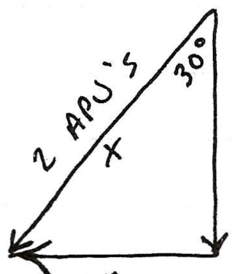
APU vector analysis

Both APU's trained to 150 / 210

each APU = 325 HP

APU's in tandem = 2 × 325 HP

= 650 HP



side vector:

sine 30° = $\frac{A}{X}$

A = (sine 30°)(x)

A = (0.5)(650)

A = 325 HP

astern vector:

cosine 30° = $\frac{B}{X}$

B = (cosine 30°)(x)

B = (0.866)(650)

B = 563 HP

$\frac{563\ HP}{325\ HP} = 1,73$

note: values for side/astern vectors are reversed for train angles of 120/240

OLIVER HAZARD PERRY CLASS FFG
PIER WORK SCENARIO

Situation: Your ship is moored starboard side to, bow in along the wall in FFG alley at Naval Station, Mayport. Ship's heading is 153 degrees true. You will be the Conning Officer for an unassisted, i.e., no tug or pilot, departure. Winds are light and variable and current is negligible. There are no material degradations that will affect propulsion, navigation, or ship control. The Auxiliary Propulsion Units (APU's) have been extended, but not started. Your Commanding Officer's preference is that you operate the APU's "in tandem" (always trained to the same angle) rather than "split."

A typical sequence of events **might be**:
- XO reports to the CO that the ship is ready in all respects to get underway.
- CO directs you to get the ship underway.
- Your first commands are to the helmsman: Right full rudder (to lift the stern to port once you have created ahead prop wash/flow), Train port and starboard APU's to 210 (to provide, once started, a reasonable amount of side force/vector to port and a relatively large astern force/vector to drive the engine against).
- Once the rudder and APU's are positioned, your next orders are to the deck force: Forecastle, fantail, bridge. Take in all lines.
- Your goal is to lift the entire ship off the pier and walk, or "crab,' the ship to port. Your next commands are directed to the Helmsman and Lee Helmsman: Start starboard APU, Engine ahead for 3 knots, Start port APU. The APU's trained in tandem to 210 are now simultaneously creating an astern vector and side vector to port. We know this because we have studied vector analysis in the excellent articles written by CDR John Becker.
- The ship starts to move sideways to port. So far, so good.
- After a short while, you notice that the bow seems to be coming off the pier a bit faster than the stern, and the ship has developed slight sternway. A quick glance at the bridge-wing pelorus confirms the movement of the bow. Ship's heading is now 151 degrees. This doesn't surprise you. A force working against you, especially when the ship is at low speed, is the stern-walk force which tends to move the stern to starboard due to the direction of propeller rotation. When walking the ship to port, the stern-walk must be overcome.
- Your next commands are: Train APU's to 200, Engine ahead for 4 knots. These actions will slightly reduce the side vector and increase the astern vector created by the APU's, and result in more wash across the rudder due to the increased power setting on the engine. This creates more lift from the rudder.
- It appears the stern and the bow are now moving away from the pier at approximately the same rate. This is good. When the ship is approximately 3 ship-widths away from the pier, you are ready to start backing towards the turning basin.
- You order: Train APU's to 180, engine ahead for 2 knots, rudder amidships. These actions should result in the ship backing due to setting the APU's to achieve the maximum astern vector. With the engine ahead for two knots, the APU's astern vector will overcome the ahead thrust from the engine and the ship will back.
- The ship is gaining sternway at a nice rate. However, the stern seems to be moving to starboard and the ship's heading is now 150 degrees and slowly swinging to the left.

After muttering, “Damn stern-walk monster” under your breath, you order: Right 20 degrees rudder. This seems to do the trick. The stern stops swinging to starboard and is now slowly moving to port. As the ship’s heading is approaching 153 degrees, you order: Ease your rudder to right 10 degrees. This seems to eliminate the swing and the ship is now backing in what looks like a straight line. It appears that with the engine ahead for 2 knots, there is enough prop wash for the rudder to respond, but not enough ahead power to kill the sternway.

- The ship backs nicely into the turning basin and is in a good position to make a port turn towards the channel. You recall learning about the “FFG twist” the last time you were at the simulator. This looks like a good opportunity to try it out. You issue the following commands to the ship control personnel: Rudder amidships, Train APU’s to 240, Engine ahead for 4 knots, Left full rudder. The bow starts to swing to port as the sternway comes off the ship. The APU’s at 240 are right at one of the train limits for tandem operations. The 240 angle on the APU’s generates a maximum side vector to port and minimum astern vector. The stern is lifting to starboard due to the large rudder angle and engine going ahead. As the ship moves ahead slowly and swings to the outbound course you place the rudder amidships, stop the APU’s and train them to 180 degrees. You then increase speed to 5 knots and request permission from the CO to retract the APU’s.

Special: The FFGs

Handling the FFG-7

By Commander John J. Becker, U. S. Navy

EDITOR'S NOTE: *This is the first part of a two-part feature on shiphandling characteristics of the* Oliver Hazard Perry*-class guided-missile frigates. Part II will appear in the February* Proceedings.

When I was commissioned in the late 1960s, the officers I served under had been at sea during World War II, or they had trained under others who had. They were masters of the shiphandling art. The ships of the destroyer navy had grown only slightly as each new class was introduced. They were twin-screw, steam propelled, and very similar in their handling characteristics. An officer could spend an entire career with only a short learning curve at each new duty station. The result was a more or less standard way of shiphandling that, when combined with the immense experience of the conning officers, set a standard of excellence that is rarely equaled.

Now an officer is frequently required to handle several destroyer types—twin-screw destroyers, single-screw frigates, gas-turbine propulsion with controllable-pitch propellers, and steam propulsion with fixed-pitch propellers and auxiliary propulsion units (APUs).

The *Oliver Hazard Perry* (FFG-7)-class guided-missile frigates are the most numerous of any U. S. Navy ship class yet, but there is little published on this class's shiphandling. The basic premise for handling the FFG-7 is simple: APUs to oppose the main engine and move the bow, rudder to control not only ship course but also lateral movement of the stern, and main engine to keep an effective flow across the rudder as well as move the ship.

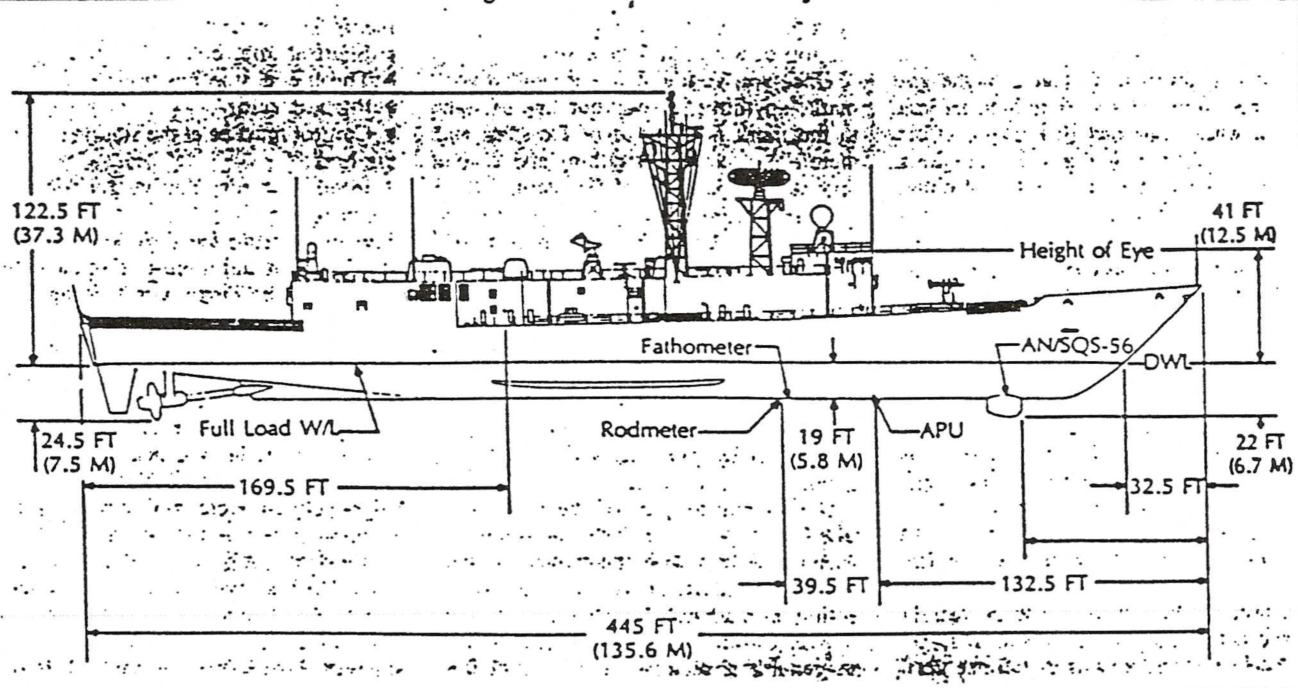
Using the combination of engine, rudder, and APUs it is possible to recapture the shiphandling excellence that was the traditional hallmark of the destroyerman. The FFG is fairly forgiving once you understand the vector logic. You can usually be a little slow in making your decisions and still recover nicely. You will find your FFG to be a handy, responsive ship that is fun to handle. It really is the sports car of the fleet.

The FFGs are a legacy of Admiral Elmo R. Zumwalt's tenure as Chief of Naval Operations.[1] The theory is you don't need an Aegis cruiser for every destroyer mission and you can build two low-mix FFGs for the price of one high-mix *Spruance* (DD-963)-class destroyer (or five FFGs for one *Arleigh Burke* [DDG-51] Aegis destroyer)—but that's politics and this is about shiphandling.

What low mix means to the FFG driver is that the designers said the hell with redundancy and gave you only one propeller shaft instead of two, one anchor instead of two, one boat . . . well, you get the picture. Unlike earlier single-screw frigates, however, the FFG-7 has gas-turbine engines, a variable-pitch propeller, and APUs. Its handling characteristics are unique, and the combination of what you have to handle the ship with is unique.

Let's start with an outboard profile. Standing on the bridge, your height of eye is 41 feet, the bull nose is 132 feet in

Figure 1 *FFG-7 Outboard Profile*



front of you, and the stern is either 313 feet or 321 feet behind you depending on your FFG's flight deck/stern design. Your ship has a 47-foot beam, and the deepest projection below the waterline is the screw. The screw is 10 feet 2 inches below the keel. The screw's depth is a function of displacement—generally about 24½ feet.

