

TOWING PROCEDURES ON THE PANAMA CANAL ✓

Capt. P. S. Jennings
Towboat Master
Panama Canal Commission

INDEX

	Page
INTRODUCTION	1
CHAPTER I - Tug Fleet	3
CHAPTER II - Harbor Work	9
CHAPTER III - Dead Ships and Barges	22
CHAPTER IV - Procedures in and around Locks..	26
CHAPTER V - Gaillard Cut	31
CHAPTER VI - Unusual Tows	33
CHAPTER VII - Dredging Operations	39
CHAPTER VIII - Offshore Towing	55
CHAPTER IX - Licensing	66

INTRODUCTION

Towboating on the Panama Canal has been humorously defined to be "Hours and hours of boredom interrupted by moments of sheer terror." First, there is nothing boring about towing; secondly, there is no reason to place yourself in a position to become terrorized. This is a profession which requires serious attention and the desire to learn, primarily through experience, adequate knowledge to enable you to handle each and every crisis that may arise. The tug fleet is an essential service on the Canal which should be manned by well trained and responsible professionals.

This manual is intended for those who are newly enrolled in the Panama Canal training program to learn to become competent towboat captains. This does not contain technical information to the physics of towing, navigation, deck maintenance, or other subjects related to the profession. Rather, it is an introduction to common methods of towboating on the Canal, stressing the old slogan that "The power is in the wheelhouse, not the engineroom." By no means are any of the methods illustrated in this manual unbreakable rules. On the contrary, it is encouraged that an apprentice tug captain try alternate methods to suit his style, enabling him to have more confidence in his ability to cope with unusual circumstances.

THE MASTER:

The towboat captain is at all times completely responsible

for a two or three million dollar tug and all hands on board. He must be able to act coolly and efficiently in every situation. He sees that the tug is properly maintained and kept in top operating condition. He must be able to settle the needs of his deckhands and maintain strict discipline. He must be able to cooperate with the Canal Pilots and other floating equipment personnel, but without giving up his individuality. He knows how to apply first aid and is prepared to handle any emergencies. In short, the towboat Master can take any boat at any time, go any place, and perform any job under any condition. True, tugboat captains are probably the "saltiest" of all seagoing professionals and pride themselves toward the "can-do" approach to their work. They don't complain when things get tough, as they often will, and you can bet they'll be there when you need 'em.

There is a poem of unknown author, about tugboats, and the last two verses go like this:

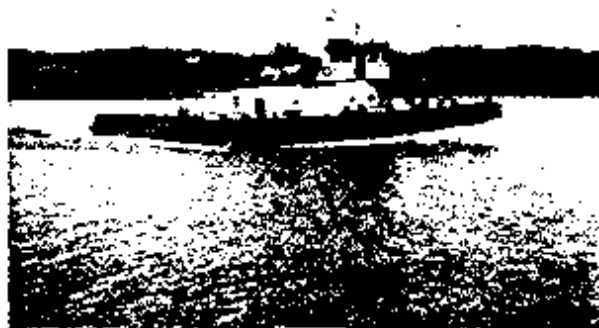
The tug - he bucks the river
when it's full of grinding ice,
And when there's trade to handle
why...you needn't call him twice.
For he's there a-riding combers
maybe, fifty miles at sea,
And he doesn't stop for danger
when he's looking for a fee!

He's a giant little helper
he's the live-wire of the port.
He's a nervy, nifty snorter
and a winner and a sport.
He's a snubby-nosed exploiter
of the chances of the game:
And he's never much on beauty,
but he gets there just the same.

CHAPTER I - The Tug Fleet

1. TRINIDAD Class

These are beautiful twin-screw tugs of 3000 HP which are 96 feet long and 28 feet wide, capable of handling most any harbor work. They handle extremely well in close quarters and have sufficient power to work with the largest ships that transit the Canal. They are a pleasure to operate and the Pilots like them. There are five, stationed at Cristobal and Balboa harbors, occasionally transiting the Canal on various tows. A small wheelhouse enables them to work well under bows and flares. They are not equipped with towing winches.



2. JOHN F. STEVENS Class

There are three of these single-screw tugs. They are 105 by 26 feet, have 2400 HP with variable pitch propellers, and are equipped with towing winches and radar. They have plenty of power, but the relatively large superstructure makes them slightly more difficult for use around ships. One is based at Gamboa for use primarily in Gaillard Cut where it's

radar can best be utilized during foggy conditions; the other two are based in Cristobal.



3. FOLMAN Class

Two single screw tugs 109 by 29 feet with 2000 HP, no towing winches aboard. These are fine handling tugs based in Balboa and are good harbor boats. Like all single screw tugs as opposed to twin-screw, are not as maneuverable, but can do a terrific job, depending on the man in the wheelhouse.



4. BURGESS Class

These are the "latest" in harbor tug design with their tv

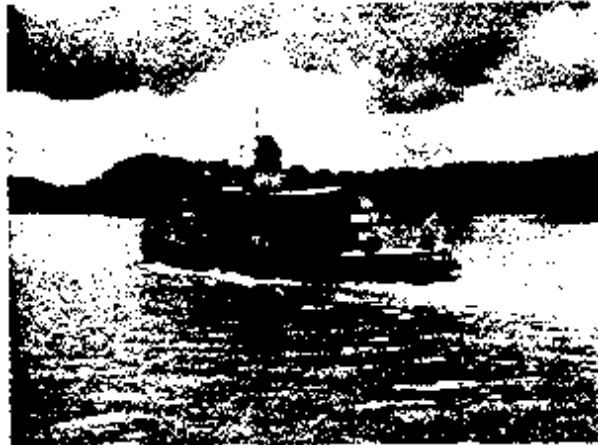
kort-nozzle system which provides maximum maneuverability and therefore maximum usage around ships. They can perform better than conventional tugs, have low profiles, and can apply power in any direction instantaneously. Called "tractors" in many places because of their unconventional method of handling, they are able to assist ships in a manner which no other tugs can. They are 96 X 33 feet, are powered with 2400 HP, and have towing winches. At present, there are two such tugs employed on the Canal.



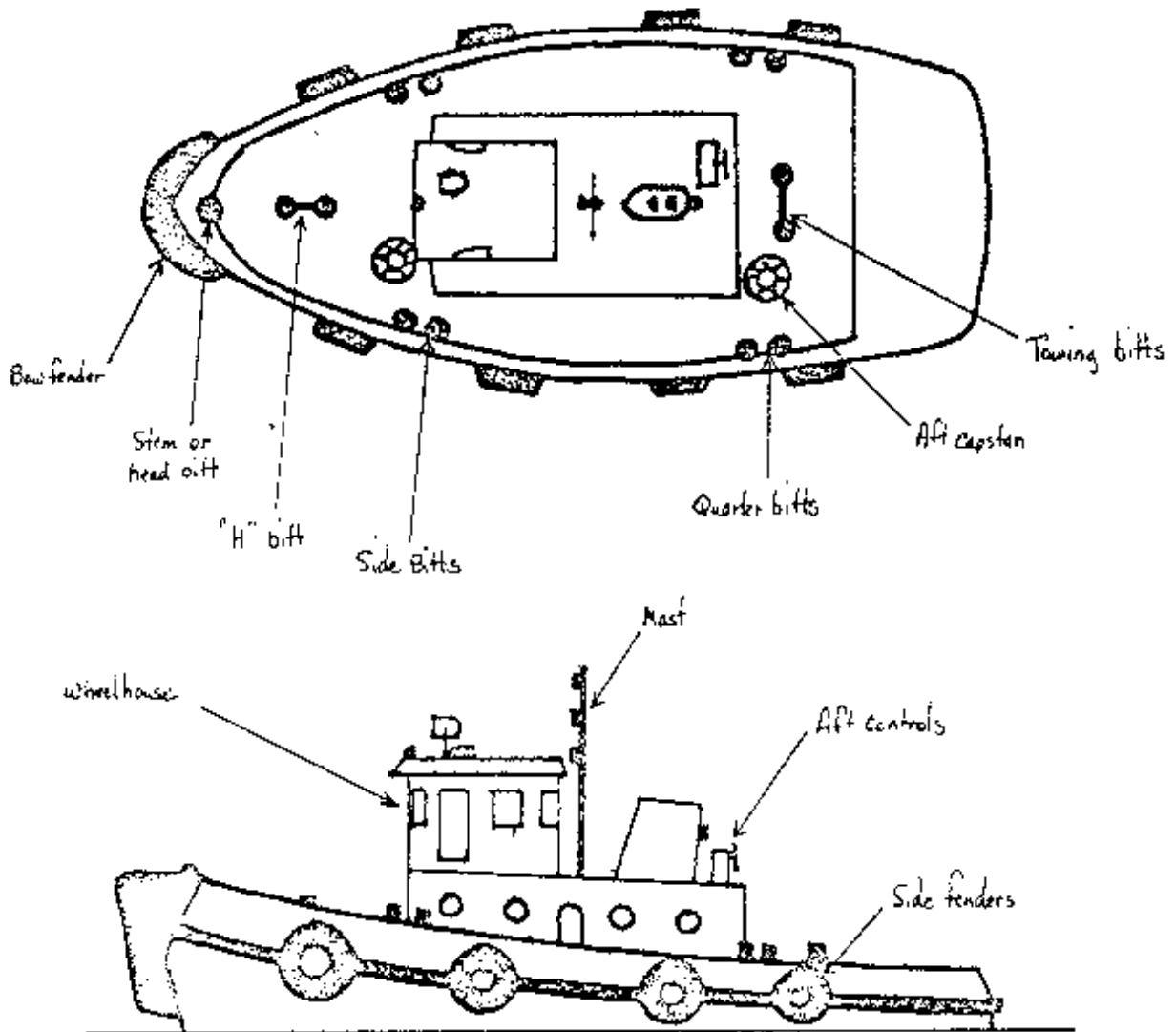
5. SAN PABLO Class

Often referred to as the "old work-horses" of the Canal, these sturdy boats have been faithfully working since the early '40's. They are 127 X 30 feet, powered with 1000 HP single screw diesel electric, and have towing winches. They are large, heavy, often difficult to maneuver, don't always have sufficient power to assist the large ships, but are reliable. They carry large quantities of fresh water useful for dredgesupport. We presently employ four

tugs of this type, mostly based at Gamboa, one of which primarily supports Dredging activities and occasionally does some offshore work.

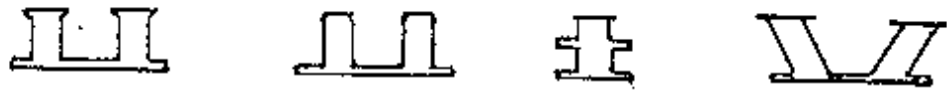
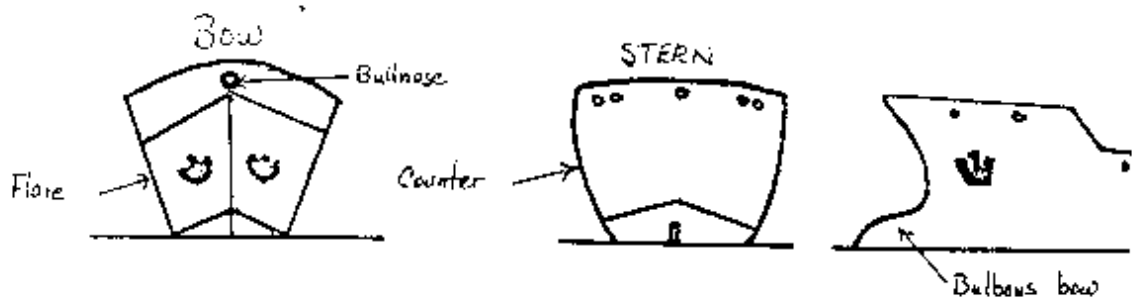
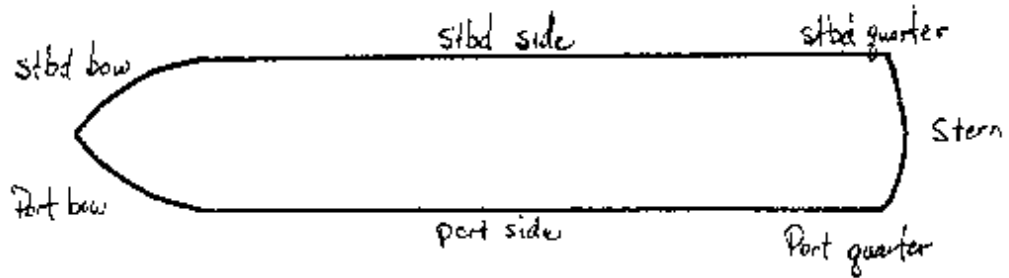


Typical Harbor Tug Layout:

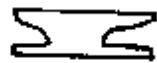


They should be short, for easier maneuvering in confined areas around locks and piers. Note recessed superstructure for getting under flares and counters.

Terms:



Types of Bits



Cleat



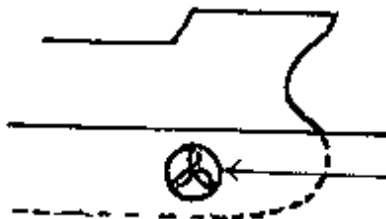
Closed Chock



Open Chock



Roller chock



Bow thruster



Padeye

CHAPTER II - Harbor Work

The majority of the towboat work in the Panama Canal is the job of assisting ships on and off docks and piers, in and out of the locks and Cut, and to moorings. Harbor work is pretty tricky due to the fact that you will be assisting ships going astern as well as ahead, and turning them around. At all times the tug captain must be totally aware of the ship's motion and be able to anticipate what course of action to take to maintain good position with his tug. The purpose of the tug is to help the Pilot control his ship, and this can be accomplished only by keeping the tug in a workable position. This position varies from ship to ship, but essentially it means that the tug is able to push or pull with full power whenever the Pilot desires.

Generally, the Pilot will instruct the tug captain to make fast on the port or starboard bow, port or starboard quarter, or on the stern.

1. Working on the ship's bow.

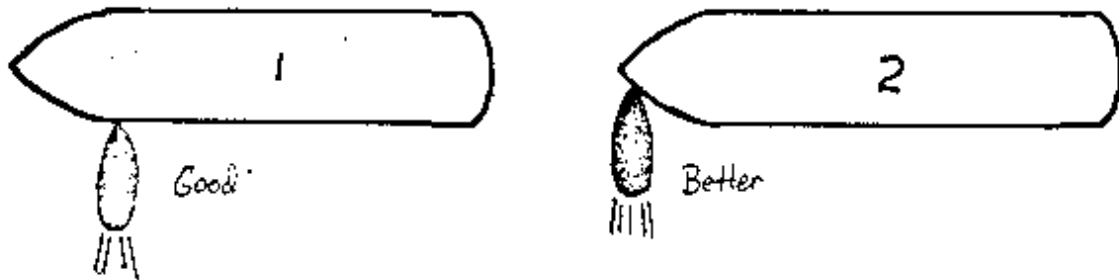
When approaching a ship with the intention of coming alongside and putting up lines on the bow, take note of the following:

1. Ship's speed
2. Amount of flare
3. Availability of chocks and bits
4. Bulbous bows
5. Ship's draft
6. Ship's anchor

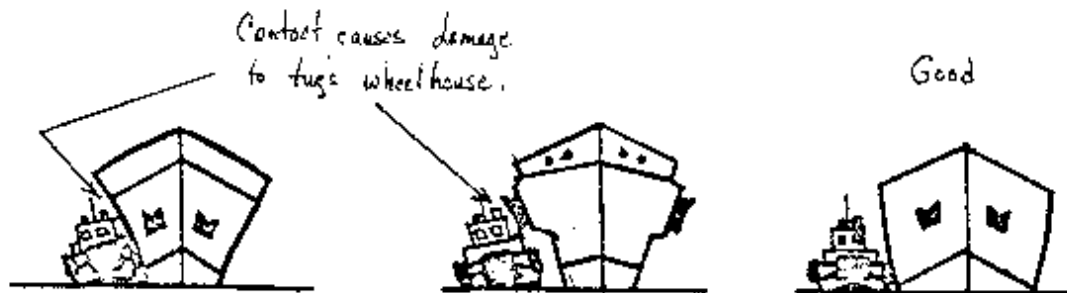
7. Bow thruster

The main idea is to make fast as far forward on the ship as possible without placing the tug in a dangerous position.

The further forward you can get with the tug, the greater the effect your power will have.

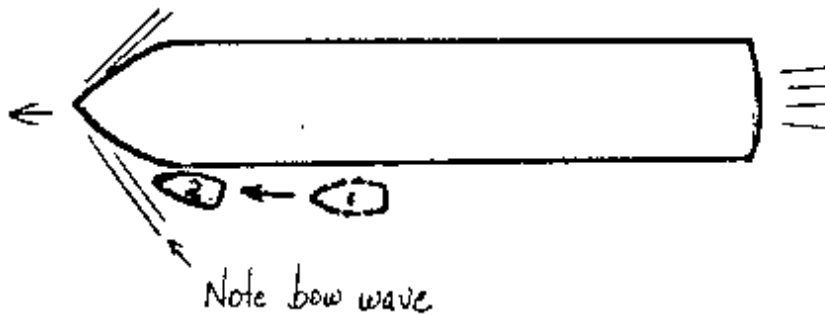


Possible damage may be done to your tug if the ship has a pronounced flare or there exists an obstruction, such as an anchor.

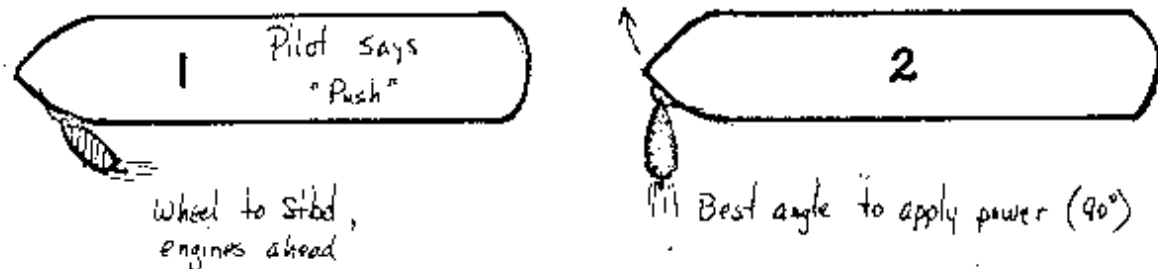


Be aware of bow thrusters, as they can make things difficult for you by throwing wash.

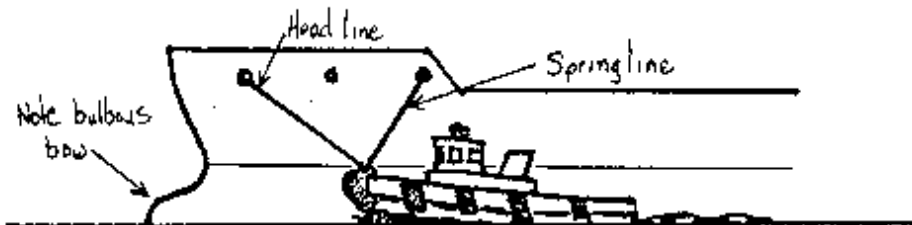
Upon making an approach and you're not sure of the flare, especially during darkness, ease the tug close to the ship well aft of the bow and slide forward, observing the flare while doing so.



Upon reaching the point where you desire to make fast, you may ease the tug against the side of the ship where it will generally become "pinned" due to the force of the ship's bow wave. Run your lines up as soon as possible and notify the Pilot when ready to work. Generally, you will use a head line and a spring line. (Except with twin-screw boats.)



When made up like this, you may push the ship's bow to starboard or pull it to port. The spring line prevents the tug from sliding ahead when the pilot orders the tug to push.



The Pilot will give by radio or by whistle signals:

- 1 whistle - push
- 1 whistle - stop
- 2 whistles ~ back
- 1 whistle - stop
- 1 slow whistle - push easy
- 2 slow whistles - back easy
- 1 long and 2 short whistles - let go

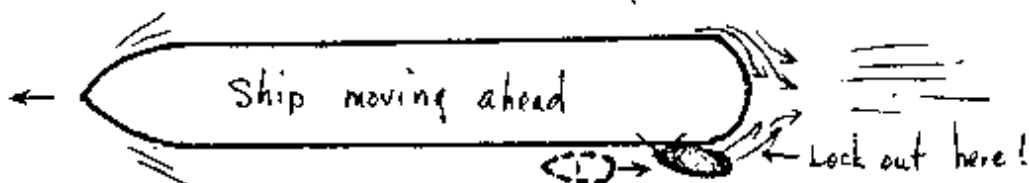
2. Working on a ship's quarter.

When approaching a ship with the intention of coming alongside and putting lines on the quarter, take note of the following:

- 1. Ship's speed
- 2. Counter
- 3. Availability of chocks and bits
- 4. Propellers and rudders
- 5. Ship's draft

Again, the idea is to place the tug as far aft as possible, enabling you to be more effective with your power, so long as you don't place the tug into danger. Steep counters may damage the tug's wheelhouse as under a flare.

When approaching a counter, do so with caution. When a ship is making forward motion, a vacuum is formed at the stern. Since water must fill that vacuum, strong suction currents are set up at the quarter; strong enough to catch a tug!



Therefore, ease the tug well ahead of the quarter and steadily drop back, keeping a close eye on the counter and maintaining control at all times.

Lashups on the quarter are usually similar to that on the bow, so long as the tug can be worked ahead and astern. The signals from the Pilot are the same.

