Oilfield Trivia

Or

How Well Do You Know Your Oilfield?

A Presentation by Mark Venettozzi

Shell Deepwater Learning Advisor

Shell Robert Training and Conference Center
The Origin of the Word ‘Derrick’

The traditional oilfield structure is named for a famous seventeenth century hangman. The derrick was named after Thomas Derrick, an English executioner in the Elizabethan era because of its resemblance to the frame from which a hangman’s noose hangs.
The Origin of the Forty-Two Gallon Barrel

In the Oil & Gas industry there are literally hundreds of abbreviations that we use everyday - for example, feet becomes ‘ft’ and pounds per square inch becomes ‘psi.’ These in themselves are understandable, but do you know how barrel became ‘bbl’?

The origins of the 42-gallon oil barrel are obscure, but some historical documents indicate that around 1866 early oil producers in Pennsylvania came to the conclusion that shipping oil in a variety of different containers was causing buyer distrust. They decided they needed a standard unit of measure to convince buyers that they were getting a fair volume for their money. They agreed to base this measure on the more-or-less standard 40-gallon whiskey barrel, but added an additional two gallons to ensure that any measurement errors would always be in the buyer's favor as an additional way of assuring buyer confidence, apparently on the same principle as is behind the ‘baker’s dozen’ and some other long units of measure. By 1872 the standard oil barrel was firmly established as 42 US gallons.

The "b" may have been doubled originally to indicate the plural (1 bl, 2 bbl), or possibly it was doubled to eliminate any confusion with bl as a symbol for the bale. Some sources claim that 'bbl' originated as a symbol for "blue barrels" delivered by Standard Oil in its early days; this is probably incorrect because there are citations for the symbol at least as early as the late 1700s, long before Standard Oil was founded. Still, Standard Oil started manufacturing 42 gallon barrels that were blue for transporting petroleum. Refineries, who at that time were housing the crude product in blue barrels, began storing refined product in red barrels. Finally, in early oil transportation times in Pennsylvania, good barrels for hauling oil in were marked with a blue ‘X’ to distinguish them from barrels with holes.
The P.L.U.T.O project was the birth of coiled tubing as we know it today. The Pipe Lines Under The Ocean or “P.L.U.T.O.” project occurred during World War II. The allied forces needed a way to get petroleum to the European forces from Great Britain. Their engineers developed a method of coiling the tubing and then laying it across the English Channel. The actual steel tubing, called “HAMEL”, was designed by two engineers, HA Hammick and BJ Ellis. The pipelines were vital arteries that pumped millions of gallons of fuel from Britain to Allied forces in France.

Two lines were built, codenamed Dumbo and Bambi. Pumping stations were disguised as ice cream shops, garages and bungalows. The seabed lines were laid by 30ft diameter ‘Conun’ drums pulled by tugs.

The project was deemed “strategically important, tactically adventurous, and, from the industrial point of view, strenuous”. Existing cable ships were not large enough, nor were their loading and laying gear sufficiently powerful and robust for the task, so a number of merchant ships were converted to pipe-laying vessels by stripping the interiors and building in large cylindrical steel tanks, fitting special hauling gear and suitable sheaves and guides. Early trials with 2-
inch diameter pipe proved successful, so the decision was made to produce 3-inch pipe, which would reduce the total numbers of pipelines due to the increased capacity of the larger pipe.

The P.L.U.T.O. Pipelines were linked to pump stations on the English coast, housed in various inconspicuous buildings including cottages and garages. Though uninhabited, these were intended to cloak the real purpose of the buildings. Pluto Cottage at Dungeness, a pumping station built to look like a small house, is now a Bed and Breakfast. In England, the P.L.U.T.O. pipelines were supplied by a 1,000 mile network of pipelines (constructed at night to prevent detection by aerial reconnaissance) to transport fuel from ports including Liverpool and Bristol. In Europe, the pipelines were extended as the troops moved forward and eventually reached as far as the Rhine.

In January 1945, 300 tons of fuel was pumped to France per day, which increased to 3,000 tons per day in March, and eventually to 4,000 tons (almost 1,000,000 Imperial gallons) per day. In total, over 172 million imperial gallons of gasoline had been pumped to the Allied forces in Europe by VE day, providing a critical supply of fuel until a more permanent arrangement was made, although the pipeline remained in operation for some time after.

Dumbo was the codename given to the pipeline that ran across Romney Marsh to Dungeness and then across the English Channel to France. The route of the pipeline can be traced in various places on Romney Marsh. Where the pipeline crossed water drainage ditches it ran above ground in a concrete case, and several of these can still be found today.

