SECTION 5

WORKING TIPS

The following are a few working tips I have picked up over the years. I hope they will be of some use to you.

RIGS AND RIG DIVING

I have served on rigs both as a Diver and Derrick Man. There never seems to be a compatible relationship between divers and drillers. This I am sure is because divers are usually hanging around on standby, only called for when everyone is in trouble, and usually the bearer of bad news! However, unlike construction barges divers are usually pretty ignorant of the working of a drillship. Therefore I have gone to some lengths to explain it.

A divers main responsibility is to the guide base and wires, and the B.O.P. A working relationship should be forged with the Sub-sea Engineer aboard. And divers should not let the BOP leave the surface without knowing -

a) How to release the ax rings top and bottom.

and b) After consultation with the Sub-sea Engineer, have all relevant valves, bolts, etc. they might be called upon to turn or release, whatever, greased, painted, and clearly marked.

I hope the following will increase your interest and knowledge. You need to get "on" the drill floor.

When changing the bottom B.O.P. or top hydril ax ring, make sure B.O.P. is held by the following:

1) Electric Brake
2) Manual brake held in place by chain
3) Ruckers tightened and full air pressure on them.
4) Chocks in drill floor turntable.
5) Mark and check hydraulic overrides

This is possibly the most dangerous job you will be asked to do in drilling support.

B. O. P.

B.O.P.'s are standard equipment for drilling. B.O.P. means BLOW-OUT PREVENTER. There are three principal brand names: CAMERON; VETCO; and SHAFFER.

There are three basic sizes in use: the 13-$^5/_8$", the 20" and the 16" B.O.P.'s. The 13-$^5/_8$" and the 20" B.O.P.'s work together, while the 16" incorporates the features of the 13-$^5/_8$" and the 20" into one unit.

13-$^5/_8$" B.O.P.

I HYDRAULIC SYSTEM

A. The hydraulic system is used to open and close the different valves and safety system on the B.O.P.

B. The hydraulic fluid is pumped from the ship via an accumulator down through two bunches of high pressure hoses to the B.O.P. Different rigs use different systems, but primarily there are two main systems for distributing the hydraulic fluid to the different valves on the B.O.P. These systems are:

The "POD SYSTEM" and the "REGAN SYSTEM."

1. The Payne Pod System is a system by which the hydraulic fluid is circulated down two central 1" H.P. hoses to the two pods located on top of the B.O.P. The fluid travels under pressure from the hose into manifold inside the pods. At the MANIFOLD small valves are used to control the fluid. When a small valve is opened, the hydraulic fluid in the collector then passes via H.P. pipe to the main valves on the B.O.P., which will then open or close. (The small valve inside the collector are operated by 1/4" H.P. hoses which come from the ship to the pod in a bundle with the 1" hose carrying the main fluid.)

The main benefit derived from the pod system is that the bulk fluid is always at the B.O.P. under pressure in the collector, thus eliminating the time necessary to pump up pressure in the hose from the surface and thereby making it possible to open and close the different valves on the B.O.P. more rapidly. Also, there are only two High Pressure lines from the surface. The small valves open at 300 p.s.i.

2. The Regan System: The Regan itself has two functions: It carries the hydraulic hoses to the B.O.P. and is also the means for locking onto the B.O.P. for raising and lowering the B.O.P. and also for attaching the mud riser to the B.O.P. We are now interested in the hydraulic functions and will discuss the other functions later.

The Regan System incorporates 1/2", 3/4" and 1" H.P. hoses which in two bunches run from the surface and join into either side of the Regan. These hoses except for two, connect to pins which stick down about 6" below the Regan. These pins sticking below the Regan fit into cylinders

on top of the B.O.P. It is here, when the Regan is lowered on to the B.O.P., that the hydraulic connection is made from the surface to the B.O.P. itself. (The two hoses left out above go directly into the Regan to lock the Regan to the B.O.P.) on the bottom side of the cylinders H.P. hoses are connected, and these hoses go directly to the valves and safety systems.

The main benefit derived from the Regan System is that in pulling the riser in an emergency, the hydraulic system is also freed, avoiding damage to the hydraulic hose bundles.

II VALVES AND SAFETY SYSTEMS

A. On top of the B.O.P. is the "HYDRIL".

1. The hydril primarily is a large cylinder (located near the top of the B.O.P.) with a strong heavy rubber lining around its inner circumference.

2. It has two hydraulic lines running to it, one of which will pump up the rubber, (which makes the inside of the cylinder smaller.) The other hydraulic line will release the pressure on the rubber, allowing it to open again.