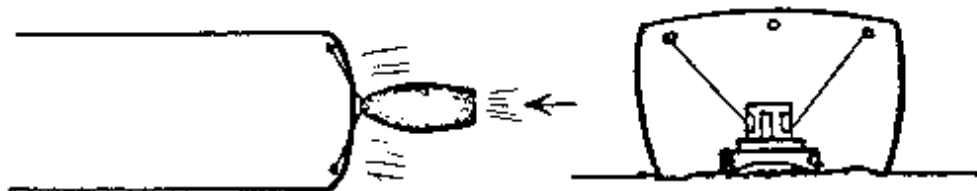
3. Working on the ship's stern.

When approaching a ship with intentions of making fast to the stern, take note of the following:

1. Ship's speed
2. Rudders and propellers
3. Availability of chocks and bitts
4. Ship's draft

If the rudder or propeller of the ship are protruding above the water, and it is apparent that you cannot work the stern without causing damage, then don't do it. Notify the Pilot that you cannot work his stern and he'll probably tell you to make fast at another location or stand off. NEVER place your tug in a dangerous position REGARDLESS of what the Pilot may instruct. Remember, the tug is your responsibility, and you are willing to do everything possible to assist the Pilot so long as it is safe to do so.

Approach the ship from dead astern, noting the amount of wheel-wash the ship is throwing at you. Ease you tug in close to the ship, even to point of contact if possible, and run your lines up.



Put two lines up to the outer limits of the ship's stern. This lashup, called the "Cut-style" lashup, is very effective. The tug becomes a huge rudder, being able to push to starboard, to port, and back down to help stop the ship. The tug is usually clear of all obstructions and is able to use its power efficiently. The only danger occurs if the ship should start to make sternway, causing the tug to fall around under the counter. You must skillfully maneuver the tug to prevent being run over, by pushing against the ship if necessary.

The Pilot signals are:

- 1 whistle - push stern to starboard
- 1 whistle - stop
- 2 whistles - push stern to port
- 1 whistle - stop
- 3 whistles - full astern
- 1 long and 2 short whistles - let go

These are the three basic lashups used while assisting ships. Naturally, there are many other variations due to the characteristics of different ships. But the principle remains the same: Approach the ship cautiously, noting every detail which may be useful. Make up to the ship as quickly but safely as possible in a location where you can do the best job with your particular tug. Go into a job with a positive attitude and be willing to be as helpful as possible to the Pilot. That is what you're being paid for.

Using a hawser.

It is interesting to note that a subject as important as hawser towing receives second place of importance. In reality, the vast majority of towboat work is done on a hawser. The whole basis for towboat work revolves around the theory of

towing objects astern. However, here on the Canal, we actually do very little. Hawser work requires considerably more skill and experience and is often more dangerous than most other methods of moving large objects on the water in close quarters, such as exists in the Canal. Imagine a mouse pulling an elephant on a skateboard down a concrete slope, and you may see the implications.

This is not to say that towing astern is anything special or next to impossible. On the contrary, it is efficient and in many cases the best and easiest manner to accomplish a job.

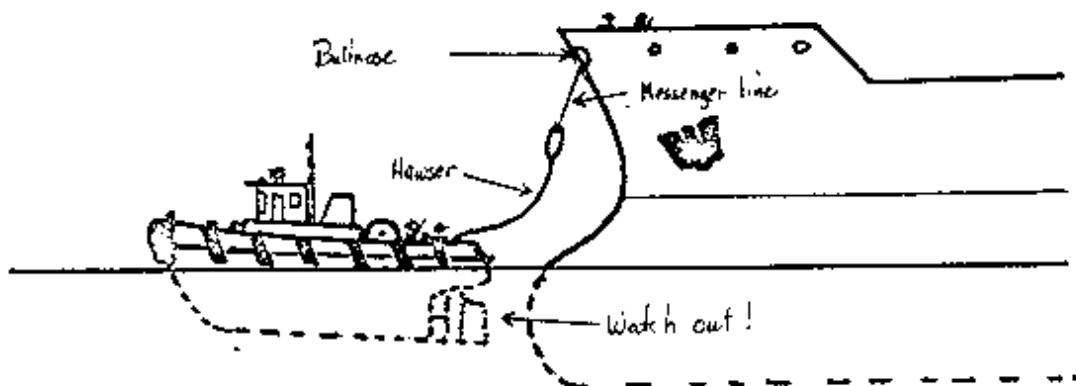
When approaching a ship with intentions of putting out a hawser, usually on the bow, note the following:

1. Vessel should be stopped
2. Flare
3. Bulbous bow
4. Bullnose
5. Ship's draft
6. Wind and current
7. Anchors and other obstructions

Have your deckhands alerted, messenger lines and hawser ready. Ease the stern of your tug under the bow, never using excessive engine power, thus creating currents which will affect your drift. Watch out for bulbous bows and protruding anchors. How is the wind and current setting? You must be able to hold your tug stationary for several minutes within "spittin" distance of the ship until your hawser is secured. Run it through the bullnose if one is available. The greatest danger is damaging the tug's screw on the bulbous bow.

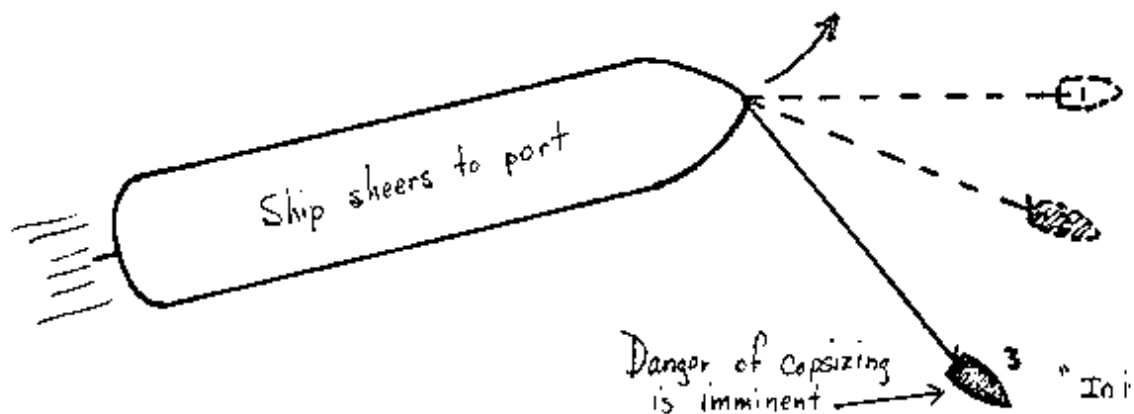
When the hawser is secured to the ship, ease off, paying out hawser as you go. When you have out enough scope, perhaps

150 to 300 feet, brake the winch, watching carefully that the tug isn't moving fast enough to surge on the hawser and possibly part it.



The rest is pure experience. Keep a sharp eye on the ship, she may sheer on you. Always reserve some power, never get in a hurry, be thinking ahead.

Now the danger becomes the chance of being overrun by the ship. Since the ship has engines in operation, the Pilot must be careful not to overtake the tug. If the ship should take a sheer, the tug may be caught "in irons" and be tripped.

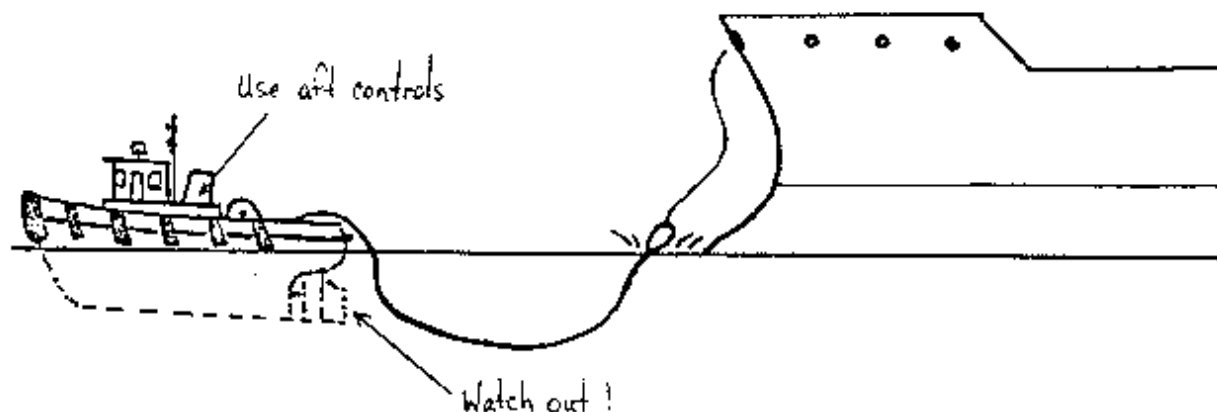


If this should happen, stop engines. The tug will drop back and should put some slack in the hawser, enabling you to then come ahead with hard left rudder and maneuver the tug ahead of the ship again. If not, release the winch brake

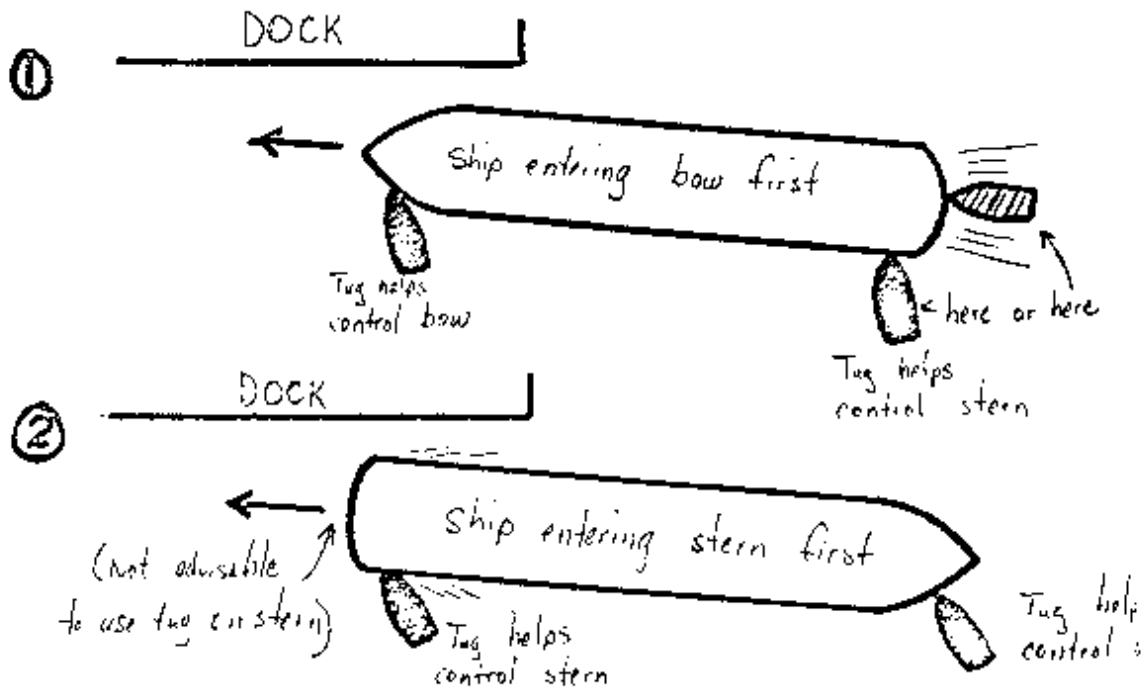
and let the hawser run off the drum, or, if necessary, cut the hawser with an axe. This is a very critical situation and you must respond instantly. It is too late to help the ship, so save the tug.

However, by watching the ship closely, and responding properly, the tug never need be caught in irons. You can break the sheer with that reserve power you've been holding, and remain in proper position as well. Experience will tell you where the "point of no return" is on the particular tug you're operating.

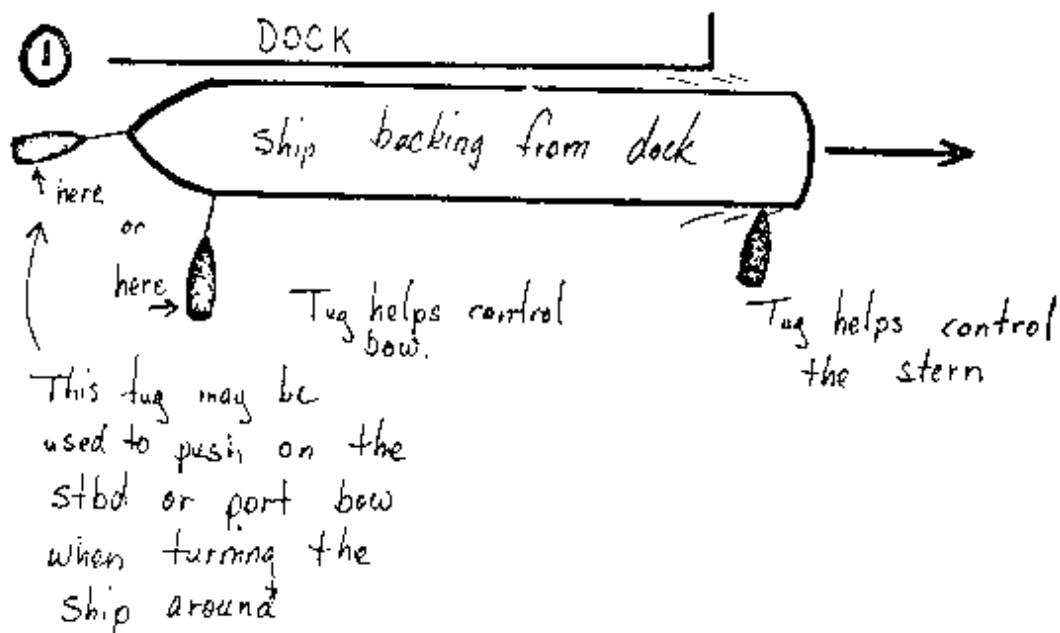
Letting go from the ship can be done whether or not the ship is in motion. Ease the tug astern while picking up the hawser at the same time, being especially careful not to foul the hawser in the screw. Blow 1 long and 2 shorts on your whistle, come slow ahead upon seeing the hawser released from the ship. Don't relax until the hawser is completely aboard the tug, including the messenger line.



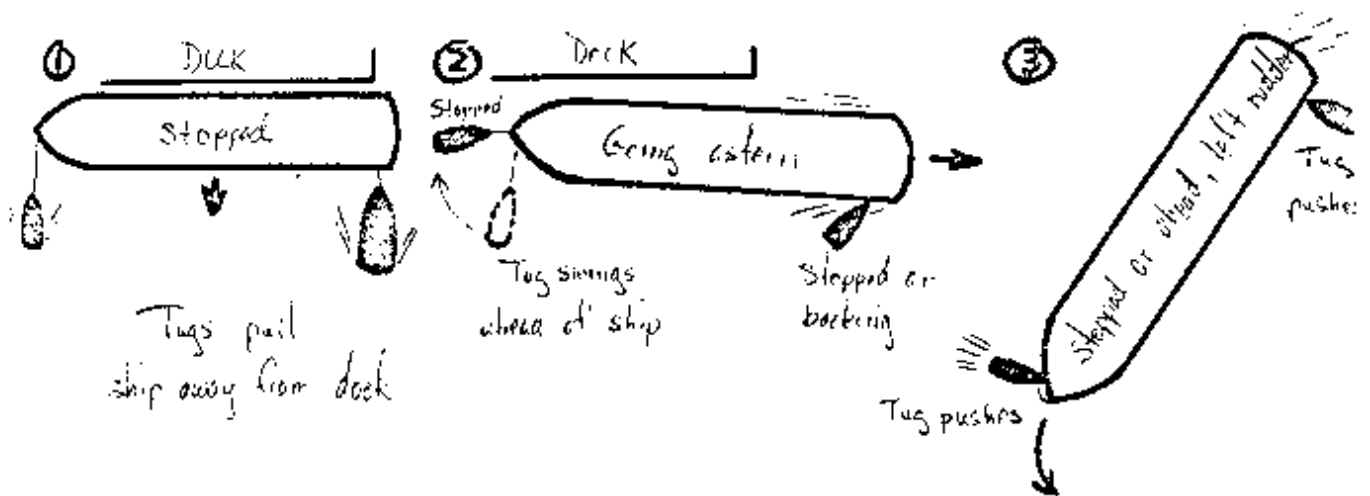
Illustrated below are common methods of tug assistance when docking a ship.



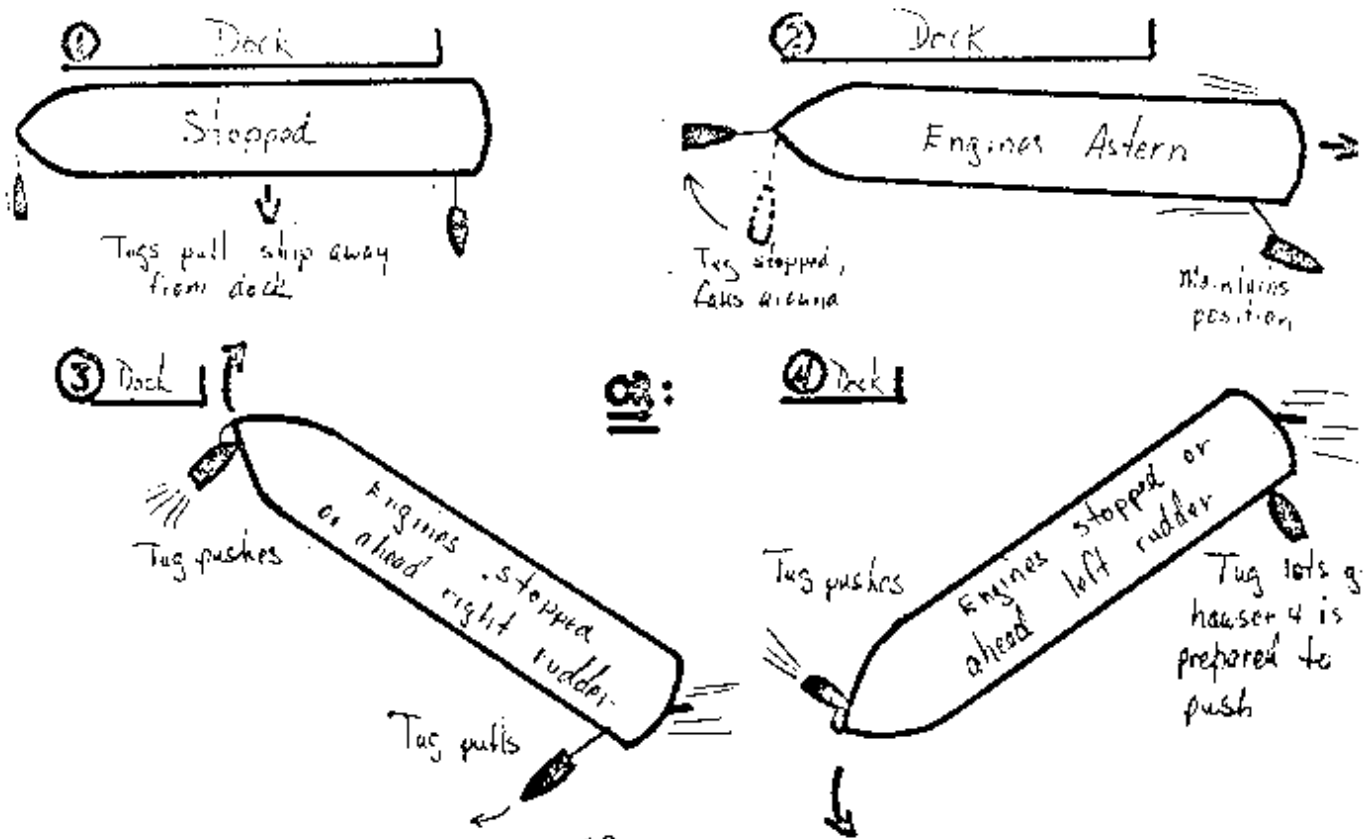
Methods of tug assistance when undocking a ship may often be more difficult, since the ship will usually be backing out, will often use more speed in doing so, and may desire to be turned around upon clearing the dock.



