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Cargo Stowage

Stowing cargo safely is necessary to prevent damage to the cargo and ensure the safety of the ship. Safety is always the most important aspect in any repetitive operation. The first concern any captain and crew has is to ensure the cargo is stowed so the ship will be stable and seaworthy, (e.g., secured in such a manner that it cannot shift if the vessel encounters bad weather).

The type of vessel, the cubic capacity of her cargo compartments and the appliances used for loading or discharging, as well as the nature of the cargo, affect the stowage of cargo in the best possible manner. The ship's stability or trim is of utmost importance. Since a ship is supported by fluid pressure she will incline in any direction according to the position of the weights placed on her. The trim is the angle that a ship makes, fore and aft, with the water. The heel, the list or inclination from one side to the other caused by loading, also needs to be considered. The cargo is loaded so that stresses in the ship are minimized or evenly distributed.

The loads acting on the hull structure when a ship is floating in still (calm) water are **static loads**. A major static load is created by the cargo. The main hull stresses set up by the cargo are **hogging** (entire load in one location generally in the middle of the ship), **sagging** (load at the bow and stern and too little in the middle), and **shearing** (where multiple holds are present and alternate holds are filled to capacity while the others remain empty). These problems can be minimized by evenly distributing the cargo.

Dynamic loads are those additional loads exerted on the ship's hull structure through the action of the waves and the effects of the resultant ship motions (i.e., acceleration forces, slamming and sloshing loads). Hogging and sagging forces are at a maximum when the wave length is equal to the length of the ship. **Sloshing loads** may be induced on the ship's internal structure through the movement of the fluids in the holds. A

common cause is when the bow of the ship slams into a wave in heavy weather.

Cargo over-loading in individual hold spaces will increase the static stress levels in the ship's structure and reduce the strength capability of the structure to sustain the dynamic loads exerted in adverse sea conditions.

The next consideration is for the safety of the cargo itself. It must not be damaged by shifting; certain commodities become easily tainted by others, water might find its way into the hold; and condensation or sweating must be prevented. Valuable cargo may be stolen or broached.

Various methods of prevention were used when stowing general cargo, to eliminate shifting and possible cargo damage. Dunnage was commonly used between the cargo and the hold sides. Netting and canvas was typically used during the age of sail. Bracing with lumber was also highly effective but costlier and time consuming to install. Any sailing vessel had available lumber on board. Cargo holds varied in height so general cargo was loading in layers, with wood planks separating each layer. These wood 'floors' allowed men to shift heavy containers more readily than manually lifting them over other cargo on a lower layer to get the container to the hatch.

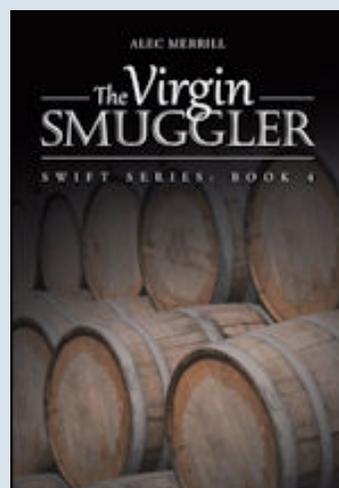
In the case of sailing vessels, virtually all cargo loading / unloading was completed using a yardarm or two rigged for hoisting. The exception was the availability of a large cheap labour force (e.g., slaves) and products that were light enough to be carried by a man (e.g., 100 pound bags of agricultural products).

A final consideration is the destination of the cargo. If there was multiple destinations for the cargo, that cargo must be loaded so it can be removed at the first destination (e.g., first out, last in).

Cargo loading is a skill developed over time by experience. Someone could pick up the basics in a few minutes, but the practical application took some time. The first mate / first lieutenant is responsible for cargo loading.



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