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Basic Ship Types & Their Uses (Part 1)

by

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Ships come in a multiple of types predicated on their purpose. They come in small sizes of under 100 feet (32.8m), up to over 1400 feet (427m). In this brief course we will explain various ship types and their uses, what characteristics distinguish them, and how to recognize them when you see them.

Bulk Cargo Ships

Cargo ships come in many of types depending on the type of cargo they carry. The purpose of these types of ships is to make money for the owner by carrying cargos from one place to another. These days cargo is either some form in bulk, such as coal, oil, chemicals, wine, water, cement, ores such as nickel and iron, containerized freight carried in standard sized boxes, “break bulk” freight which is a bunch of crates of various sizes, machinery, smaller boats, live animals, refrigerated cargo, and many more.



Figure 1: Bulk Carriers are distinguished by their multiple matches. This one is not capable of self-unloading and must tie up to a dock with loading/unloading cranes and conveyor belts

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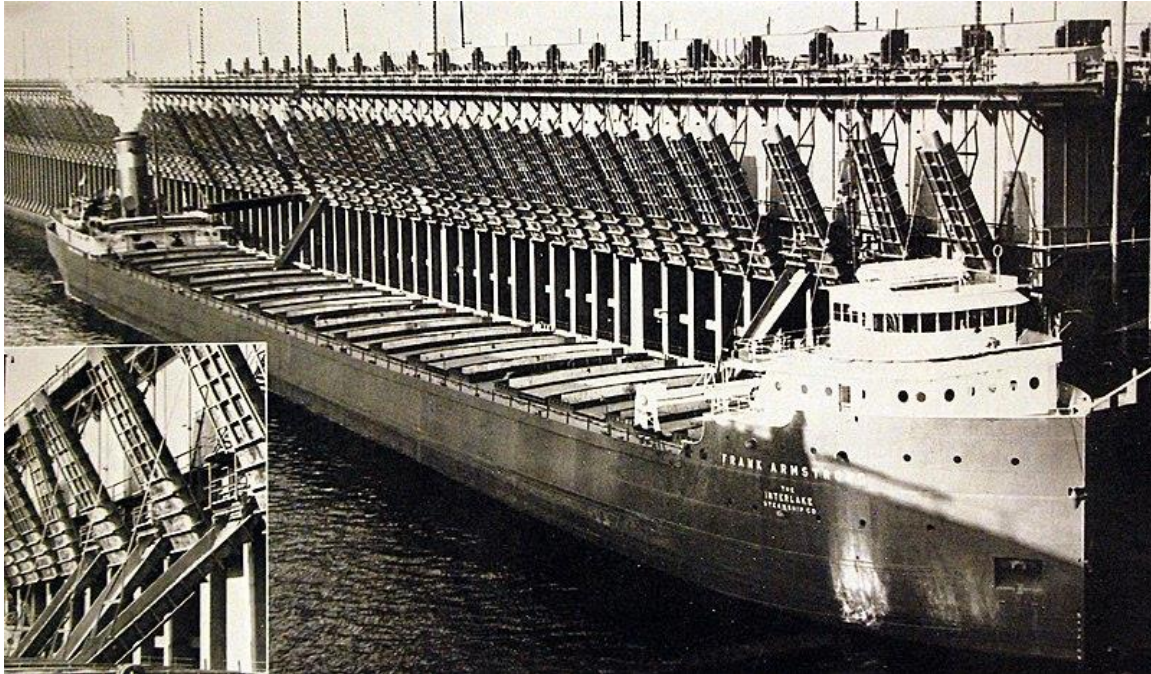


Figure 2: Great Lakes Iron Ore Carrier loading at the dock. Most of these are quite old because the hulls do not rust as much in fresh water, so they have much longer working lives.



Figure 3: This is a self-loading/unloading bulk carrier, distinguished by the large cranes capable of reaching all the cargo holds.



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Roll On-Roll Off Cargo Ships



Figure 4: This is a Roll On-Roll Off car or truck carrier, which carries freight containers on trailers and/or cars that are driven onto and off the ship.



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Figure 5: Large Landing Craft RO-RO Carrier. These have a large ramp at the bow that drops down to allow vehicles to drive on and off. Many ex-military landing craft are in use today as inter-island cargo ships.