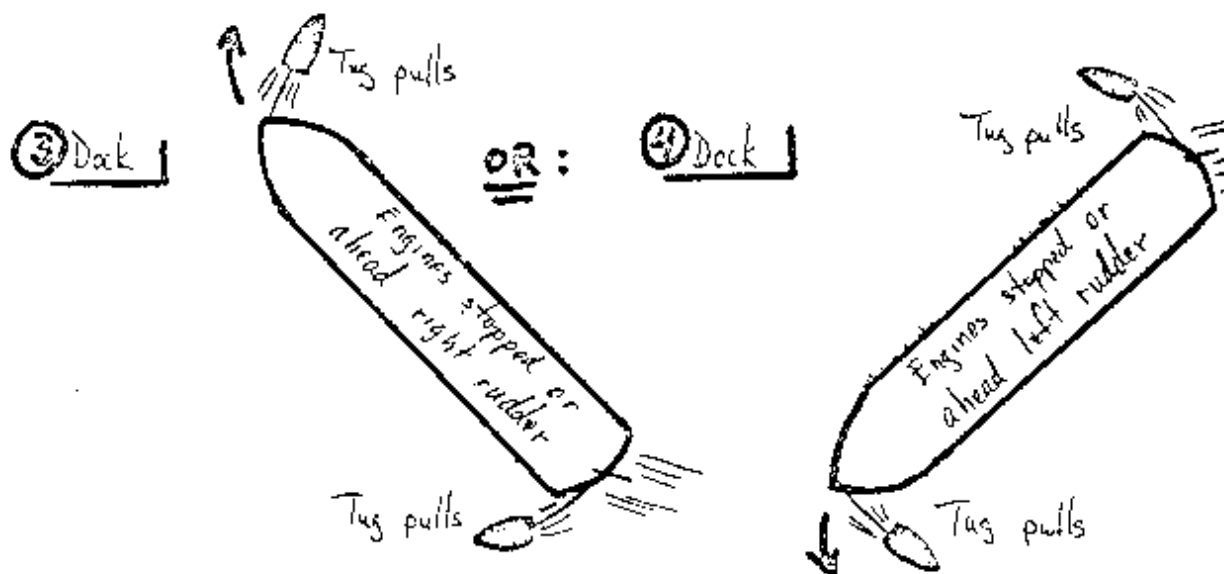
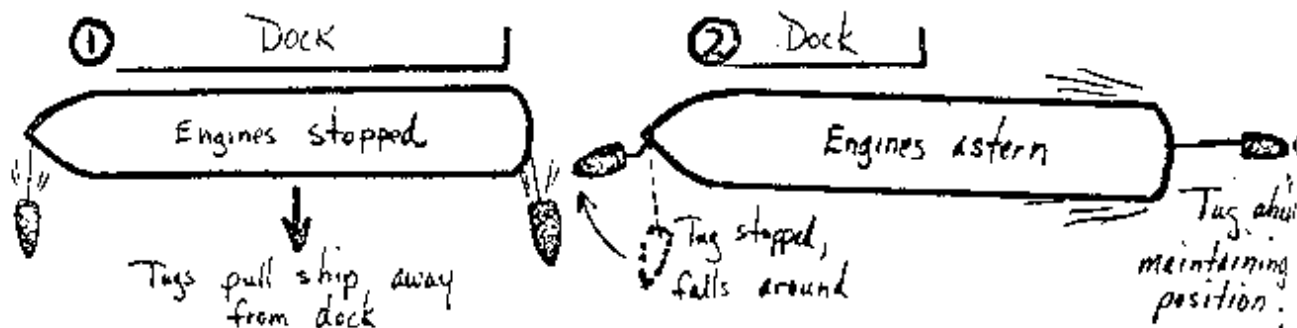
In sequence:



Sometimes when undocking a ship, the Pilot will instruct the stern tug to use his hawser. This can be a better way to assist, but may be more difficult. Ease your tug stern first under the chock you have selected, using a closed chock when possible. Take note of wind and current. Get your hawser aboard the ship and pay out the desired scope. (100' to 150' perhaps) Be prepared to follow the Pilot's instructions.

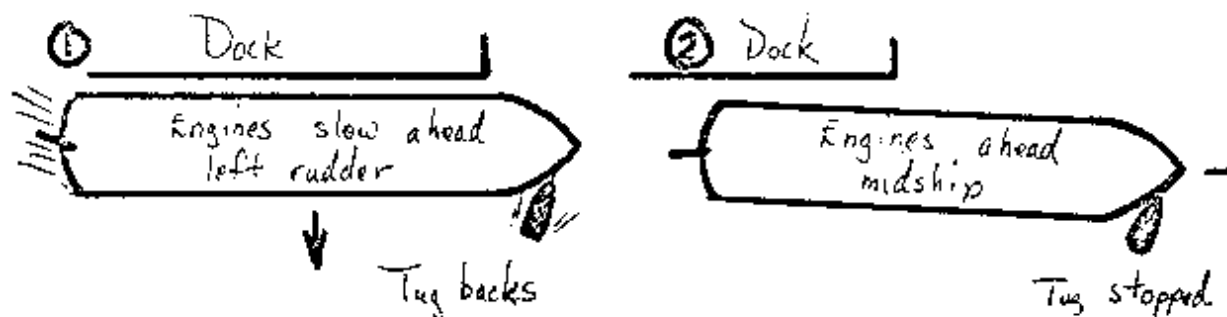


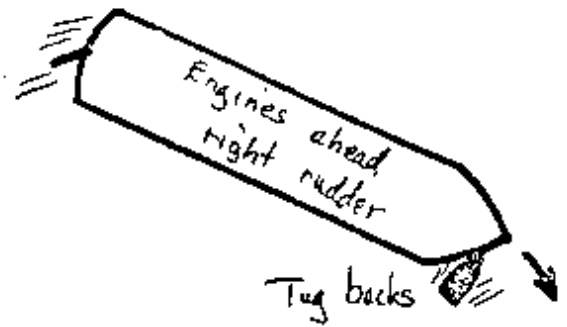
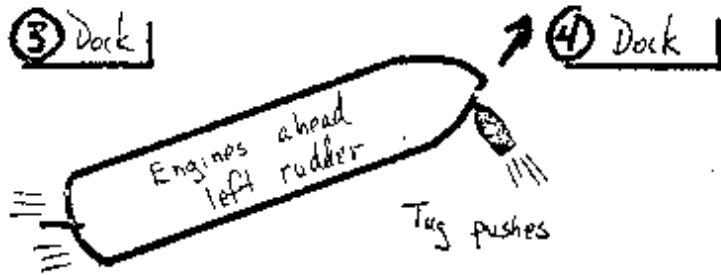
The bow tug could also be used on a hawser and the stern tug on a hawser placed on the very stern of the ship:



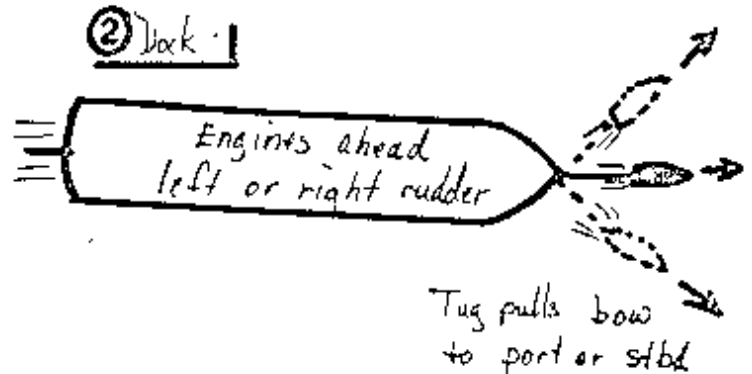
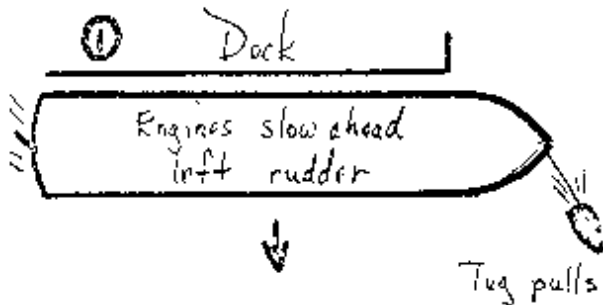
In these instances the Pilot must be careful not to endanger the tugs by using excessive speeds ahead or astern on the ship, causing the tugs to be caught "in irons".

When undocking a ship bow first, the Pilot may require only one tug on the bow.





Or he may place the tug on a hawser:



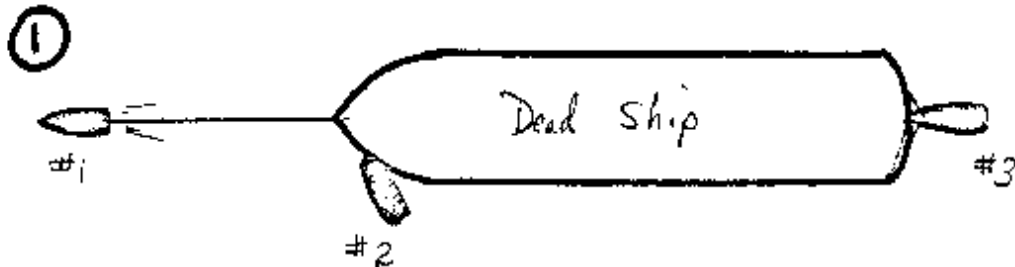
At all times pay close attention and maintain good position. Watch what the Pilot is doing and be ready to help him. Again, be careful of flares, counters, bulbous bows, anchors and rudders. Look things over before putting lines on the ship, and know what the Pilot is intending to do. Communicate with the Pilot and advise him if you get into trouble. Be flexible and don't hesitate to change plans even though it may cause some embarrassment. The most important single piece of advice I ever received from a very experienced tug captain is contained in two simple words: **PAY ATTENTION!** If you follow that advice to the letter, you will never get into trouble.

CHAPTER III - Dead ships and barges.

In the previous chapter we spoke of working around ships that had power. All you do is assist.

When a ship is dead, the role changes. You become the power and you become the rudder. That ship is in your hands. Obviously, this requires more concentration and more expertise.

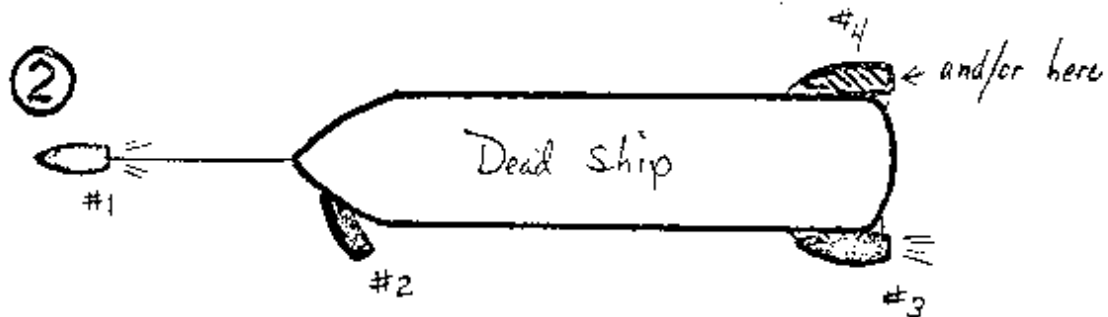
Illustrated are some common methods of towing a dead ship with several tugs:



Tug #1 is the lead tug. He is the only one applying power to tow the ship. He steers the ship and does most of the work.

Tug #2 helps control the bow, should the ship take a sheer.

Tug #3 acts as a rudder to steer the ship and is used to slow or stop it.



Tug #1 - same.

Tug #2 - same.

Tug #3 acts as a rudder and may also apply power to help push the ship as well as slow or stop it.

Tug #4 may be used with #3 for better control.

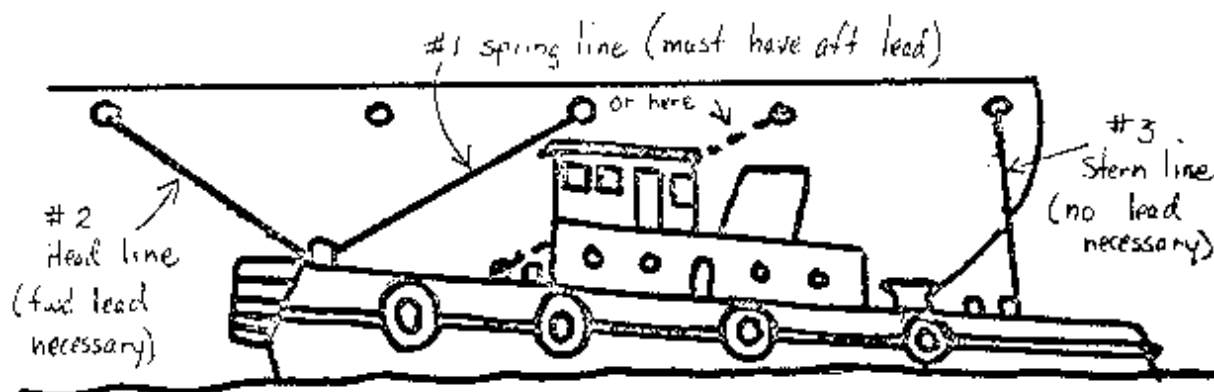
A Pilot will be in overall charge of the tow, and will select and utilize the tugs as he sees fit. But this does not prevent a wise tug captain from making useful recommendations, nor does it make his job easier.

Lashing up to dead ships.

A good, tight lashup on a dead ship is essential. You cannot steer properly with slack lines nor be very helpful in a poor position. Usually the Pilot will instruct the tug to lash up on the port or starboard quarter so it can be used to steer.

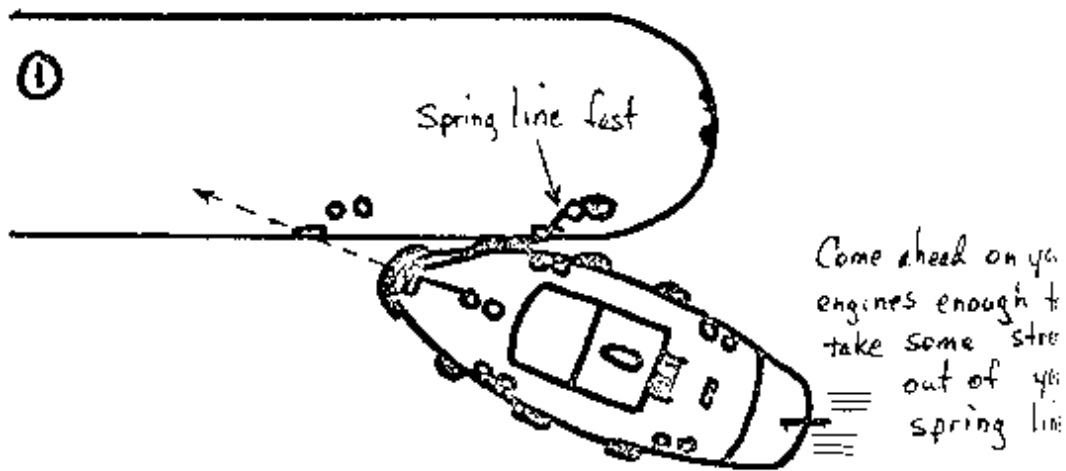
Approach the ship as in any normal quarter lashup (chapter 2), only give extra attention to the availability of chocks and bitts. Ease the tug against the ship and run up three lines in this order:

1. Spring line, to proper length, make fast.
2. Head line.
3. Stern line.



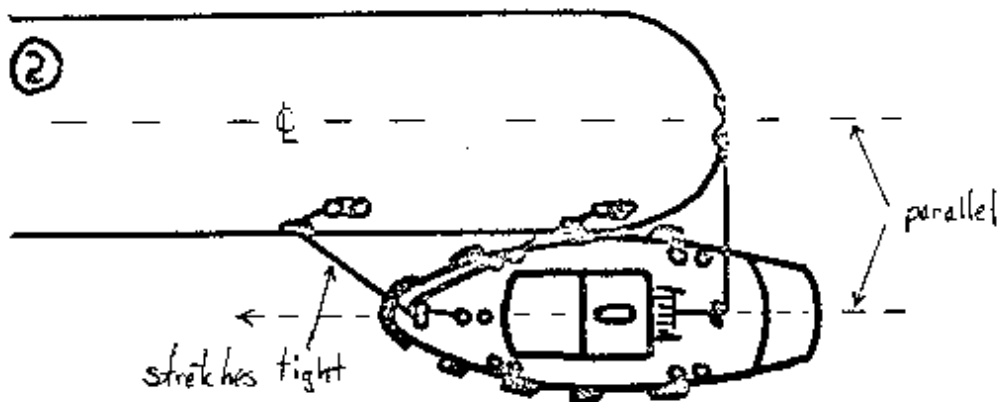
Put the spring line up first so you will then have something to work against to hold the tug next to the ship. This line must have an after lead, since it is the line which takes all the stress when the tug is pushing. Make it fast to your head bitt or side bitt. Double it up if you wish.

Next, swing the tug and point the bow directly at the chock through which you wish to pass your head line, then do so:



In this position, once the head line is secured aboard the ship, pull it in tight, tight with your capstan, put on a stopper, remove it from the capstan, and make it fast to a solid bitt, remove the stopper. (Again, double it up if you wish.) This line needs a forward lead for backing.

Now, swing the stern of the tug toward the ship and run up a stern line, using a wire if you have a towing winch aboard.



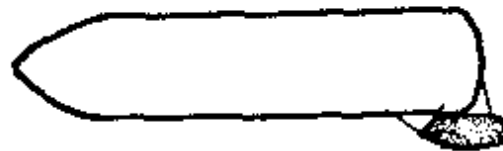
Heave your stern line in tight and secure it. If done properly, this will leave you tight against the ship with the tug's keel parallel to the ship's keel. You are now able to push,

back and steer left or right. This is an easy method and can be done in less than half an hour.

Naturally, there are variations to this, but the purpose remains the same: to make up tight against the ship as far aft as possible.



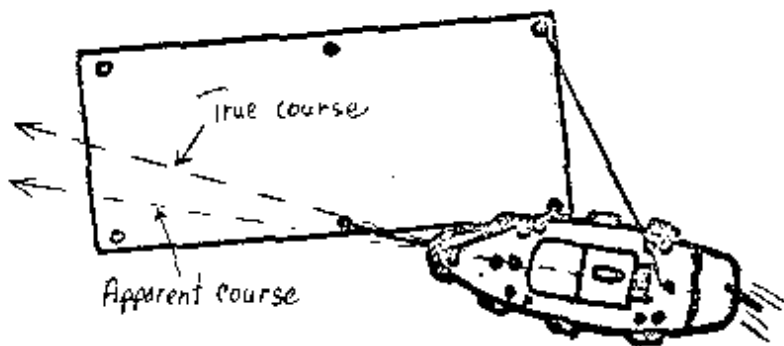
Good



Better

Lashing up to barges.

The principle is the same for barges as for ships, except that you will want to angle the tug slightly toward the barge when you are the only tug on the job. This will enable you to steer the barge better by overcoming the pronounced "crabbing" effect caused by having the tug so far off the center line of the barge.

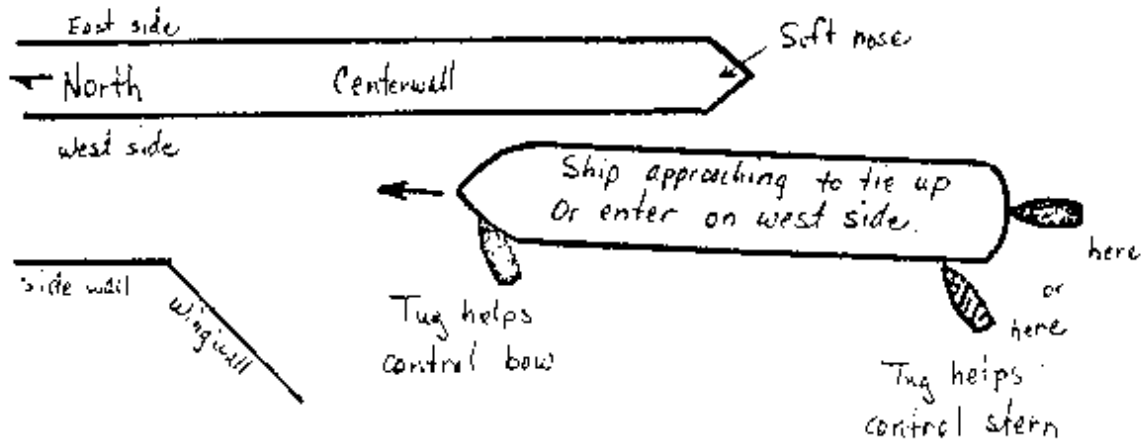


Some left rudder
necessary to steer
a straight course

Principles of barge handling will be discussed in greater detail in chapter VII.

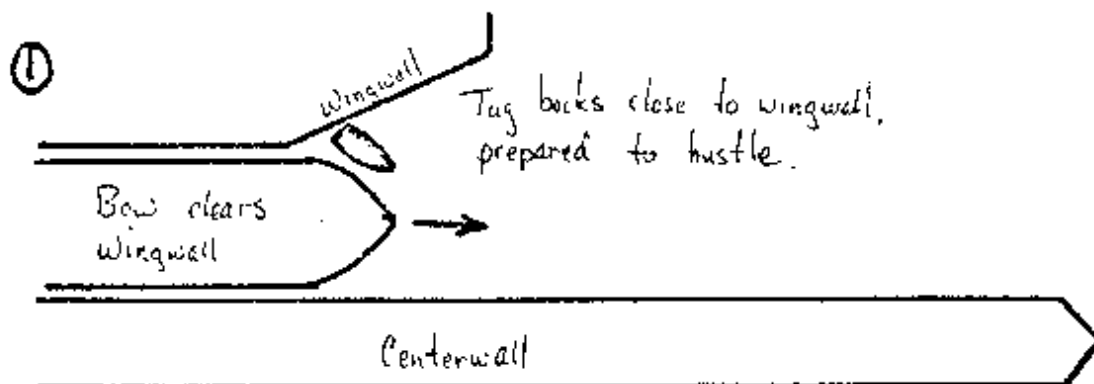
CHAPTER IV - Procedures in and around the Locks.