The Bridge: This area is designed to support the "minimum manning concept" (another low-mix legacy). The helmsman not only controls the rudder but also has direct control of the main engines and APUs. During restricted maneuvering conditions, a lee helmsman is assigned to operate the main engine programmed control lever.

This throttle, located on the helmsman's right, controls both propeller pitch and engine speed through the processor in the central control station (CCS). The processor, when in the "programmed control" mode, adjusts the pitch and shaft revolutions per minute (rpm) to obtain the speed you have ordered on the throttle. Programmed control is the only way you will have control on the bridge. CCS can take control from the bridge for lighting off or securing engines or during a casualty. Changing the shaft rpm and/or the pitch will alter the ship's speed. At lower speeds, the propeller's pitch is the primary impetus to change: an increase in pitch increases the ship's speed while rpm changes are minimal. Once maximum pitch is reached, all further speed increases are achieved by increasing shaft rpm. (See Table 1.)

Table 1 *Ship speed, shaft rpm and propeller pitch*

Single Engine				Two Engines		
Ship Speed	*Shaft rpm*	*Prop Pitch*		*Ship Speed*	*Shaft rpm*	*Prop Pitch*
25	142	+23.5	ahead flank	29+	180	+23.5
20	112	+23.5	ahead full	25	142	+23.5
15	82	+23.5	ahead standard	15	82	+23.5
10	50	+23.5	ahead 2/3	10	52	+23.5
7	37	+23.5		7	46	+16.5
5	33	+15.0	ahead 1/3	5	46	+10.0
0	44	+1.5	stop	0	56	+1.5
5	54	−14.8	back 1/3	5	54	−14.8
10	83	−14.8	back 2/3	10	83	−14.8
15	113	−14.8	back 2/3	15	113	−14.8

Notice that shaft rpm drops slightly as pitch is applied in the ahead direction at low speeds. When there isn't a lot of wind you can hear a change in the gas turbines on the bridge. This will let you know when your order is taking effect and is helpful when all you want to do is give the ship a little push. Notice also that full astern pitch is reached at back one-third. This is a major cause of greater stern walk while backing.

Where's the Stern? Ever since the Navy got serious about putting helicopters on board destroyer-type ships, our superstructures have begun to look more and more like big boxes. At the same time, the hulls have been getting longer and longer, but the bridge wings have stayed about the same—they don't extend over the side and the net result is poor or nonexistent visibility aft.

This is particularly troublesome when mooring in a situation with little clearance astern. Most ships rely on the fantail line-handling party to keep them advised. In the best of circumstances, all one gets is a "guesstimate" by someone claiming to have "seaman's eye." Some ships put out flags on horizontal poles that can be seen from the bridge.

My local harbor pilot in Mayport, Captain Tom Reynolds, told me the flags reminded him of training wheels and passed along the following method for telling where the stern is:

Stand on the bridge wing from where you normally conn the ship alongside. Have someone place a life ring in the water, positioning it even with the aftermost part of the stern, but far enough from the side so you can see it from the bridge. As you look at the life ring, try to sight some object on the side of the ship that is in line with the ring. On my ship I painted a small white band around a deck drain pipe just forward of the hangar. It was seven feet four inches from the main deck to the mark. On your ship, it may be the top of a handrail or a vent.

Once you've identified or painted your mark, anything below your line of sight to the mark is forward of the stern and therefore a danger. Anything above your line of sight is clear of the stern.

Main Engines: The engines are General Electric LM2500 gas turbines. Although they are capable of 25,000 horsepower, they are regulated by speed- and torque-limiting circuits in the engine-control computer to 20,500 shaft horsepower each. If that doesn't impress your friends, tell them you have the seagoing version of the TF-39 engine used in the DC-10 airliner and the Air Force C-5A Galaxy.

The jet engine part of the LM2500s, called the "gas generator," has no direct mechanical link with the reduction gear or propeller shaft. Power is produced by putting another turbine wheel, called the "power turbine," in the exhaust of the gas-generator section of the LM2500. This is called "air coupling." It's possible to run the gas turbine without turning over the reduction gear or shaft. We do this by engaging the shaft brake.

Shaft Brake: Use of this brake is governed by a set of important rules:

- Before engaging the shaft brake, tell CCS so they can pass the word for people in the main engine room to stand clear. The brakes have, on occasion, thrown various pieces around the engine room after coming apart.
- Don't leave the brake engaged for more than 14 minutes.[2]
- Don't use the shaft brake more than six times in one hour; this will prevent excessive heat buildup.[3]

Sounds easy, doesn't it? But hold on—you're not ready for your surface warfare officer (SWO) board until you can list in proper "GITMO" fashion the requirements for the brake to engage. They are:

- Shaft at idle, below 75 rpm.
- Throttle at stop position.
- Pitch at zero.
- Control must be at the station engaging the brake.

In other words: You've got control on the bridge and want to engage the brake. You must bring the throttle back to the stop position and it must be in the detent; otherwise, the brake won't engage.

While this may sound like SWO trivia, the shaft brake is one tool you have in your ditty bag to fight the awesome "Sternwalk Monster."

Clutch: The power turbines are coupled to the reduction gear using a synchronized self-shifting (that's triple *s* to snipes) clutch. Here you've really got the *Spruances* beat—no air bags or failed operational propulsion plant examinations (OPPEs) owing to clutch problems. The triple *s* clutch is a simple reliable system that automatically engages or disengages the gas-turbine engines as they come on the line or are secured.

Propeller: Once the clutch engages, the reduction gear turns and power is transmitted to the controllable-pitch propeller (CPP to FFG handlers, not to be confused with the controllable reverse pitch—CRP—propeller on the *Spruance*). The CPP is 16½ feet in diameter and creates the Sternwalk Monster.

APUs: What makes FFGs unique among U. S. Navy surface combatants is the addition of two retractable APUs installed side by side directly underneath the bridge. They were designed to get the ship back to port after a main engine casualty, but are used for all low-speed shiphandling evolutions. The APUs are constant-speed, 325-horsepower electric motors driving a 36-inch propeller. This is an important point: you can't adjust their speed. What you can do, however, is change their direction. By doing this you change the force exerted on the ship in the ahead/astern direction and the port/starboard direction. The APUs are positioned using relative train orders with the ordered bearing being the direction in which you want the APU to push.

Some APU Rules:

- Ship speed must be below five knots for raising or lowering, or for operating the APUs.[4]
- Have three ship service diesel generators (SSDGs) on the line.
- Do not exceed three starts in rapid succession or six starts per minute with less than a five-second off period between starts.[5]
- Don't start both APUs together.
- Never operate both APUs.[6]
- Don't train an operating APU in the wake of another operating APU. The wake boundaries are defined in the Tail-to-Tail and the Head-to-Tail rules (see Figure 2).[7]

Some APU Suggestions: Use the APUs in tandem. A lot of people like to put one APU athwartships (090 or 270) and one at 180. This has been called the APU power makeup and works adequately in some situations, usually at the beginning or end of a mooring evolution. Once you start changing APU directions and are keeping both of them energized, however, it's easy to get confused. You're trying to keep track of enough things as it is. Give yourself a break—for most evolutions keep both APUs trained in the same direction. If you want to move the bow to port or starboard you will get more of a push with both APUs at 240 or 120 than with one at 270 or 090. For those who don't believe me, calculate the cosine of 30 degrees times 2 (APUs) times 325 (horsepower). My calculator gets 563 horsepower push to the side.

Using both APUs together also gives you more flexibility in maneuvering the ship. Your FFG will almost never move exactly according to your initial game plan. When you've got your APUs in the APU power makeup position you've lost the ability to make fine adjustments to the movement of the bow. All you can do is start and stop the athwartship APU. With both APUs you can make small changes to the bow by training them. The same

Table 2 *APU Head/Tail Boundary Restrictions*

Head to Head	Port APU between 060 and 120 and starboard 240 to 300
Tail to Tail	Port APU between 240 and 300 and starboard 060 to 120
Head to Tail	Port APU between 060 and 120 and starboard 060 to 120
	or
	Port APU between 240 and 300 and starboard 240 to 300

Figure 2 *APU Head/Tail Boundary Restriction*

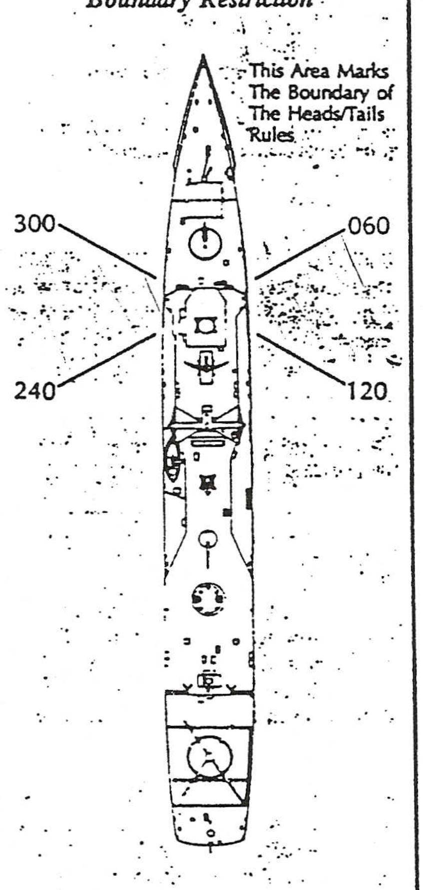
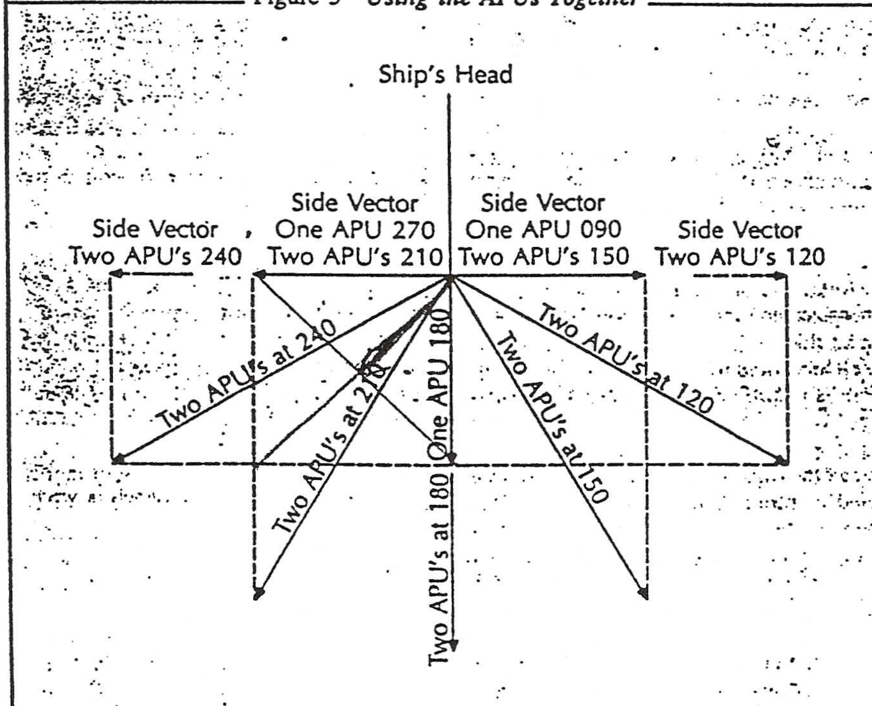


Figure 3 *Using the APUs Together*



applies to using the APU at 180. You can only use 325 horsepower's worth of your main engine without getting headway, but by using two APUs and changing the APU train you can not only make incremental fore and aft adjustments, you can also use more main engine power, which will in turn give you greater control of the stern by using the rudder. (See Figure 3.)