3. The purpose of the "hydril" is to close tightly around the drill pipe in case of a blowout to stop gas from coming to the surface. The hydril on the 13-$^5/_8$" B.O.P. is capable of holding up to 5000 p.s.i.

B. RAMS

1. There are three different types of rams:

a. Pipe rams

b. Blind rams

c. Casing rams

2. The Rams are the big horizontal cylinders in the center of the B.O.P. There maybe three or four rams, depending on the system.

3. Pipe Rams, usually two sets to a B.O.P., close around the drill pipe and shut off the hole below.

4. Blind Rams, usually one set to a B.O.P., shut off the hole completely when closed and are capable of smashing the drill pipe flat. They are used when there is no pipe in hole below, or if there is pipe in the hole in a state of emergency.

5. Casing Rams, one, two, or none to a B.O.P., are used in case of a blowout while the casing is being run in the hole. They will shut around the casing, shutting off the hole below.

C. CHOKE AND KILL

1. Choke

a. The choke leads from a point off the side of the ship, down a pipe on the outside of the riser, through the framing of the B.O.P., but not actually inside the B.O.P., and finally down to two fail-safe valves. These fail-safe valves are hydraulic open and spring close. The two valves are set one on top of the other. The top fail-safe valve being called the "outside valve" the bottom valve the "inside valve." Below these valves the piping continues and enters into the B.O.P. just below the top blind ram.

b. The main purpose of the "choke" is that in case of H.P. gas (beyond the safe limits of what the mud can hold down) the rams can be closed on the B.O.P. to stop the blowout, and the choke valves opened, so as to slowly bleed off, or "choke down", the excess gas safely off the side of the ship.

2. KILL LINE

a. The kill line leads from the cement pump and mud pits onboard the ship to a pipe running down the riser. From here it runs the same as the choke line except on the other side of the riser, to two fail-safe valves. Again the piping continues, but this time enters the B.O.P. just below the bottom set of rams.

b. The purpose of the "kill line" is to pump cement or a heavier mud than they were using into the well and kill a potential blowout.

D. COLLET CONNECTOR

1. The "collet connector" is on the bottom of the B.O.P. and has a hydraulic open and lock system. (It also has manual over-ride arms in case of hydraulic failure.)

2. The purpose of the collet connector is to lock onto the 13-$^5/_8$" casing head and hold and seal the B.O.P. to the well.

III GUIDE FRAME

A. The "guide frame" is located around the center of the B.O.P.

B. It has tow main functions:

1. To protect the central workings of the B.O.P.

2. To guide the B.O.P. with the use of guide wires, to the well head.

IV WEIGHTS OF 13-3/8"'s B.O.P. AND PARTS

A. Hydril		13,800 lbs.
B. Rams		22,500 lbs.
C. Frame		4,000 lbs.
D. Collet Connector		1,200 lbs.
E. Fail-safe valves		1,200 lbs.
	TOTAL	50,500 lbs. + 5%

*Note: Weights vary, some B.O.P.'s weigh up to 75,000 lbs., even when made by the same manufacturers. The above weights apply to one model of the 13-$^5/_8$" CAMERON stack.

20" B. O. P.

The 20" B.O.P. goes down before the 13-$^5/_8$"s B.O.P. and is made for working in shallower drilling depths and lower pressures. It therefore has less in the way of safety equipment.

I. HYDRAULIC SYSTEM

A. Payne Pod System: The pod system is basically the same as the 13-$^5/_8$"s B.O.P. The only differences being that there is only one pod on the 20" B.O.P. instead of two as with the 13-$^5/_8$"s, and only one of the two pod hose bundles is used.

b. Regan System: The hydraulic system with the Regan system is the same with the 20" B.O.P. as with the 13-$^5/_8$"s B.O.P. The Regan latches on to the 20" B.O.P. with pins fitting into the cylinders as before. The only difference is that some of the cylinders are blanked off and not used.

II VALVES AND SAFETY SYSTEMS

A. HYDRIL: On top of the B.O.P. is the Hydril. It is the same in principal as the 13-$^5/_8$"s hydril, only a larger 20" inside diameter, and not capable of holding as much pressure, 2000 p.s.i. instead of 5000 p.s.i.

B. RAMS: Some 20" B.O.P.'s have one set of "Pipe Rams"; some have no rams at all.

C. CHOKE and KILL

1. Next down on the B.O.P. is the "Choke and KIll."

2. The choke is the same as on the 13-$^5/_8$"s B.O.P. in all respects (ref. pg 3) except that it only has one fail-safe valve. It is a hydraulic-open, spring-close valve.