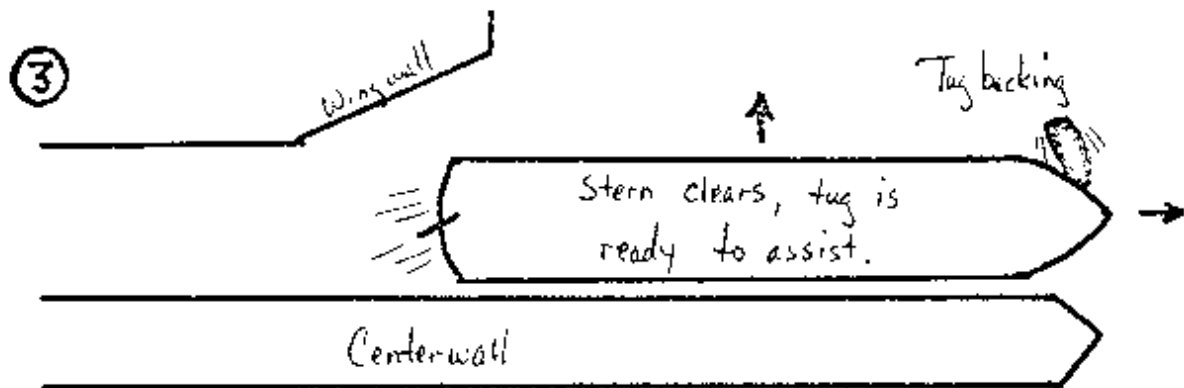
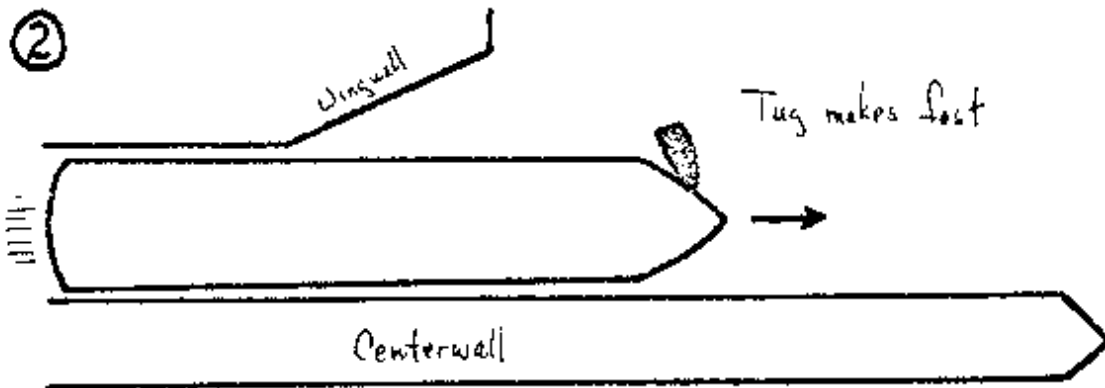
Assisting ships tying up to, into, or out of the locks is very similar to the docking procedures. There may be more than one tug assisting the larger ships. The ship will be locking up or down on the east or west side.



The Pilot will generally hold the tug until he gets tied up or has the centerwall locomotive wires aboard the ship. The bow tug must be prepared to let go hastily, since it is in danger of being crushed between the ship and the wing wall.

Often, a Pilot may require tug assistance getting away from the centerwall when leaving a lock. The tug must position himself to place lines on the bow of the ship as soon as it clears the wingwall.





If the tug captain doesn't have his lines secured to the ship by the time it's bow clears the soft nose, he will be useless to the Pilot. The main object in this case is to get in there quick and be useful.

The Locks radio frequencies are channels 3 and 5 for the east side and 4 and 6 for the west. The Lockmaster is present on the appropriate radio channel to give information. The Pilot will also be on one of those channels giving orders to the locomotives.

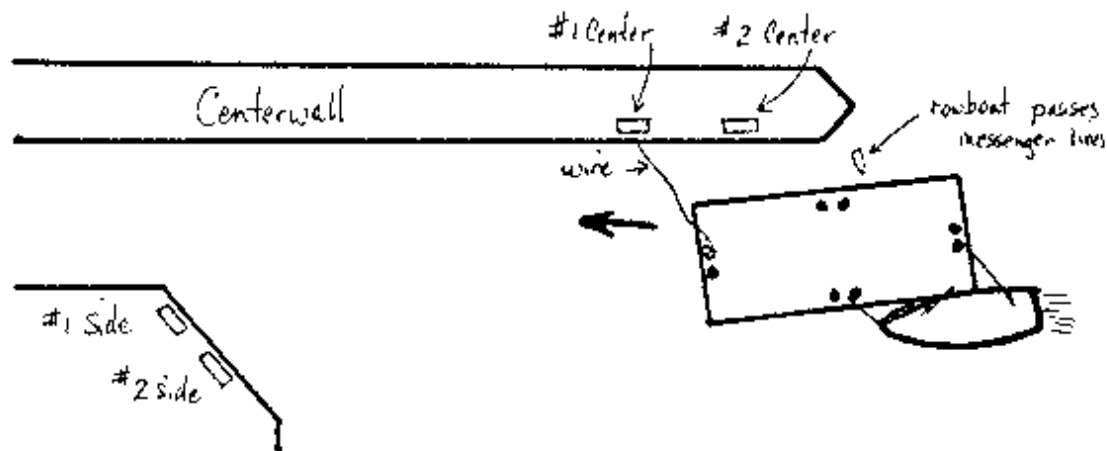
When locking your tug in tandem with a ship, tie up behind the ship during up lockages and ahead of the ship during down lockages.

Using locomotives.

Occasionally the tug captain will be called upon to take various tows through the locks using locomotives. He has the

option to use Canal deckhands to handle the wires if he desires. Marine Traffic Control will give the lockage time and place. The tug captain must time himself prudently to prevent a delay in traffic.

Upon reaching the desired locks and receiving the green arrow to enter, the tug shall call the lockmaster by radio to confirm lockages, get a radio check, and instruct the locomotive operators where their wires shall be placed. He then eases the tug and tow close to the centerwall and picks up the #1 and #2 centerwall loco wires, maneuvering carefully all the while. (Generally, tugs and tows shall get 4 loco, 4 wire lockages.)



The tug captain has total control of tug and tow, all four locomotives, and deckhands. Upon reaching the wingwall he picks up the #1 and #2 sidewall locos.

By radio, instructions will be given like this:

"Number one center, slack wire."

"Number two side, coil in."

"Number two side, stop coiling."

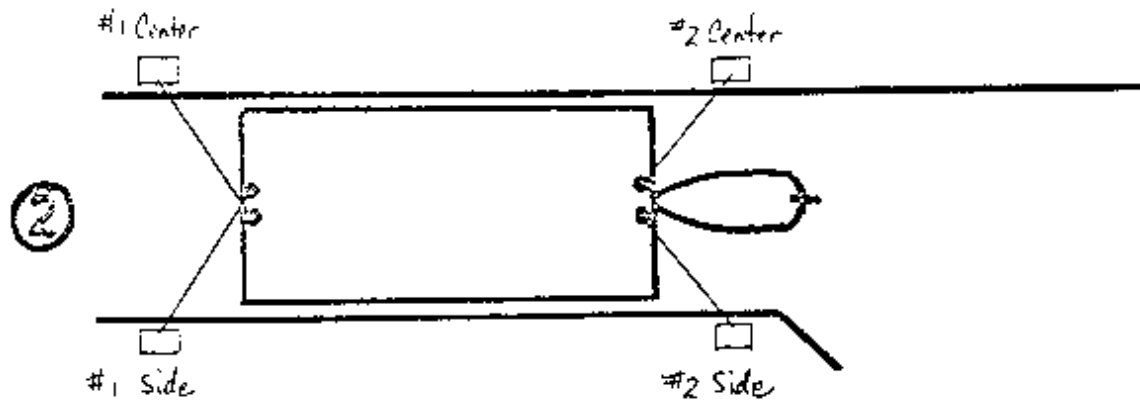
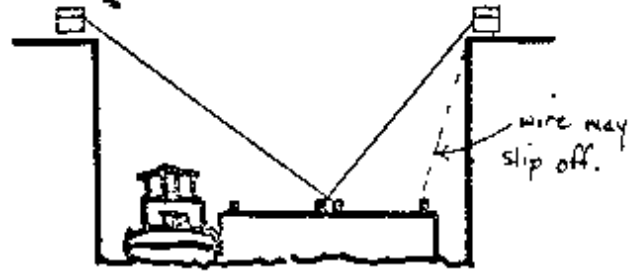
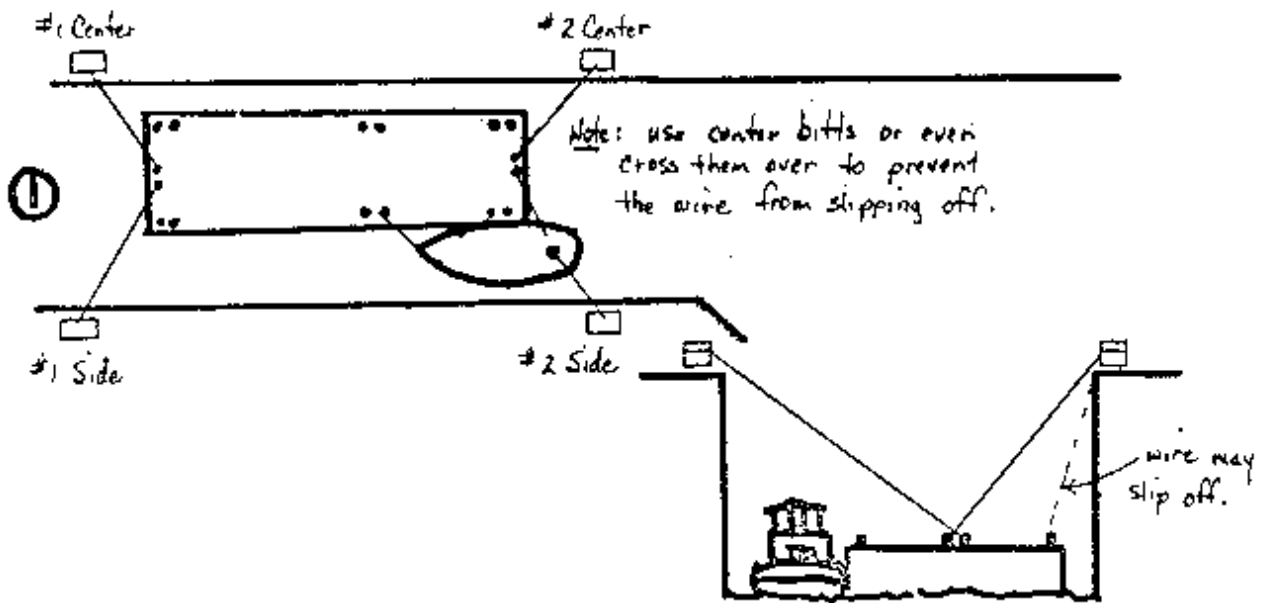
"Number ones, tow together."

"Number ones, stop towing."

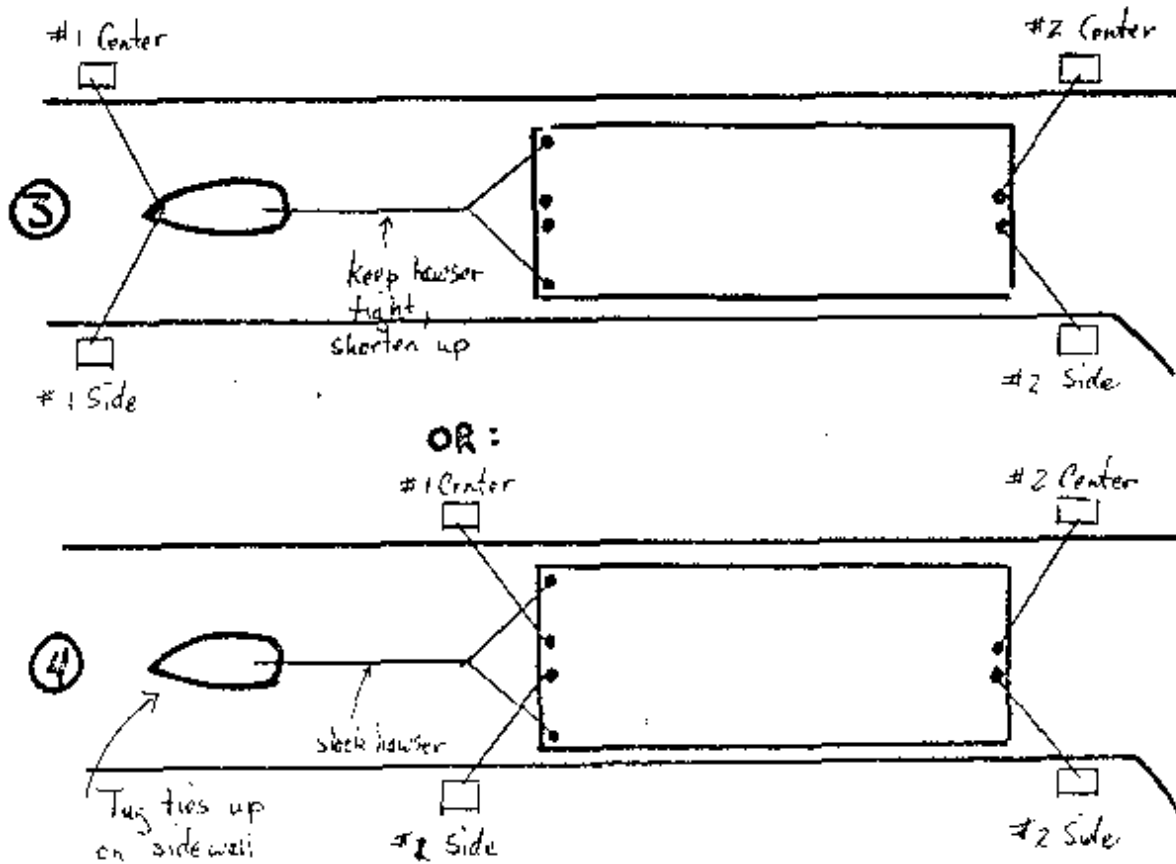
"Number twos, brake," etc.

The locos are there to help you, so use them!

Typical wire arrangements when using locomotives:



When towing on a hawser and using locomotives:



It is best to pick up the locos on the move, but be careful not to overrun them. It is permissible to rub the lock walls if you can't prevent it, but DO NOT TOUCH the lock gates!

Lockage procedures, including lights and hand signals, are discussed in greater detail in the Pilot's Handbook.

CHAPTER V - Gaillard Cut.

Since the Cut is narrow (500') and is solid rock on both sides, it is a good idea to have a tug available to act as an emergency brake or rudder, should the ship fail to respond to its engine or rudder orders. Assisting large ships through Gaillard Cut is a relatively simple task. The tug is placed on the ship's stern using two lines.



"Cut Style" Pushup

In this position it can push to starboard or port, or go full speed astern. In the past, this has proven successful.

If the tug cannot make fast to the stern due to the presence of rudders or screws, the tug may be instructed to merely stand by. The old system of placing the tug ahead on a hawser has been discontinued.

Tugs rendezvous with southbound traffic in Gamboa Reach and northbound traffic at Pedro Miguel Locks.

It often becomes quite foggy in the Cut, especially during October and November, and tugs are called out to assist fog bound ships or to make fog reports. Since few tugs are equipped with radar, this often becomes interesting! For a guideline on reporting fog density, use this:

1. Light fog - You can see all the way down the reach, but high fog extinguishes the range lights, slightly.
2. Moderate fog - Visibility is limited to half the reach or less. No range lights visible.

3. Heavy fog - No lights are visible at all.
Traffic should be stopped for the last two conditions.

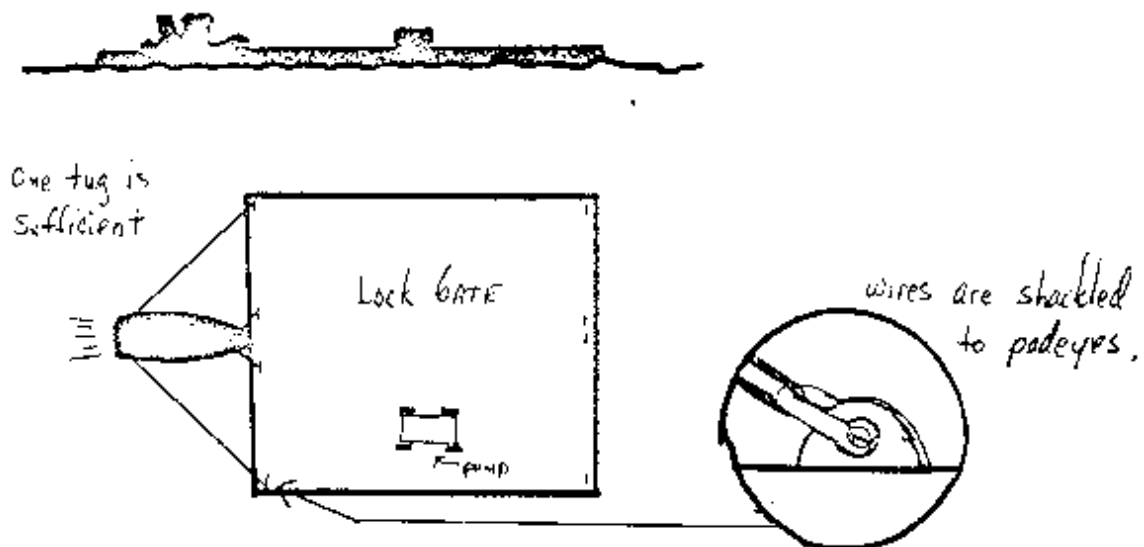
It is very important that the tug captain make accurate reports on fog conditions and be able to forecast whether they will get better or worse. Remember, hundreds of thousands of tons of shipping may be delayed solely on the report of one tug captain!

CHAPTER VI - Unusual tows.

There are a few jobs on the Cabal which are routine, yet infrequent, and require some attention.

1. Lock gates.

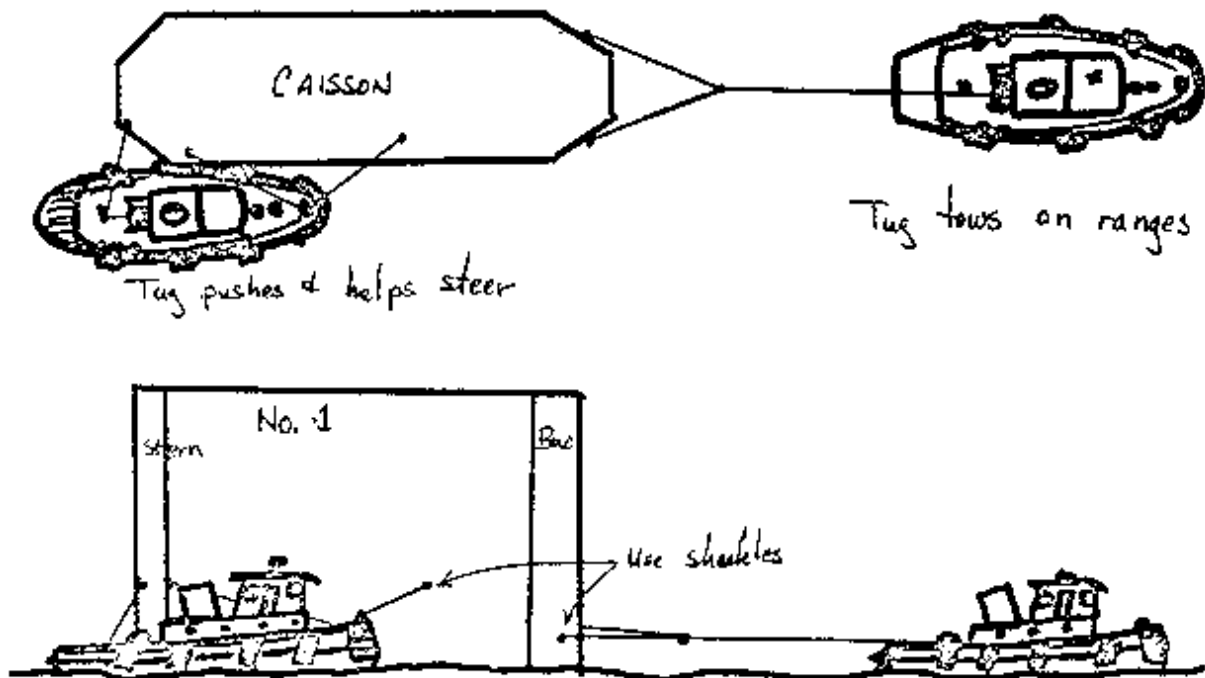
These are bulky objects which must be towed to Industrial Division occasionally for overhaul. They are not extremely heavy, but lie flat on the water, have no bitts to secure to, and push rather slowly. The accepted method used is to push them ahead, using a tight lashup for better steering.



Since there are no bitts, you must use shackles. When locking, the locomotive wires must also be shackled to padeyes. Since the gates are hollow, a self-contained pump will be placed on the gate should it start sinking.

2. Caissons.

These are awkward tows which generally require two tugs for better control, one on a hawser, the other on the hip. Again, bitts and cleats are lacking, so shackles must be used.



The caissons are labeled "bow" and "stern" and should be towed that way. Getting locomotive wires aboard can be a little difficult. There will generally be a Pilot in charge of this operation.

