ANCHORS AWRY

by

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Oh why, oh why did Uncle Sam
Build two ships not worth a damn
The Omaha *and the* Birmingham
In the armored cruiser squadron?

That was the refrain of a song that we sometimes sang late at night, after much beer and other liquid refreshment. It was World War II, and I was a Naval Reserve officer on active duty in the Bureau of Ships of the Navy Department, where I played a small but not insignificant part in the greatest military shipbuilding program in history.

There is a dirty little secret about war. If you are in no immediate danger of getting killed, it's great fun. Washington was not bombed like London, surrendered and occupied like Paris, or totally destroyed like Dresden. Instead, it was converted almost overnight from a sleepy little southern town into a pulsating hive of energy and activity. The population quickly doubled. A great deal of this increase was accounted for by young people like myself, drawn from all over the country to help with the immense planning and administrative problems of fighting what amounted to two wars at once. The problems were so vast and so urgent that if one showed any signs of competence and energy, one could be quickly promoted to a position of power and responsibility not usually attained until much later in life. Even the air that we breathed seemed permeated with energy and excitement, and we soon discovered the marvelous effect that a well tailored military uniform had on the attractive young women who seemed to swarm everywhere.

So we worked hard and we played hard. Every Friday, toward the end of the day, the corridors of the Navy buildings along Constitution Avenue would be filled with questions about where the party was that night. Because there was always a party, usually given by some defense contractor, supposedly for the officers concerned with his project, but not too closely policed, because there was plenty of money, and after all we were at war. If you made a good appearance and had an air of confidence and command, you could toss off a few drinks, scarf up some of the shrimp, and be off into the night looking for adventure, often ending up much later somewhere along the Tidal Basin, singing endless versions of "Roll Me Over in the Clover" and occasionally the song about the two unfortunate ships. But what was wrong with the *Omaha* and the *Birmingham*?

The trouble was that they were beasts to sail on in any kind of rough weather. In a storm they were like any other ship—they went through a complex series of motions that included rolling, pitching, and yawing. The most noticeable motion, and the one that usually sets stomachs to churning, is rolling. Apparently the *Omaha* and the *Birmingham* were famous for this. As we shall see later, this tendency to roll can be a strength rather than a weakness, but this knowledge is not much of a consolation when one is doubled over the rail.

The lateral stability of a ship is its tendency to constantly maintain an upright posture in relation to the level of the sea. This tendency is controlled primarily by two parameters: metacentric height and righting level. Both depend on the relative positions of the ship's center of gravity and center of buoyancy. The center of buoyancy is defined as the center of gravity of the volume of displaced water when the ship is floating normally.

The trouble is that until the development of computers the center of buoyancy was very difficult to determine accurately. Those of you who remember your calculus will remember Simpson's rule for calculating the volume of irregular solids. If you do, you will remember the enormous amount of calculation involved and the difficulty of finding integrable functions to define the boundaries. It is no wonder that early ship designers more or less gave up on finding a scientific solution to the stability problem and designed on the basis of rules of thumb drawn from past experience. Sometimes this worked and sometimes it didn't.

Men have been building ships for over ten thousand years, but progress has not been uniform. Instead, there have been periods of advance and retreat, with occasionally a real disaster. An early high point was reached with the Greek galleys that defeated the Persians at the battle of Salamis and saved Western civilization. Much credit must be given to the superior strategy of Themistocles and to the better training and motivation of the Greek crews. But these would not have been decisive against the much superior force of the Persians if the Greeks had not had better ships—faster, more agile, and more maneuverable—all qualities of great importance in the narrow waters into which Themistocles had lured his enemy.

Another high point was reached with the Yankee clippers that dominated the Asian trade in the early years of our country. These were probably the finest wind-powered ships ever built—fast, beautiful, and seaworthy enough to survive repeated passages of Cape Horn, the most severe test that a sailing ship can meet.

A notable low point occurred in the sixteenth century with the development of the great battle galleons. These ships carried as many as 120 guns, mounted on three decks, with a high stern castle so that gunners with small arms could shoot down on the enemy. All of this raised the center of gravity while increasing what engineers call the moment of inertia. As long as they could be kept afloat these ships were formidable fighting machines, but they were notoriously unseaworthy. This factor, as much as the skill of Drake and Hawkins, caused the almost complete loss of the great Spanish Armada that sailed in 1588 on what King Philip called "the enterprise of England."

These sixteenth century ships illustrate the fact that naval design involves constant compromise between competing interests, in this case between seaworthiness and battle capability. This struggle was still going on when I was in the Bureau of Ships.

Remember that stability is the tendency to stay upright in relation to the level of the sea, not the level of the horizon. When a wave passes under a ship the stable ship reacts quickly to the change in sea level. Then, when the wave passes under the ship, the ship reacts again in a reverse direction. Thus, the more stable the ship, the more violent its rolling action.

