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 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.

Annuar pressure Fluid pressure in the annulus between tubing and casing or between two strings of casing.

Annuar 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, casings 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.

Anulus 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).

Back off To unscrew drilling components downhole. The drillingstring, including drillpipe and the bottomhole assembly, are coupled by various threaded connections, known as connections, or tool joints. Often when a drillingstring becomes stuck, the string is 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, which unbolts the connected component easily. 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 (BaSO₄) is the most common weighting agent used today. It is a mineral material to an API specification such that particle sizes are predominantly in the 3 to 74 micron range.

Blank pipe A plug made from weighting materials that is placed at the bottom of a wellbore. Unlike a cement plug, the settled solids do not 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 drillingstring, 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 tool formations. 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. Often times 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 drillingstring 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.

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.

Blowoff 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 lost 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 cause 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 a well blow or 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) and intervention efforts will be averted.
BHP

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 actuation), 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 relate pressure control.

BOP tests vary from daily tests to short tests. 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's are 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 cutting edges that can actually pierce or 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.

Bridge plug
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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, as mud loggers and 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 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 condition. 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 mud tends to become less fluid and more gelatinous or semisolid with time.

Bridge plug
A dowl hole tool that is located and set to isolate the lower part of the wellbore. Bridge plugs may be permanent or retrievable, enabling the lower part of the well to be permanently sealed from production or temporarily isolated for inspection or cementing operations.

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 be sustained, or if pressure cannot be maintained. The 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 portion of the wall. In addition, if only shallow casing is cemented in the well, the bullheading operation can cause wellbore fluids to broach through 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 force.

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 (nugatory), 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 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.

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 drilling 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 plug 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, bore hole centralizers are sufficient and commonly used. For deviated wellbores, where gravitational forces pulling casing to the low side of the hole, more robust semi-traded 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 solids that are carried to the surface by the bowl of the centrifuge generally have limited processing capacity (50 to 250 gpm) but are useful for processing weighted drilling fluids and can remove finer solids that high-speed hydrocyclones or shaker screens. They can also be used for water clarification for processing 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 through the well choke to the choke, reducing the fluid pressure to atmospheric pressure. In floating offshore operations, the choke and kill lines extend 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 the 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 affect good cuttings transport and hole cleaning before the string is retrieved.

Circulation system
The complete, circulatory path that the drilling fluid travels. Starting at the main rippers, major components include surface piping, the standpipe, the Kelly (rotary) hose, the Kelly, the drippipe, drill collar, 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 rippers.

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 determine the “true” sample flow rate or the rate at which a formation is being circulated. 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 unreacted 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 zones 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 straightforward 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 a few hundred to 15,000 ft (60 to 4570 m) or greater length. It may be used for drilling, CT Coiled tubing, circulation, and well testing or workover operations.

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 needs of the completion of the company man when they are on the rigsite. Offshore, depending on the regulatory requirements, there may be an offsite 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 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. 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.

Crosstie
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 affect good cuttings transport and hole cleaning before the string is retrieved.

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 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 igniter 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 multwell 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 Drilling of a derrick 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.

Derriman
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 55 ft [26 m] above the rig floor, during trips. On small land drilling crews, the derriman is second in rank to the driller. Larger offshore crews may have an assistant driller between the derriman and the driller. In a typical trip out of the hole (TOP), the derriman wears a special safety harness that enables him to lean out from the work platform (called the monkeyboard) to reach the driller 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 derriman controls the machinery rather than physically handling the pipe. In an emergency, the derriman can quickly reach the ground by an escape line often called the Germirano 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 deviated away from vertical.

Degasser
A device that removes airs or gases (methane, H2S, CO2, 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 to the point where the bubbles escape through the use of various cascading baffles. A high-pressure gas separator (“poor boy degasser”) is used, because it has a higher capacity than standard degasers and routes the evolved gases away from the rig to a flaring area complete with an igniter source.

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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 the diamonds, 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 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  
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, and motor and special BHA components and drill bits. The directional driller also exploit drilling parameters such as weight on bit, rotary speed, friction, distance and rate to deflect the bit away from the axis of the existing wellbore. In some cases, such as a long-distance drilling or a high percentage of the wellbore being deviated, the directional driller may limit drilling by removing the bit from the wellbore and replacing it with another. The bit in the wellbore is replaced with another bit that is designed to produce a new wellbore direction. In this case, the directional driller also exploit drilling parameters such as weight on bit, rotary speed, friction, distance and rate to realign the new wellbore direction with the desired one.