3. Sometimes the 20" B.O.P. only has a choke and no kill line. In this case the choke can be used as a kill line if necessary.

4. When the kill line is used on the 20" B.O.P. it is the same as

on the 13-$^5/_8$"s B.O.P. except again it only has one fail-safe valve which is also hydraulic-open and spring-close.

III COLLET CONNECTOR

A. The collet connector is on the bottom of the B.O.P. and has the same hydraulic and manual overide system as the 13-$^5/_8$"s B.O.P.

B. The purpose of the 20" collet connector is to lock and seal the B.O.P. to the 20" casing head.

When the 20" B.O.P. and 13-$^5/_8$" B.O.P. are used

The 13-$^5/_8$"s B.O.P. and the 20" B.O.P. work together. Basically the system works as follows: The ship moves over the location to be drilled and either drills a hole big enough for the 30" casing or "jets" the casing down with water. The 30" casing head is attached to the guide-base and lowered to the mud line. At this point the bottom of the 30" casing is about 100ft. into the ocean floor and the top of it is just above the mud line supporting the guide base. Drill pipe is used to lower the casing and hold the top of it above the mud line. Cement is then run down the drill pipe followed by mud. The mud pushes the cement down though the casing and up along the outside of the casing. The cement is allowed to set, usually six to eight hours and the drill pipe and plug are then removed. The 26" drill bit is then lowered down and run inside the 30" casing. Drilling resumes, this time down to usually six or seven hundred ft. The drill bit is brought out of the hole and 20" casing lowered and stabbed inside the 30". The 20" casing is lowered down to the bottom, and cemented as before. The bottom of the casing being about six or seven hundred feet into the ocean floor, the top of the casing running up through the 30-" casing and stopping just 4 to 6" above the top of the 30" casing. At the top of the 20" casing is the 20" Casing head, sometimes call the casing hanger. This casing head or hanger is wider then the rest of the casing and stops the casing from falling into the 30" casing. At this point after the cement has set, the 20" B.O.P. is lowered and attached to the 20" casing head. Drilling than proceeds through the 20" B.O.P. This time down from 1600 to 2000ft. Then the 13-$^5/_8$"s casing is lowered, this time through the 20" B.O.P., through the 20" casing and down to the bottom. The top of the casing sits just above the 20" casing (about 1ft.) in the same manner as the 20" casing sits on the 30" casing. The 13-$^5/_8$"s casing is cemented, and the 20" B.O.P. is taken off the well head. The 13-$^5/_8$"s B.O.P. is lowered and latched onto the 13-$^5/_8$"s casing head. Again drilling resumes, this time through the 13-$^5/_8$"s B.O.P. until T.D. (total depth) or basement (hard rock below which no oil is ever found) is reached. That's basically the casing programme. It varies according to location and depth of drilling expected. There is also 9" and 7" casing which can be run inside the 13-$^5/_8$"s casing. It is used if the well is exceptionally deep, or if there have been some oil finds along the way to be tested.

16" B. O. P.

At present there are not many 16" B.O.P.'s in use, although we'll probably be seeing more of them.

The 16" B.O.P. is basically the same equipment as the 13-$^5/_8$"s B.O.P., except it has a 16" inside diameter. Also, the collet connector is made to latch on to the 20" casing. The idea of the 16" B.O.P. is that it can be latched to the 20" casing as the 20" B.O.P. does, but incorporating all the safety equipment of the 13-$^5/_8$"s B.O.P. so it can be left down for the entire drilling operation, thereby eliminating having to set two different B.O.P.'s

SUB - SEA EQUIPMENT

I. GUIDE BASE

A. Many different designs of guide bases are in use. To go into them all indepth would be confusing, but basically there are the "guide post" type and those without the guide posts. There are three wire systems and four wire systems.

B. The purpose of the guide base is simply to help guide the equipment into or onto the well head. Also it acts as a platform from which the diver can work.

II GUIDE WIRES

A. There are three of four guide wire systems, sometimes called "rucker wires", placed equal distance around the guide base and made firm to the guide base. Those guide wires lead from the guide base to points on the ship where they can be tightened by winches or "ruckers".

B. The purpose of the guide wires is to guide the tool through the water to the well. To do this the tool is attached to the guide wires. As the tool is lowered, it slides down the guide wires to the well.