Liquid and Gas Cargo Carriers

Tankers ply the seas by the thousands, carrying various oils, chemicals, water, etc. as a liquid cargo in large quantities, and are among the very largest vessels afloat. In fact, the largest tankers are so big and so deep in draft that they seldom get into a harbor to dock—they anchor or tie up to an offshore mooring and smaller tankers called “lighters” come alongside and offload portions of their cargo and take it elsewhere on voyages of their own. These lighters may be as large as about 600 feet (183m) long, with much less draft than the largest tankers. The shallower draft permits them to travel up rivers such as the Mississippi, or into harbors, to offload their liquid cargo. These lighters may also offload some of their cargo to even smaller tankers that go to special receivers, such as chemical plants. A tanker generally looks like the picture below:

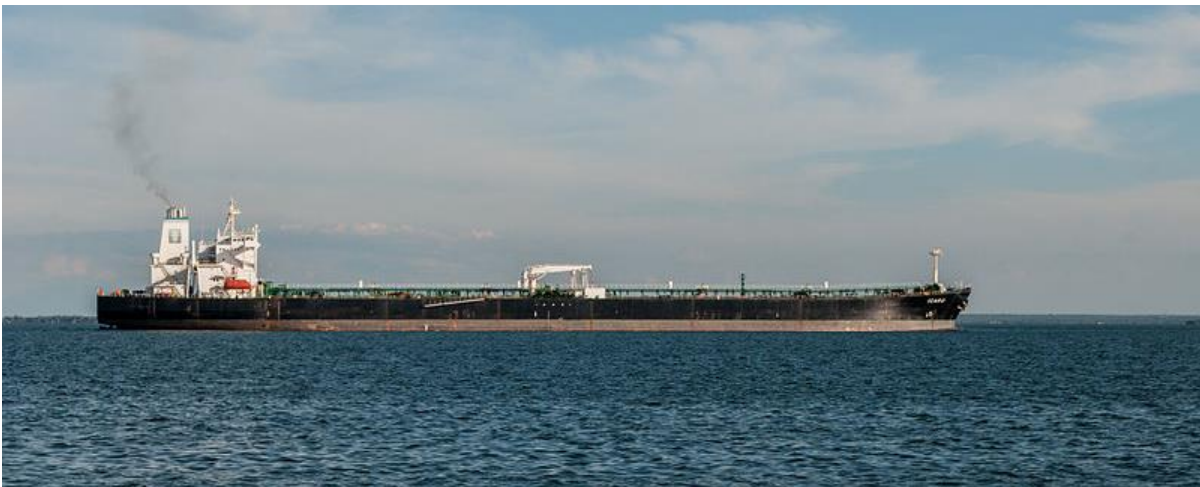


Figure 6: A large tanker distinguished by a lack of cargo masts

Notice that the deckhouse is tall and at the aft end of the ship, and that when loaded, the ship has a small amount of freeboard (the height of the ship above the water level). There are few masts on a tanker—just the ones required for the navigation lights, radars, and antennas, and perhaps some that hold the cargo hoses used for transferring the liquid cargo from ship to ship or shore. The deck has lots of pipes running on it to transfer cargos from one individual tank or filling point to another tank, or to the discharge station. When tankers are empty, they



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are quite a lot taller out of the water-the red portion in the picture below is the part that is submerged when the ship is full. You can see that when they are empty, they barely draw enough water to keep the propeller submersed! The economics of tankers is such that they make the most money by carrying the most cargo, so many of the largest ones are as large as man can currently engineer and build; and that's how it has always been since they first started being built in the 19th century. Tankers generally are 12-15 knot ships depending on how much the buyers are willing to pay to get the cargo there. They do not need to be faster, because the cargo doesn't spoil over time.

Liquified Natural Gas (LNG) tankers look similar to oil or chemical tankers, except they have large cryogenic tanks set into the hull, which usually stick up above the main deck.



Figure 7: LNG Tanker

A Floating Production Storage Ship (FPSO) is a special form of tanker, often an old single-skin type, that has been converted to serve as floating oil production storage to take the oil produced by an offshore well, waiting for the pickup by a regular tanker. The OPA90 ship design regulations outlawed single skin tankers, so some of those ships in better condition were converted to storage use.

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Figure 8: A tanker converted to an FPSO ship. An FPSO ship is similar to a tanker but it has additional piping and equipment on deck.