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 drilling and out the bottom of the drilling or bit. While the spacer and second fluid are pumped into the wellbore, the first fluid is forced out of the annulus between the drilling tool 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 drilling. 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 carted off from the main body structure supporting the rig.

DLS  
Dogleg,  
Drgleg Severirt  
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 wellbores trajectories, a standard calculation of dogleg severity is made, usually expressed in two-dimensional units. One calculation of doglegs is limited to 3-3.5 degrees/30m. Higher doglegs may create problems, such as key seating or damage to the drilling.  

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 or malfunction of the valves are generally set in a fail-safe mode, so that any interconnection 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 rig as well as the safety of the crew and typically has many years of rigsite experience. Most drillers have worked their way up from 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 prioritize responsibilities. The driller is responsible for communicating with the mud pumps, drawworks, and rotary table via the driller's console-a control room of gauges, controls levers, motors and other 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 size (high-speed drilling) rather than shale (low-speed drilling). The fast-drilling formations may or may not contain high-pressure fluids. Therefore, the driller commonly stops and performs a break-out 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 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, gasses and solids) used in operations to drill boreholes into the earth. Synonymous with "drilling mud" in general usage, although some workers may reserve the term "drilling fluid" for more sophisticated and well-defined "muds." Drilling fluid 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 productive 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 "dry" 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 drilling 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 shackle or pin 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 drilling 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 EOWR 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 wellbore fluids, the BHP (Bottomhole pressure) increases by the amount of fluid friction in the annulus. This pressure may be calculated as an apparent mud density. The equivalent circulating density is the density of a fluid that will result in the same pressure-generating capacity as the fluid being circulated. This pressure gradient is a function of the fluid's density and the annular cross-sectional area of the wellbore. When a fluid has a density gradient similar to the equivalent circulating density, it will result in the same pressure as the fluid being circulated, allowing the well to be circulated without the need for additional pressure from the circulation system.
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. Filter cake 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, stickiness and permeability are important because the cake that forms on permeable zones in the wellbore can cause stick 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 wells, 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 hard 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 flap- or 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 zone close to the borehole wall in which all of the movable fluids have been displaced by mud filtrates. The flushed zone contains filtrate and the remaining hydrocarbons, the percentage of the former being the flushed-zone water saturation, Sw. 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 diameter, 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).

Geopressure gradient
The change in pore pressure per unit depth, typically in units of pounds per square inch per foot (psi/ft or 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 drilling 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 drilling fluid 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 drilling 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 drilling 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.

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.
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 into the seafloor, preloaded to the required load, 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 structure, so that 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 relatively small legs and not the bulky barge and drilling package.

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 dampening 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 drilling bit while the BHA does not move. Since the top of the drilling bit is moving up, this means that the drilling bit is self-threading and self-stroking. When the jars reach their firing point, they suddenly allow one section of the jar to move axially relative to the second, being pulled up rapidly in 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 jarring jar is built such that it can better withstand the rotary and vibrational loading associated with drilling.

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.

A tool run into the wellbore to retrieve junk from the bottom of the hole.

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.

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.

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 the drilling can resume.

The time taken for cuttings to reach the surface. The term is also used in place of cycle time.

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 leak-off 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 leak-off test result.

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 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.

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.

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.

The reduced or total absence of fluid flow up the annulus when fluid is pumped through the drillstring. Though the definitions of different 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.

A fluid loss test designed to determine the long-term loss rate over time. This material is generally fibrous or plate-like in nature, as suppliers attempt to design slurries that will efficiently bridge vugular formations. This material is generally fibrous or plate-like in nature, as suppliers attempt to design slurries that will efficiently bridge vugular formations. This material is generally fibrous or plate-like in nature, as suppliers attempt to design slurries that will efficiently bridge vugular formations.

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 vugular formations.

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 carbide cutting surfaces.

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.
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 lb/gal (also known as ppg), kg/m³ or g/cm³ (also called specific gravity or SG). It/ft³ or in hydrostatic gradient. lbs/1000 ft or ppg (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.

Mud logger

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 the loss of drilling mud to the formation and, in extreme cases, a loss of hydraulic 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 causes. 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 tubing or tool. A grappling, or similar slip mechanism, on the overshoot grips the fish, allowing application of tensile force and jarring action. If the fish cannot be removed, a release system within the overshoot allows the overshoot to be disengaged and retrieved.