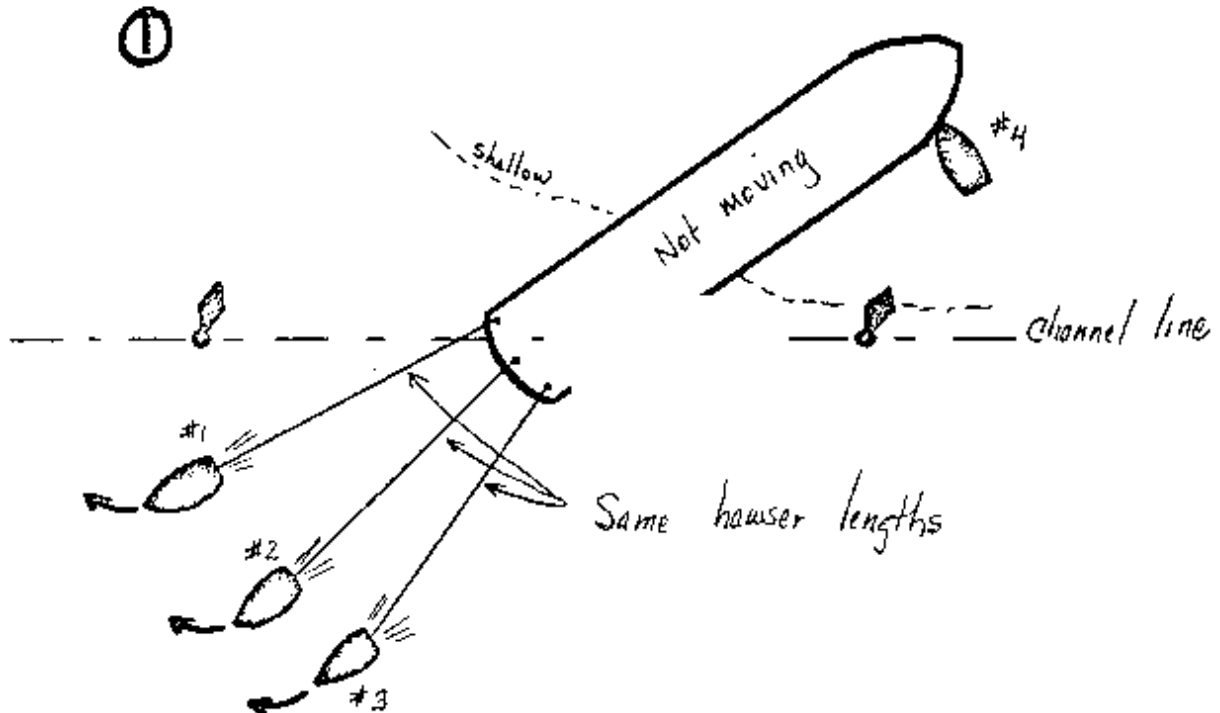
3. Ships aground.

Not too infrequently tugs will be called to render assistance to ships that have gone aground. Sometimes this will require as many as six or seven tugs. An Assistant Port Captain will take charge of the operation and instruct the tug captains where he wishes to position them, depending on the location and situation of the ship.

When called in to assist a grounded ship, note the following:

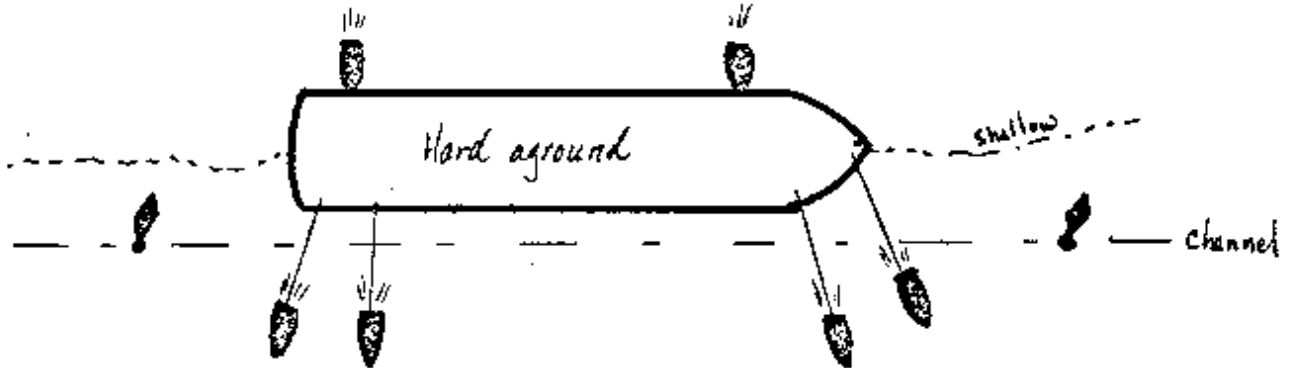
1. Ship's position in relation to the channel.
 2. Ship's draft, water depth.
 3. Wind and current.
- Availability of chocks and bits.

The APC may position the tugs as follows:

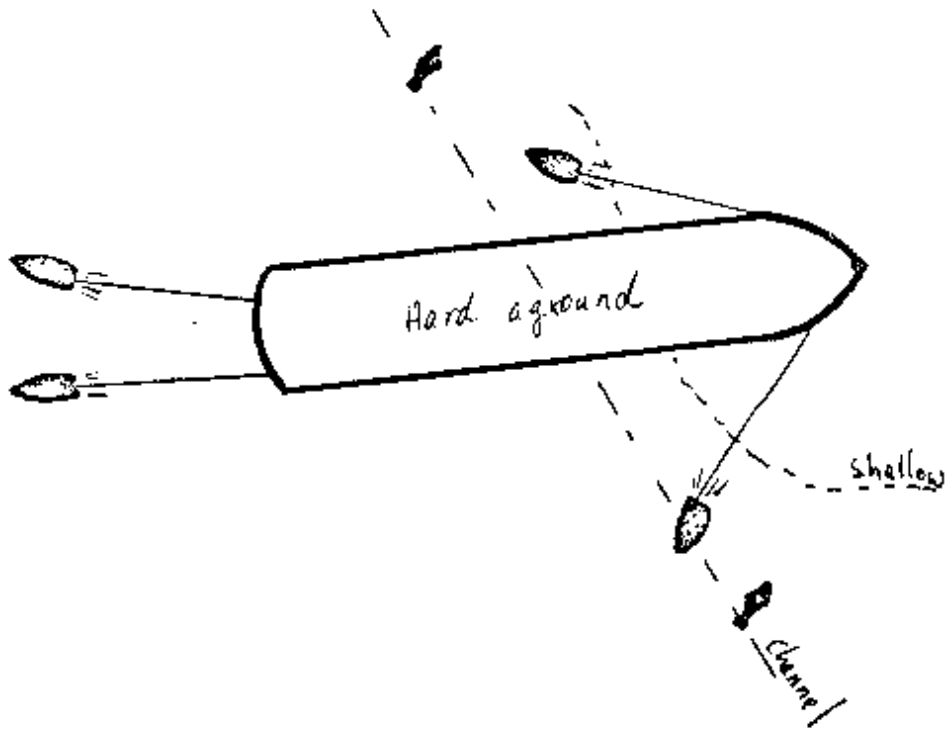


Tugs #1, #2, and #3 will try to pull the ship off, while the Pilot simultaneously uses the ship's engines. These tugs should use the same length of hawser (200' to 300' perhaps) so that, should they swing toward each other, they will not cross wires but will bump tug-to-tug instead. They will swing together left and right, attempting to "wiggle" the ship and break suction with the bottom. At all times pay close attention to the ship, knowing immediately when it starts to break free. Tug #4 will push and pull to break the bow loose and to help control the bow when the ship breaks free.

The Pilot may place his tugs like this:



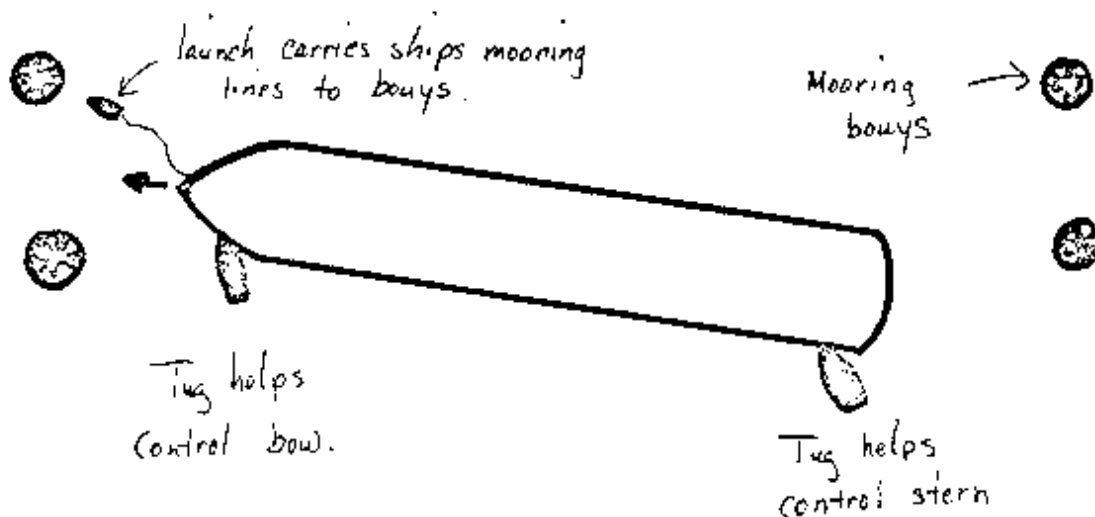
Or like this:



In any case, the tug captain must be extremely careful and positively alert, making constructive suggestions to the Pilot when necessary. It is very easy to get the tug "in irons" with the ship as well as foul the hawser of another tug.

4. Assisting ships to a mooring.

The Pilot may request tug assistance to moor his ship. He will place the tug or tugs at his disgression, usually on the bow or stern. Lash up as usual and be ready to assist the Pilot whenever possible. Pay close attention not to foul the mooring lines in your screw. Be prepared for the ship to come astern.



CHAPTER VII - Dredging Operations.

Supporting Dredging operations includes the towing of dredges, booms, pipelines, water and fuel barges, drill-barges, various flat barges, and floating cranes. It involves many diversified methods of towing on the hip, hawser towing, and pushing. Handling large equipment in confined areas can be interesting, and every well trained tug captain must be able to take it in stride.

First, a few basic rules about moving dredging equipment:

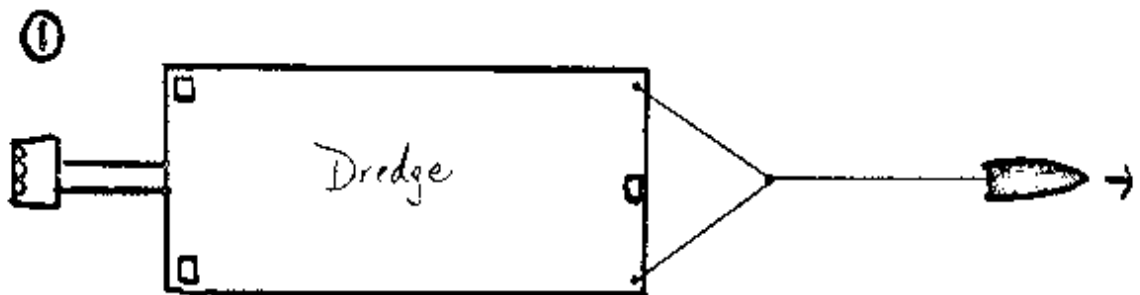
1. Approach the equipment cautiously, looking for cleats and bitts.
2. Communicate with the personnel aboard, if any.
3. Get a good, tight lashup before getting underway.
4. Clear with Marine Traffic Control when preparing to move equipment in and about the Canal.
5. Be aware of all traffic.
6. Stay in control - it is the tug captain's responsibility to see that the equipment is moved efficiently and safely.

1. Dipper dredges.

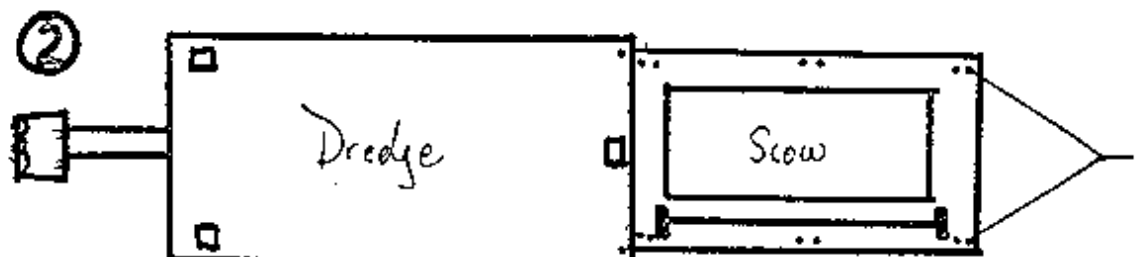
The two dipper dredges the "CASCADAS" and the "RIALTO" M. CRISTENSEN" are flat bottomed barges about 175' X 60' with large superstructures.

Tug support includes towing them on location, supplying them with light scows and taking away loaded ones, and delivering fuel and water barges.

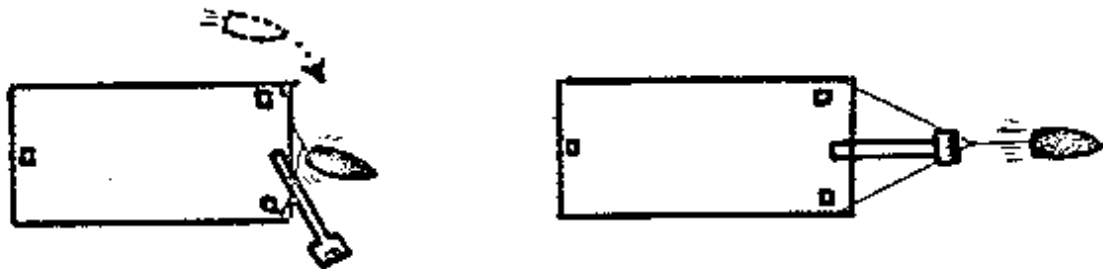
Generally, the dredges will be towed on a short hawser, either from the bow or the stern. (The bow is the end which does the digging.) Ease the tug's stern close to the stern (or bow) of the dredge, pass a wire bridle to the outer bits, pay out the desired amount of hawser, notify the dredge operator to lift his spuds, and start towing.



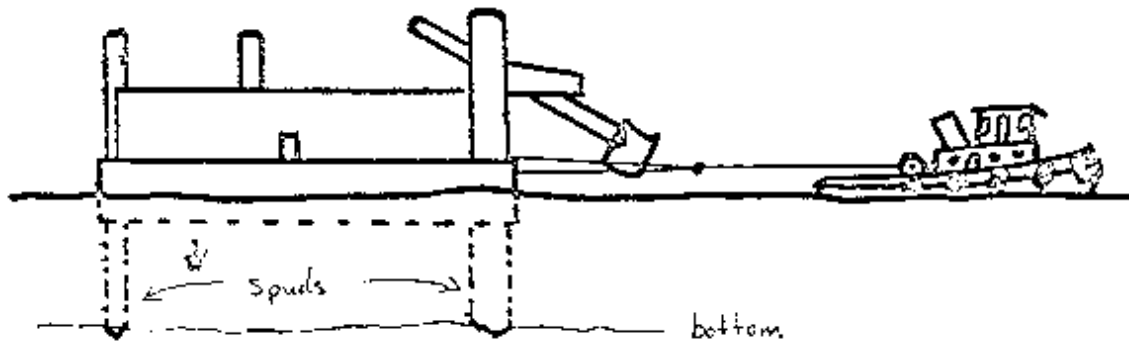
OR, sometimes there may be a scow on the stern:



OR, you may be asked to tow from the bow. If so, have the operator swing the buckets out of the way while you get your hawser secured:



The dredge will tow slower bow first, and you must watch out for the bucket. If you get in trouble, the dredge can drop its spuds any time to stop itself.

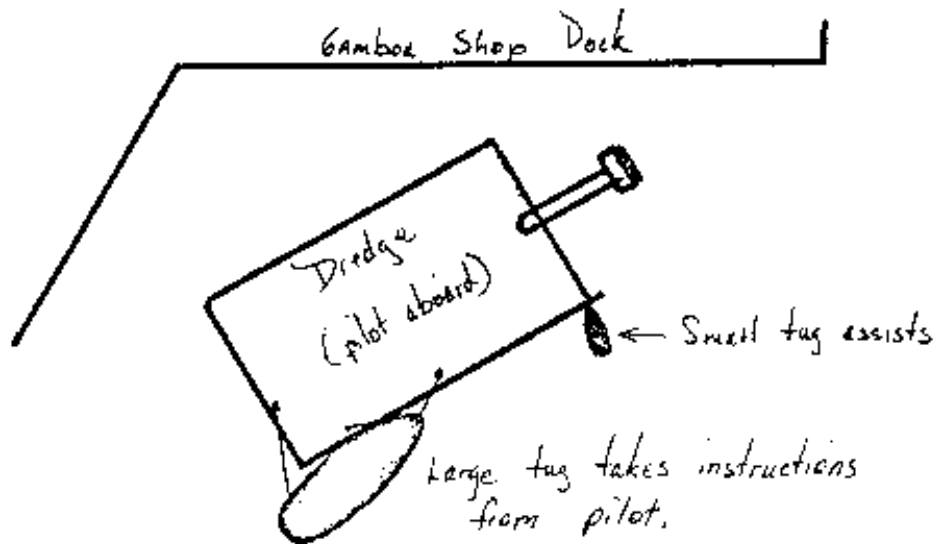


The dredge operator will tell you where he wants to go. For instance, he may say, "Take me to station 1765, west side, 150 feet west of the center line." Your job is to get him as close to this position as possible before letting go.

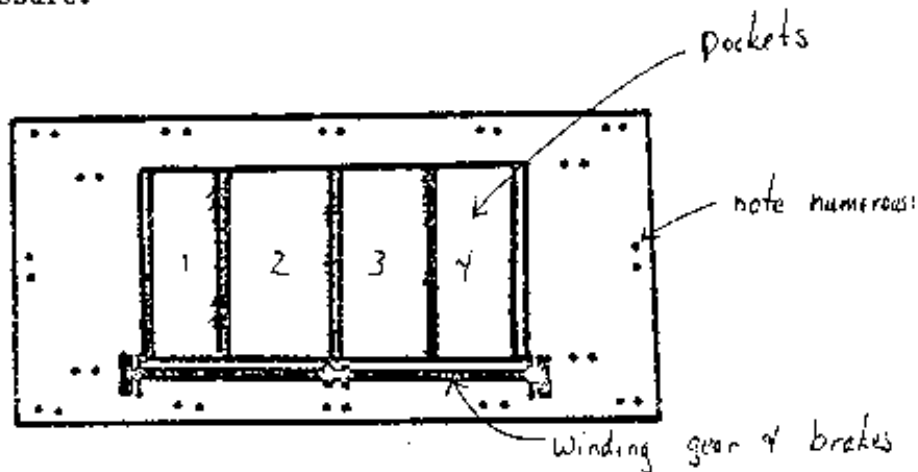
Always check with MTC to get clearance, and watch out for traffic.

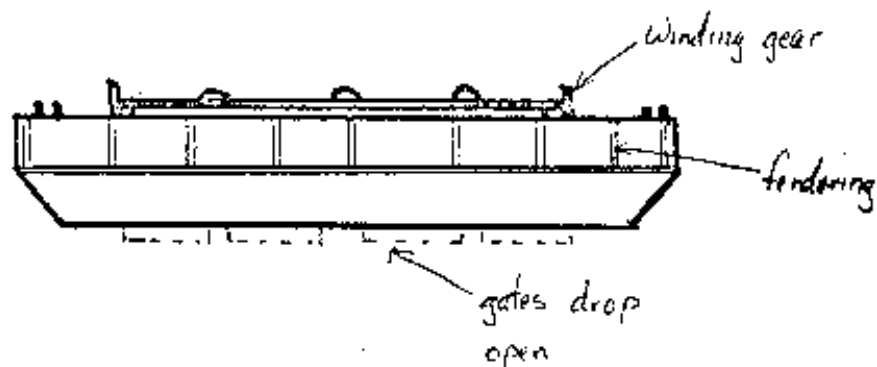
When putting dredges to the dock, simply make up on the hip, as with any barge. There will generally be a small tug

to assist and another tug captain available as pilot, since visibility is sharply restricted from the wheelhouse.



Handling dump scows is fun. They are barges 150' X 50', displacing 600 tons when light and up to 4000 tons loaded, which are used to remove the earth dredged from the channel and deposit it in certain designated dump areas. They have gates which open, upon releasing a brake system, which discharges the material through the bottom. The tug takes empty scows to the dredges, takes away loaded ones, and makes trips to the dump with as many as five at a time. The scows are marshalled at the Gamboa barge service station where they are maintained and the gates rewound with air pressure.



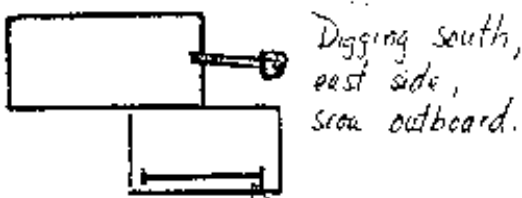


When instructed to take a scow to the dredge, remember this:

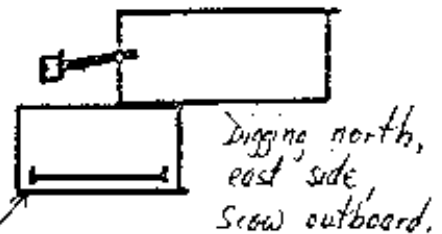
1. The winding gear must be placed outboard of the dredge.
2. How is the dredge digging (north or south, east side or west side) and does he want the scow on his inboard side or outboard side?