Notice that with both APUs at 150/210 you get a side vector equal to one APU at 090/270 (the same as APU power makeup), but you get a larger astern vector. Now you can use a larger engine-ahead vector to control the stern. For this reason, APUs at 150 is a good starting point to crab to starboard. To crab to port you will want to use more engine and rudder power to overcome the starboard stern walk, so a 200 train for both APUs is a good starting position. Because of the larger astern vector from the APUs, you can use a 3½–4-knot ahead bell without getting headway.

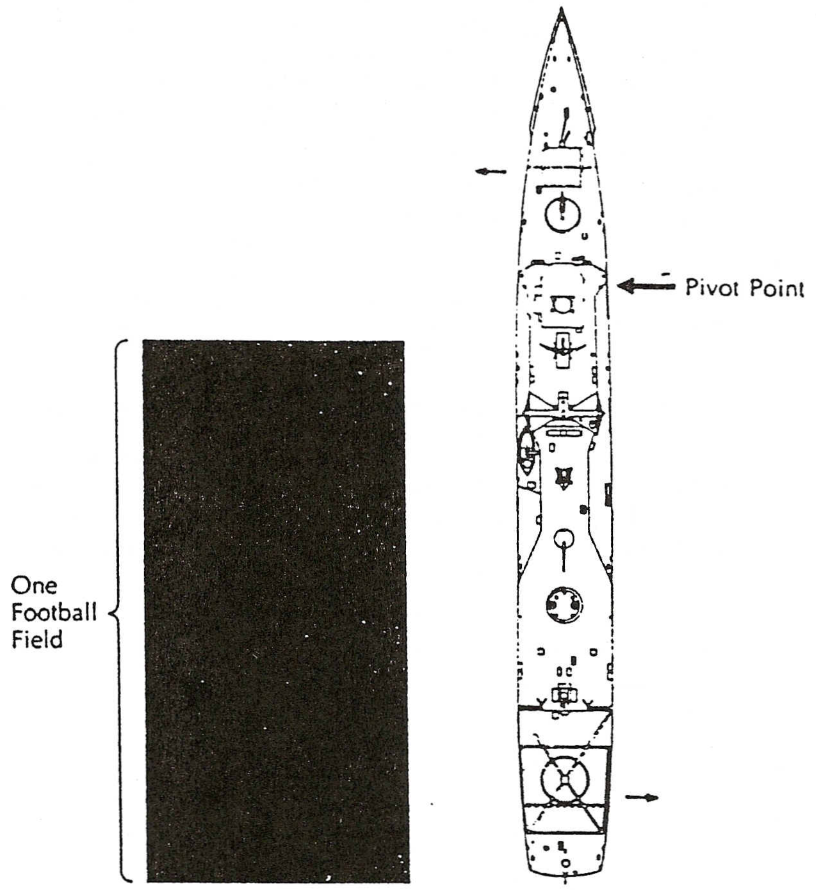
Some APU Reminders:

- Remember the APU locations—below the bridge (frame 100) just forward of the pivot point. The APUs not only push the bow, they also tend to move the entire ship. You can't twist the ship by pointing one APU ahead and one astern.
- It takes time to raise and lower APUs. In making a landing you must plan ahead on when to slow the ship below 5 knots, and then allow about 2½ minutes to lower the APUs.
- Both APUs operated at 180 will require about 4½ knots ahead on the main engine to keep the ship dead in the water.
- The Heads or Tails rule applies only when both APUs are energized.
- APUs can be trained while they are energized as long as you don't violate the wake rule.

Other Factors:

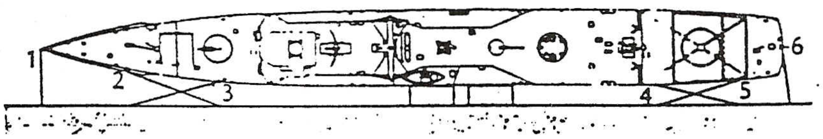
- *A lot of sail area.* FFGs are very sensitive to the wind. Even a 5-knot cross wind will cause a noticeable set. It's time to call the tugs if you have an unfavorable wind of more than about 12 knots. Remember the hangar doors during shiphandling evolutions. Open hangars tend to catch any wind from astern and push the stern accordingly. This has occasionally been used as an assist by some sharp FFG handlers. When CCS totally loses it (i.e. experiences main propulsion casualty), an FFG will lie broadside to the wind.
- *Thin skin.* FFGs (we're low mix, remember) have thin hull plating—as thin as ⅜-inch amidships. You may get to leave your FFG with a permanent record of your shiphandling expertise, while your buddies on other ship classes can paint over their mistakes. Watch out for the masker belts, and also for the replenishment outriggers.
- *A pivot point slightly abaft the bridge.* You can't be too precise here. Is it under the combined antenna system (CAS)? In the charthouse? Just assume it's between you and the SPS-49 air search radar platform. Leave the jackstaff up during sea detail so you have a quick reference of the bow falling off to one side or the other, but remember—you have a football field behind you that will move to the side from a pivot point only slightly astern of your conning position on the bridge. Experienced shiphandlers, regardless of ship class, always watch the stern for early indications of the ship twisting around the pivot point. The 35-foot whip antennae on the back of an FFG's 02 level are excellent reference points. One note of caution: when using APUs, the pivot point will move aft, depending upon the trained position of the APUs.
- *A 6,000-pound anchor and 13 shots (1,170 feet) of a 1⅜-inch chain.* Low mix here means only one anchor. The hawse is located on the starboard bow.

Figure 4 *Pivot Point*



With left rudder the bow goes to port and the stern moves to starboard around the pivot point.

Figure 5 *FFG Standard Mooring Lines*



Note the position of the camels between Frames 186 and 253.

▶ *Standard destroyer mooring lines.* Lines one and six are six inches and are used as breast lines, to control lateral movement of the ship. Lines two, three, four, and five are five-inch lines and are used as spring lines, to control fore and aft movement. Lines two and four check headway and lines three and five check sternway.

▶ *A warping capstan aft and an anchor windlass forward.* The anchor windlass is fitted with a gypsyhead for handling lines. The gypsyhead and the capstan are usually used with the breast lines in mooring evolutions.

▶ *A keel-mounted rubber sonar dome.* The dome is 20 feet aft of the anchor hawsepipe.

▶ *Helo safety nets mounted outboard of the hull.* A lot of shore intermediate maintenance activity sailors have made a career of repairing the fiberglass net frames. Whether yours are aluminum or fiberglass, you can easily decertify your flight deck with a misplaced tug or a sloppy landing.

▶ *Sharp sides.* No, we're not talking about your paint job. We're talking about the angle between the side and the main deck. This is particularly important when mooring alongside another FFG. Returning from sea you will usually be riding higher than your sister ships, which is a perfect way to make an impression. The areas below the bridge wing and the hangar sides are the most vulnerable. Hand-tended fenders are essential here.

If your FFG is going to be held off the pier or another ship with camels, the camels need to be placed between the masker belts. This is the only place where the sides stay vertical for any depth below the waterline. If the camel is fore or aft of the masker belts, your FFG may ride up and over the camel because the slope of the hull.

"Different ships, different long splices," is the old saying. Just as there are many ways to handle an FFG, there are also different ways to give conning orders. Find out what's in style on your ship before your first watch.

Engine Orders: Some differences include giving engine orders in feet of pitch for low-speed maneuvering or giving engine orders in shaft rpm when alongside other ships for underway-replenishment (UnRep) operations. One variation on the second case is giving CCS engine control because they can read shaft speed to single rpm's. The bridge dial indicator can only read to the nearest five rpm's. I think all of these methods are unnecessary. Keep throttle control on the bridge and give engine orders in terms of knots or half knots. Even alongside during UnReps, half-knot engine orders will keep you on station without difficulty. Phrases like "ahead easy" are fine when talking to your tugmaster, but are imprecise to your bridge crew and should not be used.

APU Orders: APUs are another area of difference. Some ships call them thrusters, some "start" the APUs and some "energize" them. I prefer "start" only because that has been a standard command in the engineering world and APUs are not thrusters, as any ex-tank landing ship driver will tell you. Because the "head-to-head" configuration is often a convenient way to leave the APUs when making fine adjustments to the bow, the order "train the APUs head to head" can be used as a standard command. Remember the rule against having both APUs energized while head to head. The helmsman should always respond to a completed APU order with whether the APUs are "on" or "off."

Rudder Orders: Chalk one up for tradition, mates! If you can overlook that poor excuse for a wheel on the ship control console, you can give the same standard rudder orders your great-grandpappy gave in the Big One. As with all destroyer types, standard rudder is 15°, full rudder is 30°, and hard rudder is 35°.