Pack off

To plug the wellbore around a drilling string. 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 drilling string. 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.
**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 stoned, 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 rakes back pipe after the stand is unsecured from the rest of the drilling string. The floor crew can then move the floor away from the rotary table to a position on one side of the sea-door. While the floor crew is moving the drillstring, the derrickmen get ready to pull the top of the stand over (and into) the fingers. Once the rig crew has the pipe in the correct location, the derrickmen slide the pipe onto the derrick and slide the stand up into the fingers. The derrickmen then slide the pipe back into the fingers for storage. Modern rigs 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 Instantaneous ROP, i.e., the rate of change in depth on a short timescale (seconds), and Average ROP, where a fixed distance (such as one whole meter or one full section) is divided 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 may not be discovered until the bit is tripped out of the hole, and some undersize 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.

**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 circulation in a wellbore. Since the inside volume of the drillpipe is considerably less than the volume of the annulus, 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, wooker and completion fluids, cements and specialty fluids used in完钻. 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-based 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 drilpipe or to from the drillstring. The rig floor is the most dangerous location on the rig because heavy iron is moved around 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.

**R/RH**
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 drillingstring, or threaded and coupled connections for casing, liners and most tubulars.

**Rollercone bit**
A tool designed to crush rock efficiently while incurring a minimal amount of wear on the cuttings 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 through 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 the only continuous process because cuttings are removed as drilling fluids circulate up the annulus and downwards to the bit face. 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**
A 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 drilling, 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 thedrillstring 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 remaining mud to the surface and then uses the rig to unscrew the drillstring from the bottom. After the running tool is screwed onto the bottom of the drill collars with the help of the bit breaker, the drill collars are run into the hole (RHD), and the trip 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 36,000 ft [9200 m] well might take 32 or more hours, especially if intermediate hole-cleaning operations must be undertaken.

Roustabout
Any unskilled manual laborer on the rig. 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 clearing trees to digging trenches for spooling 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 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 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 passes through the screen, while the larger solids 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, a wire-cloth screen designed to be used in the drilling operation seeks 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 providing 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 shear is cut (shredded) by the shear ram, 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 largely unaffected by the operation of shear rams.

SIBHP 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 SIBHP 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.

Sidetrack
1. To drill a secondary wellbore away from an original wellbore. A sidetracking operation may be done intentionally or may occur accidently. Intentional sidetracks might bypass an unusable section of the 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 injurious fish, sink in the hole, or a collapsed wellbore. 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.

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 fatigue 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 lifted and slippage through the crown block and traveling block sleeves and drawworks spool, with the excess on the drawworks spool 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 emit slightly into the side of the pipe. The outside 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 drilling. 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 shearing force inward on the drillpipe and effectively locking everything together. The slips are designed to cut the drillpipe ( ifXy, saver sub, or joint or stand of pipe) while the lower part is suspended. After some other component is screwed onto the upper part of the drillstring, the driller raises the drilling to unlock the gripping action of the slips, and the rig crew replaces 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 when replacing fluid or flushing out 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 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 depths.

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. Gauer 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 fluffed out with time. 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 between the bottomhole pressure and surface pressure. The squeeze operation, 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 trip operations. Most modern medium- to deep-capacity drilling rigs handle three-joint stands, called "triples" 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 up the hole and placed into fingerboards to keep them orderly. This is a relatively efficient way to remove the drilling fluid from the well when changing the bit, as it allows adjusting 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.

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 response 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.

**Strokes per minute (SPM)**
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.

**Stick, Shock 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 seafloor. 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.

**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 diverer 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 directions and straight holes, the position of the well must be known with both directional accuracy to ensure the correct wellbore path and to prevent any location in the event a relief well must be drilled. The 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 MOD 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.

**Sweat**
A relatively small volume of viscid 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 the drill floor. 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 joint provides a low stress area where pipe tonges are used to grip the pipe. Hence, relatively small cuts caused by the pipe tonga 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 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 rig, including the operator’s representative, the company man.

**Top drive**
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 conventional rotating table and the 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. Topdrives in modern topsides are a major improvement to drilling rig technology and are a large contributor to the ability to drill more difficult extended-reach wells. 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 “reved”) 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).

**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**
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 fitted 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 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.