GLOSSARY OF OILFIELD TERMS
Drilling Operations

	Abnormal pressure	A subsurface condition in which the pore pressure of a geologic formation exceeds or is less than the expected, or normal, formation pressure. When impermeable rocks such as shales are compacted rapidly, their pore fluids cannot always escape and must then support the total overlying rock column, leading to abnormally high formation pressures. Excess pressure, called overpressure or geopressure, can cause a well to blow out or become uncontrollable during drilling. Severe underpressure can cause the drillpipe to stick to the underpressured formation.
	Air drilling	A drilling technique whereby gases (typically compressed air or nitrogen) are used to cool the drill bit and lift cuttings out of the wellbore, instead of the more conventional use of liquids. The advantages of air drilling are that it is usually much faster than drilling with liquids and it may eliminate lost circulation problems. The disadvantages are the inability to control the influx of formation fluids into the wellbore and the destabilization of the borehole wall in the absence of the wellbore pressure typically provided by liquids.
	Annular pressure	Fluid pressure in the annulus between tubing and casing or between two strings of casing.
	Annular velocity	The speed at which drilling fluid or cement moves in the annulus. It is important to monitor annular velocity to ensure that the hole is being properly cleaned of cuttings, cavings and other debris while avoiding erosion of the borehole wall. The annular velocity is commonly expressed in units of feet per minute or, less commonly, meters per minute. The term is distinct from volumetric flow.
	Annulus	The space between two concentric objects, such as between the wellbore and casing or between casing and tubing, where fluid can flow. Pipe may consist of drill collars, drillpipe, casing or tubing.
API	**American Petroleum Institute**	A trade association founded in 1919 with offices in Washington, DC, USA. The API is sponsored by the oil and gas industry and is recognized worldwide. Among its long-term endeavors is the development of standardized testing procedures for drilling equipment, drilling fluids and cements, called API Recommended Practices ("RPs"). The API licenses the use of its monogram (logo), monitors supplier quality assurance methods and sets minimum standards for materials used in drilling and completion operations, called API Specifications ("Specs"). The API works in conjunction with the International Standards Organization (ISO).
Az	**Azimuth**	The compass direction of a directional survey or of the wellbore as planned or measured by a directional survey. The azimuth is usually specified in degrees with respect to the geographic or magnetic north pole.
	Azimuthal	In well logging: Pertaining to being focused in one direction. An azimuthal, or azimuthally focused, measurement has one or more directions perpendicular to the surface of a logging tool from which it receives most of its signal. Examples are the density, laterolog and microresistivity logs. Recent applications include azimuthal density and gamma ray in LWD tools. A nonazimuthal, or azimuthally symmetric measurement is one which measures equally in all directions around the tool. Examples are the induction, propagation resistivity log and gamma ray.
	Back off	To unscrew drillstring components downhole. The drillstring, including drillpipe and the bottomhole assembly, are coupled by various threadforms known as connections, or tool joints. Often when a drillstring becomes stuck it is necessary to "back off" the string as deep as possible to recover as much of the string as possible. To facilitate the fishing or recovery operation, the backoff is usually accomplished by applying reverse torque and detonating an explosive charge inside a selected threaded connection. The force of the explosion enlarges the female (outer) thread enough that the threaded connection unscrews instantly. Backing off can also occur unintentionally.
	Barite	Weighting material with a specific gravity of 4.37 used to increase the apparent density of a liquid drilling fluid system. Barite [$BaSO_4$] is the most common weighting agent used today. It is a mined material ground to an API specification such that particle sizes are predominantly in the 3 to 74 micron range.
	Barite plug	A plug made from barite weighting materials that is placed at the bottom of a wellbore. Unlike a cement plug, the settled solids do not set solid, yet a barite plug can provide effective and low-cost pressure isolation. A barite plug is relatively easy to remove and is often used as a temporary facility for pressure isolation or as a platform enabling the accurate placement of treatments above the plug.
BHA	**Bottom Hole Assembly**	The lower portion of the drillstring, consisting of (from the bottom up in a vertical well) the bit, bit sub, a mud motor (in certain cases), stabilizers, drill collars, heavy-weight drillpipe, jarring devices ("jars") and crossovers for various threadforms. The bottomhole assembly must provide force for the bit to break the rock (weight on bit), survive a hostile mechanical environment and provide the driller with directional control of the well. Oftentimes the assembly includes a mud motor, directional drilling and measuring equipment, measurements-while-drilling tools, logging-while-drilling tools and other specialized devices. A simple BHA consisting of a bit, various crossovers, and drill collars may be relatively inexpensive (less than $100,000 US in 1999), while a complex one may cost ten or more times that amount.
	Bingham Plastic Model	A two-parameter rheological model widely used in the drilling fluids industry to describe flow characteristics of many types of muds. Fluids obeying this model are called Bingham plastic fluids and exhibit a linear shear-stress, shear-rate behavior after an initial shear-stress threshold has been reached.
	Bit	The tool used to crush or cut rock. Everything on a drilling rig directly or indirectly assists the bit in crushing or cutting the rock. The bit is on the bottom of the drillstring and must be changed when it becomes excessively dull or stops making progress. Most bits work by scraping or crushing the rock, or both, usually as part of a rotational motion. Some bits, known as hammer bits, pound the rock vertically in much the same fashion as a construction site air hammer.
	Bit breaker	A special tool used by the rig crew to prevent the drill bit from turning while the bit sub on top of it is tightened or loosened. Bits have noncylindrical shapes, so the conventional wrenches used by the rig crew to tighten cylindrical shapes like pipes do not fit the bits properly. In addition, some bits, such as PDC bits, have a wide range of unusual and asymmetric shapes or profiles. The bit breaker must match the bit profile or the bit may be ruined before ever being used.
	Bit nozzle (or jet)	The part of the bit that includes a hole or opening for drilling fluid to exit. The hole is usually small (around 0.25 in. in diameter) and the pressure of the fluid inside the bit is usually high, leading to a high exit velocity through the nozzles that creates a high-velocity jet below the nozzles. This high-velocity jet of fluid cleans both the bit teeth and the bottom of the hole. The sizes of the nozzles are usually measured in 1/32-in. increments (although some are recorded in millimeters), are always reported in "thirty-seconds" of size (i.e., fractional denominators are not reduced), and usually range from 6/32 to 32/32.
	Bit record	A historical record of how a bit performed in a particular wellbore. The bit record includes such data as the depth the bit was put into the well, the distance the bit drilled, the hours the bit was being used "on bottom" or "rotating," the mud type and weight, the nozzle sizes, the weight placed on the bit, the rotating speed and hydraulic flow information. The data are usually updated daily. When the bit is pulled at the end of its use, the condition of the bit and the reason it was pulled out of the hole are also recorded. Bit records are often shared among operators and bit companies and are one of many valuable sources of data from offset wells for well design engineers.
	Blank pipe	A short section of plain tubing used to separate or space-out specialized components in a completion assembly. Blank pipe is commonly used in sand control completions where intervals of screen are separated by short sections of blank pipe. The term is also used to describe unperforated sections of casing or liner.
	Bleed off	To equalize or relieve pressure from a vessel or system. At the conclusion of high-pressure tests or treatments, the pressure within the treatment lines and associated systems must be bled off safely to enable subsequent phases of the operation to continue. The bleedoff process must be conducted with a high degree of control to avoid the effect of sudden depressurization, which may create shock forces and fluid-disposal hazards.
	Blowout	An uncontrolled flow of reservoir fluids into the wellbore, and sometimes catastrophically to the surface. A blowout may consist of salt water, oil, gas or a mixture of these. Blowouts occur in all types of exploration and production operations, not just during drilling operations. If reservoir fluids flow into another formation and do not flow to the surface, the result is called an underground blowout. If the well experiencing a blowout has significant openhole intervals, it is possible that the well will bridge over (or seal itself with rock fragments from collapsing formations) downhole and intervention efforts will be averted.

BOP	**BlowOut Preventer**	A large valve at the top of a well that may be closed if the drilling crew loses control of formation fluids. By closing this valve (usually operated remotely via hydraulic actuators), the drilling crew usually regains control of the reservoir, and procedures can then be initiated to increase the mud density until it is possible to open the BOP and retain pressure control of the formation. BOPs come in a variety of styles, sizes and pressure ratings. Some can effectively close over an open wellbore, some are designed to seal around tubular components in the well (drillpipe, casing or tubing) and others are fitted with hardened steel shearing surfaces that can actually cut through drillpipe. Since BOPs are critically important to the safety of the crew, the rig and the wellbore itself, BOPs are inspected, tested and refurbished at regular intervals determined by a combination of risk assessment, local practice, well type and legal requirements. BOP tests vary from daily function testing on critical wells to monthly or less frequent testing on wells thought to have low probability of well control problems.
	Borehole	The wellbore itself, including the openhole or uncased portion of the well. Borehole may refer to the inside diameter of the wellbore wall, the rock face that bounds the drilled hole.
BHP	**Bottom Hole Pressure**	The pressure, usually measured in bar at the bottom of the hole. This pressure may be calculated in a static, fluid-filled wellbore with the equation: BHP = ρ g h where ρ is the fluid density in kg/m^3, g is gravity in m/s^2, and h is the vertical depth of the well in meters.
B/U	**Bottoms-up**	1. Pertaining to the mud and cuttings that are calculated or measured to come from the bottom of the hole since the start of circulation. Circulation may be initiated after a static period, such as a trip, or from a given depth while drilling. This latter type is particularly useful to mud loggers and others trying to discern the lithology being drilled, so mud loggers or mud engineers often retrieve what is referred to as a "bottoms-up sample" of the cuttings or the drilling fluid. 2. The sample obtained at the bottoms-up time or a volume of fluid to pump, as in "pump bottoms-up before drilling ahead."
	Break circulation	To establish circulation of drilling fluids after a period of static conditions. Circulation may resume after a short break, such as taking a survey or making a mousehole connection, or after a prolonged interruption, such as after a round trip. The operation is of more concern to drillers and well planners with longer static intervals, since immobile drilling mud tends to become less fluid and more gelatinous or semisolid with time.
	Break out	To unscrew drillstring components, which are coupled by various threadforms known as connections, including tool joints and other threaded connections.
	Bridge plug	A downhole tool that is located and set to isolate the lower part of the wellbore. Bridge plugs may be permanent or retrievable, enabling the lower wellbore to be permanently sealed from production or temporarily isolated from a treatment conducted on an upper zone.
