US LAPR3

US417

The “control” bridge of a ship is intended to be the heart of the vessel and must provide a clear and unobstructed view of the surrounding area.

Depending on the type of cargo the ship carries, it is generally located in a position that facilitates loading and offloading and ensures immediate access to the essential areas of a ship.

Control bridge in the bow:

Roll-on/roll-off (RORO) ships:

These are cargo ships designed to carry wheeled cargo that are driven on and off the ship on their own wheels or using a platform vehicle.

The vessels have either built-in or shore-based ramps that allow the cargo to be efficiently rolled on and off the vessel when in port.

Normally these ramps are made towards the stern of the ship to allow a better flow of the load in and out of the vessel, therefore the “control” bridge is usually found in the bow.

The ro-ro passenger ferry with the greatest car-carrying capacity is the Ulysses.

It weighs 50,938 GT (‘Gross Tonnage’ = overall size of a ship) and is 209.02 m long and 31.84 m wide. It can carry 1342 cars and 4101 lane meters of cargo.

Control bridge in the stern:

Container Ships.

These vessels are structured specifically to hold huge quantities of cargo, goods, and materials compacted in different types of containers from one port to another. Therefore, the cargo space can be maximized with the control bridge in the stern of the ship.

Bulk Carrier.

Bulk carriers are a type of ship that generally transport dry and loose cargo in bulk quantities and usually contains items like food grains, coals and even cement. Consequently, having the control bridge in the stern is not a bad idea, since just like the container ship, a lot of space is needed.

Both ships above are cargo ships and for the “Panamax” size category, the general characteristics are a tonnage of 52,500 DWT (‘Deadweight tonnage’ = carrying capacity of a ship in tonnes), length of 289.56 m, width of 32.31 m, height equals to 57.91 m, draft of 12.04 m and capacity of 5,000 TEU (‘twenty-foot equivalent unit’ = a standard measure used to calculate how many containers a ship can carry)

Control bridge in the midship:

Navy Ships:
Guided Missile Cruisers
These ships usually carry Tomahawks, Harpoons, and other missiles. They are designed to provide defense against enemy aircraft.
They usually have a weight equal to 9,800 tons full load, length of 173 m, width equal to 16.8 m and draft of 10.2 m.

