become fishing sites. Fishing is a big deal around here. We have a lot of anglers. You can go to the stores and buy maps that show this is where the platforms are. Those are all fishing spots because the steel attracts microorganisms, and then they attract bigger organisms, all the way up the food chain. Eventually, there are fish there. If you remove the platform, take it to shore and sand blast it and recycle it and install it somewhere else, well, all that community is killed, and there is nothing there anymore. But if you topple it in place or you tow it 10 miles into a designated reef site, then the communities can continue." – Chris Oynes (2003), Minerals Management Service Gulf of Mexico Regional Director



Workers fishing from a platform, Joseph Schouest (2002)

1953: Outer Continental Shelf Lands Act and implementing regulations established decommissioning obligations for oilfield operators, including the requirement to apply for and obtain a permit for platform removal.

1983: MMS announced its support for Rigs-to-Reefs programs to turn dismantled platforms into artificial marine habitats.

1984: National Fishing Enhancement Act established national standards for the construction and siting of artificial reefs in the waters of the United States.

1985: National Artificial Reef Plan developed by the Secretary of Commerce to guide artificial development and use.

2001: World oil prices began to climb toward 2008 peak.

Global: World War II | Arab Oil Embargo

1930s-1950s: Near Shore | 1960s-1980s: Deepwater | 1990s-beyond: Ultra Deepwater

Regional: Hurricanes | Hurricanes

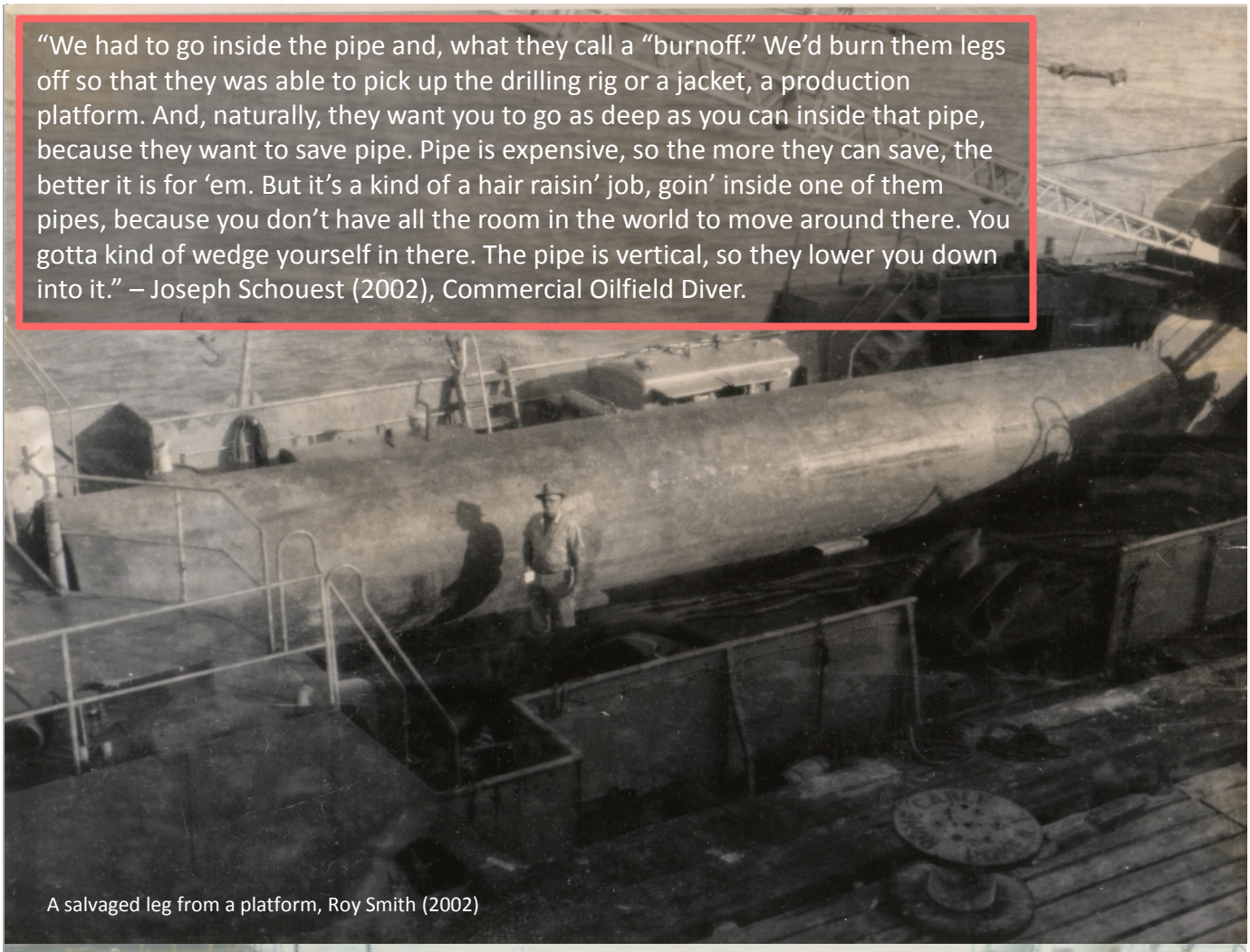
1979: First planned conversion of oil platforms to artificial reefs took place in Florida.

2002: Offshore platform removals began exceeding installations.

2005: Storms destroyed 113 offshore platforms, seriously damaging 52 more.

2008: MMS reviewed idle structures and wells on active Gulf of Mexico leases and identified many needing removal.