	Bullhead	To forcibly pump fluids into a formation, usually formation fluids that have entered the wellbore during a well control event. Though bullheading is intrinsically risky, it is performed if the formation fluids are suspected to contain hydrogen sulfide gas to prevent the toxic gas from reaching the surface. Bullheading is also performed if normal circulation cannot occur, such as after a borehole collapse. The primary risk in bullheading is that the drilling crew has no control over where the fluid goes and the fluid being pumped downhole usually enters the weakest formation. In addition, if only shallow casing is cemented in the well, the bullheading operation can cause wellbore fluids to broach around the casing shoe and reach the surface. This broaching to the surface has the effect of fluidizing and destabilizing the soil (or the subsea floor), and can lead to the formation of a crater and loss of equipment and life.
	Buoyancy	The upward force acting on an object placed in a fluid. The buoyancy force is equal to the weight of fluid displaced by the object. Buoyancy can have significant effects in cases in which the wellbore and tubing string contain liquid and gas. Any change in the relative volumes or fluid levels will change the buoyancy forces.
	Caliper log	A representation of the measured diameter of a borehole along its depth. Caliper logs are usually measured mechanically, with only a few using sonic devices. The tools measure diameter at a specific chord across the well. Since wellbores are usually irregular (rugose), it is important to have a tool that measures diameter at several different locations simultaneously. Such tools are called multi-arm calipers. Drilling engineers or rigsite personnel use caliper measurement as a qualitative indication of both the condition of the wellbore and the degree to which the mud system has maintained hole stability. Caliper data are integrated to determine the volume of the openhole, which is then used in planning cementing operations.
CH	**Cased hole**	The portion of the wellbore that has had metal casing placed and cemented to protect the openhole from fluids, pressures, wellbore stability problems or a combination of these. Antonym: openhole.
	Casing	Large-diameter pipe lowered into an openhole and cemented in place. The well designer must design casing to withstand a variety of forces, such as collapse, burst, and tensile failure, as well as chemically aggressive brines. Most casing joints are fabricated with male threads on each end, and short-length casing couplings with female threads are used to join the individual joints of casing together, or joints of casing may be fabricated with male threads on one end and female threads on the other. Casing is run to protect fresh-water formations, isolate a zone of lost returns or isolate formations with significantly different pressure gradients. The operation during which the casing is put into the wellbore is commonly called "running pipe." Casing is usually manufactured from plain carbon steel that is heat-treated to varying strengths, but may be specially fabricated of stainless steel, aluminum, titanium, fiberglass and other materials.
	Casing grade	A standardized measure of casing-strength properties. Since most oilfield casing is of approximately the same chemistry (typically steel), and differs only in the heat treatment applied, the grading system provides for standardized strengths of casing to be manufactured and used in wellbores. The first part of the nomenclature, a letter, refers to the tensile strength. The second part of the designation, a number, refers to the minimum yield strength of the metal (after heat treatment) at 1000 psi [6895 KPa]. For example, the casing grade J-55 has minimum yield strength of 55,000 psi [379,211 KPa]. The casing grade P-110 designates a higher strength pipe with minimum yield strength of 110,000 psi [758,422 KPa]. Since the well designer is concerned about the pipe yielding under various loading conditions, the casing grade is the number that is used in most calculations. It is also important to note that, in general, the higher the yield strength, the more susceptible the casing is to sulfide stress cracking (H_2S-induced cracking). Therefore, if H_2S is anticipated, the well designer may not be able to use tubulars with strength as high as he or she would like.
	Casing shoe	The bottom of the casing string, including the cement around it, or the equipment run at the bottom of the casing string.
	Catwalk	A long, rectangular platform about 3 ft [0.9 m] high, usually made of steel and located perpendicular to the vee-door at the bottom of the slide. This platform is used as a staging area for rig and drillstring tools, components that are about to be picked up and run, or components that have been run and are being laid down. A catwalk is also the functionally similar staging area, especially on offshore drilling rigs, that may not be a separate or raised structure.
	Cementing	To prepare and pump cement into place in a wellbore. Cementing operations may be undertaken to seal the annulus after a casing string has been run, to seal a lost circulation zone, to set a plug in an existing well from which to push off with directional tools or to plug a well so that it may be abandoned. Before cementing operations commence, engineers determine the volume of cement (commonly with the help of a caliper log) to be placed in the wellbore and the physical properties of both the slurry and the set cement needed, including density and viscosity. A cementing crew uses special mixers and pumps to displace drilling fluids and place cement in the wellbore.
	Centralizer	A mechanical device to position casing concentrically in the wellbore. A centralizer is usually used during cementing operations to provide a constant annular space around the casing, rather than having the casing lying eccentrically against the borehole wall. For straight holes, bow spring centralizers are sufficient and commonly used. For deviated wellbores, where gravitational force pulls casing to the low side of the hole, more robust solid-bladed centralizers are better if hole conditions allow their use.
	Centrifuge	An item of solids-removal equipment that removes fine and ultrafine solids. It consists of a conical drum that rotates at 2000 to 4000 rpm. Drilling fluid is fed into one end and the separated solids are moved up the bowl by a rotating scroll to exit at the other end. Centrifuges generally have limited processing capacity (50 to 250 gpm) but are useful for processing weighted drilling fluids and can remove finer solids than can hydrocyclones or shaker screens. They can also be used for water clarification or for processing oily cuttings.
	Choke line	A high-pressure pipe leading from an outlet on the BOP stack to the backpressure choke and associated manifold. During well-control operations, the fluid under pressure in the wellbore flows out of the well through the choke line to the choke, reducing the fluid pressure to atmospheric pressure. In floating offshore operations, the choke and kill lines exit the subsea BOP stack and then run along the outside of the drilling riser to the surface. The volumetric and frictional effects of these long choke and kill lines must be considered to control the well properly.

	Christmas tree	The set of valves, spools and fittings connected to the top of a well to direct and control the flow of formation fluids from the well.
	Circulate	To pump fluid through the whole active fluid system, including the borehole and all the surface tanks that constitute the primary system.
	Circulation loss	The loss of drilling fluid to a formation, usually caused when the hydrostatic head pressure of the column of drilling fluid exceeds the formation pressure. This loss of fluid may be loosely classified as seepage losses, partial losses or catastrophic losses, each of which is handled differently depending on the risk to the rig and personnel and the economics of the drilling fluid and each possible solution.
	Circulation sub	A downhole tool typically used with motors or assemblies that restrict the allowable fluid-circulation rates. When operated, the circulation sub allows a higher circulation rate to be established by opening a path to the annulus in the top section of the tool string. This is especially useful in applications such as drilling in slim-diameter wells, where a higher circulation rate may be necessary to effect good cuttings transport and hole cleaning before the string is retrieved.
	Circulation system	The complete, circuitous path that the drilling fluid travels. Starting at the main rig pumps, major components include surface piping, the standpipe, the kelly (rotary) hose, the kelly, the drillpipe, drill collars, bit nozzles, the various annular geometries of the openhole and casing strings, the bell nipple, the flowline, the mud-cleaning equipment, the mud tanks, the centrifugal precharge pumps and, finally, the positive displacement main rig pumps.
	Circulation time	The elapsed time for mud to circulate from the suction pit, down the wellbore and back to surface. Circulation time allows the mud engineer to catch "in" and "out" samples that accurately represent the same element of mud in a circulating system. Circulation time is calculated from the estimated hole volume and pump rate and can be checked by using tracers such as carbide or rice granules.
	Clay swelling	A type of damage in which formation permeability is reduced because of the alteration of clay equilibrium. Clay swelling occurs when water-base filtrates from drilling, completion, workover or stimulation fluids enter the formation. Clay swelling can be caused by ion exchange or changes in salinity. However, only clays that are directly contacted by the fluid moving in the rock will react; these include authigenic clays, some detrital clays on the pore boundaries and unprotected clay cement. The nature of the reaction depends on the structure of the clays and their chemical state at the moment of contact. The most common swelling clays are smectite and smectite mixtures that create an almost impermeable barrier for fluid flow when they are located in the larger pores of a reservoir rock. In some cases, brines such as potassium chloride [KCl] are used in completion or workover operations to avoid clay swelling.
	Close-in	To close a valve to stop or isolate fluid flow. The term is most commonly applied to "closing-in the well," meaning isolation of the wellbore by closing the master valve.
CT	**Coiled tubing**	A long, continuous length of pipe wound on a spool. The pipe is straightened prior to pushing into a wellbore and recoiled to spool the pipe back onto the transport and storage spool. Depending on the pipe diameter (1 in. to 4 1/2 in.) and the spool size, coiled tubing can range from 2000 ft to 15,000 ft [610 to 4570 m] or greater length. May be used for drilling; i.e. Coiled Tubing Drilling.
	Collapse pressure	The pressure at which a tube, or vessel, will catastrophically deform as a result of differential pressure acting from outside to inside of the vessel or tube. The collapse-pressure rating of perfectly round tubing is relatively high. However, when the tubing is even slightly oval, the differential pressure at which the tube will collapse may be significantly reduced. This is an important factor in determining the operating limits of coiled tubing strings since the action of spooling the string tends to induce some ovality.
CoMan	**Company man**	The representative of the oil company or operator on a drilling location. For land operations, the company man is responsible for operational issues on the location, including the safety and efficiency of the project. Even administrative managers are expected to respond to the direction of the company man when they are on the rigsite. Offshore, depending on the regulatory requirements, there may be an offshore installation manager, who supervises the company man on safety and vessel integrity issues, but not on operational issues.
	Completion	The hardware used to optimize the production of hydrocarbons from the well. This may range from nothing but a packer on tubing above an openhole completion ("barefoot" completion), to a system of mechanical filtering elements outside of perforated pipe, to a fully automated measurement and control system that optimizes reservoir economics without human intervention (an "intelligent" completion).
	Control line	A small-diameter hydraulic line used to operate downhole completion equipment such as the surface controlled subsurface safety valve (SCSSV). Most systems operated by control line operate on a fail-safe basis. In this mode, the control line remains pressurized at all times. Any leak or failure results in loss of control line pressure, acting to close the safety valve and render the well safe.
	Core, Coring	To deepen the wellbore by way of collecting a cylindrical sample. A core bit is used to accomplish this, in conjunction with a core barrel and core catcher. The bit is usually a drag bit fitted with either PDC or natural diamond cutting structures, but the core bit is unusual in that it has a hole in its center. This allows the bit to drill around a central cylinder of rock, which is taken in through the bit and into the core barrel. The core barrel itself may be thought of as a special storage chamber for holding the rock core. The core catcher serves to grip the bottom of the core and, as tension is applied to the drillstring, the rock under the core breaks away from the undrilled formation below it. The core catcher also retains the core so that it does not fall out the bottom of the drillstring, which is open in the middle at that point.