Container Ships

Container ships, like tankers, operate in an economic system where the ships that can carry the most cargo containers are the cheapest to operate, and therefore make the most money for the owners. With the globalization of world trade, container cargo lines have developed where ships that each carry thousands of containers make regular scheduled trips across the Pacific, Atlantic, and other routes all over the world depending on how much demand there is for their services. The cargo they carry started to be standardized in the 1960's, when the SeaLand Corporation invented the standard 20' and 40' long cargo container. These are 8' wide x 8' tall, made from corrugated steel, have twin doors at one end, and have hold-down points in the corners so they can be stacked and held in place on the ships and on truck trailers. You see them on railroad flatcars, truck trailers, and stacked in ports all over the world. The genius of these containers is that they are also the size of a truck trailer, so they are often lifted off the ship, then landed on a trailer, for the semi-truck cab to take to its destination. This method eliminated much of the cargo theft and damage that used to occur when break-bulk (crated) freight was the primary means of dry cargo transportation. Container ships are open on most of the main deck and the containers are stacked to the limits of the ship's stability and/or pilothouse visibility when full. The pictures below show a modern trans-ocean container ship.

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Figure 9: An older, 1970's style partially loaded containership



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Figure 10: A modern containership that is partially loaded by onshore cranes



Figure 11: A fully loaded, self-loading/unloading containership. These ships operate between ports that do not have the large cranes shown in Figure 4.

Some container ships are self-unloading, for use in smaller ports, but the large ones are all unloaded swiftly by shoreside cranes. Container ships are generally much faster than tankers, since they must make voyages on a regular schedule. Some were as fast as 40 knots, but the speed, like tankers, depends on how willing the customers are to pay extra for it.

Break-Bulk Freighters

A Break-Bulk Freighter is a type that carries many various and different cargo types, all loaded by cranes mounted on the decks. These are the older type cargo ships that you see in the old movies with lots of cargo masts and derricks on deck-the way it was done before the 1960's container revolution. Although the majority of cargo is now carried on container ships, there is still a place for these to carry vehicles, boats, odd boxes and crates, and other cargos that don't fit in a standard container to out-of-the-way ports.

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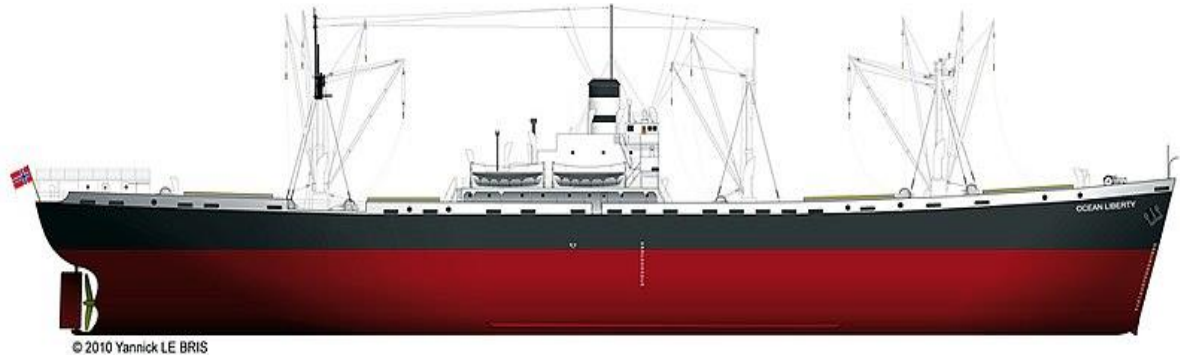


Figure 12: This is a Liberty Ship, a type of break-bulk cargo ship built in the U.S. by the thousands during World War II. These were sold cheaply after the war, and they continued to do the larger share of freight hauling until the containerships took over.

Heavy Lift Ships

Specialized heavy lift ships look quite peculiar, since they can either self-load with cranes or submerge the cargo deck to float on yachts, small ships, offshore construction assemblies, and various really large items. They have a tall deckhouse forward, a deep cargo deck aft, and they are the pickup trucks of the sea. See them below:



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Figure 13: A heavy lift crane ship that carries large loads on deck. This cargo is the leg of a jack-up offshore oil rig.