Table 3 *Sample Conning Orders*

Right full rudder
Engine ahead standard
Indicate 12 knots
Train port APU to 120
Start port APU
Port APU is trained to 120 and on, Sir
Train port and starboard APUs to 180
Port and starboard APUs are trained to 180 and off,-Sir
Train APUs head to head
Port APU is 090 and off, starboard APU is 270 and off, Sir

Sample Orders: Table 3 lists some recommended conning orders for an FFG. They are not all-inclusive. They should be considered a supplement to the *Watch Officers Guide*. For the sake of clarity, orders will be indicated in bold type and responses in italic.

[1] Adm. Elmo R. Zumwalt, Jr., USN (Ret.), *On Watch* (New York: Quadrangle/New York Times Book Co., 1976), pp. 72–75.
[2] *Navsea Tech Manual*, S9234-AD-MMO-010/LM2500, Vol. I Pt. I, p. 3.2.
[3] FFG-7 Class Advisory 15/84, Commander Naval Sea Systems Command message, 061542z March 1984.
[4] *NavSea Tech Manual* 0963-LP-047 Retractable Auxiliary Propulsion System, pp. 2–11.
[5] Ibid., pp. 2–12.
[6] NavSea Tech Manual, Retractable Auxiliary Propulsion System, pp. 2–12.
[7] FFG-7 Class Advisory 38/80, revision one, APU Train Motor Overcurrent, Commander Naval Sea Systems Command message 082026Z January 1986.

A winner of the Junior Officer Shiphandling Competition as a lieutenant, Commander Becker has served on a variety of destroyers, frigates, an amphibious ship, and on Swift boats in Vietnam. He commanded the USS *Antrim* (FFG 20) from January 1986 until March 1988. Commander Becker is currently the surface operations officer for Carrier Group Six.

The USS *Ingraham* Last of the Breed, First of a Kind

By Commander Richard H. Purnell, U. S. Naval Reserve

The USS *Ingraham* (FFG-61), commissioned 5 August 1989, is the 51st and final USS *Oliver Hazard Perry* (FFG-7)-class ship delivered to the U. S. Navy. The *Ingraham* was constructed at the Todd Shipyard in San Pedro, California. Combat system integration was accomplished by Unisys Corporation, Defense Systems, primarily at the FFG-7 Combat System Test Center (CSTC) in Ronkonkoma, New York. The U. S. Navy FFG-7 ship construction program will end after almost two decades when *Ingraham* completes her post shakedown availability in early 1990.

Combat system development work for the USS *Oliver Hazard Perry* (FFG-7) began in 1972 at the Sperry (now Unisys) land-based test site in New York, which featured a physical mock-up of the combat system, including a functional combat information center (CIC), equipment rooms, and live radars. Weapon system simulators and a dedicated simulation support program provided realistic FFG-7 combat environments for CIC operations.

Development progressed through four baselines using the Combat System Test Center as a working laboratory before the Navy approved the final *Oliver Hazard*

Special: The FFGs—Part II

Handling the FFG-7

By Commander John J. Becker, U.S. Navy

EDITOR'S NOTE: *This is the second part of a two-part feature on shiphandling characteristics of the* Oliver Hazard Perry-*class guided-missile frigates. Part I appeared in the January* Proceedings.

Vector Logic for Black Shoes

The F-14 jocks have their vector logic grid for getting to the right station in fighting the outer air battle. Blackshoes soon learn that handling an FFG is simply a matter of controlling and balancing vectors—using all of the forces available to move the ship where you want it to go.

The Sternwalk Monster: Go look at the aft starboard side of any FFG that has been in commission for more than a few years and you will see the bites of the Sternwalk Monster. There are always those who don't believe or who forget. Never forget the Sternwalk Monster on an FFG.

The theory is that the propeller blades deeper in the water exert a greater force than those nearer the surface. The result is a side force; the fact that the propeller is at the stern cause the stern to "walk" to the side.

Imagine that someone replaced the controllable-pitch propellors (CCPs) with a giant truck tire. Then picture the tire touching the bottom. When the shaft turns, the stern will move as the tire rolls across the bottom. This is sternwalk.

On an FFG the shaft always turns clockwise when one is looking from astern, therefore sternwalk is always to starboard, regardless of engine order. Once you start the engines, the shaft begins to roll and sternwalk is created by the screw. Shaft rpm with one engine at idle is 40–45 rpm and 60–65 rpm with two engines on line.

Feeding the Sternwalk Monster: Anything you do to increase either propeller pitch or shaft rpm increases the sternwalk. Adding pitch in the astern direction increases sternwalk significantly more than ahead pitch.

Killing the Sternwalk Monster: You've got only two options: engage the shaft brake or shut down the main engines.

Caging the Sternwalk Monster: The best you can do under most situations is to neutralize an undesired sternwalk. Other than the screw, you've got only one other controllable force that acts on the stern—the rudder. This is the key. At very low speeds the main use of the rudder will be to control sternwalk. Right rudder will try to move the stern to port around the pivot point and neutralize or overcome the starboard sternwalk.

The rudder needs a water flow across it to be effective, usually at least three-knots on an FFG. With the FFG rudder behind the screw, the means you will have to use an ahead bell. Hold on a minute . . . now your FFG wants to go ahead at three knots. No problem. Use the auxiliary propulsion units (APUs) at 180.

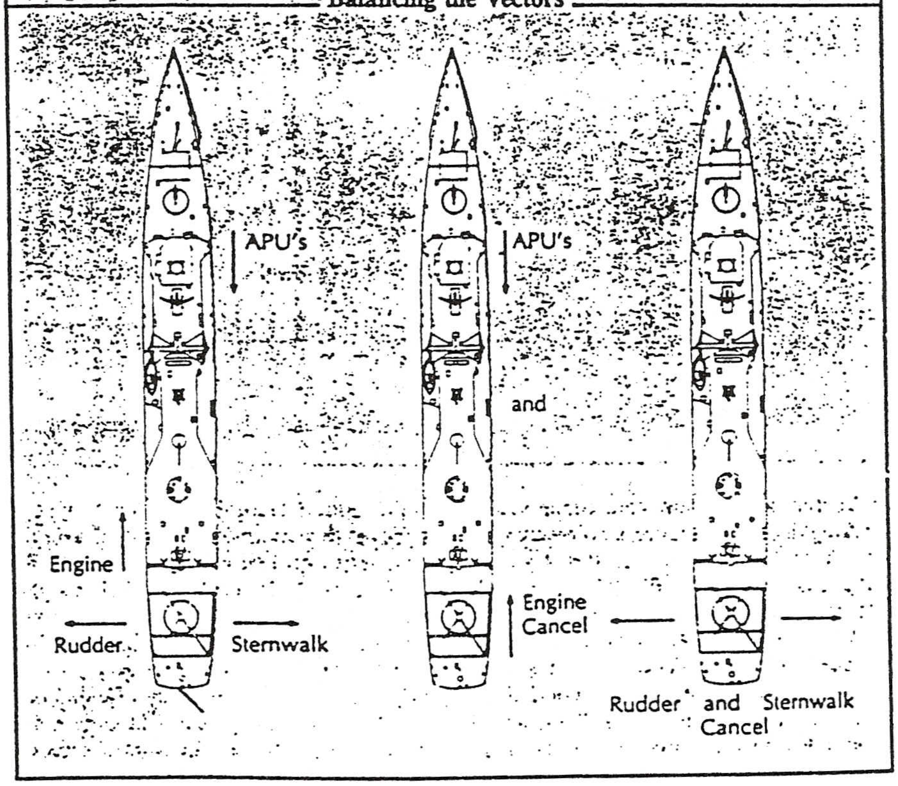
Vector Logic: Once you understand how to balance the vectors, it's relatively simple to move your FFG by unbalancing them. You will almost always want to use a combination of engine, auxiliary propulsion units, and rudder:

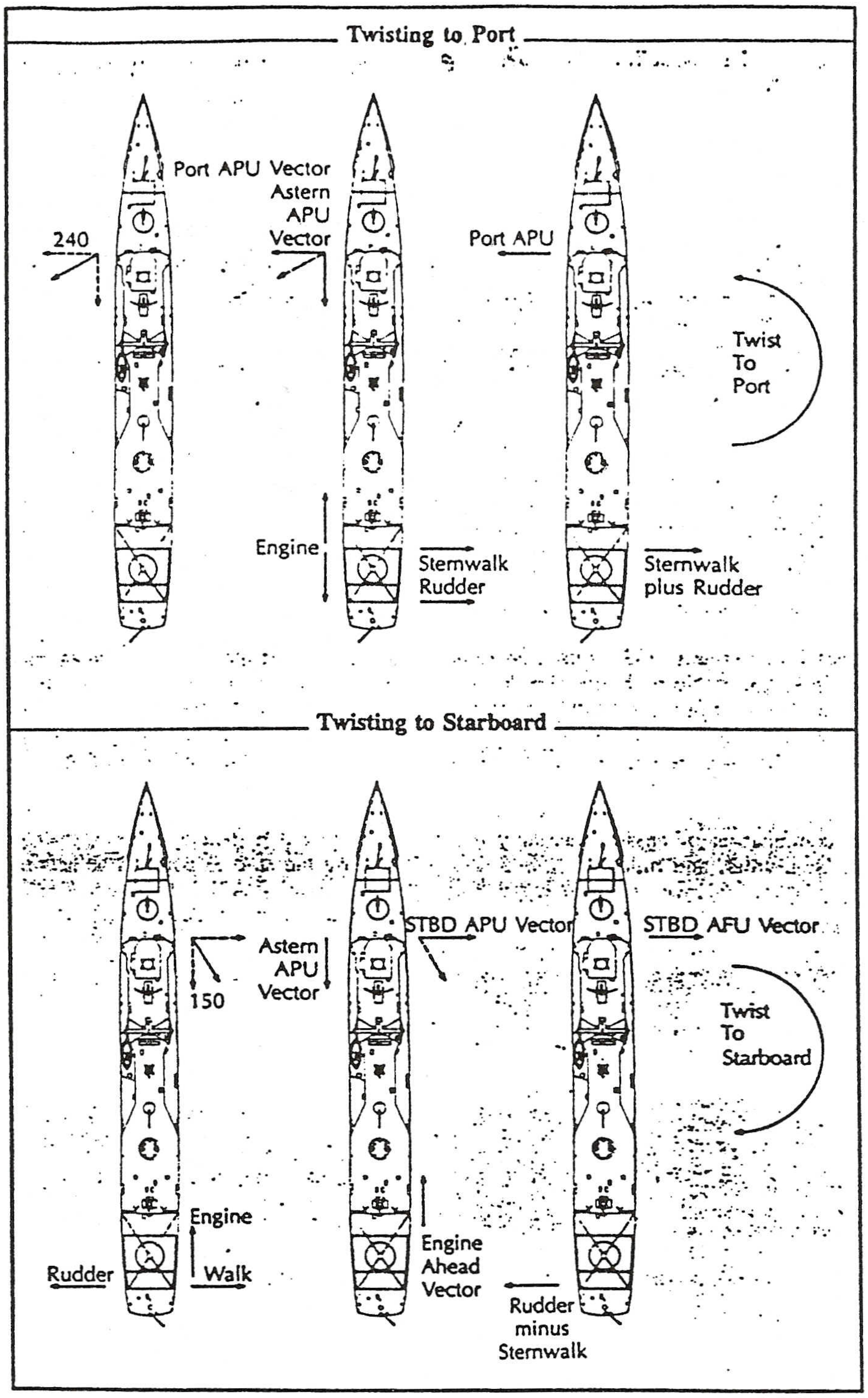
- APUs to balance the main engine and move the bow.
- Rudder to oppose or increase sternwalk.
- Main engine to move the ship and to create flow across the rudder.