XO	**Crossover**	A short subassembly used to enable two components with different thread types or sizes to be connected.
	Cuttings	Small pieces of rock that break away due to the action of the bit teeth. Cuttings are screened out of the liquid mud system at the shale shakers and are monitored for composition, size, shape, color, texture, hydrocarbon content and other properties by the mud engineer, the mud logger and other on-site personnel. The mud logger usually captures samples of cuttings for subsequent analysis and archiving.
	Degasser	A device that removes air or gases (methane, H_2S, CO_2 and others) from drilling liquids. There are two generic types that work by both expanding the size of the gas bubbles entrained in the mud (by pulling a vacuum on the mud) and by increasing the surface area available to the mud so that bubbles escape (through the use of various cascading baffle plates). If the gas content in the mud is high, a mud gas separator or "poor boy degasser" is used, because it has a higher capacity than standard degassers and routes the evolved gases away from the rig to a flaring area complete with an ignition source.
	Depth reference	The point in a well from which depth is measured. Alternatively, the depth reference is the point at which the depth is defined as being zero. It is typically the top of the kelly bushing or the level of the rig floor on the rig used to drill the well. The depth measured from that point is the measured depth (MD) for the well. Even when the drilling rig has been removed, all subsequent measurements and operations in the well are still tied in to the same depth reference. However, for multiwell studies, the depths are normally shifted to the permanent datum (Generally Mean Sea Level). The depth reference and its elevation above the permanent datum are recorded on the log heading. In some contexts, the term may refer to any point from which depth is measured.
	Derrick	The structure used to support the crown blocks and the drillstring of a drilling rig. Derricks are usually pyramidal in shape, and offer a good strength-to-weight ratio. If the derrick design does not allow it to be moved easily in one piece, special ironworkers must assemble them piece by piece, and in some cases disassemble them if they are to be moved.
	Derrickman	One of the rig crew members who gets his name from the fact that he works on a platform attached to the derrick or mast, typically 85 ft [26 m] above the rig floor, during trips. On small land drilling crews, the derrickman is second in rank to the driller. Larger offshore crews may have an assistant driller between the derrickman and the driller. In a typical trip out of the hole (TOH), the derrickman wears a special safety harness that enables him to lean out from the work platform (called the monkeyboard) to reach the drillpipe in the center of the derrick or mast, throw a line around the pipe and pull it back into its storage location (the fingerboards) until it is time to run the pipe back into the well. In terms of skill, physical exertion and perceived danger, a derrickman has one of the most demanding jobs on the rig crew. Some modern drilling rigs have automated pipe-handling equipment such that the derrickman controls the machinery rather than physically handling the pipe. In an emergency, the derrickman can quickly reach the ground by an escape line often called the Geronimo line.
	Development	The phase of petroleum operations that occurs after exploration has proven successful, and before full-scale production. The newly discovered oil or gas field is assessed during an appraisal phase, a plan to fully and efficiently exploit it is created, and additional wells are usually drilled.
	Deviated well	A wellbore that is not vertical. The term usually indicates a wellbore intentionally drilled away from vertical.

	Diamond bit	A tool for drilling rock that works by scraping industrial grade diamonds against the bottom of the hole. The diamonds are embedded into the metal structure (usually a sintered or powdered carbide base matrix) during the manufacture of the bit. The bit designer has virtually unlimited combinations of bit shape, the placement of hydraulic jetting ports, the amount of diamonds and the size of the diamonds used (usually expressed as diamonds per carat). In general, a diamond bit that drills faster has a shorter lifetime. Similarly, a bit designed for extremely long life will typically drill at a slower rate. If a bit has a relatively high number of diamonds compared with other bits, it is said to be “heavy-set” and has higher durability. A “light-set” bit, on the other hand, drills more aggressively, but wears out faster because fewer diamonds do the work.
DD	**Directional driller**	An individual trained in the science and art of intentionally drilling a well along a predetermined path in three-dimensional space, usually involving deviating the well from vertical and directing it in a specific compass direction or heading. The directional driller considers such parameters as rotary speed, weight on bit, control drilling and when to stop drilling and take surveys of the wellpath, and works closely with the toolpusher.
	Directional drilling	The intentional deviation of a wellbore from the path it would naturally take. This is accomplished through the use of whipstocks, bottomhole assembly (BHA) configurations, instruments to measure the path of the wellbore in three-dimensional space, data links to communicate measurements taken downhole to the surface, mud motors and special BHA components and drill bits. The directional driller also exploits drilling parameters such as weight on bit and rotary speed to deflect the bit away from the axis of the existing wellbore. In some cases, such as drilling steeply dipping formations or unpredictable deviation in conventional drilling operations, directional-drilling techniques may be employed to ensure that the hole is drilled vertically. While many techniques can accomplish this, the general concept is simple: point the bit in the direction that one wants to drill. The most common way is through the use of a bend near the bit in a downhole steerable mud motor. The bend points the bit in a direction different from the axis of the wellbore when the entire drillstring is not rotating. By pumping mud through the mud motor, the bit turns while the drillstring does not rotate, allowing the bit to drill in the direction it points. When a particular wellbore direction is achieved, that direction may be maintained by rotating the entire drillstring (including the bent section) so that the bit does not drill in a single direction off the wellbore axis, but instead sweeps around and its net direction coincides with the existing wellbore. Rotary steerable tools allow steering while rotating, usually with higher rates of penetration and ultimately smoother boreholes.
	Displacement	The act of removing one fluid (usually liquid) from a wellbore and replacing it with another. This is accomplished by pumping a spacer fluid that is benign to both the first and second fluid, followed by the new fluid, down the drillstring and out the bottom of the drillstring or bit. While the spacer and second fluid are pumped into the top of the wellbore, the first fluid is forced out of the annulus between the drillstring and the wellbore or casing. In some cases, this general procedure may be reversed by pumping in the top of the annulus and taking fluid back from the drillstring. Since this is the reverse of the normal circulation path, this is referred to as “reversing out” or “reverse circulation.”
	Doghouse	The steel-sided room adjacent to the rig floor, usually having an access door close to the driller’s controls. This general-purpose shelter is a combination tool shed, office, communications center, coffee room, lunchroom and general meeting place for the driller and his crew. It is at the same elevation as the rig floor, usually cantilevered out from the main substructure supporting the rig.
DLS	**Dogleg, Dogleg Severity**	A particularly crooked place in a wellbore where the trajectory of the wellbore in three-dimensional space changes rapidly. While a dogleg is sometimes created intentionally by directional drillers, the term also refers to a section of the hole that changes direction faster than anticipated or desired, usually with harmful side effects. In surveying wellbore trajectories, a standard calculation of dogleg severity is made, usually expressed in two-dimensional degrees per 100 feet [degrees per 30 m] of wellbore length. Generally, intentional doglegs are limited to 3-3.5 degrees/ 30m. Higher doglegs may create problems , such as key seating or damage to the drillstring.
DSV	**Downhole safety valve**	A downhole device that isolates wellbore pressure and fluids in the event of an emergency or catastrophic failure of surface equipment. The control systems associated with safety valves are generally set in a fail-safe mode, such that any interruption or malfunction of the system will result in the safety valve closing to render the well safe. Downhole safety valves are fitted in almost all wells and are typically subject to rigorous local or regional legislative requirements.
	Drillable packer	A packer assembly that can be removed from the wellbore only by drilling or milling. Drillable packers, and similar tools such as bridge plugs, are typically made from cast iron, aluminum, plastic or similar brittle materials.
	Driller	The supervisor of the rig crew. The driller is responsible for the efficient operation of the rigsite as well as the safety of the crew and typically has many years of rigsite experience. Most drillers have worked their way up from other rigsite jobs. While the driller must know how to perform each of the jobs on the rig, his or her role is to supervise the work and control the major rig systems. The driller operates the pumps, drawworks, and rotary table via the drillers console-a control room of gauges, control levers, rheostats, and other pneumatic, hydraulic and electronic instrumentation. On older drilling installations, the driller also operates the drawworks brake using a long-handled lever. Hence, the driller is sometimes referred to as the person who is “on the brake.”
	Driller’s depth	The depth of a well or features within the wellbore as measured while drilling. The measured length of each joint of drillpipe or tubing is added to provide a total depth or measurement to the point of interest. Drillers depth is the first depth measurement of a wellbore and is taken from the rotary table level on the rig floor. In most cases, subsequent depth measurements, such as those made during the well completion phase, are corrected to the wellhead datum that is based on drillers depth.
	Drilling break	A sudden increase in the rate of penetration during drilling. When this increase is significant (two or more times the normal speed, depending on local conditions), it may indicate a formation change, a change in the pore pressure of the formation fluids, or both. It is commonly interpreted as an indication of the bit drilling sand (high-speed drilling) rather than shale (low-speed drilling). The fast-drilling formation may or may not contain high-pressure fluids. Therefore, the driller commonly stops drilling and performs a flow check to determine if the formation is flowing. If the well is flowing, or if the results are uncertain, the driller may close the blowout preventers or circulate bottoms-up. Depending on the bit being used and the formations being drilled, a formation, even if sand, may sometimes drill slower rather than faster. This slowing of drilling progress, while technically also a drilling break, is usually referred to as a “reverse drilling break”, or simply “reverse break.”
	Drilling fluid	Any of a number of liquid and gaseous fluids and mixtures of fluids and solids (as solid suspensions, mixtures and emulsions of liquids, gases and solids) used in operations to drill boreholes into the earth. Synonymous with “drilling mud” in general usage, although some prefer to reserve the term “drilling fluid” for more sophisticated and well-defined “muds.” Classifications of drilling fluids has been attempted in many ways, often producing more confusion than insight. One classification scheme, given here, is based only on the mud composition by singling out the component that clearly defines the function and performance of the fluid: (1) water-base, (2) non-water-base and (3) gaseous (pneumatic). Each category has a variety of subcategories that overlap each other considerably. Synonyms: Drilling mud, mud.
	Drop ball	A ball that is dropped or pumped through the wellbore tubulars to activate a downhole tool or device. When the ball is located on a landing seat, hydraulic pressure generally is applied to operate the tool mechanism.
	Dry hole	A wellbore that has not encountered hydrocarbons in economically producible quantities. Most wells contain salt water in some zones. In addition, the wellbore usually encounters small amounts of crude oil and natural gas. Whether the well is a “duster” depends on many factors of the economic equation, including proximity to transport and processing infrastructures, local market conditions, expected completion costs, tax and investment recovery conditions of the jurisdiction and projected oil and gas prices during the productive life of the well.