This is not at all what the gunnery people want. They want as little motion as possible, and that gentle, so they can lay their guns. And, of course, the naval aviators want as motionless a deck as possible to land on. These compromises are not easy, and any error can be deadly.

In the case of passenger vessels, compromise often involves the level of comfort. A stable ship is a safe ship, but it is not likely to be comfortable. During the great days of the transatlantic steamers in the 1920's and 30's competition was intense. The passengers made it very clear that what they wanted were speed and comfort. The gyroscopic stabilizer had not yet been invented, so the designers did the only thing they could—they bought speed and comfort at the cost of seaworthiness, shaving the envelope of safety as closely as they dared.

The fastest, most beautiful, and most elegant of these great ships was the French liner *Normandie.* When France surrendered to the Germans, the *Normandie* was in New York, having just completed her westward crossing. We commandeered her and began her conversion into a troop carrier. A workman's welding torch started a small fire and, when the fire boats poured in some water, the ship turned over. Later, the Board of Inquiry discovered that the *Normandie* had a negative metacentric height. This meant that, given any trauma, she was rather more likely to turn over than not. You may be sure that this fact was not widely known by the movie stars and other celebrities who crowded her passenger lists.

* * *

The navigator's a terrible tar
He shot the truck light for a star
And never can tell where the hell we are
In the armored cruiser squadron.

Modern ships know exactly where they are at all times. Information beamed from satellites and shore stations is processed into latitude and longitude by the ship's computer and displayed on monitors in the chart room and elsewhere if needed. The hapless navigator of our song was not so lucky. He had to use celestial navigation, an art finally perfected late in the eighteenth century after the development of accurate marine chronometers.

To mistake the mast head light for a navigational star is certainly an egregious error. But before you judge him too harshly let me take you in imagination through the procedure that he had to follow. It will start when you select three stars whose names and addresses are listed in the *American Ephemeris and Nautical Almanac.* You must then go on deck with your sextant, measure the altitude of each star, and note the exact time of observation.

The New American Practical Navigator by Nathaniel Bowditch has been the bible of this art for over one hundred years. It has this to say: "By selecting certain bright stars well located in azimuth and listing their altitudes and azimuths, the stars are readily identified in the heavens and are easily picked up in the sextant."

Nothing could be further from the truth. The night sky as seen from the deck of a ship at sea looks different from the star charts that you have been studying. The difference between the stars of first and second degree magnitude, so obvious on the chart, no longer seem at all apparent. When you look through the sextant the magnification makes the neighboring portions of the constellation disappear. You move the sextant a little and another star comes into view. Which is the right one? Well, you hope for the best and move the arm of the sextant down. Your objective is to bring the image of the star down until it touches the horizon.

But where is the horizon? Often a low lying bank of clouds creates a band of grey with no apparent boundary. But let's say that you have been lucky and there is a clear horizon line. You move the arm of the sextant until the image of the star touches it and say "mark" to the seaman who is acting as your assistant. He notes the time in hours, minutes, and seconds from the navigational watch that he is carrying, and you read and note down the altitude of the star from the vernier scale of the sextant. You repeat this procedure for two more stars and go below with your data.

You must now correct the times of observation to convert them to true Greenwich Civil Time. This involves applying two corrections, one to adjust for the difference between the navigational watch and the ship's chronometer, and the other to adjust for the accumulated error in the chronometer since it was last set and calibrated.

You must now make several corrections in the observed altitudes. You must correct for the known error of the sextant which you can read from a table inside its box. You must correct for the refraction of the atmosphere based on present barometric pressure and temperature, using a table that you will find in the *Nautical Almanac.* Finally, you must correct for the parallax error created because your observation was not from sea level but from the bridge of the ship, some thirty feet higher.

Now you are ready to go to work with your observations and the information in the *Nautical Almanac.* You will use the time-honored cosine haversine formula which involves a number of calculations that will end by developing two numbers. You will use these numbers and your parallel rulers to draw a line of position on the chart known as the Sumner line. The intersection of two of these lines yields the ship's position. The third serves as a check. Remember that calculators have not yet been invented so you must do all of this with pencil and paper.

If I have now persuaded you that this is a procedure with many opportunities for error, you are absolutely right. The first time I did it, while on a training cruise, I located our ship's position in Iowa, somewhere near Des Moines. And remember that I had the use of a hand calculator. My mistake was in transposing some digits in one of the quantities. The way to guard against this kind of mistake is to adopt the approach that we now use in programming computers—an almost fanatically meticulous concentration on each step, with frequent backtracking. Of course it helps a great deal to know exactly what you are doing, but this requires a firm grasp of spherical trigonometery, by no means the easiest branch of mathematics.

It helps even more if you are a genius. In every field of human activity, rare individuals emerge whose abilities so far transcend ordinary human capacity that they seem to be visitors from another planet. Mozart was one of these. Einstein was another. Michael Jordan is a third.