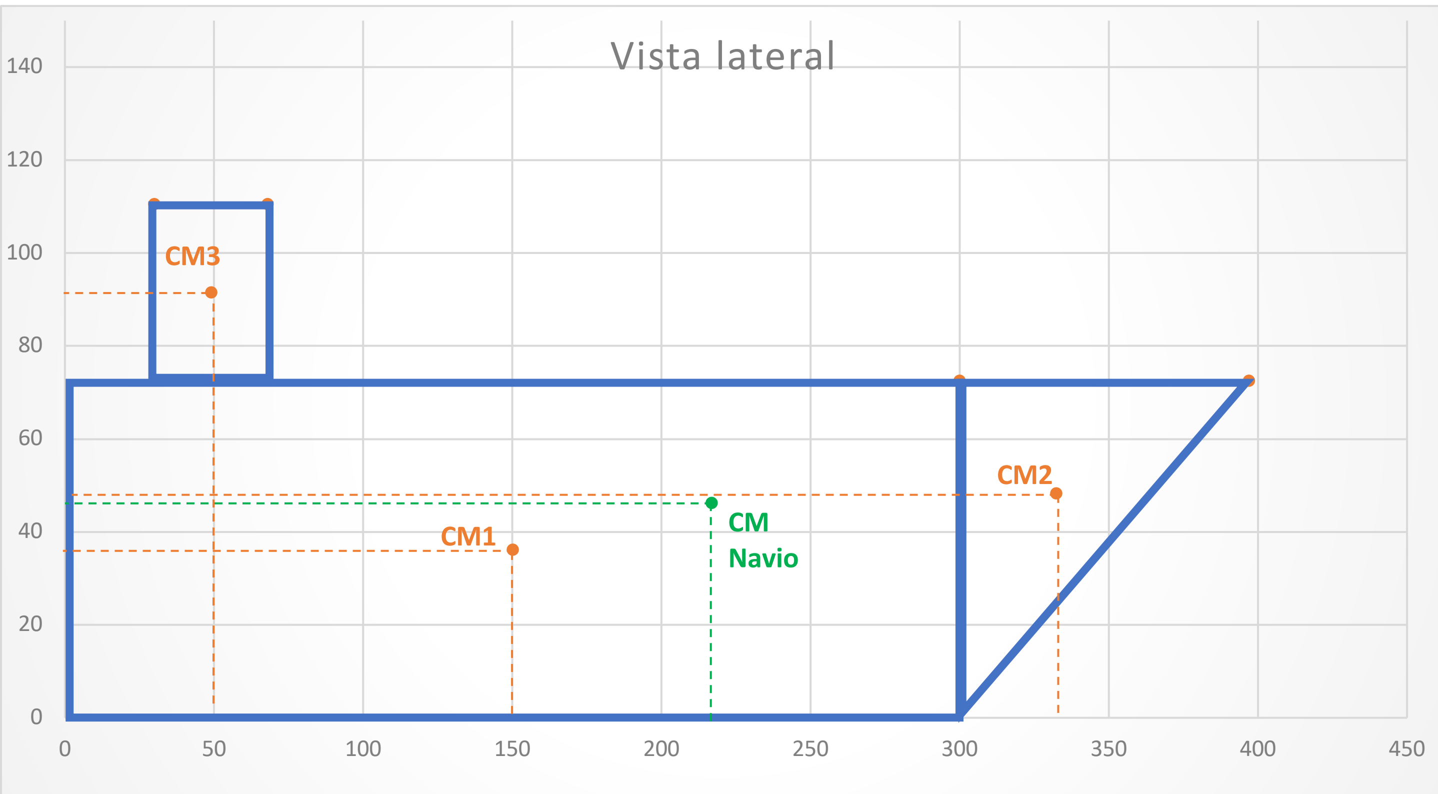
US418

O **navio** tem cerca de comprimento de 397 metros, 56 metros de largura e um **peso** bruto total de 55 mil toneladas.
Sendo que a altura média de um navio é de 72,5m de altura.
Consideramos o navio como a forma geométrica representada no gráfico, um retângulo, um triângulo e para torre de controlo, um quadrado.

Assim, iremos considerar como coordenadas do seu centro de massa:

$$X_{cm} : \frac{X_{CM1} \times m_1 + X_{CM2} \times m_2 + X_{CM3} \times m_3}{m_1 + m_2 + m_3} = \frac{150*2500000+332,33*1500000+49*1000000}{5500000} \approx 216,82\text{m}$$

$$Y_{cm} : \frac{Y_{CM1} \times m_1 + Y_{CM2} \times m_2 + Y_{CM3} \times m_3}{m_1 + m_2 + m_3} = \frac{36,25*2500000+48,33*1500000+91,5*1000000}{5500000} \approx 46,30\text{m}$$



CM (216,82; 46,30) m

$$X_{cm} : \frac{X_{CM1} \times m_1 + X_{CM2} \times m_2 + X_{CM3} \times m_3}{m_{1+} m_{2+} m_3} = \frac{150*2500000+332,33*1500000+49*1000000}{5500000} \approx 191,36m$$

$$Y_{cm} : \frac{Y_{CM1} \times m_1 + Y_{CM2} \times m_2 + Y_{CM3} \times m_3}{m_{1+} m_{2+} m_3} = \frac{36,25*2500000+48,33*1500000+91,5*1000000}{5500000} \approx 59,38 \text{ m}$$