II MUD RISER

A. The mud riser has two main functions:

1. As a guide to run tools down inside the well, once the B.O.P. is set.

2. To bring back to the surface returns made while drilling and to bring back the drill mud circulated out through the drill bit back to the ship.

B. The mud riser is made up of pipe sections made together with "Cameron Clamps." It usually has slots for funneled supports along its length to hold the choke and kill pipes.

At the upper end of the riser is the "slip joint." The slip joint is a slightly smaller piece of pipe which just fits inside the riser. The slip joint is hung just underneath the drill floor and goes down inside the riser. It is here that the ship's up and down movement is compensated for. As the ship goes down on a wave the slip joint goes further into the riser, as the ship comes up the slip joint pulls that much out of the riser pipe. At the end of the slip joint that is inside the riser is a ring to prevent the slip joint from pulling all the way out of the riser. The seal between the slips joint and the riser is made on the top of the riser. Here on the inside of the riser is a rubber ring which when air or hydraulic pressure is applied, closes around the slip joint, stopping the mud and returns from leaking, but still alows the joint to slipup and down. The mud then can continue up the slip joint to the "bell housing" from which it runs off into the "shakers". The shakers clean out the drill returns and the mud continues on to the mud pits where it is used again. The "Ball Joint" or the "Flex Joint", two different systems which do the same job, is located near the bottom of the riser and allows for forward and backward as well as lateral movement of the ship. The ball joint is a typical ball-type joint on a large scale. The flex joint is a series of short pieces of pipe with a very hard durable rubber in between.

At the bottom of the riser is a mechanism for connecting the riser to the "Mandril" on top of the B.O.P. There are three types:

A. The Shaffer system is much like the system between the top of the riser and slip joint. It has a rubber donut on the inside of the riser which, when air or hydraulic pressure is applied, grips around the mandril making a seal. Its disadvantage is that for obvious reasons the B.O.P. cannot be lowered with the risers. However its advantage is that it is possible for the ship to pull off the well very fast in an emergency without damaging the riser. (It is used with the pod system.)

B. The collet system is the same as the collet connector used on the bottom of the B.O.P. The collet is attached to the bottom of the riser and hydraulically closes around the mandril. (It is used with the pod system.)

C. The Regan System is basically the same in principal as the collet system. It hydraulically locks onto the mandril, the main difference being that it also carries the entire hydraulic system for the B.O.P. as described under the section on hydraulic systems.

GENERAL

1) Use soft line "always" with slings and clamps. Always rig with some method of diver adjustment chain block, etc.

2) Always try to have a down line.

3) Always try to position tuggers on stationary platforms.

4) Move rigging in small amounts.

5) Mark tuggers, clamps, etc for divers identification.

JETTING = JET BARGE

1) Get to know layout of claw. You may be operating in nil visibility.
2) Pumps should be OFF whilst diver on job.
3) Always swim for and aft on downcurrent side.
4) Check divers descending line or swimline, is attached to Apex of towing bridle.
5) Always carry 50' of soft line for dropping off claw onto pipe.
6) If hand jetting for setting of claw frequently, see if there is a rack to stow hand jet on sled permanently.
7) Always report damage to pipe. Try and note field joint no.
8) Make sure you fully understand before diving how claw or jet is set on pipe.
9) Check pipe is sitting in ditch nicely, "NEVER" go below pipe.
10) Check distance of top horizontal roller to pipe.
11) Take nemos on pipe top, ditch bottom, natural sea bed - 3 -- 4M away from sled.
12) When crossing side to side, if necessary swim over jet to keep hose clear.
13) Check hose connections.
14) Check bridle connections.
15) And nozzles, none missing or plugged up.

DOPE COATING

1) On the surface or splash zone wear rubber gloves.
2) In 70^0 - 80^0 F it sets in 1 hour approx.
   In 50^0 - 60^0 F it sets in 15 min. approx.
3) Use Pycoflex or plastic pipe tape to secure dope in place. Always carry tape over onto undamaged pipe a few turns.

SETTING PLATFORMS

1) Divers usually perform a pre-setting sea-bed debris survey.
2) You could be called on to open grout or flood valves so if you get the opportunity view them on surface.
3) Divers check level of mud boards on or under sea-bed.
4) Always keep your hose going over the top of the lowest horizontal bracing.
5) Be careful of pressure when taking grout samples.
6) Permits are required before any underwater cutting or welding takes place.
7) Piling usually stops whilst diver is in water.
8) Beware of welders, riggers, working over diver.
9) No casing is lifted over worksite whilst diver is in water.
10) Make sure Deck Foreman "always" knows what divers are doing.
11) Look at blueprints. Know your way around the plaform.