A friend of mine encountered one of these superhuman creatures while on a shakedown cruise, testing out the new light cruiser *Canberra* that we had built for the Australians. In these tests we would take the ship out into the Atlantic and put her through her paces, making high-speed maneuvers, firing all the guns, and generally having a great time playing with one of the most complicated pieces of machinery ever created. At this point the ship was not yet commissioned and therefore still technically the property of the contractor. Naval regulations did not apply so the atmosphere was quite relaxed. It was not unusual for each officer to find a bottle of Chivas Regal in his stateroom when first coming aboard. You may be sure that there was much competition to be allowed to participate in these tests.

When my friend sailed on the *Canberra* everything went very well except that there was a heavy overcast for the entire week that they were at sea, preventing any celestial observations. Under these conditions the navigator carries forward what is called a dead reckoning position, extrapolating forward based on the ship's course and speed. The trouble was, of course, that the tests had required many more-or-less violent changes in both.

As they prepared to return back to port, my friend and the navigating officer stood in the chart room looking at the dead reckoning position and wondering what it meant, if anything. The door opened and the captain came in. He looked at the chart and said, "That's not where we are, here's where we are," and made a mark on the chart some thirty miles to the south. He then turned and went back on the bridge. My friend and the navigating officer looked at each other and shrugged. Then they calculated the new heading and ~~gave~~ it to the officer of the deck. The *Canberra* swung through ten degrees of arc and steadied on her new course. Four hours later the lookout raised Cape Henry light, ahead on the starboard quarter, exactly where it should be.

* * *

> *The Engineer's a terrible joke*
> *As along at seven and a half we poke*
> *And fill the ocean full of smoke*
> *In the armored cruiser squadron.*

Well, seven and a half knots would not cut it, even in the period before the First World War. The engineer officer should have been able to get twice that with what he had to work with. But he was not to blame for the smoke.

The *Omaha* and the *Birmingham* were each driven by two screws powered by triple-expansion reciprocating engines that drew their steam from six boilers, heated from fire boxes that consumed prodigious quantities of bituminous coal. The coal was stored in bunkers that ran along the two sides of the ship and extended for its full height. When the bridge rang down for flank speed, the chief machinists mate would turn up the big blowers that sucked air into the boiler room, and the black gang would go to work, shoveling coal from the bunkers onto the deck plates and then into the fires. Except in cold weather, this was one of the most miserable and exhausting ordeals that men have ever been called on to suffer. Not infrequently, men would collapse, and when that happened they would be hauled up on deck, hosed down until they were conscious, and then sent back down. However, there was no way to prevent the smoke, which rose in a column that could easily be seen from over the horizon.

After the First World War coal was replaced by oil, and steam engines began to be replaced by diesels. When I arrived in the Bureau of Ships, diesels had been accepted as the preferred power source for all smaller ships.

However, in the Bureau at that time there was a small but passionate group of engineers who still carried the torch for steam. They believed that with new technology they could use very high pressures, up to 1200 pounds per square inch and more, to drive high-speed turbines and achieve performances that the diesels could not match.

After much bitter controversy, they finally got approval to build two destroyer escorts as a test using this system. They failed, not because the the basic concept was wrong, but because the engineers were never able to solve the related minor problem of providing a reliable source of feed water to the high-pressure boilers.

And so the last effort to revolutionize steam power passed into history. It is ironic that the same technology that these renegade engineers were promoting could be used today to produce a steam-powered automobile that would be non-polluting, efficient, and economical. It will not be built, not because it cannot be, but because to our modern minds the era of steam has passed into history. Fashion rules technology as it does everything else.

* * *

And when Saint Peter tolls his knell
We'll drop our hook at the gates of hell
And the Executive he'll say "Very well"
In the armored cruiser squadron.

Throughout this strange and wonderful period we were all tormented by the feeling that we were not doing our part. We could not get away from the dark suspicion that somehow we were impostors. We held naval commissions, wore uniforms, and were saluted by enlisted men on the street. But instead of commanding ships and fighting battles we worked at desks, doing much the same sort of thing that we did in civilian life.

I was well aware of Dr. Johnson's observation that he who has not fought in battle will always think himself less the man. Each month, as permitted by naval regulations, I filed a formal request to be transferred to sea duty. Each month it was refused, on the very sensible grounds that my abilities were being better used where I was. The fact that this made sense did not detract from the uneasy feeling that I was cast in a false role.

We shared another dark secret. Behind the excitement and the febrile gaiety, behind the partying, drinking, and sex, lay the terrible knowledge that many of the beautiful ships that we launched would end up at the gates of hell. One that did was the *Canberra.* On August 9, 1942 off Savo Island, near Guadalcanal, she met the main force of the Japanese battle fleet under Admiral Mikawa. She was taken under heavy fire. The captain was killed on his bridge. Fires broke out and the engines were disabled. The forward magazine exploded. Finally, she was torpedoed and sunk. The cruiser *Patterson* was able to save some of the crew, but all of the rest perished. Her position at that time was 9 degrees 13 minutes south, 159 degrees 54 minutes east.

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