Let's get under way and start with some basic maneuvers:

Twisting: In twisting your FFG, the shortest way may not always be the most direct route. If you're twisting to port, then the sternwalk helps you. What's more, you can increase the sternwalk by rocking the engine from ahead to astern. You can't hurt the engine by doing this, because there is a special engine-control subprogram called the "crash-back processor" that takes over and protects the engine. Watch the water around the ship while you're rocking the engine, and reverse pitch as soon as you see the ship pick up either headway or sternway. Twisting the ship to port can be accomplished without APUs, but use the APUs

Balancing the Vectors





trained to port to help you. Since you're rocking the engine, there's no need to use the APUs to counter the thrust of the main engine. With two APUs energized, the maximum train to the left is 240.

Twisting to starboard is a lot slower because the sternwalk works against you. You can't rock the engines to good effect because each astern bell will create an overpowering side-force vector. The only thing you can do is power ahead with right rudder. Here the APUs will have to oppose the main-engine thrust so you probably won't be able to use them at the maximum side vector of 120. Let's start with APUs at 150. In this situation you will be adjusting both main engine pitch and APU train if you want to keep your FFG from getting way on. Remember, you'll need to keep the main engine bell greater than three knots to overcome sternwalk.

So now you're in the channel and the executive officer left his report chits on the pier. You've got the conn and the commanding officer tells you to twist the ship while staying in the channel. Your FFG is stopped with APUs extended.

Train APUs to 150.

APUs are trained to 150 and off, Sir.

Right full rudder.

Rudder is right full, Sir.

Engine ahead one-third indicate three knots.

Engine answers ahead one-third for three knots, Sir.

Start port APU.

Port APU is trained 150 and on, Sir.

Start starboard APU.

Starboard APU is on trained 150. Both APUs are trained 150 and on, Sir.

Now you notice the ship is starting to gather sternway. The astern component of the APU vector is overcoming the ahead vector of the main engine. You have three choices: train the APUs farther to starboard (increasing push on the bow to starboard and decreasing the astern vector); increase the main engine ahead thrust; or do both. You decide to increase the main engine only.

Engine ahead one-third indicate 3½ knots.

Engine answers ahead one-third for 3½ knots, Sir.

Now the twist increases but you start to gather headway. You decide to adjust engine, APUs, and rudder.

Increase your rudder to right hard.

Rudder is right hard, Sir.

Train port and starboard APUs to 170.

Port and starboard APUs are trained 170 and on, Sir.

Engine ahead one-third indicate three knots.

Engine answers ahead one-third for three knots, Sir.

Hard rudder gives you a bigger side vector and is a perfectly safe order with your sea-detail helmsman. An easy way to keep an overzealous helmsman from slamming the rudder into the stops is to order full rudder and then follow it with hard rudder after the indicator shows the rudder has reached the full position.

Back to your twist. You notice the headway has stopped but the rate of twist has slowed. Why? APUs at 170 have only a small starboard vector and the rudder at three knots will have a smaller port vector than it did at 3½ knots. But luckily you notice the jackstaff almost lined up with your desired heading and you make a mental note to twist to the left and do it the easy way next time.

Crabbing: No, seafood lovers, we're not talking about catching them, we're talking about walking like them—sidewise. Getting under way and mooring alongside a pier are the evolutions where the FFG's special handling characteristics are most useful. It is normally desirable to keep the ship as parallel to the pier as possible and move the ship in or out laterally—this is crabbing.

Once again, it's easier if the sternwalk is in the desired direction. If you want to crab to starboard, you will use the APUs to match the sternwalk. The main engine will oppose the astern vector of the APUs and the rudder will be used to control the sternwalk, either adding to it or opposing it.

You're alongside the pier, port-side to. With ships nested both fore and aft, you want to get under way by crabbing to starboard. The whistle just blew—you're under way!

Train port and starboard APUs to 120.

APUs are trained to 120 and off, Sir.

Left full rudder.

Rudder is left, Sir.

Start port APU.

Port APU is trained 120 and on, Sir.

Engine ahead one-third indicate three knots.

Engine answers ahead one-third for three knots, Sir.

Start starboard APU.

Starboard APU is trained 120 and on, Sir. Both APUs are trained 120 and on, Sir.

You notice the ship begin to move forward.

Train port and starboard APUs to 150.

Port and starboard APUs are trained to 150 and on, Sir.

That doesn't do it—you're still moving forward and that fantail on the ship ahead is getting closer.

Engine stop

Engine answers stop, Sir.

What have you done? You've momentarily killed your ahead vector, while leaving the astern component of the 150 APU vector to check the ship's headway. You're still moving to starboard because of sternwalk and the starboard vector component of the APUs at 150.

Now you notice the headway has stopped. Don't wait until you gather sternway to go ahead on the main engine—do it now.

Engine ahead one-third indicate 2½ knots.

Engine answers ahead one-third for 2½ knots, Sir.

Train port and starboard APUs to 120.

Port and starboard APUs are trained to 120 and on, Sir.

You didn't use at least three knots—why not? First, you are not trying to oppose the sternwalk, you're trying to assist it. Therefore, the effect of left full rudder need not be as strong as the side force; you will still get a starboard vector from the rudder even if it's not as strong as the side force. Second, by increasing pitch on the CPP you have increased the side-force vector. To keep your bow moving to starboard you've gone to the maximum side vector with both APUs—120. Now you notice your stern is going to starboard faster than the bow. You have no fore and aft motion.

Rudder amidships.

Rudder is amidships, Sir.

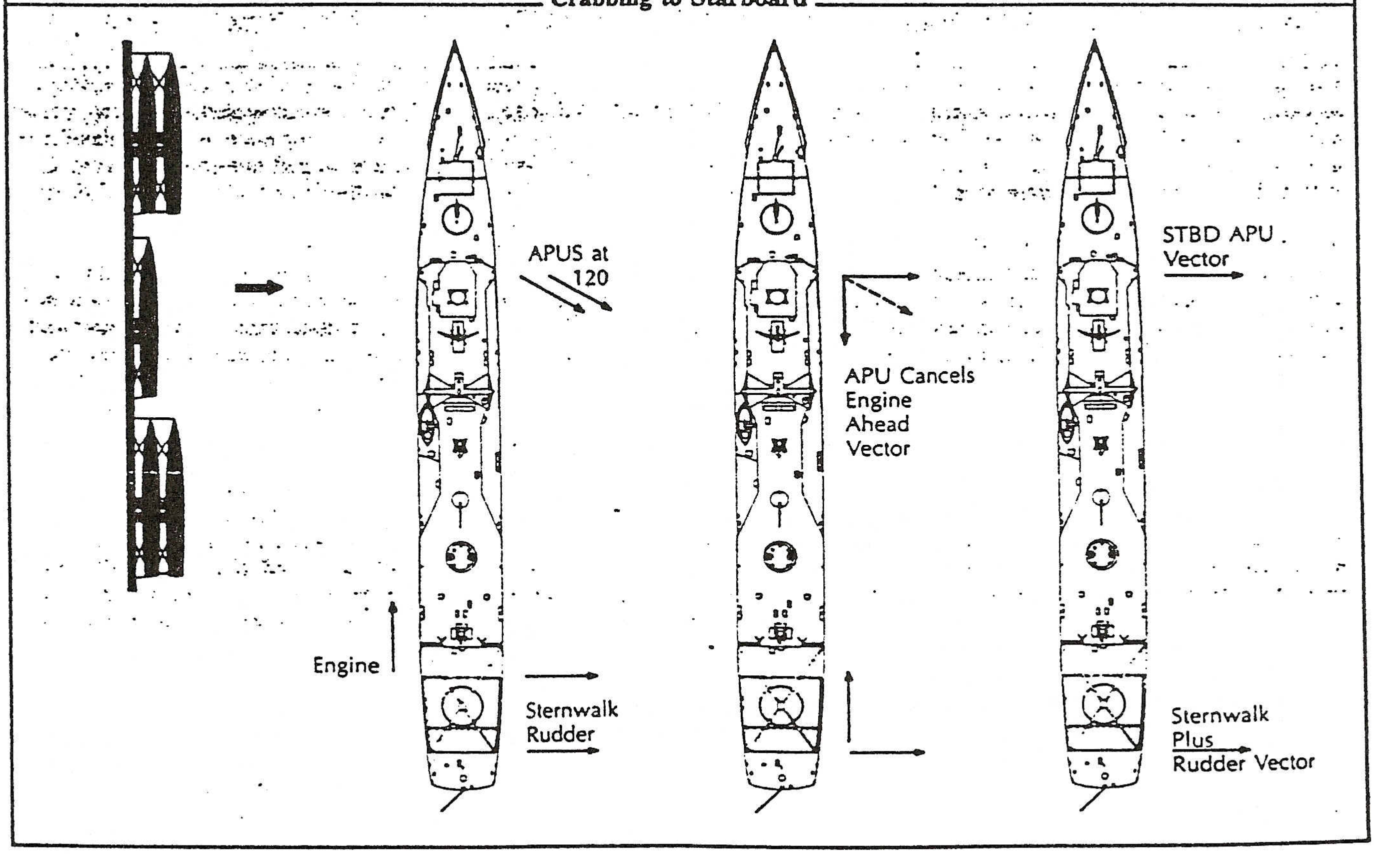
Now the ship picks up headway because essentially none of the wash from the CPP is being deflected by the rudder. How do you stop it and still let the bow move to starboard fast enough to catch up with the stern?