Figure 14: This is a semi-submersible heavy lift ship. Unlike the ship in Figure 13, this ship floods the ballast tanks in the hull so that the main deck is deep enough underwater for the cargo to float onto it, upon which they pump out the ballast water and the ship rises to the level in the picture.

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Figure 15: Another semi-submersible type carrying large container cranes to a port as cargo. This is a cargo that would make me nervous!

Passenger Ships

Passenger ships specialize in carrying passengers and their possessions, which sometimes include their vehicles and pets. These vary in size from small ferries, which carry perhaps a hundred or more passengers, cars, and trucks, across a river, harbor, or bay, up to trans-oceanic cruise ships and liners, which carry thousands of passengers. Passenger vessels must meet very stringent safety requirements and are highly regulated both internationally, and federally. The speed of passenger ferries varies for the same reasons as other ships-the price depends on how willing the customer is to pay to get there. The slower ones are often state- or federally subsidized, and the faster ones are usually not. Some states, such as Alaska, run a series of ferries up and down the coast of the lower state since highways are not very common. Ferries also are profitable in areas such as New York Harbor and Norway, where going around takes hours versus the short trip across the water.

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Figure 16: A small ferry for local passenger service in Germany



Figure 17: A new river excursion ferry on the Danube River. Europe has a booming business in luxury overnight river excursions

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Mid-size passenger vessels are often either excursion vessels, or they are ferries that allow the passengers to drive on and off, and they deliver them across wide expanses of water.

Roll On-Roll Off Ferries

These RO-RO (roll-on, roll-off) ferries are quite common in Europe and Canada, where fingers of land with bays between them make driving around cumbersome, or they make trips across from England to Ireland, for instance, a short, comfortable trip. These vessels often have passenger cabins if they do overnight voyages that last a day or so. They also offer many entertainment features to keep the passengers occupied.



Figure 18: A Roll On-Roll-Off Ferry



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Figure 19: A Roll-On-Roll-Off Truck Carrier. These ships have a large ramp at the stern that closes watertight, and it may also have a bow door that hinges up so the trucks can drive out without turning around at the other end of the trip.



Figure 20: a small double-ended car ferry for crossing a local waterway.

Cruise Ships

Large cruise ships and liners operate on scheduled routes, with cruises or trips often taking several days, to all the way around the world. The distinction between “liners” and “cruise ships”



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has to do with the former being in a trans-oceanic scheduled service, carrying passengers and cargo back and forth, whereas cruise ships generally do some sort of circular schedule of port visits, ending up back where they started. The “Queen Mary II” is the only transatlantic liner still operating as such. These ships each carry thousands of people, and like the economics of tankers and container ships, the larger the ship and the higher the passenger capacity, the lower the cost to operate and the higher the profit to the owners. There are 6000 passenger capacity vessels now in the planning stages! The author was once on a cruise with 4000 passengers on our ship, plus three other ships, in port in an Alaskan town with only 2100 people in the summer and 800 in the winter! These ships are getting to be floating cities. They can be easily recognized as looking like a huge rectangular block of cabins atop a small hull.



Figure 21: A modern cruise ship, distinguished by LOTS of windows and balconies, and a very tall superstructure.

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Figure 22: The S.S. President Wilson—an old-style combination ocean liner/break-bulk freighter that can load and unload its cargo. Note that the similar masts to the Liberty ship in Figure 12. There are still a few of these around, mainly Russian and East European.



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Figure 23: A Typical Cruise Ship Port



Figure 24: Carnival Destiny in San Juan-this is from a previous design generation to that in Figures 21 and 23.

High Speed Ships

High speed ships are often built specifically to carry cargo and/or people at high speed, and they only make a profit while economic times are good. These ships are generally long and narrow, sharp-ended, and higher freeboard at the bow (forward end of the ship). The SeaLand container ships of the 1960's were built like this (Figure 9 may be one), and there have been several attempts at starting high speed transatlantic cargo lines again, although rising fuel prices or economic panics often put an end to these. The Clipper ships of the 1850's were examples of this-thanks to the 1849-1853 California Gold Rush, there were several hundred high speed sailing ships built to service the demand for high-speed, high value cargo. When the gold fields played out, these ships were sold off to the British for their tea trade, where the first ships back to England with the first crops of Chinese and Indian teas got the premium prices for the cargo.