"We had to go inside the pipe and, what they call a "burnoff." We'd burn them legs off so that they was able to pick up the drilling rig or a jacket, a production platform. And, naturally, they want you to go as deep as you can inside that pipe, because they want to save pipe. Pipe is expensive, so the more they can save, the better it is for 'em. But it's a kind of a hair raisin' job, goin' inside one of them pipes, because you don't have all the room in the world to move around there. You gotta kind of wedge yourself in there. The pipe is vertical, so they lower you down into it." – Joseph Schouest (2002), Commercial Oilfield Diver.



A salvaged leg from a platform, Roy Smith (2002)

"A Plugging & Abandonment (P&A) decommissioning company goes to an oil company and offers to buy their platforms for chickenfeed in exchange for all of their liability. Possibly the oil company's had it 10 or 15 years so they'll sell it. Decommissioning companies will work the wells trying to get a little more out of them, trying to turn those things into gold. One company had a few platforms roll over during the hurricane. They own quite a bit of them but ended up with $400 million worth of P&A sub-sea cleanup. The company's not that big, but it's their liability now." – Bill Jackson (2006), Regional Offshore Logistics Sales Manager

Platform alongside a barge, Walter Daspit (2002)

"There were some platform abandonments that we pumped all the oil out when they removed the structure and took it to the bank. Sometimes we'd get proper approval from Louisiana or Texas if the structure was big enough and in deep enough water to donate the platform for an artificial reef. And to do that we just cut the legs off, push it over, and let it fall. All kinds of fish, marine mammals, and things attach to the steel, including oysters. They attach and then the food chain starts on up to all the different kinds and sizes of fish that hang around those platforms." – Billy Rodgers (2003), Civil Engineer

Glossary

Word	Definition
Casing	Large-diameter pipe lowered into an open hole and cemented in place, through which drill pipe will be inserted. Casing must withstand a variety of forces, such as collapse, burst, and tensile failure, as well as chemically aggressive brines.
Completion, Well	In petroleum production, the process of making a well ready for production which involves preparing the bottom of the hole and inserting tubing or casing. Final completion of the well includes installing the wellhead and Christmas tree (the main valve assembly that controls flow from the well).
Deepwater	In petroleum exploration and production, water of a depth greater than 1,000 feet.
Drilling Foreman	The supervisor of drilling or workover operations on a rig.
Dynamic Positioning	A computer-controlled system that maintains a vessel's position and heading using its own propellers and thrusters.
Jacket	Vertical section made of tubular steel that is inserted into the seabed to support a platform.
Drilling Mud (also known as Drilling Fluid)	A chemical mixture used during drilling as a lubricant and to carry materials being drilled to the surface. The mud engineer determines the appropriate mixture for the well being drilled.
Logging	The process of tracking the depths, subsurface formations, and events during drilling. Well logs are recorded according to the depth drilled and can include visual observations as well as information gathered from instruments lowered into the well during drilling.
Mudlift Drilling	A deepwater floating drilling system where the drilling mud is pumped from the seafloor to the drilling vessel so the pressure gradients in the returning mud column are matched to the natural formation pore and fracture pressure gradients, minimizing the need for casing strings and enabling better pressure control. The system can be used with or without risers.
Outer Continental Shelf (OCS)	The submerged lands, subsoil, and seabed that belong to the United States and lie seaward of the jurisdiction of individual states (3 nautical miles for all states except Texas and Florida for which jurisdiction extends to approx. 9 nautical miles).
Platform	A large structure with equipment to drill wells, to extract and process oil and natural gas, and/or to temporarily store product until it can be taken to shore for refining and marketing.
Rig	A large structure with equipment for drilling an oil or gas well.
Riser	A pipeline developed for vertical transfer materials between the seafloor and the drilling and production facilities at the water's surface.
Remotely Operated Vehicle (ROV)	Unoccupied, highly maneuverable underwater robot operated by a person from aboard a surface vessel.

Word	Definition
Seismology	The study of seismic or elastic waves, such as from earthquakes, explosions, or other causes. Seismologists exploring for petroleum interpret the structure and composition of the Earth from artificially created seismic waves.
Semi-submersible	A mobile offshore drilling unit with a platform-type deck that is supported by pontoon-type columns. The unit floats on top of the water during transport and then the columns are submerged during drilling to increase stability.
Spar	A floating platform that can support drilling, production, and storage operations.
Three-Dimensional (3-D) Seismic Surveying	An acoustic measuring technology which uses multiple vessel-towed long hydrophone streamers to generate a 3-D model of the deep seabed in order to locate and analyze oil and gas reservoirs.
Tug Boat	A boat used to tow or push other vessels in rivers, canals, and other waterways and to tow barges and platforms.
Ultra Deepwater	In petroleum exploration and production, water of a depth greater than 5,000 feet.

References

The Offshore Oil and Gas History Project resulted in a six-volume report entitled History of the Offshore Oil and Gas Industry in Southern Louisiana, Volumes I through VI. These reports can be accessed at www.data.boem.gov/homepg/data_center/other/espis/espismaster.asp?appid=1; check the box for "Report Title" and enter the title of the desired report. The recorded interviews, transcripts, and photographs collected during this study are archived at the University of Houston M.D. Anderson Library Special Collections Department, the Nicholls State University Ellender Memorial Library Archives, and the University of Louisiana Lafayette Edith Garland Dupré Library Special Collections and Archives. They are also archived at the Morgan City Archives in Morgan City, LA; the South Lafourche Library in Cut Off, LA; and the Terrebonne Parish Library in Houma, LA.

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An offshore oil rig in the middle of a storm
Lynda Miller (2006)

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