	Duster	Slang term for dry hole
	Elevator	A hinged mechanism that may be closed around drillpipe or other drillstring components to facilitate lowering them into the wellbore or lifting them out of the wellbore. In the closed position, the elevator arms are latched together to form a load-bearing ring around the component. A shoulder or taper on the component to be lifted is larger in size than the inside diameter of the closed elevator. In the open position, the device splits roughly into two halves and may be swung away from the drillstring component.
EOWR	**End Of Well Report**	End-Of-Well report. A summation of general well data, operational data, geological data etc. for a particular well after well completion. An EOW report will be generated by several parties, such as the directional drilling company, the mudlogging company, the mud company etc., all of which are used in the making of the operator’s final report.
ECD	**Equivalent Circulating Density**	For circulating wellbores, the BHP (Bottomhole pressure) increases by the amount of fluid friction in the annulus. This pressure may be back-calculated as an apparent mud density called the Equivalent Circulating Density. The ECD should exceed the formation pressure gradient to avoid an influx of formation fluid into the wellbore. On the other hand, if ECD is too high, a weak formation may fracture and cause a loss of wellbore fluids. The loss of fluid to one formation may be followed by the influx of fluid from another formation.

	Filter cake	The residue deposited on a permeable medium when a slurry, such as a drilling fluid, is forced against the medium under a pressure. Filtrate is the liquid that passes through the medium, leaving the cake on the medium. Drilling muds are tested to determine filtration rate and filter-cake properties. Cake properties such as cake thickness, toughness, slickness and permeability are important because the cake that forms on permeable zones in the wellbore can cause stuck pipe and other drilling problems. Reduced oil and gas production can result from reservoir damage when a poor filter cake allows deep filtrate invasion. A certain degree of cake buildup is desirable to isolate formations from drilling fluids. In openhole completions in high-angle or horizontal holes, the formation of an external filter cake is preferable to a cake that forms partly inside the formation. The latter has a higher potential for formation damage.
	Fines	In a broad sense, very small particles, either in a mud or a mud additive sample.
	Fingerboard	The working platform approximately halfway up the derrick or mast in which the derrickman stores drillpipe and drill collars in an orderly fashion during trips out of the hole. The entire platform consists of a small section from which the derrickman works (called the monkeyboard), and several steel fingers with slots between them that keep the tops of the drillpipe in place.
	Fish	1. Anything left in a wellbore. It does not matter whether the fish consists of junk metal, a hand tool, a length of drillpipe or drill collars, or an expensive MWD and directional drilling package. Once the component is lost, it is properly referred to as simply “the fish.” Typically, anything put into the hole is accurately measured and sketched, so that appropriate fishing tools can be selected if the item must be fished out of the hole. 2. To attempt to retrieve a fish from a wellbore. Where available, specially skilled individuals, aptly called fishermen, are called onto location to direct and assist with the fishing operations. Depending on the type of fish, the manner in which it was lost, regulatory requirements (for example a fish that includes a nuclear source, such as certain well logging tools), and the value of the fish if recovered, fishing operations may be immediately successful or may be attempted unsuccessfully for several days or even weeks.
	Float collar	A short length of casing fitted with a check valve. This device may be a flapper-valve type, a spring-loaded ball valve or another type. The float collar prevents the cement slurry placed in the annulus to U-tube, or reverse flow back into the casing. The greater density of cement slurries than the displacement mud inside the casing causes the U-tube effect.
	Flowline	The large-diameter metal pipe that connects the bell nipple under the rotary table to the possum belly at the mud tanks. The flowline is simply an inclined, gravity-flow conduit to direct mud coming out the top of the wellbore to the mud surface-treating equipment. When drilling certain highly reactive clays, called “gumbo,” the flowline may become plugged and require considerable effort by the rig crew to keep it open and flowing. In addition, the flowline is usually fitted with a crude paddle-type flow-measuring device commonly called a “flow show” that may give the driller the first indication that the well is flowing; i.e. in the initial phase of a potential kick.
	Flushed zone	The volume close to the borehole wall in which all of the moveable fluids have been displaced by mud filtrate. The flushed zone contains filtrate and the remaining hydrocarbons, the percentage of the former being the flushed-zone water saturation, S_{xo}. In simple models, the flushed zone and the invaded zone are synonymous.
	Formation exposure time	The time that has elapsed between the bit first penetrating a formation and a log being recorded opposite the formation. In logging-while-drilling operations, this time is different for each log, since it depends on the drilling rate and the distance between the bit and the particular logging sensor. May also be a relevant parameter to evaluate risk associated with formation instability.
	Fracture gradient	The pressure required to induce fractures in rock at a given depth.
	Funnel viscosity	Time, in seconds for one quart of mud to flow through a Marsh funnel. This is not a true viscosity, but serves as a qualitative measure of how thick the mud sample is. The funnel viscosity is useful only for relative comparisons.
	Gauge hole	A wellbore that is essentially the same diameter as the bit that was used to drill it. It is common to find well-consolidated sandstones and carbonate rocks that remain gauge after being drilled. For clays, it is common for the hole to slowly enlarge with the passing of time, especially if water-base muds are being used. Bit gauges, rings of defined circumference, are slipped around drill bits to detect and measure wear, which reduces the circumference of the bit during drilling.
	Gel strength	The shear stress measured at low shear rate after a mud has set quiescently for a period of time (10 seconds and 10 minutes in the standard API procedure, although measurements after 30 minutes or 16 hours may also be made).
	Gels	Jargon referring to the two gel-strength values for a mud. The 10-second and 10-minute “gels,” often written as one number over the other. For example, 6/16 means 6 lb/100 ft^2 and is 10-second gel, and 16 lb/100 ft^2 is the 10-minute gel.
	Geopressure gradient	The change in pore pressure per unit depth, typically in units of pounds per square inch per foot (psi/ft) or kilopascals per meter (kPa/m). The geopressure gradient might be described as high or low if it deviates from the normal hydrostatic pressure gradient of 0.433 psi/ft [9.8 kPa/m].
	Geothermal gradient	The natural increase of temperature with depth in the earth. Temperature gradients vary widely over the earth, sometimes increasing dramatically around volcanic areas. It is particularly important for drilling fluids engineers to know the geothermal gradient in an area when they are designing a deep well. The downhole temperature can be calculated by adding the surface temperature to the product of the depth and the geothermal gradient.
HWDP	**Heavyweight drillpipe**	A type of drillpipe whose walls are thicker and collars are longer than conventional drillpipe. HWDP tends to be stronger and has higher tensile strength than conventional drillpipe, so it is placed near the top of a long drillstring for additional support.
	Hole cleaning	Synonyms: Cuttings transport, cuttings lifting. Good hole cleaning means the cuttings are efficiently removed from the wellbore by the drilling fluid.
	Hook load	The total force pulling down on the hook. This total force includes the weight of the drillstring in air, the drill collars and any ancillary equipment, reduced by any force that tends to reduce that weight. Some forces that might reduce the weight include friction along the wellbore wall (especially in deviated wells) and, importantly, buoyant forces on the drillstring caused by its immersion in drilling fluid. If the BOPs are closed, any pressure in the wellbore acting on the cross-sectional area of the drillstring in the BOPs will also exert an upward force.
	Horizontal drilling	A subset of the more general term “directional drilling,” used where the departure of the wellbore from vertical exceeds about 80 degrees. Note that some horizontal wells are designed such that after reaching true 90-degree horizontal, the wellbore may actually start drilling upward. In such cases, the angle past 90 degrees is continued, as in 95 degrees, rather than reporting it as deviation from vertical, which would then be 85 degrees. Because a horizontal well typically penetrates a greater length of the reservoir, it can offer significant production improvement over a vertical well.
Inc	**Inclination**	The deviation from vertical, irrespective of compass direction, expressed in degrees. Inclination is measured initially with a pendulum mechanism, and confirmed with MWD accelerometers or gyroscopes. For most vertical wellbores, inclination is the only measurement of the path of the wellbore. For intentionally deviated wellbores, or wells close to legal boundaries, directional information is usually also measured.
	Injection well (Injector)	A well in which fluids are injected rather than produced, the primary objective typically being to maintain reservoir pressure. Two main types of injection are common: gas and water. Separated gas from production wells or possibly imported gas may be reinjected into the upper gas section of the reservoir. Water-injection wells are common offshore, where filtered and treated seawater is injected into a lower water-bearing section of the reservoir.
	Intermediate casing	A casing string that is generally set in place after the surface casing and before the production casing. The intermediate casing string provides protection against caving of weak or abnormally pressured formations and enables the use of drilling fluids of different density necessary for the control of lower formations.

	Jack-up rig	A self-contained combination drilling rig and floating barge, fitted with long support legs that can be raised or lowered independently of each other. The jackup, as it is known informally, is towed onto location with its legs up and the barge section floating on the water. Upon arrival at the drilling location, the legs are jacked down onto the seafloor, preloaded to securely drive them into the seabottom, and then all three legs are jacked further down. Since the legs have been preloaded and will not penetrate the seafloor further, this jacking down of the legs has the effect of raising the jacking mechanism, which is attached to the barge and drilling package. In this manner, the entire barge and drilling structure are slowly raised above the water to a predetermined height above the water, so that wave, tidal and current loading acts only on the relatively small legs and not the bulky barge and drilling package.
	Jar	A mechanical device used downhole to deliver an impact load to another downhole component, especially when that component is stuck. There are two primary types, hydraulic and mechanical jars. While their respective designs are quite different, their operation is similar. Energy is stored in the drillstring and suddenly released by the jar when it fires. The principle is similar to that of a carpenter using a hammer. Kinetic energy is stored in the hammer as it is swung, and suddenly released to the nail and board when the hammer strikes the nail. Jars can be designed to strike up, down, or both. In the case of jarring up above a stuck bottomhole assembly, the driller slowly pulls up on the drillstring but the BHA does not move. Since the top of the drillstring is moving up, this means that the drillstring itself is stretching and storing energy. When the jars reach their firing point, they suddenly allow one section of the jar to move axially relative to a second, being pulled up rapidly in much the same way that one end of a stretched spring moves when released. After a few inches of movement, this moving section slams into a steel shoulder, imparting an impact load. In addition to the mechanical and hydraulic versions, jars are classified as drilling jars or fishing jars. The operation of the two types is similar, and both deliver approximately the same impact blow, but the drilling jar is built such that it can better withstand the rotary and vibrational loading associated with drilling.
	Junk	Anything in the wellbore that is not supposed to be there. The term is usually reserved for small pieces of steel such as hand tools, small parts, bit nozzles, pieces of bits or other downhole tools, and remnants of milling operations.