There are also hundreds of catamaran ferries operating now, where they take advantage of the low hull drag of the twin long, narrow hulls and light weight of the passenger loads to achieve a high rate of speed. See high speed ships below:

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Figure 25: A Wave-Piercing Catamaran Ferry. The center hull breaks the bow wave, and the sidehulls pierce the wave like torpedoes while providing the buoyancy.





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Figure 26: Large Wave Piercing Cat from another angle. Unfortunately, the SeaCat only ran for two years across the English Channel due to low ridership, after the Channel tunnel opened.



Figure 27: A more conventional catamaran ferry

Hydrofoils enjoyed a period of popularity during the 1960's-1990's, but they have largely been replaced by catamarans due to lower operating and maintenance costs. The Soviets had large fleets of these operating as ferries on the Russian rivers back then.



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Figure 28: Soviet River Hydrofoil Ferry

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Figure 29: An old hydrofoil. These were popular in the 1960-1980's, but they have been mostly replaced by catamarans and wave-piercers.

Hovercraft ferries were also popular as high-speed passenger vessels in the 1960's-1990's, and large ones were used to cross the English Channel before the Channel Tunnel was dug. They generally look like a flat structure on top of a rubber skirt that surrounds the bottom, with propulsion provided by large propellers. Their high maintenance costs and noise generation caused them to fall out of favor compared to catamarans, but some are still operating.



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Figure 30: English Channel Hovercraft that carried cars and passengers

Live Animal Carriers

A niche trade exists between Australia and New Zealand, and several Muslim countries, transporting live sheep and goats to those countries to serve as food. According to Islamic Law the animals must be slaughtered in a particular way so their meat meets Halal standards, and this requires them to be delivered alive for butchering. They look similar to passenger vessels, but they have large open-air openings in the superstructure and are not nearly so artistically styled. The vessels that work in this trade look like this:



Figure 31: Live Animal Carrier



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Sailing Ships

Sailing ships are largely old-fashioned now, but there are occasional attempts at resurrecting sail as a means of low-cost propulsion. Prior to the invention of the steam engine and later, diesels, sail was the primary means of propulsion. But since it was so dependent on the weather, more reliable means of propulsion which could meet a schedule supplanted sail. These days there are quite a few sail training vessels operated by various governments, and a few private ones as well. The 3-masted barque “Picton Castle” makes regular trips around the world, taking on crew who pay for the education and experience of manning a square-rigger. See picture below:



Figure 32: Picton Castle Sail Training Ship

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Figure 33: Russian Sail Training Ship Kruzenstern, one of the few operating 4-masted barques in the world. The painted gunports are for decoration

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Figure 34: Passenger Schooner Boston, a typical New England-style sailing passenger vessel.

Schooners were the workhorse of coastal freight and Grand Banks fishing fleet in the 19th and early 20th Century, and they were built in the thousands, with as many as 7 masts on one. They take few crew to operate, handle well in all conditions, and they are inexpensive to operate. These days there are many companies offering local cruises out of many ports, with some trips lasting for as long as a week. The passengers get to help sail the boat, and they enjoy the nostalgia trip.



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Figure 35: Star Clipper cruise ship

The Star Clipper is one of several recreations of older-style sailing vessels. A modern innovation such as the 3-masted square rigged yacht “Maltese Falcon” is shown below. The rig on this vessel must be quite a bit more efficient than the rig above, since the sails don’t have slots below them to leak air through, there is no rigging to cause drag between the masts, the yardarms are curved instead of straight, and the entire mast turns to trim the yardarms into the proper angle without the crew having to go aloft.

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Figure 36: Sailing Yacht Maltese Falcon

Submarines

Submarines are a special type of submersible ship that is primarily used for warfare, but also for exploration of the oceans and passenger excursions. The first submarines were war machines, and started as one-man vessels such as the “Turtle”, evolving in the 19th century to multi-manned, human-powered vessels such as the Confederate “C.L. Hunley”, then to gasoline and diesel, then atomic-powered vessels and air-independent diesel and Stirling engine-powered subs we have today. Military submarines are covered in Part 2. Of Basic Ship Types & Their Uses”.

Commercial submarines are used for passenger sightseeing underwater, pipelaying and underwater construction and maintenance, ocean exploration, and salvage work. Today there are both commercial passenger submarines for shallow water (as below), and deep water. A custom-constructed passenger submarine recently visited the “Titanic” at 12,000 feet below sea level. There are also private-use submarines available as yacht “toys” that can dive as deep as several thousand feet.