Along with the Mulberry Harbours that were constructed immediately after D-Day, Operation P.L.U.T.O. is considered one of history’s greatest feats of military engineering. The pipelines are also the forerunners of all flexible pipes used in the development of offshore oil fields.
The ‘Discoverer’ of Oil

Edward Laurentine ‘Colonel’ Drake is popularly credited with having ‘discovered’ oil on August 27th, 1859 near Titusville, Pennsylvania for the Seneca Oil Company. Drake was hired by the Seneca Oil Company to investigate suspected oil deposits in Titusville, Pennsylvania. James Townsend, President of the Seneca Oil Company, sent Drake to the site in the spring of 1858. The oil company chose the retired railway man partly because he had free use of the rail. Drake decided to drill in the manner of salt well drillers. He purchased a steam engine in Erie, Pennsylvania, to power the drill. The well was dug on an island on the Oil Creek. It took some time for the drillers to get through the layers of gravel. At 16 feet, the sides of the hole began to collapse. It was at this point that he devised the idea of a drive pipe. This cast iron pipe consisted of ten-foot long joints, driven into the ground. At 32 feet, they struck bedrock. Progress was made at the rate of just three feet per day. After initial difficulty locating the necessary parts to build the well, which resulted in his well being nicknamed “Drake’s Folly,” Drake proved successful. Meanwhile crowds of people began to gather to jeer at the apparently unproductive operation. Drake was also running out of money. The Seneca Oil Company had abandoned their man and Drake had to rely on friends to back the enterprise. On August 27th, Drake had persevered and his drill bit had reached a total depth of 69.5 feet. At that point the bit hit a crevice, and the men packed up for the day. The next morning Drake’s driller, Billy Smith, looked into the hole in preparation for another day’s work. He was surprised and delighted to see crude oil rising up. Drake was summoned and the oil was brought to the surface with a hand pitcher pump, where it was collected in a bathtub.

Drake is famous for pioneering a new method for producing oil from the ground. He drilled using piping to prevent borehole collapse, allowing for the drill to penetrate further and further into the ground. Previous methods for collecting oil had been limited. Ground collection of oil consisted of gathering it from where it occurred naturally, such as from oil seeps or shallow holes dug into the ground. Drake tried the latter method initially when looking for oil in Titusville. However, it failed to produce economically viable amounts of oil. Alternative methods of digging large shafts into the ground also failed, as collapse from water seepage almost always occurred. The significant step that Drake took was to drive an iron pipe through the ground into the bedrock below. This allowed Drake to drill inside the pipe, without the hole collapsing from the water seepage. The principle
behind this idea is still employed today by many companies drilling for hydrocarbons.

While some claims of ‘prior art’ do exist (e.g., Bóbrka, Poland in 1854, Wietze, Germany in 1857, Oil Springs, Ontario, Canada in 1858), the Drake Well at Titusville was the first well to be widely copied. Within a day of Drake’s striking oil, others along Oil Creek and in the immediate area were imitating Drake’s methods. This culminated with the establishment of several oil boom towns along the creek. Drake's well produced 25 barrels of oil a day. By 1871, the entire area was producing 5.8 million barrels a year.

Drake set up a stock company to extract and market the oil. But, while his pioneering work led to the growth of an oil industry that made many people fabulously rich, for Drake riches proved elusive. Drake did not possess good business acumen, and he failed to patent his drilling invention. He then lost all of his savings in oil speculation in 1863. He was to end up as an impoverished old man. In 1872, Pennsylvania voted an annuity of $1500 to the "crazy man" whose determination founded the oil industry. He died on November 9, 1880 in Bethlehem, Pennsylvania, where he had lived since 1874. He and his wife are buried at Titusville, next to a memorial built in his honor.
Nuclear Stimulation

There was no mushroom cloud, but on December 10, 1967, a nuclear bomb exploded less than sixty miles from Farmington, New Mexico. Today, all that remains at the site is a plaque warning against excavation and perhaps a trace of tritium in your milk. The explosion was part of Operation Plowshare, a program conducted by the Atomic Energy Commission (AEC) to explore peaceful uses of atomic bombs. AEC scientists proposed using nuclear weapons as high-powered dynamite in a variety of "nuclear landscaping" projects. The most ambitious Plowshare proposal suggested setting off as many as 300 hydrogen bombs to blast a newer, larger canal across the Isthmus of Panama.

The goal of the Farmington blast, code-named “Gasbuggy”, was to see if a smaller underground nuclear explosion would stimulate the release of natural gas trapped in dense shale deposits. Gasbuggy called for a 29-kiloton warhead to be set off four thousand feet underground in an existing, low-productivity gas well. (In comparison, the nuclear warhead dropped on Hiroshima was 12 to 15 kilotons, and the Nagasaki bomb was 20 to 22 kilotons) Participants in Project
Gasbuggy included the AEC, the Bureau of Mines and the El Paso Natural Gas Company (EPNG). Ground zero was seven and a quarter miles south on Forest Road 537, south off State Highway 64, in the Carson National Forest. Geologists had discovered years before that setting off explosives at the bottom of a well would shatter the surrounding rock and could stimulate the flow of oil and gas. It was believed a nuclear device would simply provide a bigger bang for the buck than nitroglycerine - up to 3500 quarts of which would be used in a single shot. Nationwide, it was hoped nuclear stimulation of gas wells might result in the recovery of as much as ten times the amount of natural gas as was then being recovered and help relieve the nation’s energy crisis.