	Junk basket	A tool run into the wellbore to retrieve junk from the bottom of the hole.
	Kelly	A long square or hexagonal steel bar with a hole drilled through the middle for a fluid path. The kelly is used to transmit rotary motion from the rotary table or kelly bushing to the drillstring, while allowing the drillstring to be lowered or raised during rotation. The kelly goes through the kelly bushing, which is driven by the rotary table. The kelly bushing has an inside profile matching the kelly's outside profile (either square or hexagonal), but with slightly larger dimensions so that the kelly can freely move up and down inside.
	Kelly bushing	An adapter that serves to connect the rotary table to the kelly. The kelly bushing has an inside diameter profile that matches that of the kelly, usually square or hexagonal. It is connected to the rotary table by four large steel pins that fit into mating holes in the rotary table. The rotary motion from the rotary table is transmitted to the bushing through the pins, and then to the kelly itself through the square or hexagonal flat surfaces between the kelly and the kelly bushing. The kelly then turns the entire drillstring because it is screwed into the top of the drillstring itself. Depth measurements are commonly referenced to the KB, such as 8327 ft KB, meaning 8327 feet below the kelly bushing.
	Kelly down	Referring to the condition that occurs when the kelly is all the way down, so drilling progress cannot continue. A connection must be made, which has the effect of raising the kelly up by the length of the new joint of drillpipe added, so drilling can resume.
	Lag time	The time taken for cuttings to reach the surface The term is also used in place of cycle time.
LOT	**Leak-off test**	A test to determine the strength or fracture pressure of the open formation, usually conducted immediately after drilling below a new casing shoe. During the test, the well is shut in and fluid is pumped into the wellbore to gradually increase the pressure that the formation experiences. At some pressure, fluid will enter the formation, or leak off, either moving through permeable paths in the rock or by creating a space by fracturing the rock. The results of the leakoff test dictate the maximum pressure or mud weight that may be applied to the well during drilling operations. To maintain a small safety factor to permit safe well control operations, the maximum operating pressure is usually slightly below the leakoff test result.
	Liner	A casing string that does not extend to the top of the wellbore, but instead is anchored or suspended from inside the bottom of the previous casing string. There is no difference between the casing joints themselves. The advantage to the well designer of a liner is a substantial savings in steel, and therefore capital costs. To save casing, however, additional tools and risk are involved. The well designer must trade off the additional tools, complexities and risks against the potential capital savings when deciding whether to design for a liner or a casing string that goes all the way to the top of the well (a "long string"). The liner can be fitted with special components so that it can be connected to the surface at a later time if need be.
	Liner hanger	A device used to attach or hang liners from the internal wall of a previous casing string. Liner hangers are available in a range of sizes and specifications to suit a variety of completion conditions.
LWD	**Logging While Drilling**	The measurement of formation properties during the excavation of the hole, or shortly thereafter, through the use of tools integrated into the bottomhole assembly. LWD, while sometimes risky and expensive, has the advantage of measuring properties of a formation before drilling fluids invade deeply. Further, many wellbores prove to be difficult or even impossible to measure with conventional wireline tools, especially highly deviated wells. In these situations, the LWD measurement ensures that some measurement of the subsurface is captured in the event that wireline operations are not possible.
	Lost circulation, Lost returns	The reduced or total absence of fluid flow up the annulus when fluid is pumped through the drillstring. Though the definitions of different operators vary, this reduction of flow may generally be classified as seepage (less than 20 bbl/hr [3 m^3/hr]), partial lost returns (greater than 20 bbl/hr [3 m^3/hr] but still some returns), and total lost returns (where no fluid comes out of the annulus). In this severe latter case, the hole may not remain full of fluid even if the pumps are turned off. If the hole does not remain full of fluid, the vertical height of the fluid column is reduced and the pressure exerted on the open formations is reduced. This in turn can result in another zone flowing into the wellbore, while the loss zone is taking mud, or even a catastrophic loss of well control. Even in the two less severe forms, the loss of fluid to the formation represents a financial loss that must be dealt with, and the impact of which is directly tied to the per barrel cost of the drilling fluid and the loss rate over time.
LCM	**Lost Circulation Material**	Solid material intentionally introduced into a mud system to reduce and eventually prevent the flow of drilling fluid into a weak, fractured or vugular formation. This material is generally fibrous or plate-like in nature, as suppliers attempt to design slurries that will efficiently bridge over and seal loss zones. In addition, popular lost circulation materials are low-cost waste products from the food processing or chemical manufacturing industries. Examples of lost circulation material include ground peanut shells, mica, cellophane, walnut shells, calcium carbonate, plant fibers, cottonseed hulls, ground rubber, and polymeric materials.
	Make hole	Synonym for drilling.
M/U	**Make up**	To tighten threaded connections.
	Mill	A tool that grinds metal downhole. A mill is usually used to remove junk in the hole or to grind away all or part of a casing string. In the case of junk, the metal must be broken into smaller pieces to facilitate removal from the wellbore so that drilling can continue. When milling casing, the intent is to cut a window through the side of the casing or to remove a continuous section of the casing so that the wellbore may be deviated from the original well through the window or section removed. Depending on the type of grinding or metal removal required, the shape of the cutting structures of mills varies. Virtually all mills, however, utilize tungsten carbine cutting surfaces.
	Milling	The use of a mill or similar downhole tool to cut and remove material from equipment or tools located in the wellbore. Successful milling operations require appropriate selection of milling tools, fluids and techniques
	Monkeyboard	The small platform that the derrickman stands on when tripping pipe.
	Mousehole	An opening in the rig floor near the rotary table, but between the rotary table and the vee-door, that enables rapid connections while drilling. The mousehole is usually fitted underneath with a length of casing, usually with a bottom. A joint of drillpipe that will be used next in the drilling operation is placed in the mousehole, box end up, by the rig crew at a convenient time (immediately after the previous connection is made). When the bit drills down and the kelly is near the rotary table, another piece of drillpipe must be added for drilling to continue. This next piece of pipe is standing in the mousehole when the kelly is screwed onto it. Then the kelly and the joint of pipe in the mousehole are raised to remove the pipe from the mousehole, the mousehole pipe screwed onto the rest of the drillstring, and the drillstring lowered, rotated, and pumped through to continue drilling. Another piece of pipe is put in the mousehole to await the next connection.

	Mud	Synonym for drilling fluid.
	Mud additive	A material added to a drilling fluid to perform one or more specific functions, such as a weighting agent, viscosifier or lubricant.
	Mudman, Mud engineer	A person responsible for testing the mud at a rig and for prescribing mud treatments to maintain mud weight, properties and chemistry within recommended limits. The mud engineer works closely with the rig supervisor to disseminate information about mud properties and expected treatments and any changes that might be needed. The mud engineer also works closely with the rig's derrickman, who is charged with making scheduled additions to the mud during his work period.
	Mud report	The report sheets filled out by the mud engineer at the wellsite on a daily basis. The mud report supplies results of tests performed several times per day as well as details about mud product usage, inventory, recommendations and other pertinent information. Multiple-copy forms in a format approved by the API, which are provided by the mud service company, are the traditional type of mud report. Today, mud reports are more likely to be computerized and transmitted electronically.
MW	**Mud weight**	The mass per unit volume of a drilling fluid, synonymous with mud density. Weight is reported in lbm/gal (also known as ppg), kg/m^3 or g/cm^3 (also called specific gravity or SG), lb/ft^3 or in hydrostatic gradient, $lb/in^2/ft$ (psi/ft) or pptf (psi/1000 ft). Mud weight controls hydrostatic pressure in a wellbore and prevents unwanted flow into the well. The weight of the mud also prevents collapse of casing and the openhole. Excessive mud weight can cause lost circulation by propagating, and then filling, fractures in the rock. Mud weight (density) test procedures using a mud balance have been standardized and published by the API.
	Mudlogger	A person responsible for collecting cuttings samples for geological description and storage, analyzing cuttings, gas measurements and -analysis, and creating a lithological log (mudlog). Often holds a degree in geology or a related discipline.
	Multilateral	Pertaining to a well that has more than one branch radiating from the main borehole. The term is also used to refer to the multilateral well itself.
	Neutral point	The point on a string of tubulars at which there are neither tension nor compression forces present. Below the neutral point, there will be compression forces that build toward the bottom of the wellbore. Above the neutral point, tensile forces build to a maximum applied at the hanger or as hook load.
	Nipple down	To take apart, disassemble and otherwise prepare to move the rig or blowout preventers.
	Nipple up	To put together, connect parts and plumbing, or otherwise make ready for use. This term is usually reserved for the installation of a blowout preventer stack.
	Normal pressure	The pore pressure of rocks that is considered normal in areas in which the change in pressure per unit of depth is equivalent to hydrostatic pressure. The normal hydrostatic pressure gradient for freshwater is 0.433 pounds per square inch per foot (psi/ft), or 9.792 kilopascals per meter (kPa/m), and 0.465 psi/ft for water with 100,000 ppm total dissolved solids (a typical Gulf Coast water), or 10.516 kPa/m.
	Offset well	An existing wellbore close to a proposed well that provides information for planning the proposed well. In planning development wells, there are usually numerous offsets, so a great deal is known about the subsurface geology and pressure regimes. In contrast, rank wildcats have no close offsets, and planning is based on interpretations of seismic data, distant offsets and prior experience. High-quality offset data are coveted by competent well planners to optimize well designs. When lacking offset data, the well planner must be more conservative in designing wells and include more contingencies.
	Oil-based mud	A mud in which the external phase is a product obtained from an oil, such as diesel oil or mineral oil. More generally, a mud system that has any type of nonaqueous fluid as the external phase. This definition would include the newer variety of oil muds that are more exactly defined as synthetic-base muds. Synthetic mud is analogous to oil mud.
OH	**Openhole**	The uncased portion of a well. All wells, at least when first drilled, have openhole sections that the well planner must contend with. Prior to running casing, the well planner must consider how the drilled rock will react to drilling fluids, pressures and mechanical actions over time. The strength of the formation must also be considered. A weak formation is likely to fracture, causing a loss of drilling mud to the formation and, in extreme cases, a loss of hydrostatic head and potential well control problems. An extremely high-pressure formation, even if not flowing, may have wellbore stability problems. Once problems become difficult to manage, casing must be set and cemented in place to isolate the formation from the rest of the wellbore. While most completions are cased, some are open, especially in horizontal or extended-reach wells where it may not be possible to cement casing efficiently.