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Figure 37: Commercial Passenger submarine

Yachts

Yachts are generally privately- or corporately owned vessels intended to carry passengers in luxury, for entertainment purposes. Much of the upper size end of the yacht business revolves around chartering the vessel to wealthy people for as much as hundreds of thousands of dollars a week, still much less than they cost to build. This is what the author calls the “Platinum Age” of yachts, for the modern ones are much larger than the “Golden” era vessels of the latter 19th/early 20th Century. The largest yachts are now approaching 728 feet (222m)! These vessels have evolved faster than the regulations over the last 10-15 years, and so new catch-up regulations have been put into force to cover their design innovations and size growth. Yachts are often painted white, although that is changing; they are almost always very stylish and many “look fast” whether they are or not, and they often have multiple levels above the hull that get shorter as they go up, like a layer cake. Many of the world’s wealthiest individuals own them, and the largest ones cost well over \$200 million to build, and 10% per year to operate. It seems there is

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almost no end to innovative changes and entertainments being introduced onto them. Here are a few of the largest:



Figure 38: Paul Allen’s “Octopus”. This one has a basketball court two helicopter pads, a music studio, gymnasium, theatre, seven tenders in the stern “garage”, and more.



Figure 39: “Al Raya”, owned by an Arab Sheik, of course.

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Figure 40: Motoryacht “A” owned by a Russian oligarch. This one looks like a Guppy II submarine or the USS Zumwalt (which see in Part 2).



Figure 41: Motoryacht “Al Lusail”



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Fishing Vessels

Fishing Vessels are generally specialized by the types of seafood they catch, and whether, or not, they process them onboard. The higher north they go, the higher the freeboard must be on the hull, as the waves get really big in the high latitudes. The two main types are simple fishing boats that catch the fish, crabs, shrimp, scallops, oysters, or whatever, and store them in a cargo hold to carry in, iced down but unprocessed, and factory processing trawlers. The swordfish boat “Andrea Gail” in the movie “A Perfect Storm”, and Figures 45 and 46 are examples of the “simple” type of boat. The processing (cutting off heads, shells, cleaning out the innards, canning, etc) is mostly done ashore for these types of vessels. That method is giving way to the factory-processing trawler, a ship which is larger, and not only catches the cargo, but processes, packages, and freezes it onboard. The latter type has been around for a long time in other nations, but it is relatively new to the U.S. because of our protective fishing regulations and the general father-to-son or daughter nature of the business. The non-processing type vessels are often refitted with different gear depending on what type of catch is bringing the most pay. The regulation of fishing zones and quotas has a lot to do with the changing uses of these types of boats.

The newer processing vessels coming into use here carry two crews-one for the fishing and one for the processing factory. These vessels catch the fish, then send them to the factory below to be skinned, fileted, frozen, and packaged, as well as extracting fish oil and any other usable byproducts. They have a large cargo hold that is maintained at sub-zero temperatures, and they unload ready-to-sell packages of fish and byproducts at the dock when they return. The Norwegians are designing very innovative fishing/processing vessels these days, and they are a world leader in this type. Figure 44 below is a new U.S. or Canadian-built fishing seiner/processor built to a Norwegian design. Note the high freeboard and the large structural mast arch on the aft deck. This one also can break ice. The bow bulb had been added to increase running efficiency and pitch attenuation.

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Figure 42: Small European Fishing Boat At Low Tide



Figure 43: Conventional Fishing Boat alongside a Light Ship

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Figure 44: Factory Fishing Trawler



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Figure 45: Traditional Shrimp Boats.

Shrimp Boats typically have high bows, the deckhouse forward and curving up to the bow, a mast aft of the house, with two outrigger booms that swing out to spread the net.

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Figure 46: Small Alaskan King Crab Boat



Figure 47: Large Alaskan King Crab Boat

King Crab boats are generally larger than shrimp boats, have a long aft deck to carry the crab pots, and the smaller ones have a large crane boom aft of the mast that overhangs the working deck. The newer, large ones have a different arrangement as above.

Part 2 covers typical types of warships.

Part 3 covers Offshore Oilfield and other types of workboats