Engine stop.

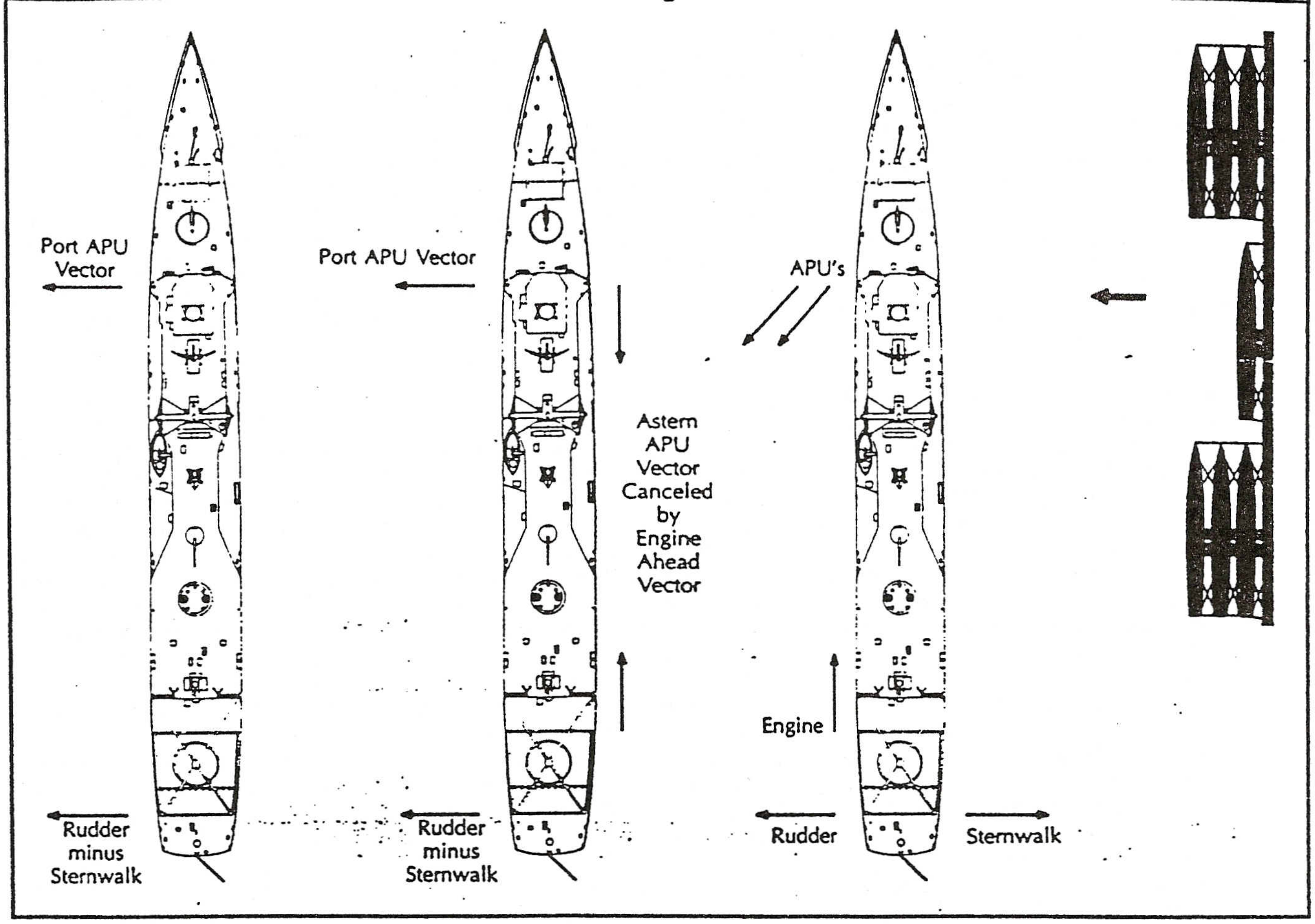
Engine answers stop, Sir.

You've done two things: reduced the sternwalk vector by reducing pitch and avoided reducing the APU starboard vector by not training the APUs farther aft.

Crabbing to Starboard



Crabbing to Port



But now you have an unbalanced astern vector from the APUs. No problem. Use an ahead bell as soon as the headway has stopped. If the stern is still getting cocked out too far you can order right rudder while going ahead on the engine. If the bow is getting cocked out faster than the stern, you can train the APUs farther aft and increase the main engine as necessary to counter the increased APU astern vector.

Crabbing to Port: Notice that when getting under way in the port-side-to scenario you've really got everything going for you because you're not opposing the sternwalk. Getting under way from a starboard-side berth is where we separate the old salts from the midshipmen. You can do it almost as easily, if more slowly, provided you don't have an onsetting wind or current. As in twisting to starboard, you will use right rudder and ahead thrust on the main engine not only to oppose the sternwalk but also to create a port vector at the stern. All lines are on deck. Under way.

Right hard rudder.

Rudder is right hard, Sir.

Train port and starboard APUs to 200.

Port and starboard APUs are trained to 200 and off, Sir.

Start starboard APU.

Starboard APU is trained 200 and on, Sir.

Engine ahead one-third indicate three knots.

Engine answers ahead one-third for three knots, Sir.

Start port APU.

Port APU is on trained 200, Sir. Port and starboard APUs are trained 200 and on, Sir.

Notice that you did not use the full port vector of the APUs at 240 to give more of an astern vector. You'll need at least three knots ahead on the main engine to get enough port vector from the rudder.

As your FFG moves away from the dock the stern begins to move faster to port than the bow.

Train port and starboard APUs to 220.

Port and starboard APUs are trained 220 and on, Sir.

You've increased the port vector on the APUs and decreased the astern vector. Now the ship starts to creep ahead.

Engine ahead one-third indicate 2½ knots.

Engine answers ahead one-third for 2½ knots, Sir.

Now the bow is moving to port faster than the stern. Why? You forgot to keep at least three knots of water flow across the rudder. This is okay for a short period because you want the bow to catch up with the stern in moving to port, but if you leave the main engine like this for too long the sternwalk will take over and move the stern to starboard. You decide to split the difference between your two previous APU orders.

Train port and starboard APUs to 210.

Port and starboard APUs are trained to 210 and on, Sir.

Engine ahead one-third indicate three knots.

Engine answers ahead one-third for three knots, Sir.

Backing: You would think backing a ship would be easy. They go ahead without any problems—why not go astern?

An FFG, like all single-screw ships, doesn't want to back straight. You can go astern all right, but keeping the ship going where you want it to calls for some clever shiphandling. The problem, as always, is our old friend the Sternwalk Monster.

Once you put on astern pitch on the CPP you cause a major increase in the sternwalk vector. Since you have also directed the screw wash away from the rudder, you have caused a major reduction in rudder effectiveness. Earlier we said that you needed at least a three-know ahead bell to make the rudder take effect. Going astern you will need to gather about three knots sternway. For the rudder to overcome the sternwalk vector, however, you will need to reduce the sternwalk as much as possible—"Take off that backing bell, Mister!" Use the FFG driver's secret weapon—the APUs.

With these thoughts in mind, let's look at some ways to back. Remember, there are several. With luck you may not need any other combinations, but one of the secrets of good shiphandling is to use everything available. Some backing possibilities include:

▶ Main engine stop, APUs at 160, rudder amidships. The vectors don't quite add up right, but once you gather sternway you will have remarkably little sideslip to starboard and can use the rudder to control the stern.

▶ Rocking the engine and shifting the rudder. It takes a little practice to get the rhythm but it works. With APUs at 180 and right hard rudder, go ahead one-third for five knots. As soon as the stern is moving to port, back the engine one-third and shift the rudder. Don't wait until the stern begins to move to starboard before shifting the rudder and going ahead again. The trick is to rock the engine and shift the rudder just fast enough to keep the ship moving astern without the stern oscillating like a rattlesnake.

▶ APUs at 180, right hard rudder, engine ahead one-third for three knots. This is probably the safest and the easiest, particularly before you have sternway on. Here we go back to our first vector diagram, and remember that it takes about 4½ knots to overcome the astern vector of both APUs. The net result of this arrangement, therefore, will be an unbalanced astern vector. Once you gather enough sternway, then you can stop the main engine and use a combination of APU train orders and rudder to control the ship.

Shiphandling Evolutions

For most evolutions you will use one or more of the basic maneuvers discussed earlier—twisting, crabbing, backing, and, or course, going ahead.

Making a Landing: During the approach, you can leave your ahead bell on a lot later than you can in most other ship classes. Don't forget to keep control of the stern with at least three knots of water flow, and don't forget that you can use the APUs to slow the ship's headway. When you ring up all stop you will, by decreasing pitch, cause the CPP blades to "close," thereby creating a lot of drag. The fast response of the CPP and the gas turbines plus the crash-back processor are other reasons to keep your ahead bell on. During the final stages of a landing, I like to stop parallel to the pier 20–40 feet away and then crab sideways up to the final mooring position. This distance is close enough to start getting lines over, and it also prevents the sharp sides from damaging another ship when mooring in a nest.

The conventional wisdom for making the approach to the pier is to make a shallow angle to the pier for a port-side siding landing and wider angle for a starboard-side makeup. The key point, as always, is whether the sternwalk helps you or not.

In the port-side case, the sternwalk moves the stern away from the pier and cocks the bow toward it. The solution is to make as shallow an approach as possible and, when the lineup is good with the pier fore and aft, to crab to port. Getting line six over as early as possible is important. Once six is over and led to the warping capstan, you've go the Sternwalk Monster all tied up. Now you can move the bow in with the APUs.

Starboard-side-to landings are easier because the sternwalk assists you. The wider approach angle allows you to get bow lines over before the sternwalk twists your bow away from the pier. Once again, use APUs to help you crab into the pier while parallel to it.

In actual practice, remember that you will almost always have something keeping your landing from being routine. Usually it's the wind and the presence of obstructions or other ships that cause you to use a combination of maneuvers. I will discuss two landings that occurred in Mayport, both with strong offsetting winds.

The first was a port-side-to landing astern of a CV tied starboard-side-to. There was a 15-knot wind blowing directly off the pier. Returning from sea, we lowered APUs prior to entering the basin and twisted to starboard in the lee of the moored CV. Because of some barges aft of the CV, we couldn't make as flat an approach as we would have liked.