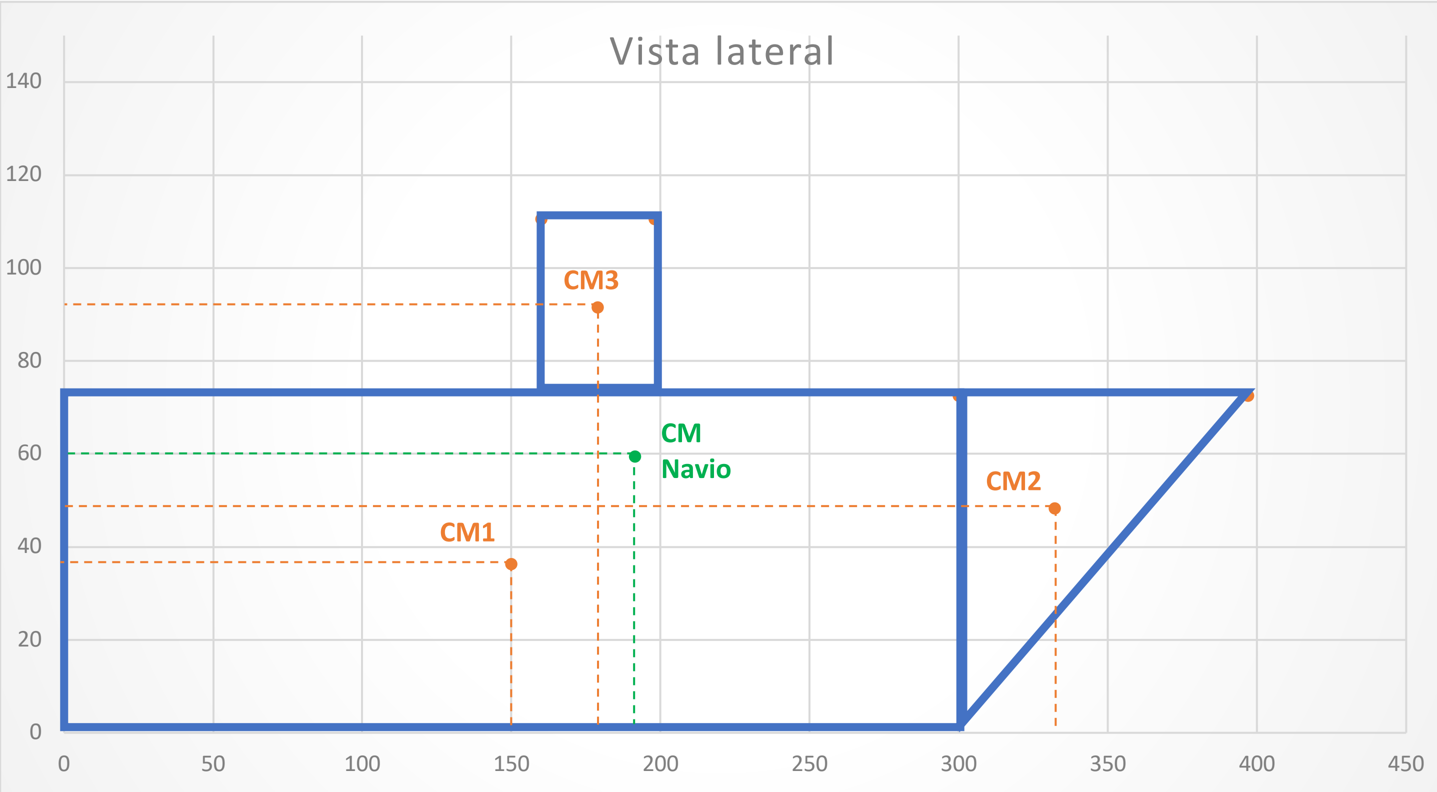


Figura 2 - Vista lateral do Navio

$$X_{cm} : \frac{X_{CM1} \times m_1 + X_{CM2} \times m_2 + X_{CM3} \times m_3}{m_{1+} m_{2+} m_3} = \frac{150*2500000+332,33*1500000+319*1000000}{5500000} \approx 216,82m$$

$$Y_{cm} : \frac{Y_{CM1} \times m_1 + Y_{CM2} \times m_2 + Y_{CM3} \times m_3}{m_{1+} m_{2+} m_3} = \frac{36,25*2500000+48,33*1500000+91,5*1000000}{5500000} \approx 46,30m$$