POST SETTING SURVEY

1) Debris clearance.
2) Anodes that may have fallen off due to hammering.
3) Clamp inspection. ie, still in correct position caps still on bolts still in and tight.
4) Skirt Pile and grout line removal.
5) Boat bumper and riser guard installation.

PLIDCO CLAMPS

1) Rig well, if clamp is heavy use sodasorb drums for handling or buoyancy bags.
2) If measurement for the (pup piece) is less tha 10', use telscoping pipe with grub screw and flat ends.
3) Clamp is placed over pup and pipe end evenly.
4) If clamp is being welded, grub and thrust screws are burned off and plugged with weld.
5) Where clamp is being installed pipes must be free of bitumen coating, clamp must be clean to metal.
6) Clamp flanges must be tightened evenly.

INSPECTION DIVING

You are looking for:

1) Loose nuts
2) Clamps not angled or fastened properly. ie. to the bata of the platform.
3) Damage to dope coating or cement.
4) Clamps at correct depths (nemo).
5) Buckles in pipe.
6) Any irregularities at all. Always carry tape measure and compass.
7) Correct sand-bagging or support at spans and crossovers.
8) If making molds of damage, use splash zone, smear damage with grease first.
9) Check how deep pipe is in ditch, be careful of cave-ins.
10) Note growth on structure & % wear on anodes.
11) Damage to platform structure or boat bumpers.
12) Check risers have rubber insulation at clamp intact.
13) Carry couple of tools for possible quick repair.

PIPELAYING - LAY BARGE

1) Check out direction of field joints at the dope section, in case you lose direction on pipe.
2) When rigging pontoon or stinger control hoses, apply plenty of grease.
3) Look at blueprints and try to visibly view stinger on deck, mark and note all flood and ballest valves at the top of each section, check they all work. Be careful, valves can suck you onto themselves and kill you. Open them in correct order. ie, if you are required to flood compartment, check top ballast or header valve is close, open bottom flood valve, then open top ballast valve. There can be 3 types of valves - flood vvs, vent vvs, and ballast vvs. Ballast vvs can also be called air or header vvs.
4) Always carry a pipe wrench with you.
5) If required to open valves when stinger is on surface, still wear diving gear, stinger might sink.
6) Rig a wire downline, pulled tight with turnbuckle down sides of stinger. (This is best done whilst stinger is out of water, if you get the chance).
7) Rig a softline downline from point of entry into water to wire downline on stinger.
8) Tend divers hose at a good angle to stinger.
9) Diver should always wear a fenzy bouyancy vest when doing stinger checks.

10) When the pipe is being lowered into water, if the head is to be in close proximity to a platform or structure, tend a downline on pulling or laydown head and attach line to platform or structure.
11) Checks on stinger or pontoon
    a) Weather permitting, there should always be a quick inspection of hitch and fingers and dogs. (Be careful of swell).
    b) Check control hoses.
    c) Check pipe on rollers.
        i) Pipe off rollers at top end heavy on bottom rollers = stinger to buoyant.
        ii) Vice versa - vice versa.
        iii) Check pipe on all rollers, make note on slate.
12) Check angle pipe leaves stinger horizontally and laterally.
13) Take nemo or cluge readings, and F/joints.
14) Always inspect below stinger pipe.

ATTACHING DAVITS

1) Number bottom block of davits clearly for diver.
2) Have running line leading from one davit to another.
3) Diver to have shackle and length of rope he can run along running line and keep himself on pipe.
4) After attaching 1st davit or big-rig, lift on this slowly to pass slings under pipe on next davit. Then lift evenly on first two to assist on 3 and so on. Discuss with Supervisor.
5) Never attach a davit on a F/Joint.

PULLING HEADS AND LAY DOWN HEADS

Note:

1) Length of pulling head from crown of eye to weld onto pipe.
2) Note valves and sizes.
3) Make sure P/H is painted clearly with pipeline number and line.
4) If it is a lay down head, make sure you are satisfied with the rigging of the chain pulley, shackles and rope which could be attached to the head to enable diver to relase hold back cable.
5) You could be asked to go to specific P/H/ and flood lines by opening valves. NEVER do this without a diffuser. A diffuser is a section of pipe that will screw into P/H valves or sit over them, full of slots and holes, to diffuse the suction of water entering pipe thus preventing diver being sucked onto valve. Do not be cajoled into doing this job without one.

RISER CLAMPS AND RISERS

(Divers must rig the clamps.)