Examples:

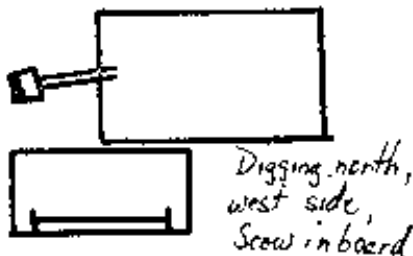
① East bank



② East bank

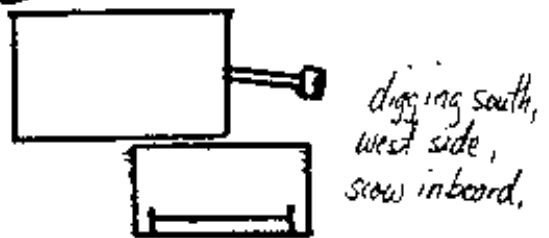


③



West bank

④

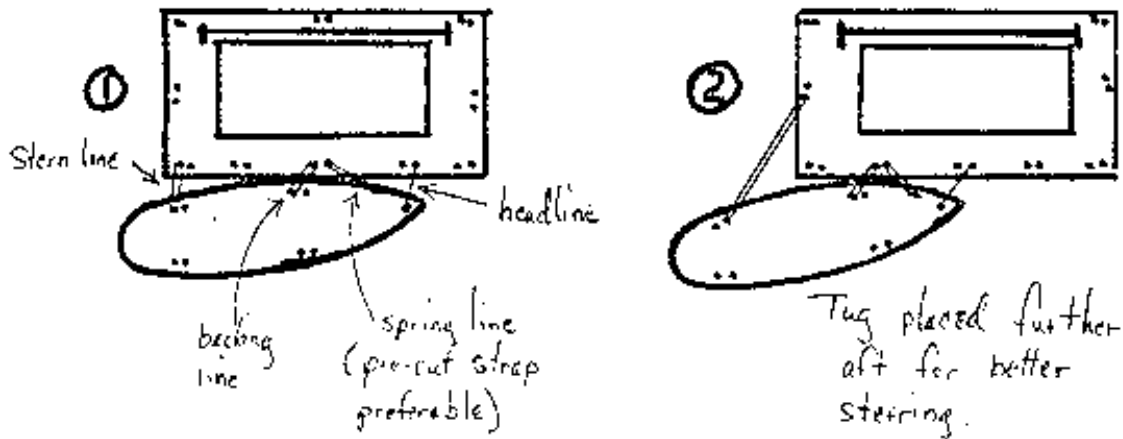


West bank



There are many different methods of handling scows, but the technique remains basically the same.

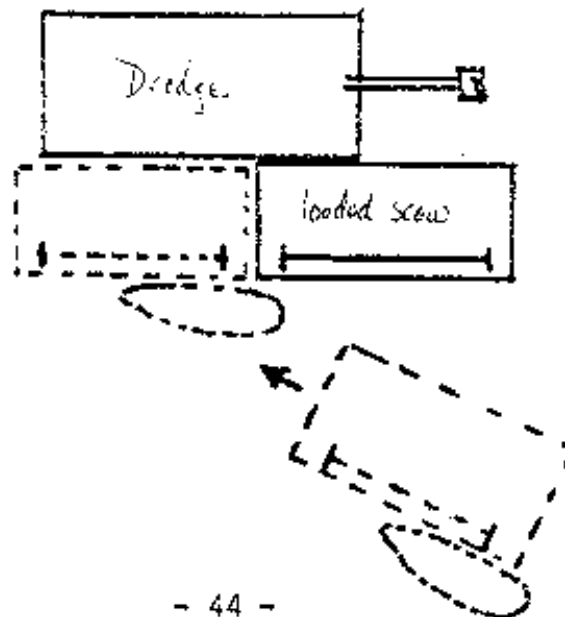
Basic lashups to a scow:



Method #2 will result in better handling, but may take longer to lash up. When you are under pressure from heavy traffic, a few minutes may seem like eternity. For this reason, method #1 is preferable. Also, a ready-made strap cut to proper length is recommended.

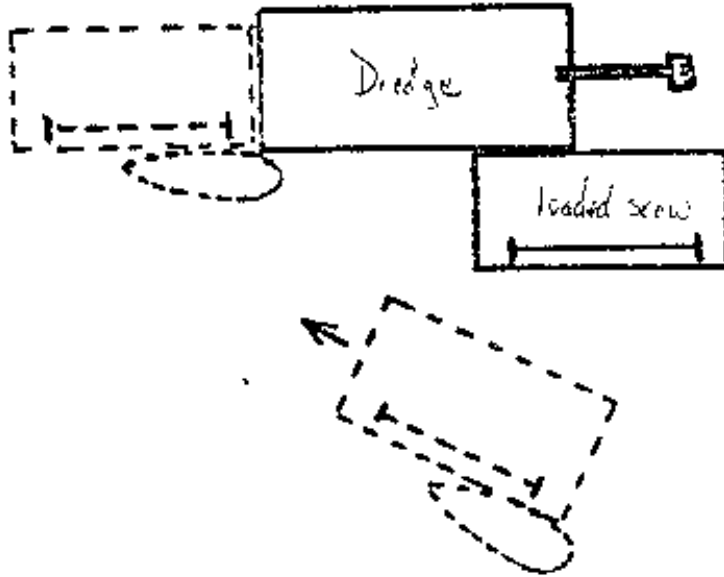
The dredge operator will request the scow to be placed on his stern or quarter, winding gear to the east or west:

① Southwily Approach West bank N →



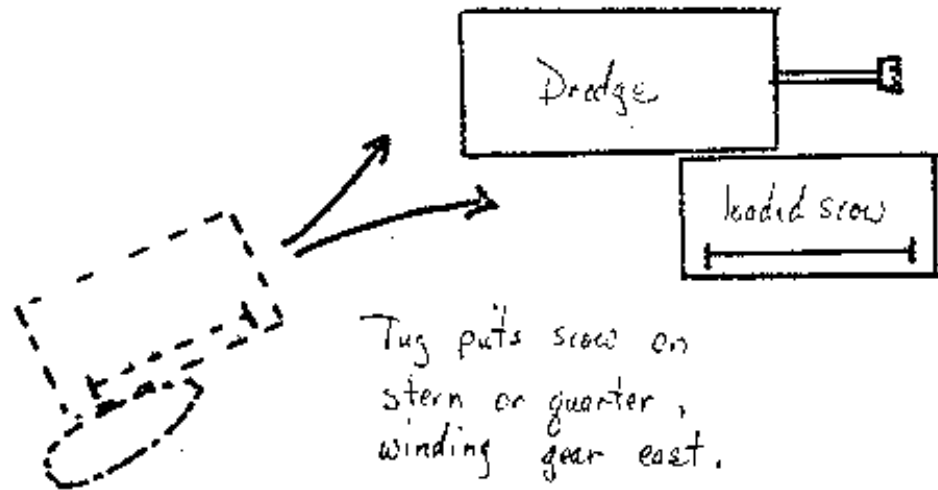
Tug puts scow on quarter, winding gear east.

② Southerly Approach west bank N →



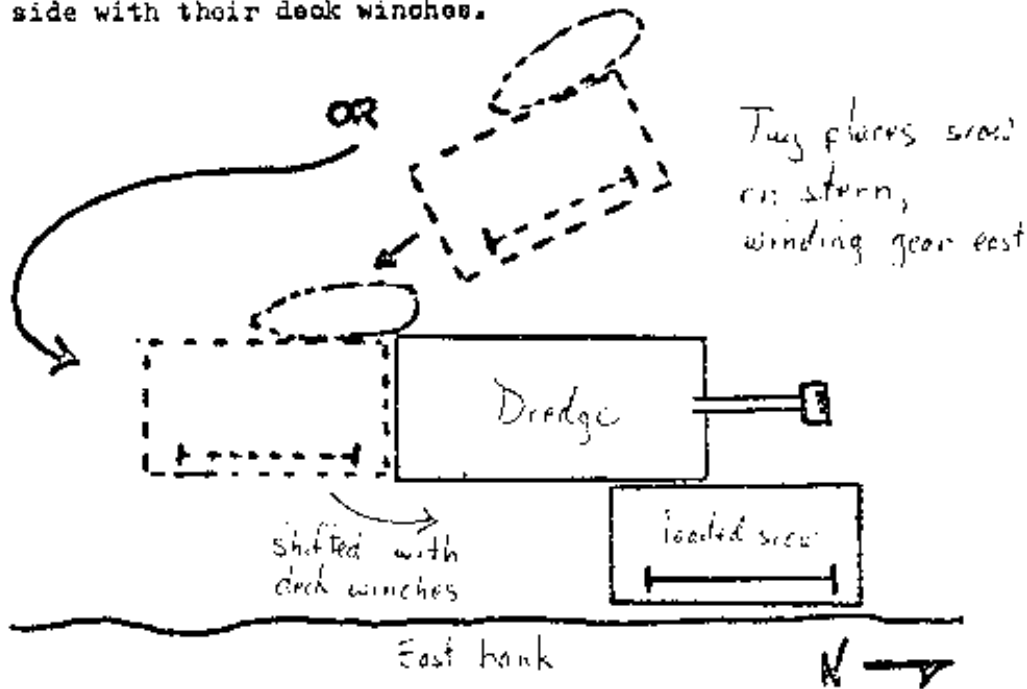
Tug puts scow on stern, winding gear east.

③ Northerly Approach west bank N →



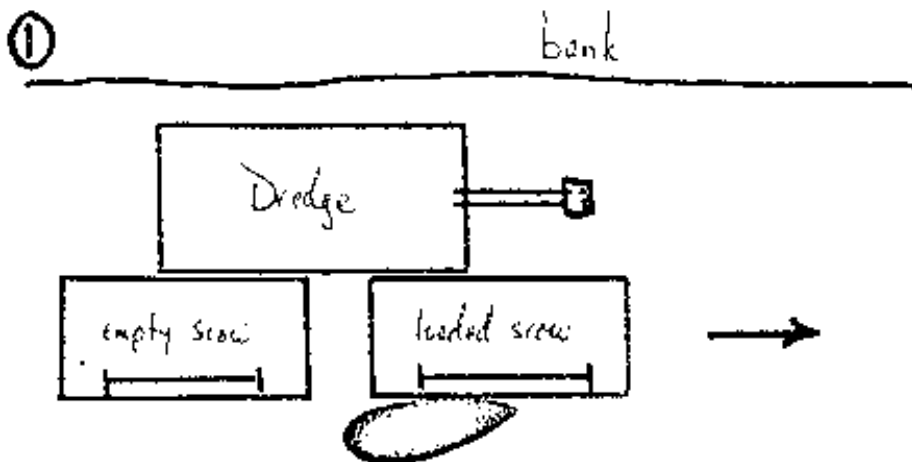
Tug puts scow on stern or quarter, winding gear east.

Generally, whenever the dredge is digging with the scows next to the bank, the tug will place the light scows on the stern. The dredge personnel will then shift the scow alongside with their deck winches.



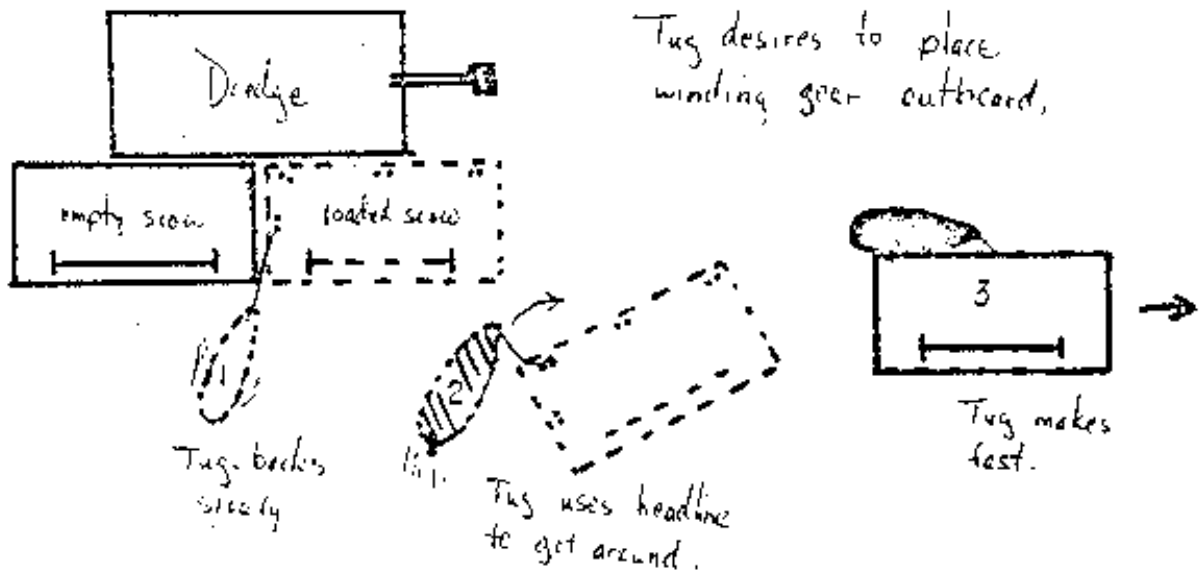
Taking scows away from the dredge is primarily a matter of experience, as there are a dozen ways to do it; some illustrated below. The basic rule is: Take it easy, don't get the scow moving too fast. Learn to do it in a manner that is comfortable to you.

Examples:



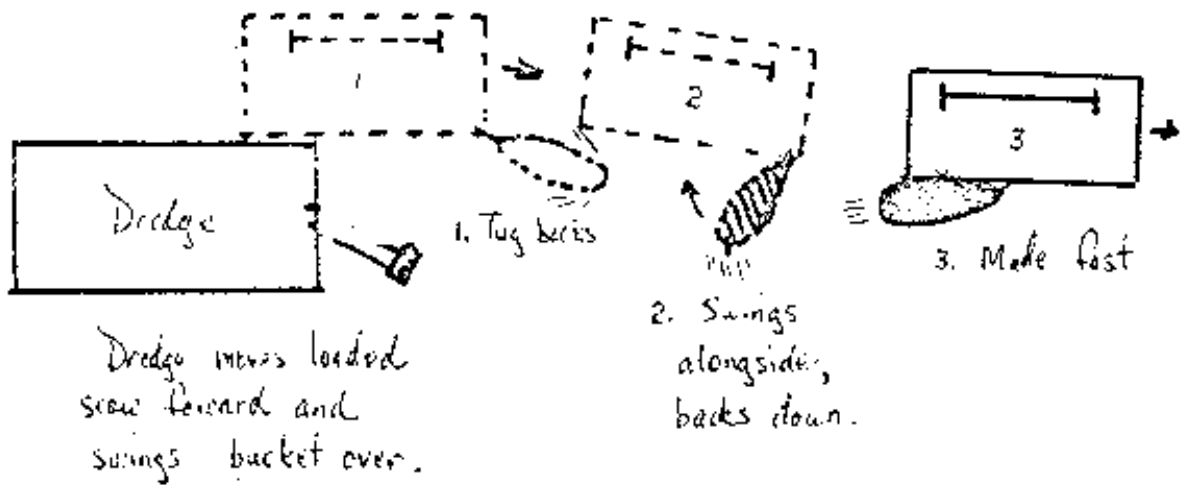
2

bank



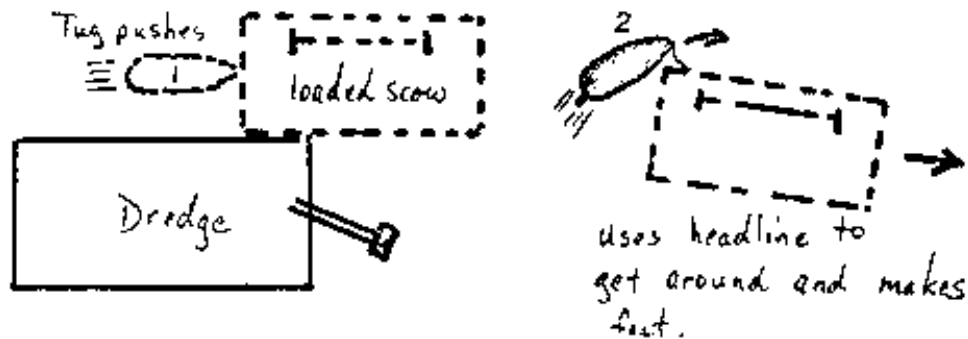
3

bank



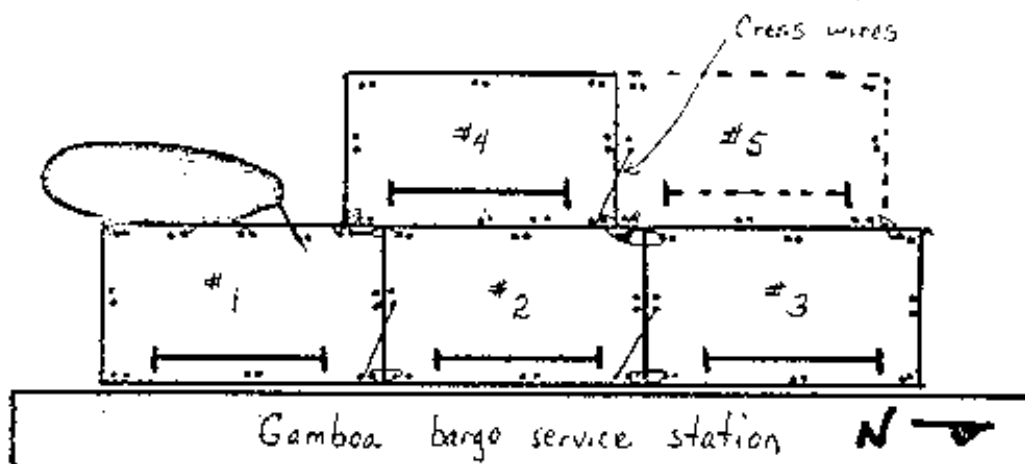
④

bank



In most of these sequences, notice that the tug is using a headline. This is the key to successful scow handling. Let your deckhands know what you intend to do. Be ready to change plans if the scow doesn't cooperate. Don't try to "force" a 4000 ton scow into control, "ease" it.

The loaded scows are marshalled at the Gamboa barge service station and lashed together. From there they are taken north to a dumping area near Barro Colorado Island and returned. Wire cables are placed as safety measures to hold the pack together along with the soft lines.

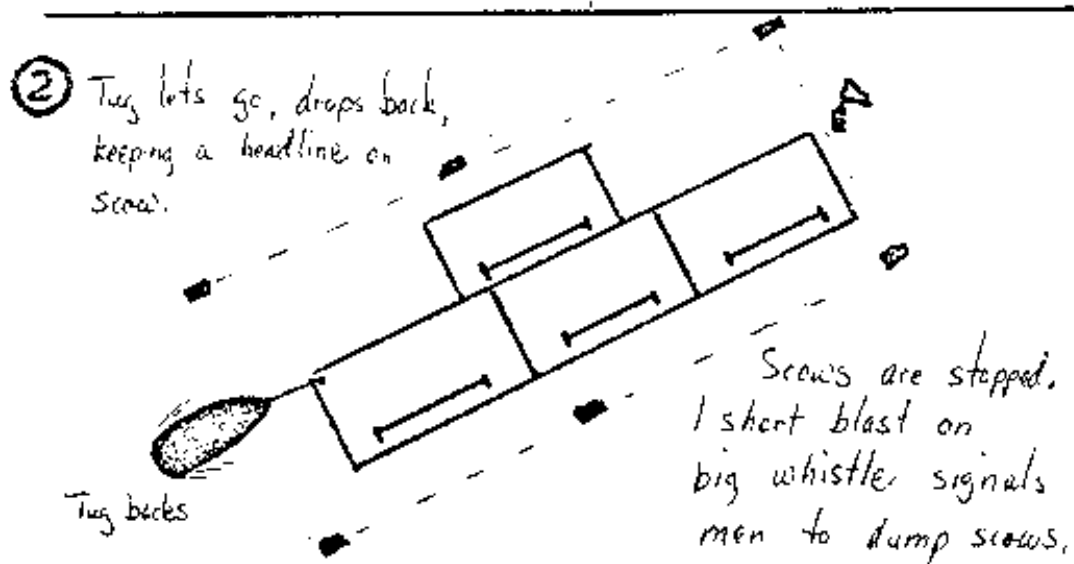
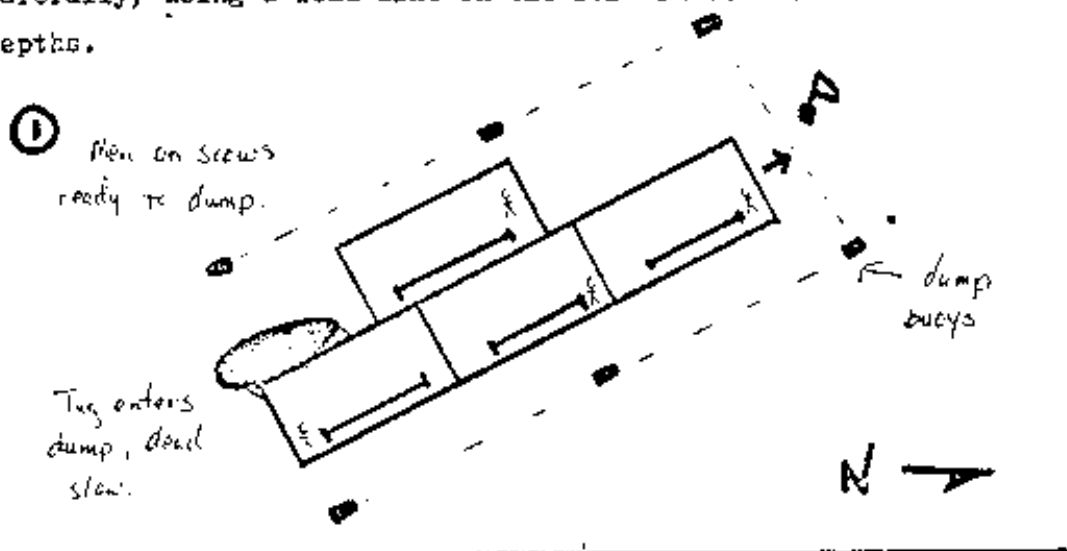


This is a basic scow lashup. When taking 5, Just place the 5th ahead of the 4th. Note that all the winding gear are toward the east. They should be returned the same way.