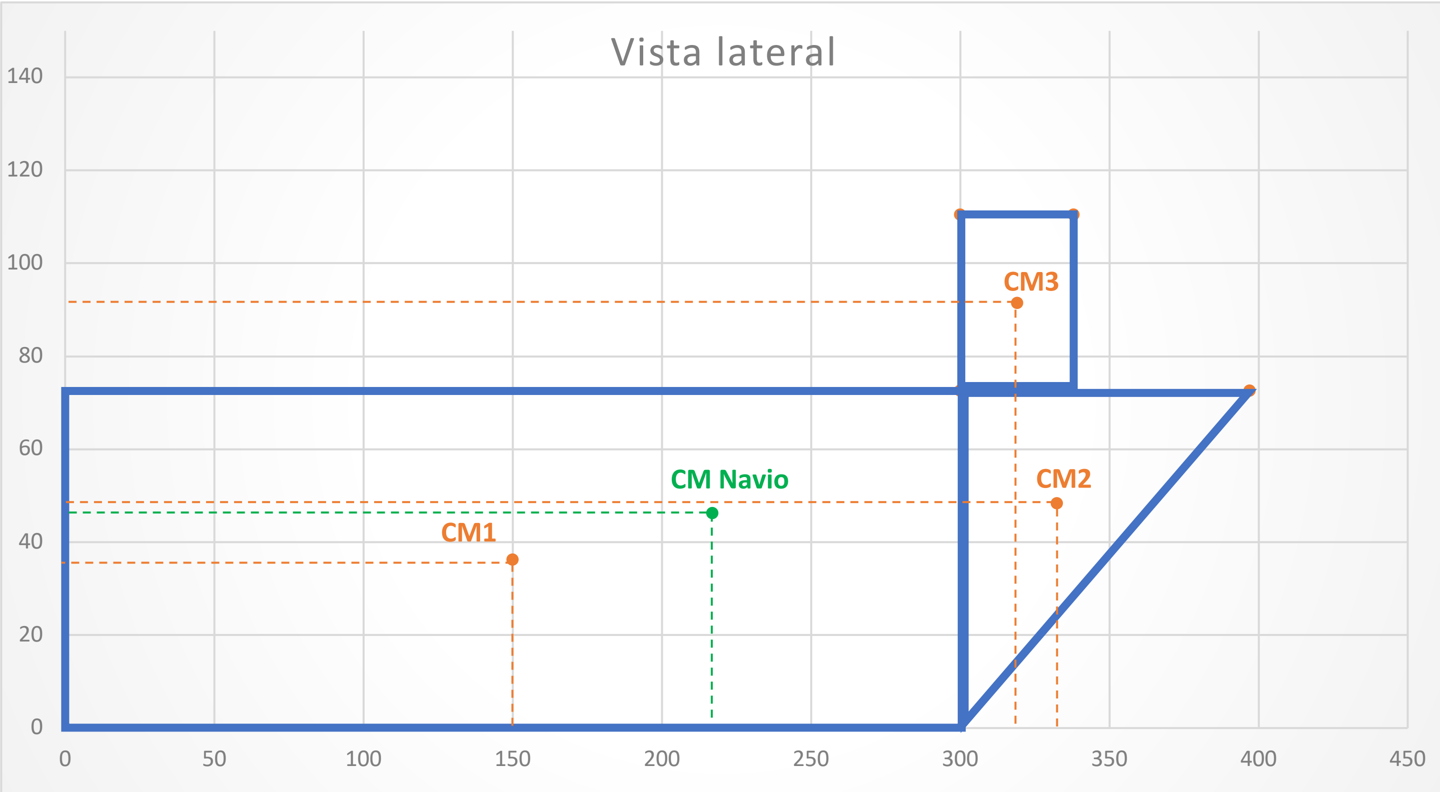


Figura 3 - Vista lateral do Navio

CM (216,82; 46,30) m

US419

O contentor tem cerca de 5,9m de comprimento, 2,4m de largura e 2,4 metros de altura. O contentor apresenta também uma massa de 500000kg.

A = 5,9 * 2,4 = 14,16 m^2

V = 5,9 * 2,4 * 2,4 = 33,98 m^3

Foi colocado um conjunto de 100 contentores, representados na forma de um retângulo.

$$X_{cm} : \frac{X_{CM1} \times m_1 + X_{CM2} \times m_2 + X_{CM3} \times m_3 + X_{CM4} \times m_4}{m_{1+} \, m_{2+} \, m_{3+} m_4} =$$

$$\frac{150 * 2500000 + 332{,}33 * 1500000 + 49 * 1000000 + x * (100 * 500000)}{5500000 + (100 * 500000)} = 216{,}82$$

$$922495000 + 50000000x = 1300920000$$

$$x = 222{,}23m$$

Y_{cm} : $\frac{Y_{CM1} \times m_1 + Y_{CM2} \times m_2 + Y_{CM3} \times m_3 + Y_{CM4} \times m_4}{m_{1+} m_{2+} m_{3+} m_4}$ =

$\frac{36{,}25*2500000+48{,}33*1500000+91{,}5*1000000+y*(100*500000)}{9820000}$ = 46,30

$$254620000 + 50000000y = 2569650000$$

$$y = 46{,}30m$$

Concluímos que não é o possível manter o y igual ao do centro de massa do navio.