The Gasbuggy blast created an underground cavern approximately 160 feet in diameter by 333 feet tall--imagine putting an oversized football field on a stick like a Popsicle, pushing it 3800 feet down into solid rock, and twirling it. A few seconds after the explosion the molten glass-lined cavern collapsed, creating a chimney filled with rubble and debris. Geologists later estimated that fractures extended out from the cavern a few hundred feet in all directions.

Residents of Farmington were quite concerned about the test, fearing an underground chain reaction or the Navajo dam bursting. An informational meeting held by the AEC at the Farmington Elks Club apparently failed to reassure residents. A drilling rig was used to drill the primary hole, and to lower the thirteen-foot by 18” diameter canister containing the nuclear bomb. After the explosion the rig was returned to the site to drill back into the “chimney.” There were numerous guards and fences around the test site at the time, as well. Declassified records from the Department of Energy in Las Vegas suggest a number of concerns with the test, both private and public. They included radioactive contamination both in, and of, the gas produced. Special “cleaner” nuclear bombs designed specifically for Plowshare blasts didn’t turn out to be as "clean" as was hoped. Among the hundreds of declassified records are memos and reports discussing increased tritium levels in surrounding vegetation, the release of radioactive Krypton-85 gas, and testing of milk from nearby dairy cows for Strontium90.

One series of letters outlines the California Public Utility Commission’s objection to any of the gas being shipped there. Even though it was only slightly radioactive, reports indicate downstream customers didn’t want it. Scientists suggested that mixing it with gas from other wells would bring the radiation levels down to what was considered "an acceptable level," but gas customers would reportedly have none of it. Another question was whether radioactivity from Gasbuggy would contaminate gas from other wells in the San Juan Basin. There were five operating gas wells within a mile of the Gasbuggy site. To be safe, EPNG had physically cut the pipelines to all five prior to the blast. Within several months, however, they were reconnected. Test results seem to indicate that there was minimal, cross-contamination, although measurable amounts of tritium began showing up several decades later.
Howard Hughes Sr. and his Bit

The Hughes Tool Company was founded by Walter Benona Sharp and Howard R. Hughes, Sr., father of Howard Hughes, Jr. In 1908, Hughes and his partner developed the first two-cone drill bit, designed to enable rotary drilling in harder, deeper formations than was possible with earlier fishtail bits. They conducted two secret tests on a drilling rig in Goose Creek, Texas. Each time, Hughes asked the drilling crew to leave the rig floor, pulled the bit from a locked wooden box, and then his associates ran the bit into the hole. The drill pipe twisted off on the first test, but the second was extremely successful. In 1909, the Sharp & Hughes bit was granted a U.S. patent.

In the same year, the partners formed the Sharp-Hughes Tool Company in Houston, Texas to manufacture the bit in a rented space measuring 20 by 40 ft. Hughes Tool Company's research, engineering and development programs were responsible for many landmark innovations. Hughes' legacy of innovation began in 1909 when he introduced the world's first rotary rock bit equipped with two rolling cone cutters. This bit revolutionized rotary drilling by making it possible to penetrate hard formations.

Prior to 1909 the traditional fishtail bit scraped the rock and quickly dulled in service. The Hughes two-cone bit's revolutionary rolling action crushed hard-rock formations with twin cone-shaped, hardened steel bits, each with 166 cutting edges, revolving on bronze bearings shaped to provide a large surface with reduced friction. This rolling motion allowed the cutting edges to chip the rock, one edge after another. Significantly, the cutting edges were designed so they would avoid falling into previous cuts, preventing what is known as tracking. This enabled each edge to continuously crush a new portion of the rock. The absence of pure scraping of the fishtail bit allowed the Hughes Two-Cone Drill Bit to drill faster and further before sharpening. The detachable cutters could be removed for sharpening or replacement when dull. The bottom of the drill hole, as formed by the operation of the bit, was a perfect seat for a watertight joint, preventing leakage after the casing had been set. The Hughes Two-Cone Drill Bit ushered in a new era of abundant, inexpensive fuel and laid the foundation for the automobile age.

Hughes established the first research laboratory to study rock bit performance in 1910. After Walter Sharp died in 1912, Mr. Hughes purchased
Sharp's half of the business, and the company was renamed Hughes Tool Company in 1915. Two years later, Hughes introduced a reaming cone bit equipped with two regular cones in addition to a reamer built into the body of the bit.

In 1921, the simplex bit was introduced. This design had a replaceable wash pipe down the center of the bit that allowed for the use of more powerful mud pumps that resulted in dramatic improvement in rates of penetration. Eight years later, the application of hardfacing on the cutting structure of cones to further increase rate of penetration and footage drilled per bit was introduced. The next major advancement was in 1931, with the introduction of the first unit-type bit with anti-friction bearings that eliminated the expense and delay caused by changing cones. A year later, Hughes introduced two more important improvements. The first was the staggered tooth cutting structure that gives all teeth maximum depth and optimum spacing for increased rate of penetration and durability. The second was the introduction of the anti-friction ball and roller bearing. This design called for the retention of the cones on a cantilevered bearing shaft while balls are inserted through a hole in the bit leg. This constituted one of the biggest improvements in bit bearings at that time. In 1933, Hughes created the Tricone design with interfitting teeth that has since gained universal acceptance and still dominates the industry to this day.