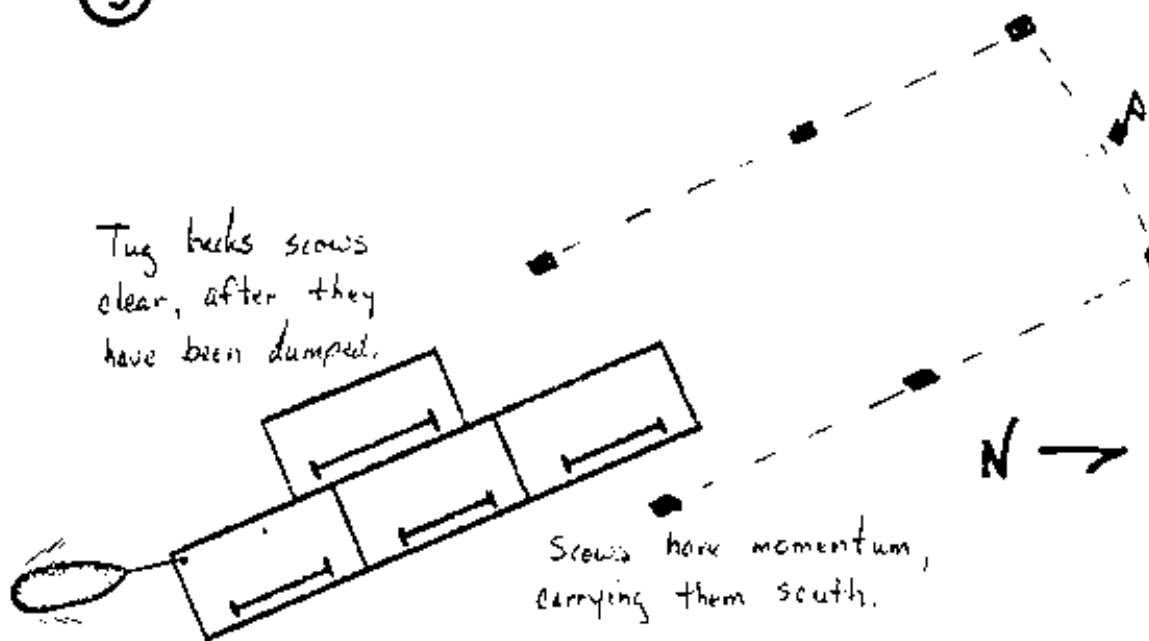
Always get clearance from MTC before departing to the dump. Always stay well to the right-hand side of the channel. You may be moving up to 20,000 tons with a 1000 HP tug, so be cautious.

The dump outside the channel west of Tavernilla Reach. It is marked with brightly painted can buoys, and there is usually a white-lighted range to assist your approach during darkness. The exact location changes frequently, so check with Dredging Division (ACD-7) for information.

Enter the dumping area between the buoys slowly and carefully, using a lead line on the forward scow to check depths.

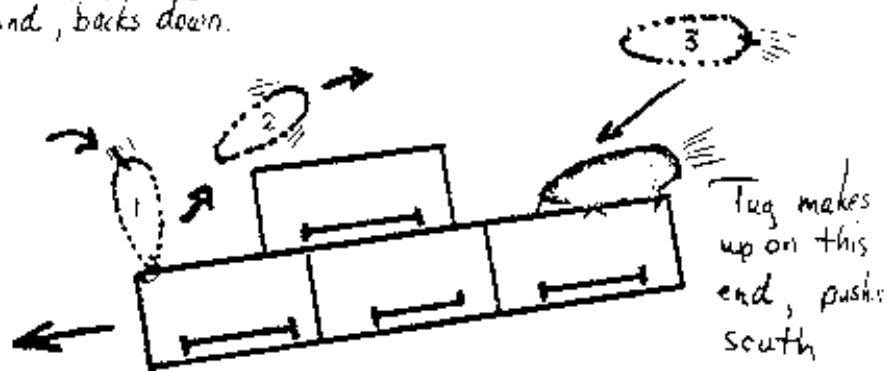


③



It is a good idea to get the screws moving outward slightly before dumping them.

④ Tug lets go, swings around, backs down.

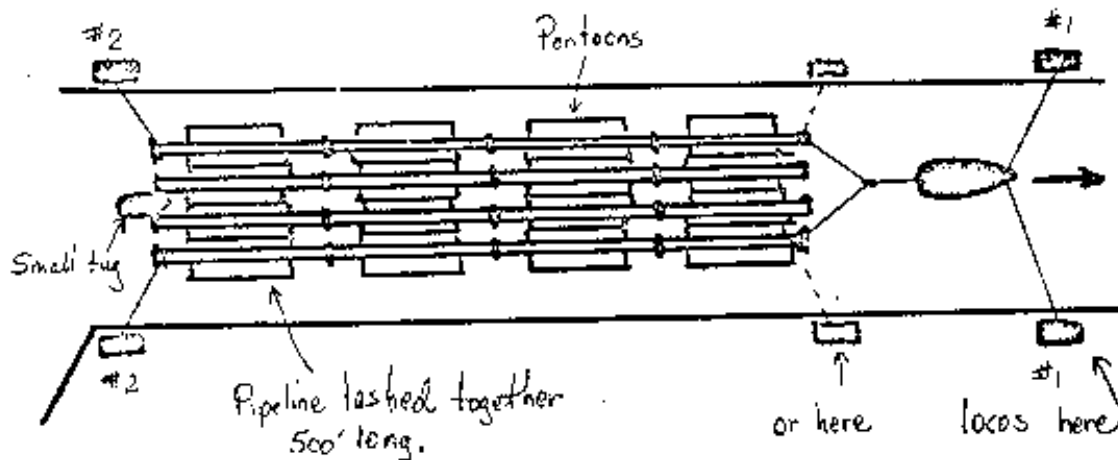


Note that the winding gear are still facing east, and the scows may be returned to the barge service station without turning them around. This is an easy and convenient method to dump, and can be learned rapidly. The procedure would remain the same regardless of the number of scows being dumped.

2. Suction Dredge.

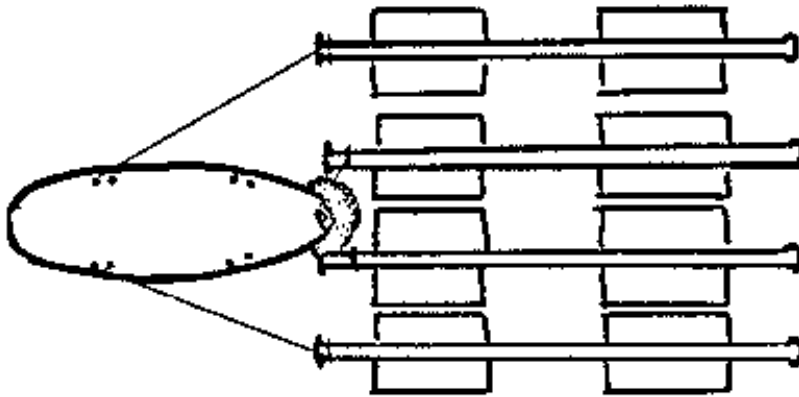
The U.S. "MINDI" is a 26" suction dredge. It is 296' by 52'. It may be towed on the hip or on a short hawser in the same manner as the other dredges. It does not require scow service, since it deposits material ashore through a long floating pipeline.

Pipeline tows will be taken on a short hawser and may be 80' wide and 500' long. There is nothing particularly difficult about towing them, except during lockages.



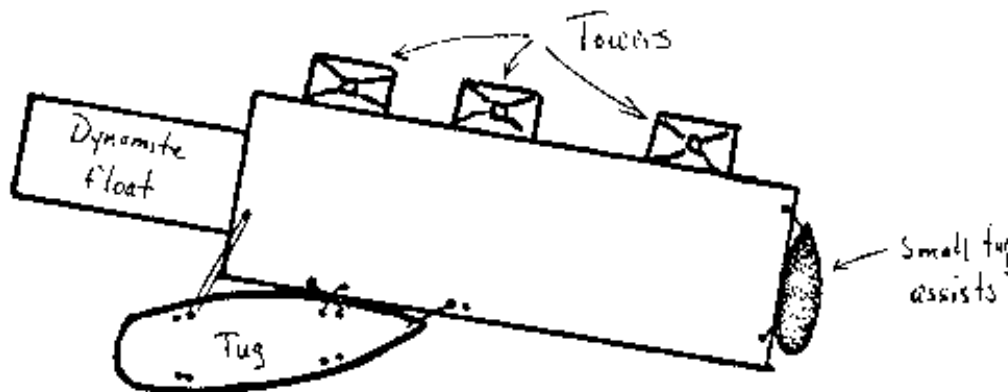
Be careful not to snag the pipe on protrusions, and don't let the locomotives pull the pipe apart. It is a light, relatively easy handling tow, but delicate. You may place your #1 loco wires on the tug, or on the forward end of the pipe and tie the tug against the sidewall.

Short sections of the pipe could be pushed ahead with the tug:



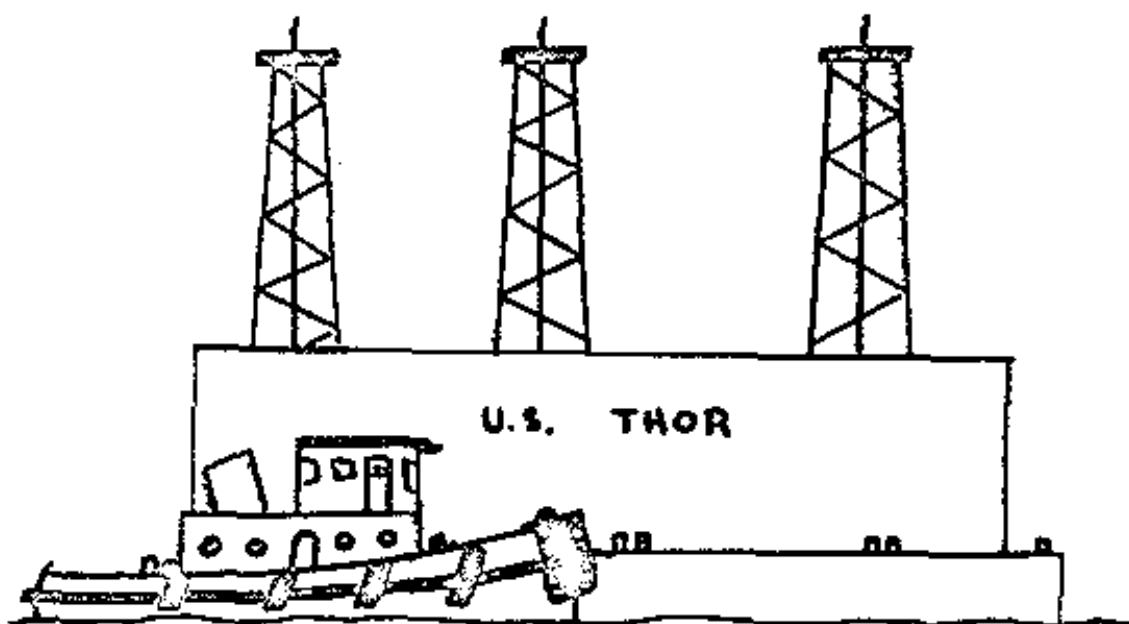
3. Drillboat "THOR".

The drillboat is not a boat at all but rather a barge 151' by 46' with large drilling towers on one side. It may be towed on the hip or on a hawser as with any barge, except that the tug cannot lash up against the towers. There is a very pronounced crabbing effect and wind is a strong detriment.



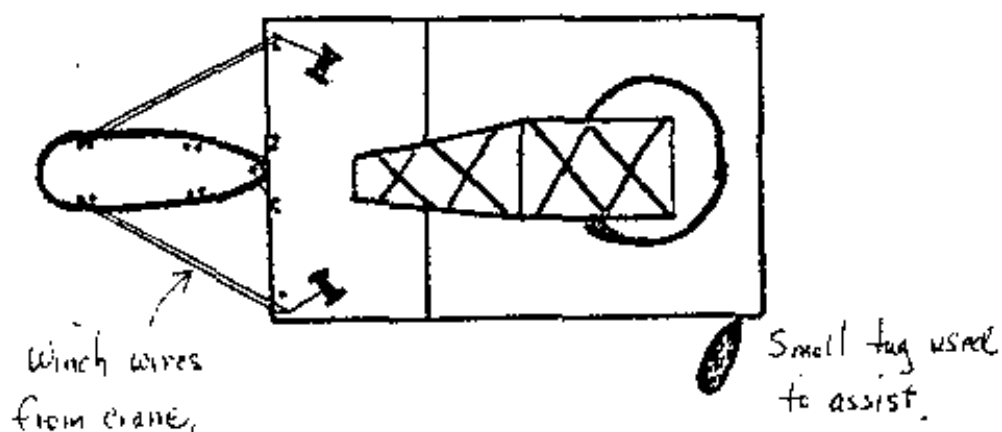
A small tug may be used to assist. There will be a pilot aboard since the high superstructure restricts visibility.

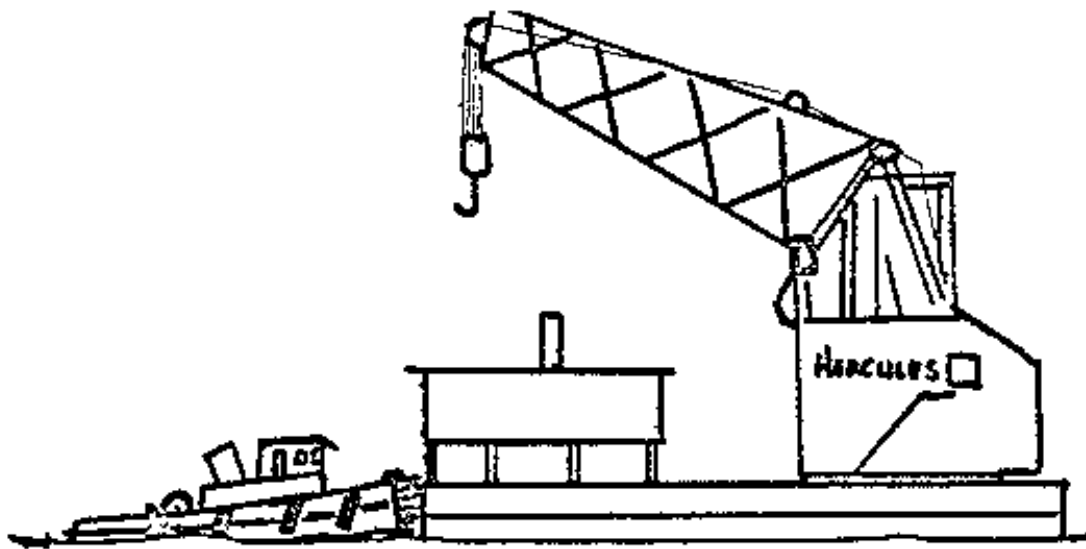
It is advisable to have the dynamite floats removed before getting under way.



4. Crane "HERCULES".

This a large unmistakable floating crane of 250 ton lifting capacity sitting on a barge 152' by 90'. It is heavy and greatly affected by the wind when under tow. The common practice is to lashup on the stern using the deck winch wires from the crane to snug the tug in tight.

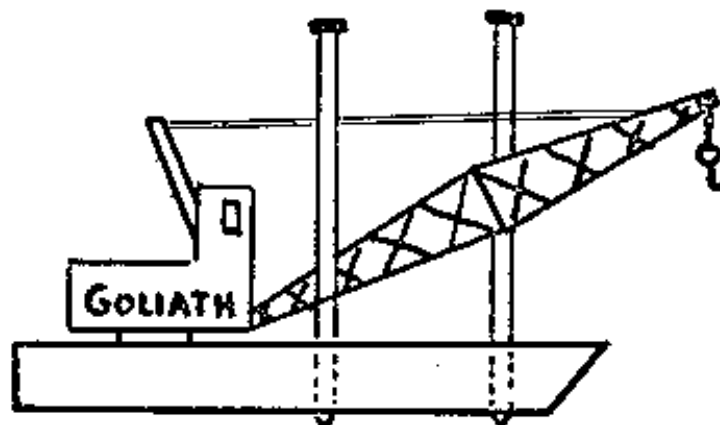




In this fashion the crane can be controlled very well with one tug. A pilot will be in charge and he will most probably use a small tug to assist. During lockages loco wires will be placed on the fore and aft ends of the crane. The tug captain steers by compass, taking rudder and engine orders from the pilot.

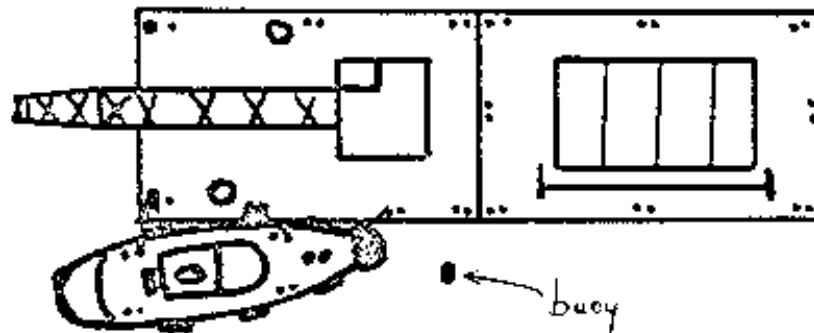
5. Crane "GOLIATH".

This is a versatile 150 ton crane mounted on a barge 150' by 50' which is used to do a million jobs around the Canal. The barge is raked at the bow and is equipped with large spuds which hold the crane stationary while it is working. No pilot is necessary and the tug captain must be able to place the crane on exact locations to do various jobs. Often times the crane must be towed outside channel areas into questionable water depths, and the tug captain must be cautious, using a lead line to obtain soundings.



The crane is towed on the hip, bow or stern first, depending on the job. There must be good communication and cooperation with the deck supervisor of the crane. The tug captain may be requested to take the "GOLIATH" and position it to:

1. Drive beacons and spuds.
2. Lift equipment on and off the shore and docks.
3. Go alongside ships and other floating equipment.
4. Dig shoals.
5. Lift locomotives at the locks.



This is a typical method of towing the "GOLIATH" and a scow when involved in shoal digging. A small buoy marks the shoal. The tug positions the crane and scow near the buoy as illustrated so the crane may clamshell the shoal and deposit the material in the scow.

Working with the crane "GOLIATH" is one of the most interesting jobs for a tug, because it is usually demanding on the captain and good tug handling is well received by the crane personnel. Also, it is interesting to watch the crane work.

CHAPTER VIII - Offshore Towing.

There are numerous books written on offshore towing and since Panama Canal tugs are not required to go to sea, this manual will merely touch on the subject. Going offshore is an entire study in itself and requires considerable experience and knowledge in seamanship and navigation.

Here are a few basic requirements:

1. Good seamanship.
2. Knowledge of wind, weather, tides, and currents.
3. Terrestrial, celestial, and electronic navigation.
4. International rules of the road.
5. Radio communications.
6. Physical stamina to function in rough weather conditions.

When called to render assistance to a vessel disabled at sea, get the following information from the ship's agent before departing:

1. Name, registry, size, location, cargo, and nature of the vessel's problem.
2. Is the vessel drifting or anchored?
3. Does the vessel have lights and radio VHF channels 12, 13, or 16?
4. Are there any injured persons aboard?
5. Get a weather forecast for that area from FAA.

To insure that your tug is prepared for the job, check the following:

1. Is there sufficient fuel and water aboard?
2. Have enough food to last at least 2 or 3 days past your expected return date.
3. Make the tug watertight and secured for sea. Be prepared for bad weather.