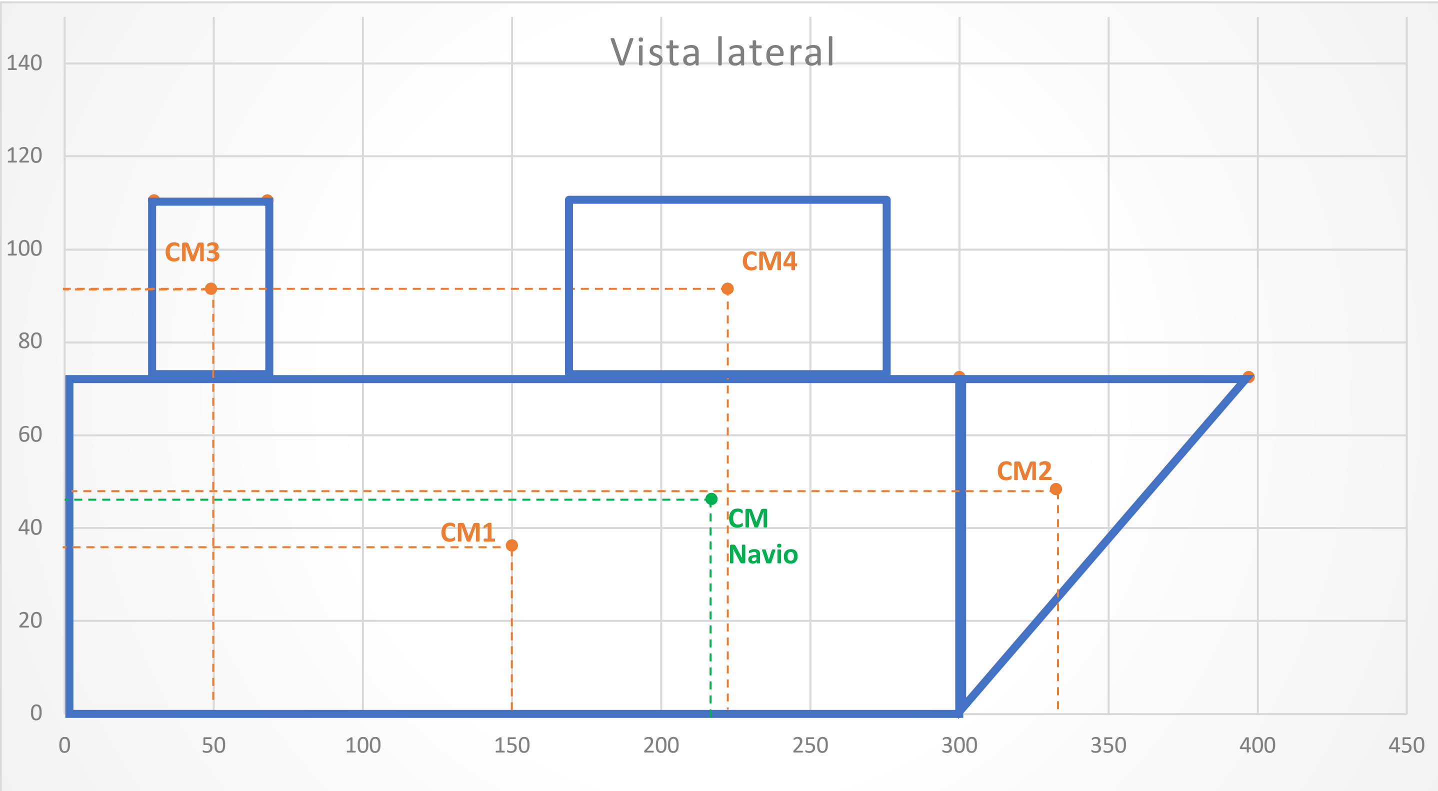


Figura 4 - Vista lateral do Navio

CM (222,23; 91,50) m

US420

Um **navio** cargueiro ou **navio** de carga é um tipo de **navio** utilizado para o transporte de cargas. Construídos para carregar cerca 4 000 **contentores.**

Tendo em conta que o peso médio de um contentor é de 5000kg, então o peso total dos contentores é de $5000 \times 4000 = 20\,000\,000kg$.

A pressão exercida por este na água será a força representada pelo seu peso.
$\vec{P}$ = (55 000 000 + 20 000 000) = 75 000 000 kg

Para se obter maior estabilidade possível, a distribuição de cargas no interior do navio é feita para que o centro de gravidade fique mais próximo possível do fundo do navio.

Princípio de Arquimedes:
Considerando a densidade da água salgada: 1,020 g/cm^3

$$F_{I=} F_g \;\Leftrightarrow\; \rho_f \times V_f \times g = m \times \; g$$

$1{,}020 \times V_f = 2\ 000\ 000 \;\Leftrightarrow\; V_f = 1\ 960\ 784{,}31\ \text{cm}^3$

$V_{barco} = 397 * 56 *72{,}5 = 1\ 611\ 820\ \text{cm}^3$

$h * A = 348\ 964{,}31\text{m} \Leftrightarrow h = \frac{348\ 964{,}31}{397*56} \Leftrightarrow h \approx 15{,}70\ m$