	Openhole completion	A well completion that has no casing or liner set across the reservoir formation, allowing the produced fluids to flow directly into the wellbore. This type of completion suffers the major disadvantage that the sandface is unsupported and may collapse. Also, without any casing or liner installed, selective treatments or remedial work within the reservoir section are more difficult.
	Operator	The company that serves as the overall manager and decision-maker of a drilling project. Generally, but not always, the operator will have the largest financial stake in the project. At the successful completion of logging the target zones, the decision to complete or plug and abandon generally has partner input and potential override clauses. As far as the drilling contractor and service companies are concerned, the designated operator is paying for the entire operation, and the operator is responsible for recouping some of that expense from the partners.
OP	**Overpressure**	The amount of pressure (or force per unit area) in the wellbore that exceeds the pressure of fluids in the formation. This excess pressure is needed to prevent reservoir fluids (oil, gas, water) from entering the wellbore. However, excessive overbalance can dramatically slow the drilling process by effectively strengthening the near-wellbore rock and limiting removal of drilled cuttings under the bit. In addition, high overbalance pressures coupled with poor mud properties can cause differential sticking problems. Because reservoir pressures vary from one formation to another, while the mud is relatively constant density, overbalance varies from one zone to another.
	Overshot	A downhole tool used in fishing operations to engage on the outside surface of a tube or tool. A grapple, or similar slip mechanism, on the overshot grips the fish, allowing application of tensile force and jarring action. If the fish cannot be removed, a release system within the overshot allows the overshot to be disengaged and retrieved.
	Pack off	To plug the wellbore around a drillstring. This can happen for a variety of reasons, the most common being that either the drilling fluid is not properly transporting cuttings and cavings out of the annulus or portions of the wellbore wall collapse around the drillstring. When the well packs off, there is a sudden reduction or loss of the ability to circulate, and high pump pressures follow. If prompt remedial action is not successful, an expensive episode of stuck pipe can result. The term is also used in gravel packing to describe the act of placing all the sand or gravel in the annulus.
	Packer	A device that can be run into a wellbore with a smaller initial outside diameter that then expands externally to seal the wellbore. Packers employ flexible, elastomeric elements that expand. The two most common forms are the production or test packer and the inflatable packer. The expansion of the former may be accomplished by squeezing the elastomeric elements (somewhat doughnut shaped) between two plates, forcing the sides to bulge outward. The expansion of the latter is accomplished by pumping a fluid into a bladder, in much the same fashion as a balloon, but having more robust construction. Production or test packers may be set in cased holes and inflatable packers are used in open or cased holes. They may be run on wireline, pipe or coiled tubing. Some packers are designed to be removable, while others are permanent. Permanent packers are constructed of materials that are easy to drill or mill out.
	PDC bit	A drilling tool that uses polycrystalline diamond compact (PDC) cutters to shear rock with a continuous scraping motion. These cutters are synthetic diamond disks about 1/8-in. thick and about 1/2 to 1 in. in diameter. PDC bits are effective at drilling shale formations, especially when used in combination with oil-base muds.
	Perforate	To create holes in the casing or liner to achieve efficient communication between the reservoir and the wellbore. The characteristics and placement of the communication paths (perforations) can have significant influence on the productivity of the well. Therefore, a robust design and execution process should be followed to ensure efficient creation of the appropriate number, size and orientation of perforations. A perforating gun assembly with the appropriate configuration of shaped explosive charges and the means to verify or correlate the correct perforating depth can be deployed on wireline, tubing or coiled tubing.

	Pill	Any relatively small quantity (less than 200 bbl) of a special blend of drilling fluid to accomplish a specific task that the regular drilling fluid cannot perform. Examples include high-viscosity pills to help lift cuttings out of a vertical wellbore, freshwater pills to dissolve encroaching salt formations, pipe-freeing pills to destroy filter cake and relieve differential sticking forces and lost circulation material pills to plug a thief zone.
	Pipe dope	A specially formulated blend of lubricating grease and fine metallic particles that prevents thread galling (a particular form of metal-to-metal damage) and seals the roots of threads. The American Petroleum Institute (API) specifies properties of pipe dope, including its coefficient of friction. The rig crew applies copious amounts of pipe dope to the drillpipe tool joints every time a connection is made.
	Pipe rack	Onshore, two elevated truss-like structures having triangular cross sections. The pipe rack supports drillpipe, drill collars or casing above the ground. These structures are used in pairs located about 20 ft [6 m] apart and keep the pipe above ground level and closer to the level of the catwalk. Pipe stored horizontally on the pipe racks can have its threads cleaned and inspected and the rig crew may roll the pipe from one end of the pipe racks to the other with relative ease. The pipe racks are usually topped with a wooden board so as to not damage pipe, especially casing, as it is rolled back and forth along the racks. When large amounts of pipe are stored, wooden sills are placed between the layers of pipe to prevent damage.
POOH	**Pull Out Of Hole**	To remove the drillstring from the wellbore. Synonyms: Trip out.
	Power Law fluid	A fluid described by the two-parameter rheological model of a pseudoplastic fluid, or a fluid whose viscosity decreases as shear rate increases. Water-base polymer muds, especially those made with XC polymer, fit the power-law mathematical equation better than the Bingham plastic or any other two-parameter model.
	Racking back pipe	To place a stand of drillpipe in the derrick when coming out of the hole on a trip. The rig crew racks back pipe after the stand is unscrewed from the rest of the drillstring. The floor crew then pushes the lower part of the stand away from the rotary table to a position on one side of the vee-door. While the floor crew is pushing the pipe, the derrickman gets ready to pull the top of the stand over into the fingerboards. Once the rig crew has the pipe in the correct location, the driller slacks off on the drawworks, allowing the stand to rest on the drillfloor. This takes weight off of the elevators previously supporting the pipe at the top, so the derrickman can then unlatch the elevators and pull the top of the pipe into the fingerboards for storage. Modern rig designs have automated pipe-handling equipment that moves the pipe. When tripping the pipe out of the hole, racking back pipe may occur every two to five minutes for hours at a time.
ROP	**Rate of Penetration**	Velocity with which drilling progresses, reported in meters/ hour or feet/ hour. Generally divided into *InstantROP*; i.e the rate of change in depth on a short timescale (seconds), and *AverageROP*; where a fixed distance (such as one whole meter or one full section) is dived by the elapsed time spent on bottom drilling.
	Ream	1. To move the pipe while maintaining (modified) drilling parameters to clean the hole; i.e. string rotation and circulation is maintained, unlike tripping, where rotation and circulation is stopped. 2. To enlarge a wellbore. Reaming may be necessary for several reasons. Perhaps the most common reason for reaming a section of a hole is that the hole was not drilled as large as it should have been at the outset. This can occur when a bit has been worn down from its original size, but might not be discovered until the bit is tripped out of the hole, and some undergauge hole has been drilled. Last, some plastic formations may slowly flow into the wellbore over time, requiring the reaming operation to maintain the original hole size.
	Returns	Mud that comes back to the surface and exits through the flowline after being pumped down the drillpipe. “Lost returns” is the situation in which some or all of the mud does not come back to the surface, which indicates that mud is being lost into weak, fractured or vugular formations downhole.
	Reverse circulation	The intentional pumping of wellbore fluids down the annulus and back up through the drillpipe. This is the opposite of the normal direction of fluid circulation in a wellbore. Since the inside volume of the drillpipe is considerably less than the volume of the annulus outside of the drillpipe, reverse circulation can bring bottomhole fluids to the surface faster than normal circulation for a given flow rate. Two potential hazards of reverse circulation include lifting cuttings and other junk into the drillstring and the rapid flow of reservoir fluids to the surface in a kick situation.
	Rheology	The science and study of the deformation and flow of matter. The term is also used to indicate the properties of a given fluid, as in mud rheology. Rheology is an extremely important property of drilling muds, drill-in fluids, workover and completion fluids, cements and specialty fluids and pills. Mud rheology is measured on a continual basis while drilling and adjusted with additives or dilution to meet the needs of the operation. In water-base fluids, water quality plays an important role in how additives perform. Temperature affects behavior and interactions of the water, clay, polymers and solids in a mud. Downhole pressure must be taken into account in evaluating the rheology of oil muds.
	Rig floor	The relatively small work area in which the rig crew conducts operations, usually adding or removing drillpipe to or from the drillstring. The rig floor is the most dangerous location on the rig because heavy iron is moved around there. Drillstring connections are made or broken on the drillfloor, and the driller’s console for controlling the major components of the rig are located there. Attached to the rig floor is a small metal room, the doghouse, where the rig crew can meet, take breaks and take refuge from the elements during idle times.
R/U	**Rig up**	To make ready for use. Equipment must typically be moved onto the rig floor, assembled and connected to power sources or pressurized piping systems.
RIH	**Run In Hole**	To connect pipe together and lower the connected length into the borehole in a controlled fashion. The pipe lengths are usually screwed together either with rotary-shouldered connections for the drillstring, or threaded and coupled connections for casing, liners and most tubing.
	Rollercone bit	A tool designed to crush rock efficiently while incurring a minimal amount of wear on the cutting surfaces. Invented by Howard Hughes, the roller-cone bit has conical cutters or cones that have spiked teeth around them. As the drillstring is rotated, the bit cones roll along the bottom of the hole in a circle. As they roll, new teeth come in contact with the bottom of the hole, crushing the rock immediately below and around the bit tooth. As the cone rolls, the tooth then lifts off the bottom of the hole and a high-velocity fluid jet strikes the crushed rock chips to remove them from the bottom of the hole and up the annulus. As this occurs, another tooth makes contact with the bottom of the hole and creates new rock chips. Thus, the process of chipping the rock and removing the small rock chips with the fluid jets is continuous. The teeth intermesh on the cones, which helps clean the cones and enables larger teeth to be used. There are two main types of roller-cone bits, steel milled-tooth bits and carbide insert bits.
	Rotary drilling	A method of making hole that relies on continuous circular motion of the bit to break rock at the bottom of the hole. This method, made popular after the Spindletop discovery by “Dad” Joiner in 1930, is much more efficient than the alternative, cable tool drilling. Rotary drilling is a nearly continuous process, because cuttings are removed as drilling fluids circulate through the bit and up the wellbore to the surface. Cable tool operations are discontinuous and cuttings removal is inefficient. This difference in efficiency becomes particularly significant as hole depth increases.
RSS	**Rotary Steerable System**	A tool designed to drill directionally with continuous rotation from the surface, eliminating the need to slide a steerable motor. Examples of brand names include Auto Trak, Power Drive and Geo Pilot.