1) Consult with Engineer, clamp sizes, angles depths, etc. Get him to have clamps marked.
2) Balance clamps for lifting, and rig so diver has manual adjustment.
3) Try to get your tuggers onto the platform see deck Foreman.
4) Paint vertical stripes down clamps and faceplates, ie., clamp may be on an angle bracing but pipe must fit in vertically.
5) Downline or wire from bottom bracing up line of where clamps are placed and tightened is a good guide for divers.
6) Correlate your blueprints, measurements, and nemo readings. See D. Foreman or Engineer if any discrepancies.
7) Thick rubber behind bolt faces keeps bolts in but they can move. Rope and welding rod for nuts.
8) Tightening clamps. If using power tools, a sodasorb drum on the end of a line can be a great assistance. If you are working too hard, look at the rigging.
9) If you have managed to secure a downline to the P/H or L.D. Head, this will now be of great assistance to the diver. Measurements these days are usually taken from a point on P/H to three places on platform or structure, so as angles can be checked.
10) When lower J tubes and knee brace, place lightsticks.
11) Before knee brace leaves surface make sure it has pad - eye for recovery.
12) If you are using a tugger to suck riser into saddle clamp (or first clamp from sea-bed), do so by running tugger behind and under neath a horizontal. Preferably below the clamp, but always clear of the clamp. Have tirfors, comealongs or 2nd tugger ready to assist. Use soft rope slings.
13) Always report how J tube is sitting in relation to s/bed and bott. horizontal before fastening more clamps or releasing knee brace. You might have to inspect back along the pipe a little.
14) Prepare long drawbolts before sucking the riser into the saddle clamp.
15) If you are using stainless steel nuts and bolts, beware of using power socket wrench they could sieze up.
16) Saddle side of knee brace clamps to have nuts welded on it. The bolts to have a nut welded one end of them for easy removal.

FLANGES

1) These days hydrotight equipment makes a divers life a little easier. Get to know all aspects of hydrotight equip. including the flange pullers.
2) Flange open at top and closed at bottom. Place two bolts directly under drift pins (drift pins 9-3) screw up nuts. Lift on pipe 30' or more behind flange.
   Flange opposite above, place two bolts above drift pins and lift on pipe 3' behind flange.
3) When placing gaskets between flanges, "never" insert your fingers, see if welding Foreman can braze a rod on gasket to enable one to insert it into flanges.
4) After hydrotighting flange, make sure spaces between flanges are even at 12-3 6-9. Take measurements. Never bullshit if you think a flange job is not good enough say so. It is better to fix it now (despite grumbles) than lose the company and your reputation.
5) Do not "forget" the gasket or `O' ring.

Note

Always report to your Diving Supervisor only. Do not tell stories to clients. If approached, just say "I would sooner report to my Supervisor". Once they realize the score people will stop hassling you. Either the Supervisor or the Superintendent, (people who should have reached this position out of experience) will deal with the client.

SBM'S (SINGLE BUOYED MOORINGS)

Firstly, should a SBM be scheduled for hose change, or complete change out, I regard it the duty of the management personnel in charge of the project to see that the last scheduled tanker on the SBM backflushes the lines.

This is a very simple process for a tanker, whereas backflushing equipment on the back of a diving barge has been known to blow-up the deck and the SBM.

Once backflushing is complete the floating and sub-sea hoses can be removed. However, to do this one must close the plem valves. Some valves are hydraulically opened/closed a factor to be taken into account when tooling up for the job. Even if the indicator indicates Closed BEWARE. If any suction is felt when releasing hose flange or blind flange, have a re-think check valves manually and be careful. It could be, a small positive press might have to be put in p/line.

The next important point is regarding the SBM anchor have usually 8. The chain is held in the skirt of the SBM by a stopper. Before removing the chain, mark with seizing wire, paint, or both, the link directly above the stopper, so as to be able to replace the chain to the exact tension when

placing the new buoy.

One needs two lift points when doing SBM's. One is usually the crane or a frame of the working barge. If a second crane or a frame is not available, one must make a lifting point on the SBM. Usually the SBM has a revolving davit and winch capable of positioning it self over every chain point. As in my first paragraph, should a SBM change out be scheduled I regard it as good project management if this davit has been maintained and in working order.

RIGGING TIPS

If the SBM has a mid-level buoy supporting the hoses, take a wire from this buoy through a snatchblock on the plem and back to a winch on deck. Some tension can be taken off lower plem hoses then. Release plem flanges first, then paying out wire let mid level buoy rise. Now release flanges under SBM itself, supporting rigging can be run through the centre of the S.B.M. If anything untoward happens and you lose hoses directly under SBM, you still have your mid level buoy on surface with all hoses attached.