As our bow passed the stern of the carrier, the full force of the wind tried to blow the ship away from the pier. To offset the wind, both APUs were used, trained to 240. Because this also gave an astern vector, we were able to keep the main engine ahead for five knots. This did two things: It kept the ship moving ahead slowly, and the greater wash on the rudder allowed the rudder to overcome both sternwalk and wind.

Once the stern was clear of the barges, rudder was increased to right hard to move the stern upwind to the pier. On this particular day, our mooring capstan aft was out of commission, but we were still able to get the ship alongside nicely and hold her in position against the pier. Although we had a tug standing by in the center of the basin, we never used it.

The second occasion was a starboard-side landing, only this time we were required to back in alongside another FFG past a destroyer tender with an minesweeper outboard. There was a 20-knot offsetting wind.

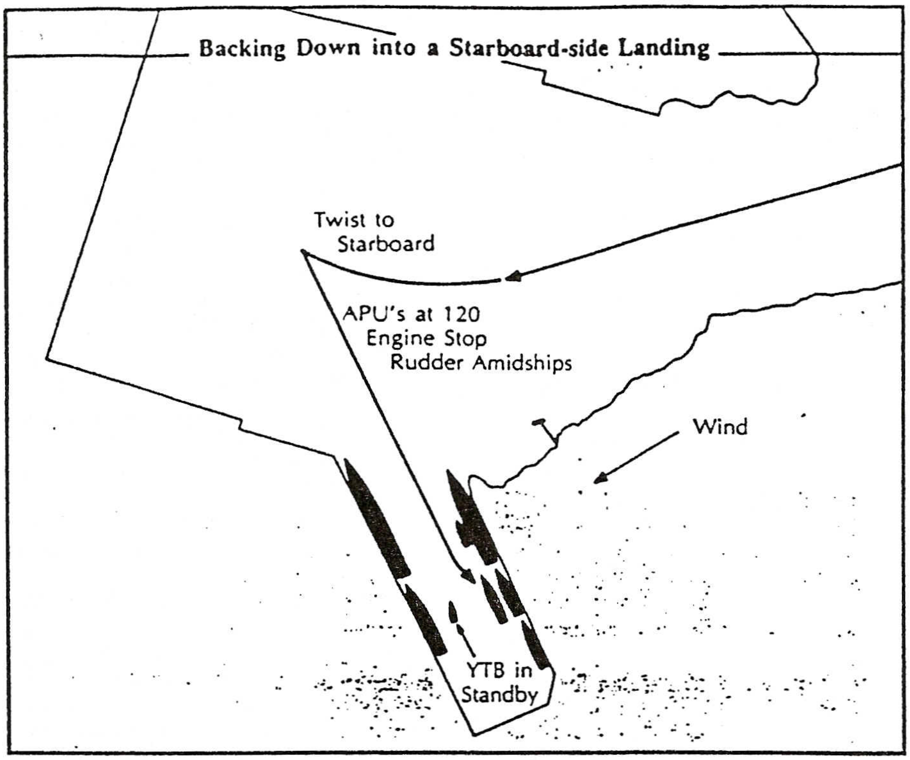
Because of the high wind, our game plan was to go as close as possible to the tender and the minesweeper, and not get caught in a situation in which we had to crab upwind. I don't think we could have done this anyway in the wind we had. We stationed the standby tug downwind in case the wind overpowered us.

Returning from sea, we started our twist to starboard early because we knew we would be getting blown downwind and we wanted to end up with our stern fairly close to the port bow of the tender.

As we came out of the twist to starboard, we initially tried to back with rudder amidships and APUs at 160. Because of the angle and strength of the wind, the bow kept falling off to port. To correct this, APUs were trained farther to starboard until the ship was moving straight astern. With the 20-knot wind it took both APUs at 120 to hold the bow into the wind.

We let the astern component of the APU vector move the ship aft. This worked fine until the stern was downwind of the tender. With the tender blocking the wind (as we wanted it to) aft, the Sternwalk Monster took over and began to move our stern toward the minesweeper. To correct this swing, rudder was placed at right full and a short burst ahead was given on the main engines. Once the ship was straightened out, the engine was stopped and the rudder shifted to left full. As the ship moved astern, the left rudder offset the sternwalk and we slid alongside the other FFG nicely.

Once alongside, we kicked the main



engine ahead to kill our sternway and stopped the APUs. We never had to call the tug.

Towing: The first thing to do is to break out Volume One of the *Ship's Information Book*. It has diagrams of the rigs for both towing and being towed. Most ships rig messengers up both sides to let the CO change his mind once he's decided to make a port-side approach. I recommend tying off the messengers with rubber bands rather than marline. The sailing community has been doing this with their spinnakers for years. It's a lot easier than having some poor boatswain's mate running down the side, tripping over coamings and cleats while trying to cut the marline lashings with a dull knife. Rubber bands will hold the messenger and break when they are supposed to—as the other ships haul in.

The unique shiphandling abilities of an FFG are especially useful in towing. Lower your APUs as you watch the drift rate on the other ship. A good seaman's eye is essential here. Remember, unless there is no wind or current you will be maneuvering on a moving ship. There are several ways to approach the ship to be towed. Most Navy ships use one of three methods. One is to come up from behind, pass parallel to the ship to be towed while putting lines over, and then stop in front of the other ship for passing of the towing hawser. The advantage of this method is the east of getting the lines over. The disadvantage is you must correct for drift.

The second method is the "cross the tee" approach at a right angle to the other ship's bow. The advantage here is that, for a ship lying broadside to the wind (like another FFG), your approach is not as dependent on the other ship's drift. Drift will be compensated for with your main engines as you slow and stop. The disadvantage is that you can't put lines over until the last moment and you give your gunner's mates much smaller target.

The third type of approach is just a combination of the first two—at an angle between parallel and 90°. Naturally you have some of the advantages and disadvantages of the other approaches, depending on the angle.

Another decision is whether to make an upwind or downwind approach. I like to have an escape route in cast things don't go as planned. With the quick response of an FFG plus the fact that approaches are limited to five knots with APUs down and upwind, a portside-to approach is ideal if the wind is not too strong. A crash-back will let the sternwalk keep the stern away from the other ship, and APUs at 120 will keep the bow out of harm's way.

Conning while towing should be by portable radio. You may start on the bridge, but walk aft on the 02 level as your FFG passes the other ship. Keep yourself positioned where you can see the action on both ships. You will end up on the after end of the 02 level, where you can see the hawser being passed. Once you get your stern by the other ship's bow, you will need to give a series of rudder, engine, and APU orders to keep the stern close to the other ship's bow. APUs at 180 and engine ahead for three or four knots will let you move your stern into position. You may also need to crab downwind. The necessity for these commands will decrease once your FFG begins to match the other ship's drift. In an actual rescue the other ship will probably not have power to her capstan, so keeping the two ships close together is essential. That's a very heavy cable to lug on board by hand!

Once they're hooked up, stay aft where you can see the strain on the hawser. Let the officer of the deck on the bridge keep a watch for contacts ahead. Now it's time to go ahead on the main engines. Start slow. Engine ahead for two knots is a good place to start. Once the hawser begins to stretch out, the towed ship should veer chain. For a towing exercise with another FFG, there shots should be sufficient. For an actual tow, you will want a lot of chain. The chain adds weight to the tow rig and acts as a shock absorber. The ideal tow length puts both ships "in step," meeting the seas at the same part of the ocean swell.

Once chain is veered, the towed ship will pass chain stoppers. Retract the APUs and work up to towing speed. Go up in half-knot increments and watch the hawser. Ensure that there is always some catenary (dip) in the hawser. The traditional rule of thumb is never to put enough strain on the hawser to cause it to come completely out of the water. When towing another FFG, you can come up to 12 knots on the engine and make about eight knots through the water.

To cast off the tow, slow gradually and lower APUs as your FFG's speed through the water passes below five knots. Once again, station yourself aft on the 02 level until all lines are on deck and you are clear of the other ship.

Underway Replenishment: UnRep alongside is just about the same as with other ships. At UnRep speeds, the sternwalk is compensated for by the helmsman, without him or you realizing it. As is common practice on all ships, give courses to steer instead of rudder angles. Give engine orders in knots and half-knots.

Probably the biggest difference from steam-powered ships is the rapid acceleration and deceleration associated with gas-turbine engines and controllable-pitch propellers. You will have to wait much longer during the approach before slowing to Romeo speed. How soon depends upon how much faster than Romeo speed you make your approach. This takes practice, so don't expect to get it right the first time. If you're going to overshoot, just make a bold speed reduction to about eight knots for a moment and then go back to Romeo speed.

Man Overboard: Forget the APUs for this one; there isn't time. Fleet Exercise Publication (FXP-3) standards fór this are: ship recovery—less than six minutes (maximum points three minutes or less); boat recovery—less than eight minutes (maximum points five minutes or less).

▸ *Ship Recovery:* Achieving the maximum is tough. Because of sternwalk, your FFG will always turn faster to port. If it's for real and the man is behind the ship, turn to port. If not, turn toward the side the man went over. This swings the stern and the screw away from the man. Once you get about 60° off your initial heading, give rudder amidships for about five seconds. This will elongate your circle, but it will allow you to steer toward the man during the last few yards of your approach. Approach so as to get upwind. With the sail area of an FFG, you will begin to drift downwind even before you are dead in the water (DIW). As you slow on your approach, remember the sternwalk and use right rudder as necessary. Use ahead flank while coming around and back full to stop. You want to be fast, drill or not, and the crash-back processor will protect the engines.

At night or in low visibility use a Williamson turn to retrace your track. SWOs basic review: After turning toward the side where the man went over, shift your rudder when you pass 60° from your initial heading. Steady on the reciprocal of your original course.

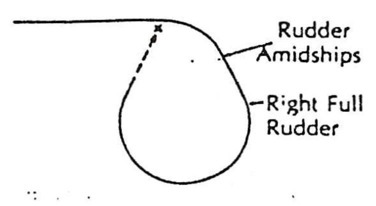
▸ *Boat Recovery:* For a boat recovery, crash back and get the ship DIW as close as possible to the man.

Anchoring: There are two schools of thought here and they seem to depend on who is watching you. In a graded precision anchorage (i.e., your GITMO big brother is watching), it's probably safer to use the APUs to control the bow as you prepare to drop the anchor.