	Rotary table	The revolving or spinning section of the drillfloor that provides power to turn the drillstring in a clockwise direction (as viewed from above). The rotary motion and power are transmitted through the kelly bushing and the kelly to the drillstring. When the drillstring is rotating, the drilling crew commonly describes the operation as simply, “rotating to the right,” “turning to the right,” or, “rotating on bottom.” Almost all rigs today have a rotary table, either as primary or backup system for rotating the drillstring. Topdrive technology, which allows continuous rotation of the drillstring, has replaced the rotary table in certain operations. A few rigs are being built today with topdrive systems only, and lack the traditional kelly system.
	Roughneck	A low-ranking member of the drilling crew. The roughneck usually performs semiskilled and unskilled manual labor that requires continual hard work in difficult conditions for many hours. After roughnecks understand how the rig operates and demonstrates their work ethic, they may be promoted to other positions in the crew.

	Round trip	The complete operation of removing the drillstring from the wellbore and running it back in the hole. This operation is typically undertaken when the bit becomes dull or broken, and no longer drills the rock efficiently. After some preliminary preparations for the trip, the rig crew removes the drillstring 90 ft [27 m] at a time, by unscrewing every third drillpipe or drill collar connection. When the three joints are unscrewed from the rest of the drillstring, they are carefully stored upright in the derrick by the fingerboards at the top and careful placement on wooden planks on the rig floor. After the drillstring has been removed from the wellbore, the dull bit is unscrewed with the use of a bit breaker and quickly examined to determine why the bit dulled or failed. Depending on the failure mechanism, the crew might choose a different type of bit for the next section. If the bearings on the prior bit failed, but the cutting structures are still sharp and intact, the crew may opt for a faster drilling (less durable) cutting structure. Conversely, if the bit teeth are worn out but the bearings are still sealed and functioning, the crew should choose a bit with more durable (and less aggressive) cutting structures. Once the bit is chosen, it is screwed onto the bottom of the drill collars with the help of the bit breaker, the drill collars are run into the hole (RIH), and the drillpipe is run in the hole. Once on bottom, drilling commences again. The duration of this operation depends on the total depth of the well and the skill of the rig crew. A general estimate for a competent crew is that the round trip requires one hour per thousand feet of hole, plus an hour or two for handling collars and bits. At that rate, a round trip in a ten thousand-foot well might take twelve hours. A round trip for a 30,000-ft [9230 m] well might take 32 or more hours, especially if intermediate hole-cleaning operations must be undertaken.
	Roustabout	Any unskilled manual laborer on the rigsite. A roustabout may be part of the drilling contractor's employee workforce, or may be on location temporarily for special operations. Roustabouts are commonly hired to ensure that the skilled personnel that run an expensive drilling rig are not distracted by peripheral tasks, ranging from cleaning up location to cleaning threads to digging trenches to scraping and painting rig components. Although roustabouts typically work long hard days, this type of work can lead to more steady employment on a rig crew.
	Running tool	A generic name for a tool or device that is used in the placement or setting of downhole equipment such as permanent packers or plugs. The running tool can be retrieved after the operation or setting process. In some cases, the running tool also is used to retrieve the equipment or tool that has been set in the wellbore.
	Saver sub	A short length of drill collar that has male threads on one end and female on the other. It is screwed onto the bottom of the kelly or topdrive and onto the rest of the drillstring. When the hole must be deepened, and pipe added to the drillstring, the threads are unscrewed between the saver sub and the rest of the drillstring, as opposed to between the kelly or topdrive and the saver sub. This means that the connection between the kelly or topdrive and the saver sub rarely is used, and suffers minimal wear and tear, whereas the lower connection is used in almost all cases and suffers the most wear and tear. The saver sub is expendable and does not represent a major investment. However, the kelly or topdrive component threads are spared by use of a saver sub, and those components represent a significant capital cost and considerable downtime when replaced.
	Shale shaker	The primary and probably most important device on the rig for removing drilled solids from the mud. This vibrating sieve is simple in concept, but a bit more complicated to use efficiently. A wire-cloth screen vibrates while the drilling fluid flows on top of it. The liquid phase of the mud and solids smaller than the wire mesh pass through the screen, while larger solids are retained on the screen and eventually fall off the back of the device and are discarded. Obviously, smaller openings in the screen clean more solids from the whole mud, but there is a corresponding decrease in flow rate per unit area of wire cloth. Hence, the drilling crew should seek to run the screens (as the wire cloth is called), as fine as possible, without dumping whole mud off the back of the shaker. Modern high-efficiency rigs are often fitted with four or more shakers, thus giving more area of wire cloth to use, and giving the crew the flexibility to run increasingly fine screens.
	Shear ram	A blowout preventer (BOP) closing element fitted with hardened tool steel blades designed to cut the drillpipe when the BOP is closed. A shear ram is normally used as a last resort to regain pressure control of a well that is flowing. Once the drillpipe is cut (or sheared) by the shear rams, it is usually left hanging in the BOP stack, and kill operations become more difficult. The joint of drillpipe is destroyed in the process, but the rest of the drillstring is unharmed by the operation of shear rams.
SIBHP	**Shut-in bottomhole pressure**	The force per unit area exerted at the bottom of a wellbore when it is closed at either the Christmas tree or the BOP stack. The SIBP is generated by a combination of the hydrostatic pressure from the weight of the liquid in the well and any additional applied pressure. The applied pressure component may be from the formation or from an external source at the surface.
	Sidetrack	1. To drill a secondary wellbore away from an original wellbore. A sidetracking operation may be done intentionally or may occur accidentally. Intentional sidetracks might bypass an unusable section of the original wellbore or explore a geologic feature nearby. In the bypass case, the secondary wellbore is usually drilled substantially parallel to the original well, which may be inaccessible due to an irretrievable fish, junk in the hole, or a collapsed wellbore. 2. A secondary wellbore drilled away from the original hole. It is possible to have multiple sidetracks, each of which might be drilled for a different reason.
	Slip-and-cut	To replace the drilling line wrapped around the crown block and traveling block. As a precaution against drilling line failure due to fatigue, the work done by the drilling line is closely monitored and limited. The work is commonly measured as the cumulative product of the load lifted (in tons) and the distance lifted or lowered (in miles). After a predetermined limit of ton-miles, new line is elly led from the storage reel and slipped through the crown block and traveling block sheaves and drawworks spool, with the excess on the drawworks spool end cut off and discarded.
	Slips	A device used to grip the drillstring in a relatively nondamaging manner and suspend it in the rotary table. This device consists of three or more steel wedges that are hinged together, forming a near circle around the drillpipe. On the drillpipe side (inside surface), the slips are fitted with replaceable, hardened tool steel teeth that embed slightly into the side of the pipe. The outsides of the slips are tapered to match the taper of the rotary table. After the rig crew places the slips around the drillpipe and in the rotary, the driller slowly lowers the drillstring. As the teeth on the inside of the slips grip the pipe, the slips are pulled down. This downward force pulls the outer wedges down, providing a compressive force inward on the drillpipe and effectively locking everything together. Then the rig crew can unscrew the upper portion of the drillstring (elly, saver sub, a joint or stand of pipe) while the lower part is suspended. After some other component is screwed onto the lower part of the drillstring, the driller raises the drillstring to unlock the gripping action of the slips, and the rig crew removes the slips from the rotary.
	Slug	A volume of mud that is more dense than the mud in the drillpipe and wellbore annulus. A slug is used to displace mud out of the upper part of the drillpipe before pulling pipe out of the hole and is mixed in the pill pit by adding additional weighting material (barite) to a few barrels of mud from the surface pits. The pill is pumped into the top of the drillstring to push mud downward, out of the pipe, thus keeping the upper stands of pipe empty.
	Slurry	A mixture of suspended solids and liquids. Muds in general are slurries, but are seldom called that. Cement is a slurry and is often referred to as such.
	Space out	To assemble components to ensure that all critical length dimensions are met, as is required to ensure that the production tubing can be landed in the wellhead and production packer with the desired weight distribution. The term also may apply to surface pressure-control equipment offshore, where well intervention equipment may be required at certain deck levels.
	Spacer	A viscous fluid used to aid removal of drilling fluids before a primary cementing operation. The spacer is prepared with specific fluid characteristics, such as viscosity and density, that are engineered to displace the drilling fluid while enabling placement of a complete cement sheath.
	Spud mud	Mud used to drill a well from surface to a shallow depth. Guar gum or salt gel are commonly used offshore as spud mud. Onshore spud mud is usually a water-base mud containing bentonite clay that is flocculated with lime. In a large-diameter surface hole, a flocculated clay-based mud can remove large gravel cuttings encountered at shallow depths and is simple and inexpensive.
	Squeeze job	The careful application of pump pressure to force a treatment fluid or slurry into a planned treatment zone. In most cases, a squeeze treatment will be performed at downhole injection pressure below that of the formation fracture pressure. In high-pressure squeeze operations, performed above the formation fracture pressure, the response of the formation and the injection of treatment fluid may be difficult to predict.
	Stand	Two or three single joints of drillpipe or drill collars that remain screwed together during tripping operations. Most modern medium- to deep-capacity drilling rigs handle three-joint stands, called “trebles” or “triples.” Some smaller rigs have the capacity for only two-joint stands, called “doubles.” In each case, the drillpipe or drill collars are stood back upright in the derrick and placed into fingerboards to keep them orderly. This is a relatively efficient way to remove the drillstring from the well when changing the bit or making adjustments to the bottomhole assembly, rather than unscrewing every threaded connection and laying the pipe down to a horizontal position.

	Stick – slip	The irregular movement of a logging tool up a well due to it being stuck at some point and then being released. In normal operation, the cable is pulled smoothly out of the well and the logging tool follows. However, the tool can become stuck by differential pressure or an irregular hole. The cable stretches, and its tension increases, until the tool is freed. At this point it moves, or slips, quickly up the hole until the normal movement is resumed. Since the depth measurement is driven by the cable, the log readings opposite a zone of stick and slip are displayed at incorrect depths. Furthermore, since each measurement has a different measure point, the zone of stick and slip shows up at a different depth on each measurement. Also used about some types of erratic movement of the drilling assembly.
SPM	**Strokes per minute**	The number of strokes the mud pumps complete in one minute. This determines the rate at which liquid is pumped. If the number of strokes per minute is increased, the fluid flow rate is also increased. This term is also referred to as stroke speed.
	Stuck, **Stuck pipe**	Referring to the varying degrees of inability to move or remove the drillstring from the wellbore. At one extreme, it might be possible to rotate the pipe or lower it back into the wellbore, or it might refer to an inability to move the drillstring vertically in the well, though rotation might be possible. At the other extreme, it reflects the inability to move the drillstring in any manner. Usually, even if the stuck condition starts with the possibility of limited pipe rotation or vertical movement, it will degrade to the inability to move the pipe at all.