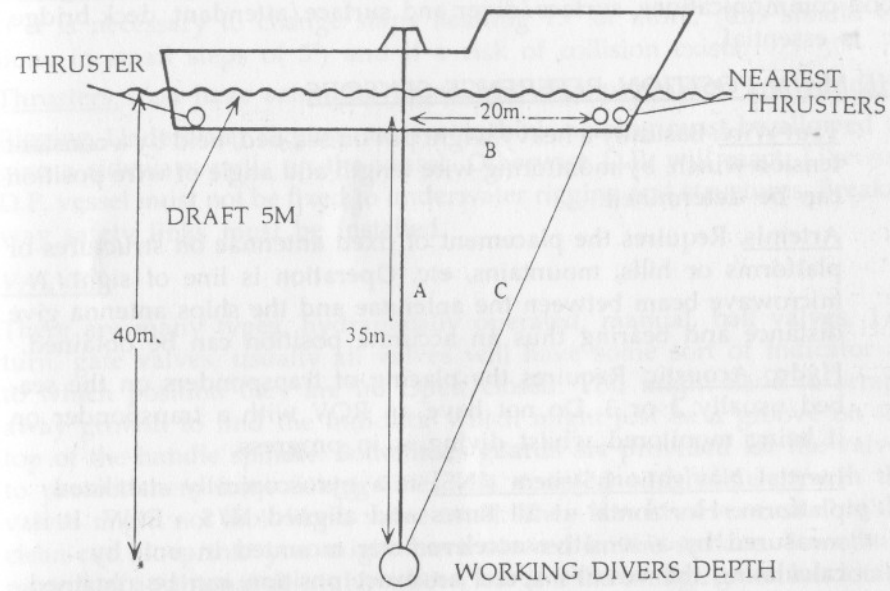
Reverse the situation when installing new hoses.

A plywood blank held on with grey tape to keep the sub-sea hoses water free and fairly buoyant assists greatly when pulling the first lengths of hoses under the SBM to be attached to the sub-sea SBM manifold flanges. As this is shallow 2-3M, usually the blanks can be safely knocked off before bolting. The other end of the lengths of hose is on the surface. Pull the hose you've floated under the SBM, up, through the centre. Remove Blank. Then lower again, water will enter and stop shortly. Diver can then bolt up.

In general SBM's are a good rigging exercise. The job should not be too difficult with good rigging.

DYNAMICALLY POSITIONED VESSELS

Working out the maximum length a surface divers umbilical can be from the surface. The divers hose leads "through" the diving stage at divers working depth.



$C^2 = A^2 + B^2$

$C = \sqrt{A^2 + B^2}$

$= \sqrt{35m^2 + 20m^2}$

$= \sqrt{1625}$

= 40.31m is the maximum divers umbilical length.

SURFACE DIVING DP VESSELS

If diving the depth of the vessels draft, plus 10m or less, diving must be done over the vessels side.

If diving to the depth of the vessels draft and more than 10m to a maximum of 50m, then diving can be conducted over the side or through the moonpool. Always use a divers cage for deployment.

Good communications, surface/diver and surface/attendant, deck bridge, etc. is essential.

THE MAIN POSITION REFERENCE SENSORS

1) Taut Wire. Basically a heavy wight put on sea-bed, held by a constant tension winch, by monitoring wire length and angle of wire position can be determined.

2) Artemis. Requires the placement of fixed antennae on structures or platforms or hills, mountains, etc. Operation is line of sight. A microwave beam between the antennae and the ships antenna give distance and bearing thus an accurate position can be obtained.

3) Hydro Acoustic. Requires the placing of transponders on the sea-bed usually 2 or 3. Do not have an ROV with a transponder on it being monitored whilst diving is in progress.

4) Inertial Navigation System (INS) is a gyroscopically stabilized platform. Horizontal at all times and aligned N/S - E/W. It is measured by a sensitive accelerometer mounted in unit by calculating the vessel's speed an exact position can be obtained. Minute imperfections, vessel movement and the earth's rotation are all calculated by the computer which checks itself against one of the other systems.

To compliment the position reference sensors we have wind sensors, gyro compasses and vertical reference sensors.

At least two of the four position reference sensors must be operational at all times for diving.

If the ship has two taut wire systems, each must work independently.

DP Alert System consists of coloured lights in dive control.