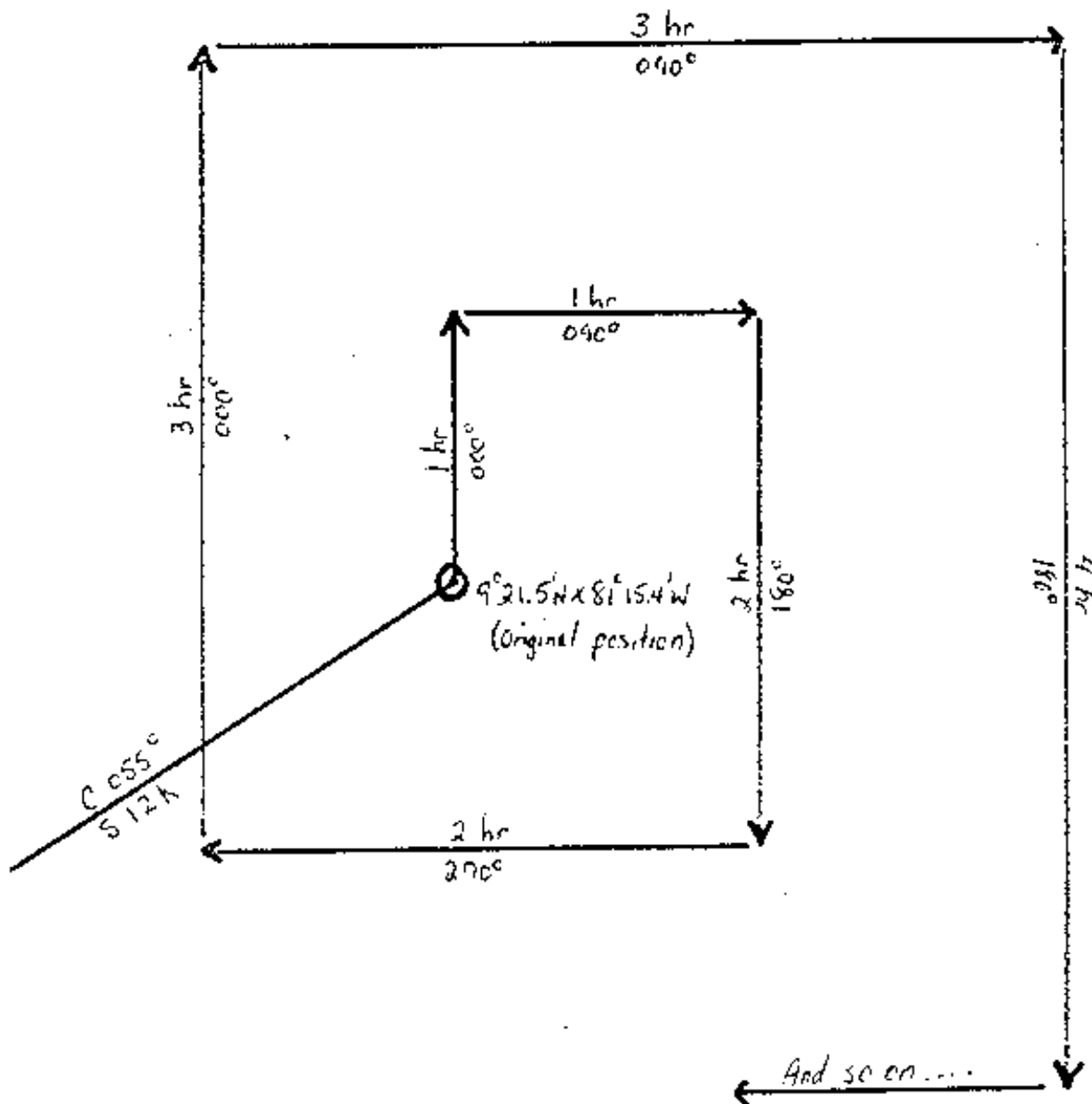
4. Do you have sufficient towing gear, bridles, shackles, heaving and messenger lines aboard?
5. Do you have adequate charts for the area?
6. Are there enough men aboard to stand a 24 hour sea watch?
7. Are your radars, SSB and VHF radios functioning?
8. Is the tug equipped with sufficient ground tackle for anchoring?
9. Are proper towing lights and day signals in operation?

Arrange with your home base to check in on your SSB radio at least twice daily. If you don't anticipate calling in to a foreign port, customs clearance will not be necessary.

When underway enroute to a distressed vessel, keep an accurate log giving your hourly dead reckoning position, course, speed, wind and sea conditions, and any other pertinent information. As you near the vessel, try to establish radio communication and get his latest position. If the vessel has not been seen by the time you have reached his supposed position, experience and common sense will tell you how to set up a search pattern. This cannot be learned from a book. The "old timer" and his experienced "hunch" will usually be the decisive factor.

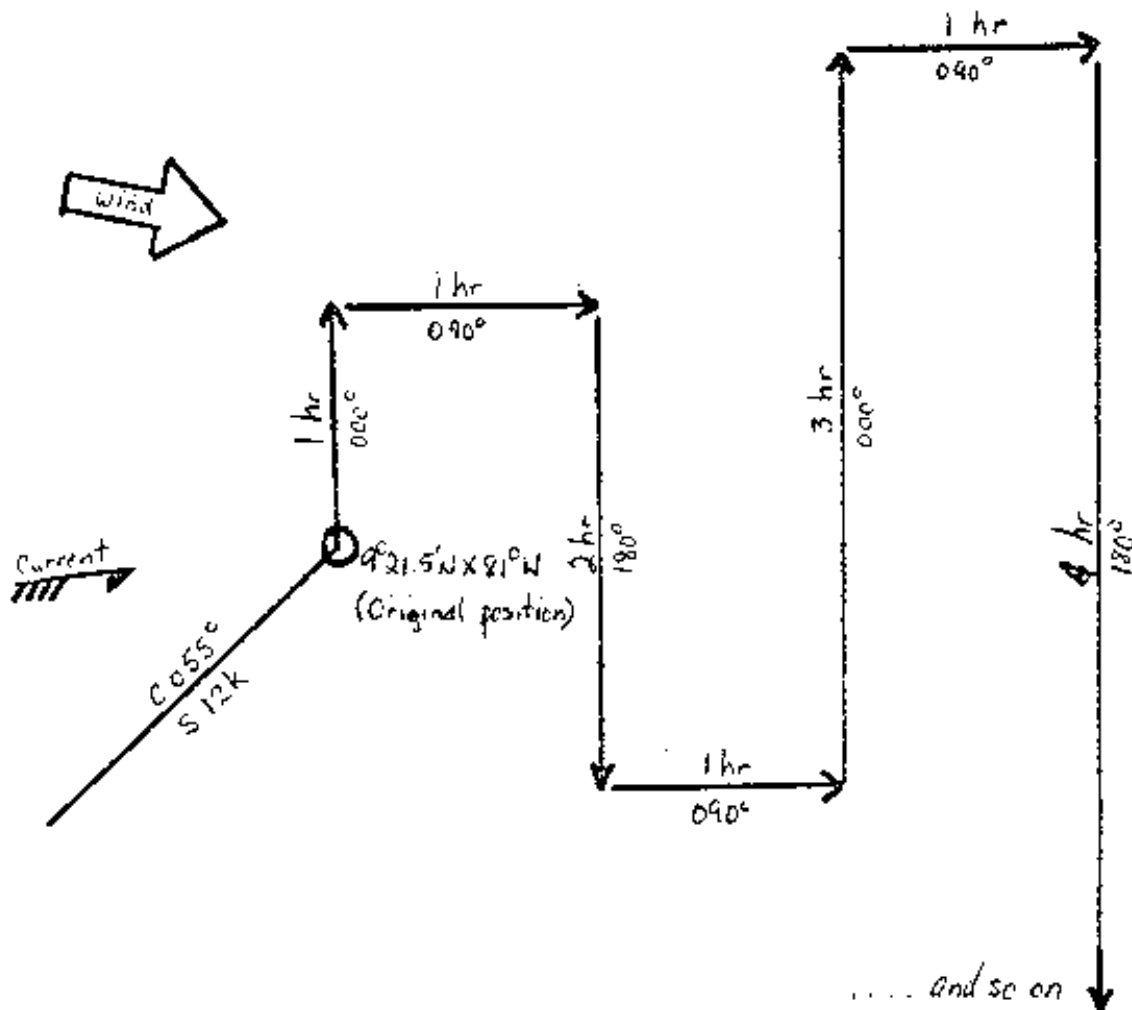
However, the basic idea may be to sail to the given position, then set up a pattern to sail around that position in ever-widening squares. Sail north and south, and east and west, so you can maintain your own D.R. position more easily.

A circular search pattern:



Or, if the wind and current are noticeably strong, and the vessel has been drifting at an appreciable rate, you

may set up a slightly different pattern to compensate for those conditions:



Again, this is only the basic idea, but the main purpose is to cover the area efficiently without getting yourself lost!

Upon seeing a vessel on the horizon either visually or by radar, the best way to determine whether or not it is the one you're after is to study it closely on your radar. In 15 minutes or less you should be able to determine if the

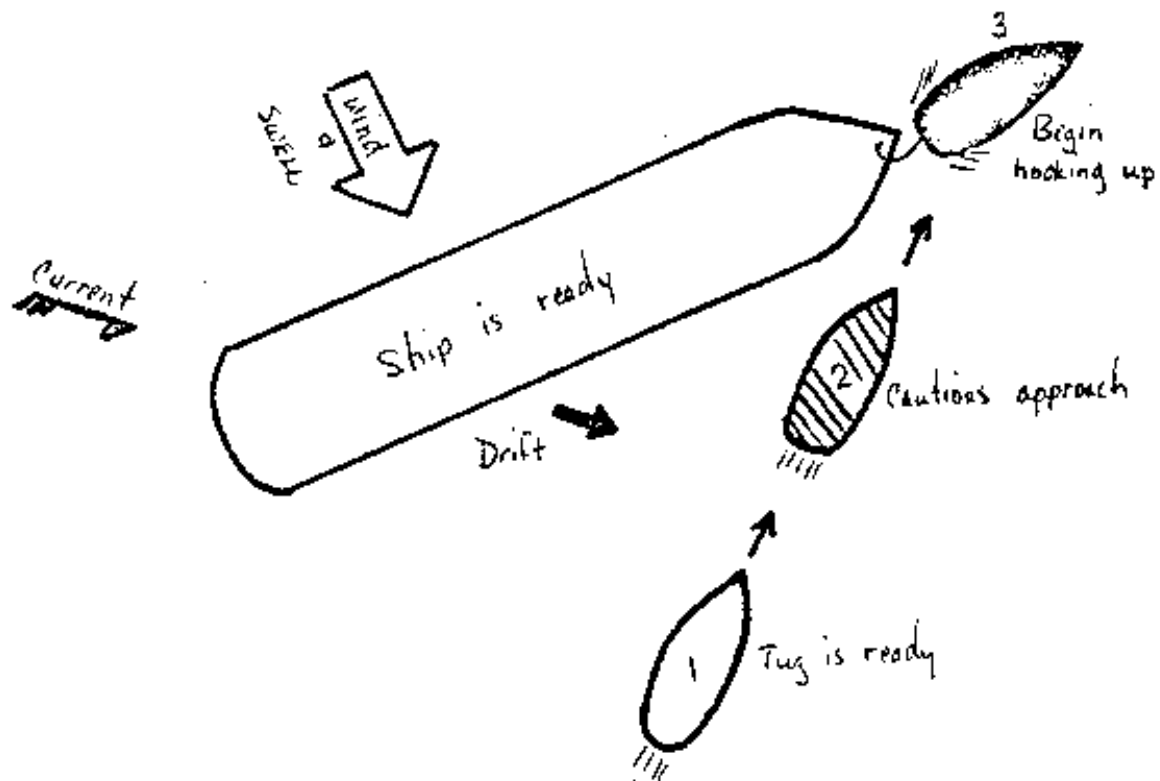
vessel is making way or stopped. If it is stopped, close in to investigate; chances are it is your ship.

Now you have confirmed that this is the vessel that needs assistance. Weather permitting, pass him a handset radio if his radios are not functioning. Establish radio communication and introduce yourself and your intentions. Ask the captain if he needs anything. Ask if he has steering.

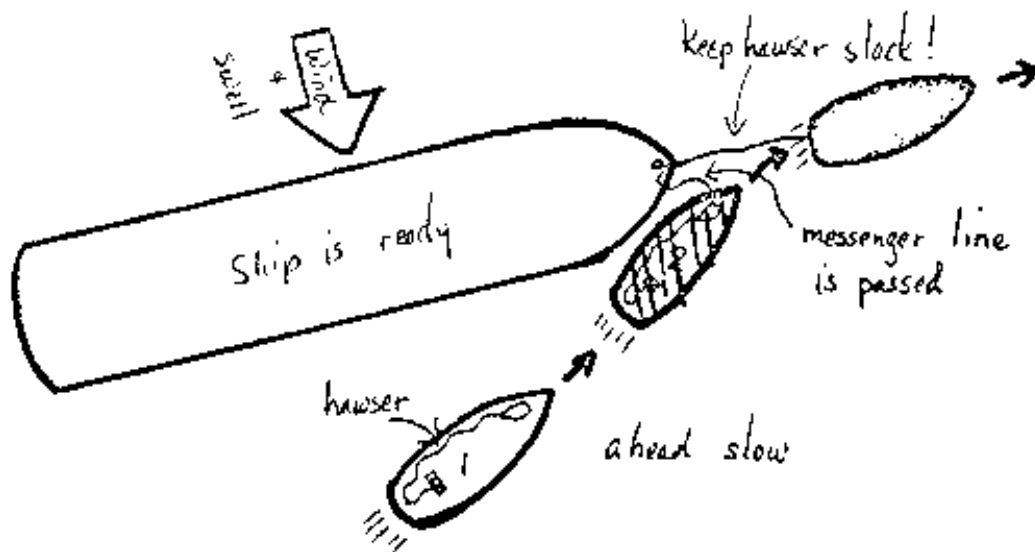
All the while, be studying the drift and roll of the ship. Have your engines stopped and see how your tug drifts in relation to the ship. Look at his bow chocks and bits and decide where you wish to pass your towing hawser. Never get in a hurry, unless the ship is in danger of drifting aground. If at night, and the weather is rough, you may wish to wait for daylight before hooking up. If the ship has an anchor down, have the captain pick it up before you go in for the hookup.

After studying the conditions for a while and you have decided what you want to do, inform the captain of the ship and be sure he understands. Tell him to have his men ready, for you want to spend as little time as possible under the bow. Have your own men well informed and standing by with the hawser and messenger lines. Then start your approach, cautiously. If something doesn't feel right, back away and start over.

It is generally best to approach the ship on his leeward side, since the lighter tug will usually drift faster than the ship. If you approach on the windward side you may be set against the ship. Also, you can control your tug better when approaching upwind.



If possible, you may flake your hawser along the deck of the tug, and pass a messenger line from the bow of the tug as you go by:



It may take several passes to get your hawser aboard the ship. After securing it, move away slowly, paying out hawser as you go. Stay in front of the ship, and let out perhaps 800'-1000' or more, being careful not to surge

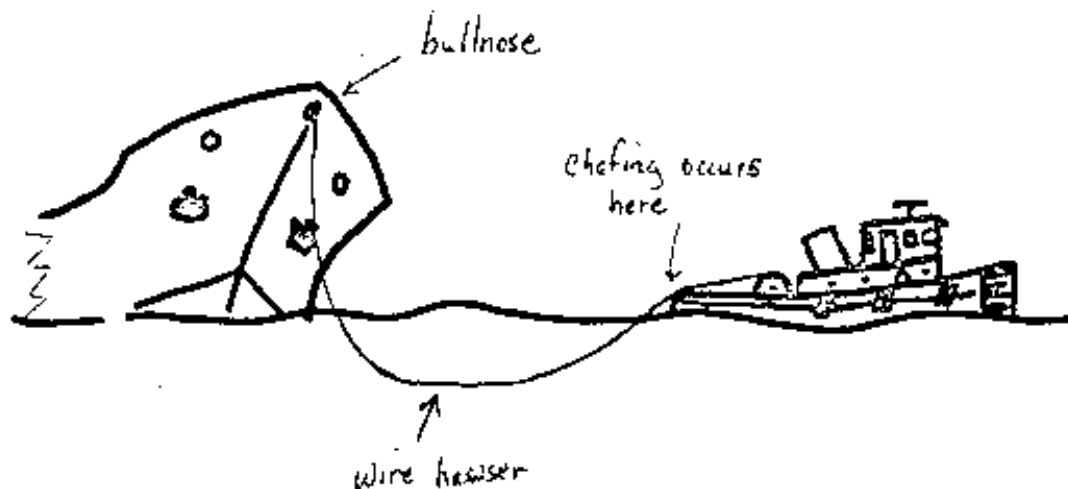
on the hawser. In rough weather let out as much scope as you can, putting greater distance between the tug and the tow. When you have out the desired scope, set the winch brake and clear your men from the area. Continue easing ahead as slowly as seems fit until the hawser begins to come up tight, and the ship begins to move forward. Again, don't get in a hurry: spend 30 minutes bringing your engines up to power a little at a time. Study the ship to see how she follows.

When you are satisfied that things are going well, get your position, set a course, get a speed check, and determine an ETA to the sea buoy. Log this information. Put up proper towing lights and day signals.

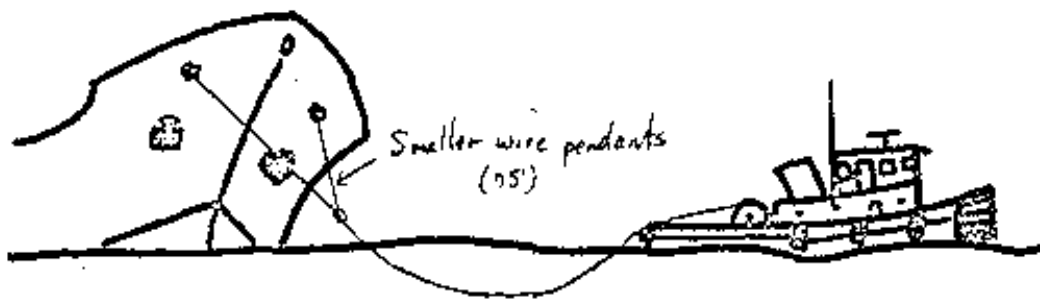
Call the ship's captain and ask him how things are back there. Give him your ETA. Tell him to put on his running lights and towing signal. (Do not have him turn on the white range lights.) Settle down to a routine watch and take him to port! But never become too relaxed!

Four ways to rig a towing bridle:

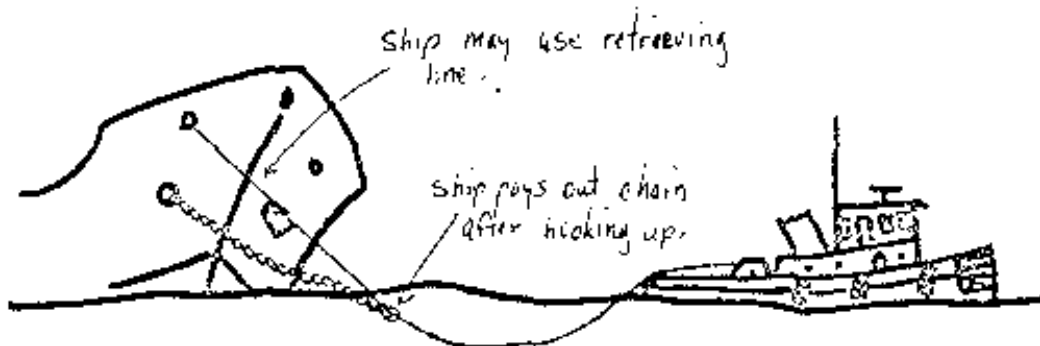
1. Wire hawser through bullnose.



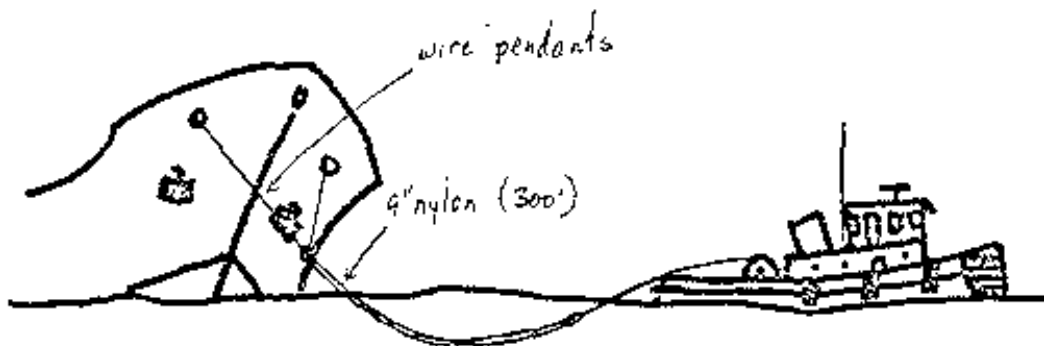
2. Pendant through each bow.



3. Attach hawser to ship's anchor chain.



4. Using a 9" soft line to act as a shock absorber.
Nylon is preferable, as it stretches more.



Upon reaching Balboa or Cristobal with your tow, notify Marine Traffic Control. Be extremely alert to all traffic. Shorten up your hawser to about 200' or less and tow the ship to the designated anchorage area. Come to dead slow, and have the ship drop his anchor. Let go your hawser and heave it in. Check with the ship's captain one more time to certify that everything is alright. Bid him good luck and fair weather and go home! Nice job!

Naturally, offshore towing involves a great deal more than this, but search and rescue is probably the most demanding part of the towboat profession. Your skills will be tested from seamanship to navigation each and every time.

CHAPTER IX - Licensing.

A Master's License is required aboard Panama Canal tugs. Local licenses are issued to those qualifying for and passing a written and practical examination. The examination contains the following subjects:

1. International and C.Z. Rules of the Road.
2. Lifesaving and firefighting.
3. Aids to navigation.
4. Seamanship.
5. Instruments and accessories.
6. Ocean winds, weather, and currents.
7. Signaling by International Code flags.
8. Ship construction.
9. Local knowledge of C.Z. waters.
10. C.Z. Rules and regulations.
11. Piloting.
12. Ship sanitation.
13. Chart navigation.
14. Panama Canal charts.
15. Oil pollution.
16. General.

Upon successful completion of the written and practical exams, a license as "Master, Steam and Motor Vessels and Pilot, US Government Local Vessels n/o 500 gross tons upon all C.Z. Waters." will be issued.

For those U.S. citizens interested in obtaining a U.S. Coast Guard license, let me clear up any doubt:

1. Watch time aboard Panama Canal tugs is accepted by the U.S. Coast Guard.
2. An inspected license as Master up to 500 tons or more can be obtained by those who have 4 or more years

aboard Panama Canal tugs. (One year means 365 days)

The Coast Guard Pamphlet 191 has all the qualifications and requirements for licensing of deck officers. The office in New Orleans, Louisiana is a good place to apply. The applicant must pass a written examination, take radar training, pass a course in CPR and first aid at sea, and get a medical checkup.