	Sub	Any small component of the drillstring, such as a short drill collar or a thread crossover.
	Submersible rig	A particular type of floating vessel, usually used as a mobile offshore drilling unit (MODU), that is supported primarily on large pontoon-like structures submerged below the seasurface. The operating decks are elevated 100 or more feet [30 m] above the pontoons on large steel columns. Once on the desired location, this type of structure is slowly flooded until it rests on the seafloor. After the well is completed, the water is pumped out of the buoyancy tanks, the vessel refloated and towed to the next location. Submersibles, as they are known informally, operate in relatively shallow water, since they must actually rest on the seafloor.
	Suction pit	A mud tank, usually made of steel, connected to the intake of the main rig pumping system. The connection is commonly formed with a centrifugal pump charging the main rig pumps to increase efficiency. Since it is the last tank in the surface mud system, the suction pit should contain the cleanest and best-conditioned mud on location. It is also the most representative of mud characteristics in the hole, except for temperature.
	Surface casing	A large-diameter, relatively low-pressure pipe string set in shallow yet competent formations for several reasons. First, the surface casing protects fresh-water aquifers onshore. Second, the surface casing provides minimal pressure integrity, and thus enables a diverter or perhaps even a blowout preventer (BOP) to be attached to the top of the surface casing string after it is successfully cemented in place. Third, the surface casing provides structural strength so that the remaining casing strings may be suspended at the top and inside of the surface casing.
SVY	**Survey**	A completed measurement of the inclination and azimuth of a location in a well (typically the total depth at the time of measurement). In both directional and straight holes, the position of the well must be known with reasonable accuracy to ensure the correct wellbore path and to know its position in the event a relief well must be drilled. The measurements themselves include inclination from vertical, and the azimuth (or compass heading) of the wellbore if the direction of the path is critical. These measurements are made at discrete points in the well, and the approximate path of the wellbore computed from the discrete points. Measurement devices range from simple pendulum-like devices to complex electronic accelerometers and gyroscopes used more often as MWD becomes more popular. In simple pendulum measurements, the position of a freely hanging pendulum relative to a measurement grid (attached to the housing of the tool and assumed to represent the path of the wellbore) is captured on photographic film. The film is developed and examined when the tool is removed from the wellbore, either on wireline or the next time pipe is tripped out of the hole.
	Swab	To reduce pressure in a wellbore by moving pipe, wireline tools or rubber-cupped seals up the wellbore. If the pressure is reduced sufficiently, reservoir fluids may flow into the wellbore and towards the surface. Swabbing is generally considered harmful in drilling operations, because it can lead to kicks and wellbore stability problems. In production operations, however, the term is used to describe how the flow of reservoir hydrocarbons is initiated in some completed wells. Antonym: Surge.
	Sweep pill	A relatively small volume of viscous fluid, typically a carrier gel, that is circulated to sweep, or remove, debris or residual fluids from the circulation system.
	Tie-back, **Tie-back liner**	A section of liner that is run from a liner hanger back to the wellhead after the initial liner and hanger system have been installed and cemented. A tie-back liner may be required to provide the necessary pressure capacity during a flow-test period or for special treatments, and is typically not cemented in place. In some cases, a tie-back liner will be installed as a remedial treatment when the integrity of the intermediate casing string is in doubt.
	Tool joint	The enlarged and threaded ends of joints of drillpipe. These components are fabricated separately from the pipe body and welded onto the pipe at a manufacturing facility. The tool joints provide high-strength, high-pressure threaded connections that are sufficiently robust to survive the rigors of drilling and numerous cycles of tightening and loosening at threads. Tool joints are usually made of steel that has been heat treated to a higher strength than the steel of the tube body. The large-diameter section of the tool joints provides a low stress area where pipe tongs are used to grip the pipe. Hence, relatively small cuts caused by the pipe tongs do not significantly impair the strength or life of the joint of drillpipe.
	Toolpusher	The location supervisor for the drilling contractor. The toolpusher is usually a senior, experienced individual who has worked his way up through the ranks of the drilling crew positions. His job is largely administrative, including ensuring that the rig has sufficient materials, spare parts and skilled personnel to continue efficient operations. The toolpusher also serves as a trusted advisor to many personnel on the rigsite, including the operator's representative, the company man.
	Topdrive	A device that turns the drillstring. It consists of one or more motors (electric or hydraulic) connected with appropriate gearing to a short section of pipe called a quill, that in turn may be screwed into a saver sub or the drillstring itself. The topdrive is suspended from the hook, so the rotary mechanism is free to travel up and down the derrick. This is radically different from the more conventional rotary table and kelly method of turning the drillstring because it enables drilling to be done with three joint stands instead of single joints of pipe. It also enables the driller to quickly engage the pumps or the rotary while tripping pipe, which cannot be done easily with the kelly system. While not a panacea, modern topdrives are a major improvement to drilling rig technology and are a large contributor to the ability to drill more difficult extended-reach wellbores. In addition, the topdrive enables drillers to minimize both frequency and cost per incident of stuck pipe.
	Traveling block	The set of sheaves that move up and down in the derrick. The wire rope threaded through them is threaded (or "reeved") back to the stationary crown blocks located on the top of the derrick. This pulley system gives great mechanical advantage to the action of the wire rope drilling line, enabling heavy loads (drillstring, casing and liners) to be lifted out of or lowered into the wellbore.
	Trip out	To remove the drillstring from the wellbore. Synonyms: POOH (Pull out of hole).
	Twist-off	Parting or breaking of the drillstring downhole due to fatigue or excessive torque.
	Underbalance	The amount of pressure (or force per unit area) exerted on a formation exposed in a wellbore below the internal fluid pressure of that formation. If sufficient porosity and permeability exist, formation fluids enter the wellbore. The drilling rate typically increases as an underbalanced condition is approached.
	Underream	To enlarge a wellbore past its original drilled size. Underreaming is sometimes done for safety or efficiency reasons. Some well planners believe it is safer to drill unknown shallow formations with a small-diameter bit, and if no gas is encountered, to then enlarge the pilot hole. An underreaming operation may also be done if a small additional amount of annular space is desired, as might be the case in running a liner if surge pressures were problematic.
	Vee-door	The upside down V-shaped opening in one side of the derrick that enables long pipes and tools to be lifted into the interior of the derrick. This opening is aligned with the slide and catwalk of the rig.
	Viscosity	A property of fluids and slurries that indicates their resistance to flow, defined as the ratio of shear stress to shear rate.

WOC	**Wait On Cement**	To suspend operations while a cement slurry to develops sufficient compressive strength to allow drilling or other wellbore activity to continue. The WOC time is generally used to test the surface pressure-control equipment, such as the BOP stack. Attempting to drill out the float or guide shoe before the cement has developed sufficient bond strength may result in backing off a casing joint.
	Washout	1. An enlarged region of a wellbore. A washout in an openhole section is larger than the original hole size or size of the drill bit. Washout enlargement can be caused by excessive bit jet velocity, soft or unconsolidated formations, in-situ rock stresses, mechanical damage by BHA components, chemical attack and swelling or weakening of shale as it contacts fresh water. Generally speaking, washouts become more severe with time. Appropriate mud types, mud additives and increased mud density can minimize washouts. 2. A hole in a pressure-containing component caused by erosion. A washout is relatively common where a high-velocity stream of dry gas carries abrasive sand. The severity generally decreases with sand content, velocity and liquid content.
	Well control	The technology focused on maintaining pressure on open formations (that is, exposed to the wellbore) to prevent or direct the flow of formation fluids into the wellbore. This technology encompasses the estimation of formation fluid pressures, the strength of the subsurface formations and the use of casing and mud density to offset those pressures in a predictable fashion. Also included are operational procedures to safely stop a well from flowing should an influx of formation fluid occur. To conduct well-control procedures, large valves are installed at the top of the well to enable wellsite personnel to close the well if necessary.
	Wellbore	The drilled well itself, including the openhole or uncased portion of the well. Synonym: borehole.
	Wellbore diagram	A schematic diagram that identifies the main completion components installed in a wellbore. The information included in the wellbore diagram relates to the principal dimensions of the components and the depth at which the components are located. A current wellbore diagram should be available for any well intervention operation to enable engineers and equipment operators to select the most appropriate equipment and prepare operating procedures that are compatible with any downhole restrictions.
	Wellhead	The surface termination of a wellbore that incorporates facilities for installing casing hangers during the well construction phase. The wellhead also incorporates a means of hanging the production tubing and installing the Christmas tree and surface flow-control facilities in preparation for the production phase of the well.
WOB	**Weight On Bit**	The amount of downward force placed on a bit by the weight of the drill stem. The WOB is generally estimated from measured parameters, not measured directly, although downhole tools for this purpose exist.
	Wiper trip	An abbreviated recovery and replacement of the drillstring in the wellbore that usually includes the bit and bottomhole assembly passing by all of the openhole, or at least all of the openhole that is thought to be potentially troublesome. This trip varies from the short trip or the complete trip only in its function and length. Wiper trips are commonly used when a particular zone is troublesome or if hole-cleaning efficiency is questionable.
	Whipstock	An inclined wedge placed in a wellbore to force the drill bit to start drilling in a direction away from the wellbore axis. The whipstock must have hard steel surfaces so that the bit will preferentially drill through either casing or rock rather than the whipstock itself. Whipstocks may be oriented in a particular direction if needed, or placed into a wellbore blind, with no regard to the direction they face. Most whipstocks are set on the bottom of the hole or on top of a high-strength cement plug, but some are set in the openhole.
	Workover	The repair or stimulation of an existing production well for the purpose of restoring, prolonging or enhancing the production of hydrocarbons.
YP	**Yield point**	A parameter of the Bingham plastic rheological model. YP is the yield stress extrapolated to a shear rate of zero. (Plastic viscosity, PV, is the other parameter of the Bingham-plastic model.) A Bingham plastic fluid plots as a straight line on a shear-rate (x-axis) versus shear-stress (y-axis) plot, in which YP is the zero-shear-rate intercept. (PV is the slope of the line.) YP is calculated from 300- and 600-rpm viscometer dial readings by subtracting PV from the 300-rpm dial reading. YP is used to evaluate the ability of a mud to lift cuttings out of the annulus. A high YP implies a non-Newtonian fluid, one that carries cuttings better than a fluid of similar density but lower YP. YP is lowered by adding deflocculant to a clay-based mud and increased by adding freshly dispersed clay or a flocculant, such as lime.