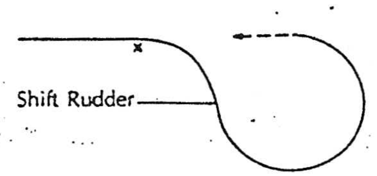
As you ring up all stop and coast up to the precision anchorage drop point, the helmsman will lose steerageway (at about three knots, right?) and your FFG will try to twist to port as a result of sternwalk acting around the pivot point. So, barring some action on your part, the bow will fall off to port, your FTG observer will chuckle to himself, and you will holler "Let go!" as your hawse continues to swing farther and farther away from the magic point on the navigator's chart.

So now you are sweating an extension of refresher training (Refra) because of

Modified Anderson Recovery



Williamson Turn Recovery



failed precision anchorages. What to do? Creep up on the damn drop point with both APUs extended head to head. Touch the port of starboard APU as needed to help keep the ship on course after slowing below steerageway.

Now you've finished Reftra and are headed to a well-earned liberty. You're to anchor in the lee of one of those sunny tropic isles. Do you really need APUs extended head to head. Touch the port or starboard APU as needed to help keep the ship on course after slowing below steerageway.

Now you've finished Reftra and are headed to a well-earned liberty. You're to anchor in the lee of one of those sunny topic isles. Do you really need APUs for this one? Probably not. You can make a precision anchor drop by minimizing the time your FFG is at speeds below steerageway. Approach your anchorage at five knots. When you get to about 100 yards from the anchorage, go directly from ahead one-third for five knots to back two-thirds for ten knots. The crash-back processor will take over. Just before your FFG goes DIW, give right full rudder to counteract the sternwalk. As you go DIW, order back one-third and let go the anchor. Once you have sternway, order stop. By this time the forecastle will be applying the wildcat brake and your anchor will take a good bite. You can then veer chain to get the desired scope.

This method will do several things. It will let you anchor without the need for APUs or a third SSDG. By not staying over the drop point, you avoid piling chain on top of the anchor. This will greatly reduce the probability of a fouled anchor. By having sternway on when the brake is applied, you will dig in the anchor right away. No doubts about whether it's holding or not. Don't wait for the wind and current to set your anchor.

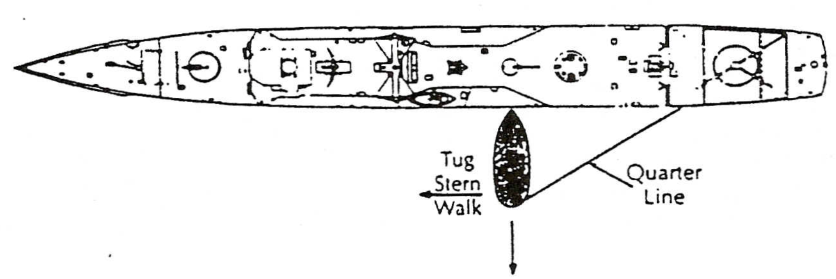
Using Tugs: "Dead stick" berth shifts are usually done by the harbor pilot using two tugs in a "power" makeup. All you do is watch. If it's a simple move and the snipes haven't torn down the main engines, do it under ship's power. It's a great way to get some extra shiphandling practice.

For almost all evolutions with ship's power and APUs available, one tug standing by is enough. You shouldn't need a tug with an FFG unless you've got an unfavorable wind or current. Then you will usually use them to help push into a berth or out of one. In these situations, make up the tug on a 90° angle aft of the torpedo tubes. Keep their bow away from those helo nets! Using a single APU at 270 or 090 will nicely balance a tug pushing in the same direction and cause you to crab evenly.

Most Navy tugs are single screw and have their own sternwalk problems. Unlike FFGs however, their sternwalk depends on what bell they have rung up.

Their shafts turn clockwise when viewed from astern and the tug is going ahead. The shaft reverses direction when going astern. Their sternwalk, therefore, is to starboard when the tug is going ahead and to port when the tug is backing. It is not uncommon for these single-screw tugs to lose steerage and end up

Tug Backing with a Quarter-line Rigged



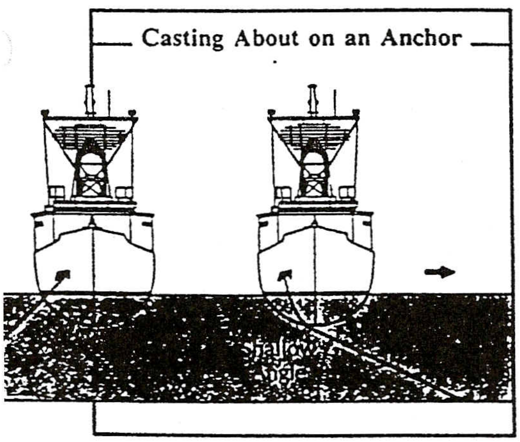
parallel to your FFG instead of "staying on a 90." If you don't give him a stop order, he will cause you to surge ahead or astern as he tries to recover his proper angle. Help the tugmaster out by rigging a quarter line (also called a stern line) from his fantail on the side opposite of his sternwalk.

There is a major safety concern here. If you get very much fore or aft movement opposite from the quarter line, it's possible to roll the tug over—that's right, capsize it. Unfortunately this sometimes occurs in the Merchant Marine.

A tug pushing ahead can usually keep perpendicular to your FFG with her rudder, so a quarter line will not be necessary; you may not even use a head line. If you have one of those twin-screw civilian tugs, a quarter line will not be needed here, either.

Orders to the tug are normally made with a working channel on the bridge-to-bridge radio and acknowledged by the tug with whistle toots. Once the tug is made up, she will report "ready to work."

Casting About Using the Anchor: I've had only one occasion to do this and I would bet most FFGs have never done it at all. The best discussions of using an anchor in shiphandling are in the SWO School handout "Shiphandling Destroyers" by John W. Schmidt, and in



Knight's Modern Seamanship. The anchor has been called the "poor man's tugboat." On most ship classes you can control the bow independently of the stern only by using tugs, mooring lines, or the anchor. On FFGs you have the APUs. Offsetting the APU advantage is that you have only one anchor and it's on the starboard side.

There are two ways to use the anchor in shiphandling. The first is to slow down movement of the bow, usually by dragging the anchor over the bottom as the ship is being worked into a berth. This is normally only for large ships and is not really applicable to FFGs; working against the anchor lets larger ships use more engine and rudder power, just like using APUs to oppose the main engine works for FFGs. (See *Knight's*.)

The anchor can also be used to assist in a turn or twist. For this purpose, the anchor is most effective when the chain tends under the keel. In other words, the anchor is opposite from the way you want to turn. This is because the chain will have a shallower lead angle with the bottom from the keel than from the hawse. On an FFG, with only a starboard anchor, this means a turn to port. Unfortunately turns or twists to port are what an FFG wants to do naturally because of sternwalk.

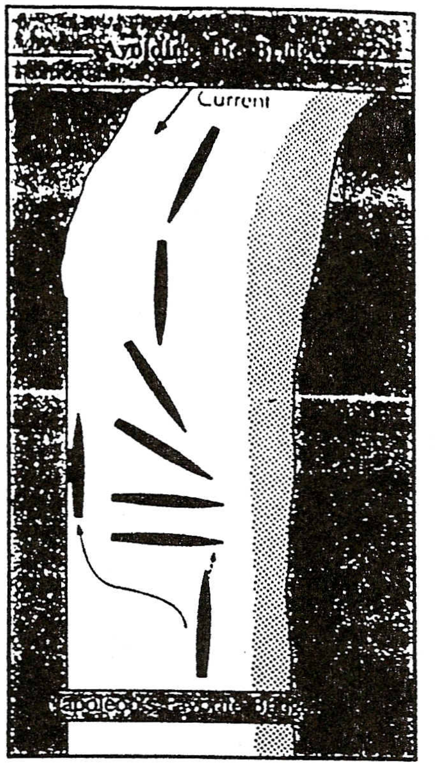
My one opportunity to turn on an anchor, the first time in 19 years of naval service, was in Bordeaux, France. Bordeaux is about 60 miles upriver. The river gets as shallow as 15 feet in some places, but there is also a 15-foot tide. By timing it right you can go upriver with the tide without danger.

Arriving with the tide, however, means that you also moor in a three-knot current. To make matters worse, you've got to do a 180° twist in a channel that's only about 500 feet wide. Downcurrent (upriver) of the berth about 600 yards is a low bridge built by Napoleon in the early 1800s. We had a French pilot on board and there was a tug standing by.

We started our twist about 1,000 yards upcurrent from the berth. We had left hard rudder and APUs at 240 for a maximum twist effect. Once we began to twist, it became very noticeable how fast the current was bringing us upriver. We got the ship broadside to the current, but the bow just wouldn't go any farther. As we passed the berth I asked the pilot to have the tug push on the starboard bow. The tug maneuvered into position but for some reason wouldn't come in and push.

By this time we were all looking with growing apprehension (fear) at the bridge. I had been using greater ahead and astern bells trying to kick the stern around until I finally ended up using ahead flank and back full. Remember, I could not allow real headway or sternway because of the narrow channel. By this time the French pilot had forgotten all his English and was yelling excitedly to the tug, which with much smoke and racing of his engine was approaching and then backing off our bow without ever touching us.

With visions of my ship pinned broadside to Napoleon's bridge in all of next day's newspapers, I ordered the anchor let go. I didn't need to use the bridge phone talker for that command. The calm



that descended after the anchor grabbed was deafening. We swung around, pointed at last in the right direction. After weighing anchor and proceeding to our berth, we needed a 3½-knot ahead bell to hold the ship in position while the lines were put over. It took several hours and more than a few drinks before my pulse rate returned to normal.

Some Final Thoughts and Reminders

- The Sternwalk Monster is really a paper tiger as long as you don't forget to correct for it.
- If the wind is greater than 12 knots, plan on using a tug assist.
- Don't count on sternwalk to help you, even if it's in the desired direction.
- Use the APUs together.
- Keep at least a three-knot flow over your rudder.
- Watch the stern for the best indication of turning.
- The APUs are our first choice for almost all close-in maneuvering situations, but your anchor may well be what saves you when things go wrong.

A winner of the Junior Officer Shiphandling Competition as a lieutenant, Commander Becker has served on a variety of destroyers, frigates, an amphibious ship, and on Swift boats in Vietnam. He commanded the USS *Antrim* (FFG 20) from January 1986 until March 1988. Commander Becker is currently the surface operations officer for Carrier Group Six.