Green — all systems go ok to dive.

Yellow — degraded operational status. Return divers to bell and get a seal. If surface diving recall divers, if necessary, surface decompress.

Red — Stop diving and get everyone back aboard a.s.a.p.

Communications are imperative. Dive control to bridge, bridge to platform or structure, etc. Inform bridge of all bell and diver movements. Likewise, the platform should keep you informed of anything affecting divers' welfare - weather, vessel and helicopter movements, other diving activities, rigging, crane lifts, discharge of chemicals, other acoustic beacons or transponders in use.

Diving will stop if a thruster works at 80% or more capacity.

If it is necessary to change ships heading 15^0 or more, (this should be done in small steps of 5^0) and if a risk of collision exists.

Thrusters. You have azimuth, tunnel, and ship propulsion and rudders.

Rigging. Underwater rigging needs a re-think nothing must be allowed to give a sideways pulls on the vessel. Otherwise D.P. will react. Likewire D.P. vessel must not be fixed to underwater rigging and structures. Breakaway safety links must be installed.

VALVES

There are many types, hydraulically operated, manual, ball valves, 1/4 turn, gate valves, usually all valves will have some sort of indicator as to which position they are in. Open/closed. You might have to scrape away growth to find the indicator which might just be a groove on the top of the handle spindle. Sometimes guards are provided for the valves to protect them from fishing lines, etc. coupled with some growth the valves might not look like a valve at all. They almost never resemble the clean-cut blueprints you might have viewed in the surface. Sometimes records of additional tie-ins have been lost and the configuration has totally changed. Be alert. Get into the habit of carrying a small slate and pencil. Build a reputation for accuracy.

CROSSHAULING

Quite often the bell must be crosshauled. Either, pressure over bottom, inside the bell, or, if midwater make sure the bottom outside bell door is closed. Fixed crosshaules whereby an anchorable point is welded to the deck or structure, the length of the crosshaul wire is calculated. Steel wire rope to safety factor of 10 is used. Always try to work with this type of crosshaul. It is safe and you do not have to co-ordinate with anyone else.

Crosshauling with a Winch. Make sure winch and rope has adequate safety factor. The winch must have a means of physically stopping it other than the brake, alternatively a cable stopper must be used in addition to the winch. Communication is vital and nothing or anybody should interfere with your communication line until maneuver is complete.

The diver returns to the bell for crosshauling, get a seal, close bottom door. Never crosshaul leaving diver out of bell.

Crosshaul maneuvers can be open to abuse. As a diver it is in your own welfare to enquire as to the procedure to be adopted.

SCUBA-DIVING

Unfortunately because this method of diving has been abused so much, in a lot of places in the world, its use is banned commercially. However, following the basic rules scuba has its uses. The main points to follow are:

A diver must have a lifeline, unless diving in pairs.

In pairs divers must be buddied together. One diver marked with a buoy or attended by a lifeline.

Scuba is to be used for inspection and very light jobs only. Shallow water pipe swims, etc.

Always wear a buoyancy compensator, mask, and snorkel.

Try to dive in no-decompression times.

Carry tables on a slate - wear a depth guage.

Always wear a compass.

Have your means of decompressing sorted out before hand ie. on jacket or platform - on downline.

It is usuall if diving out of a barge anchor pattern, a smaller vessel which can stay near your work area, large enough to have a DDC & air & oxy banks, compressor, etc. will be provided.

Aways fly flag Alpha.

If you have been free swimming, marked with a buoy. As you surface, make up your line and surface by the marker buoy.

SMALL CRAFT HANDLING

Keep in the close vicinity of the divers you are monitoring. Drive sensibly, upon approaching divers always put engine in neutral. Always check fuel beforehand, assemble a small tool kit for emergencies, learn how to check the basics in case of breakdown. In rubber boats, always carry foot pump or a bottle of air set aside for blowing up tubes.

Always have radio communication to barge or support vessel.

Be careful of the weather, if it looks like weather is worsening call in your divers, do not wait until it is too late.

Time co-ordination, a plan for emergencies, and standby divers are essential.

POWER SUPPLY FOR DIVING SYSTEMS

On a Sat System especially, there must always be a secondary means of obtaining power to the system capable of:

a) recovering the bell, and

b) supplying all life support equipment.

As a diver, I always check this out. Likewise even surface orientated systems should have standby diesel compressors, etc. if all main equipment is electrically powered.

All electrical systems must be adequately grounded.

SECTION 6

COMMUNICATIONS

CONVERSION FACTORS

MISC. INFORMATION