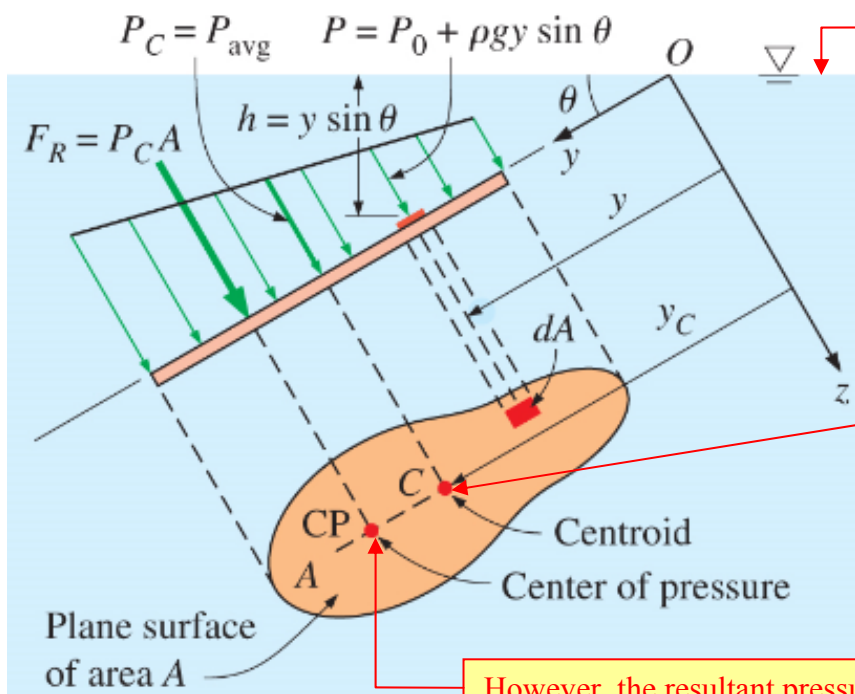


Hydrostatic Forces on Submerged Plane Surfaces (Sec. 3-5)

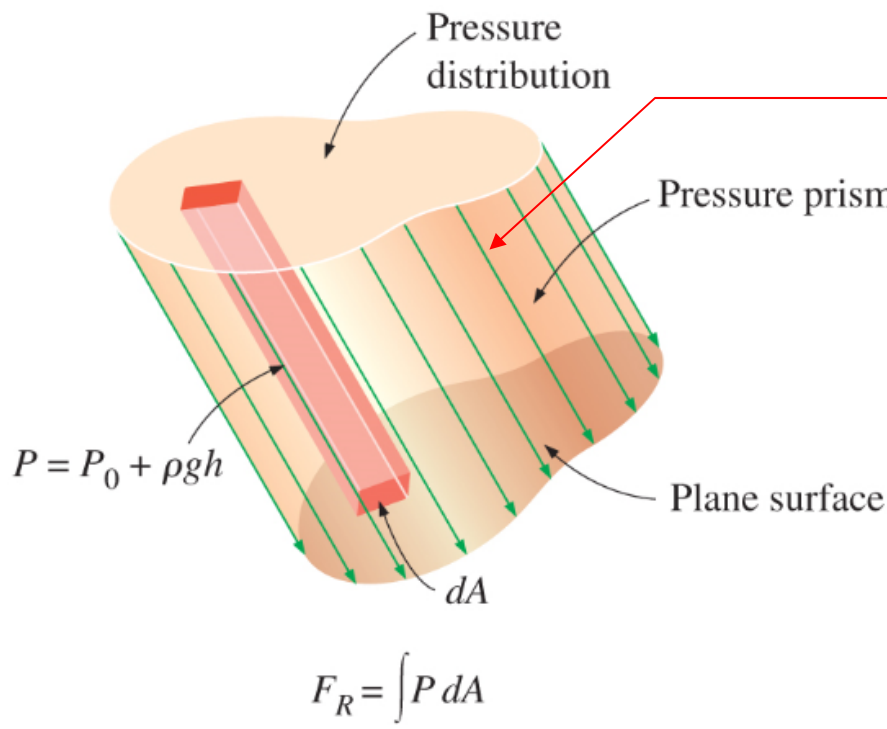
Author: John M. Cimbala, Penn State University
 Latest revision: 23 January 2015



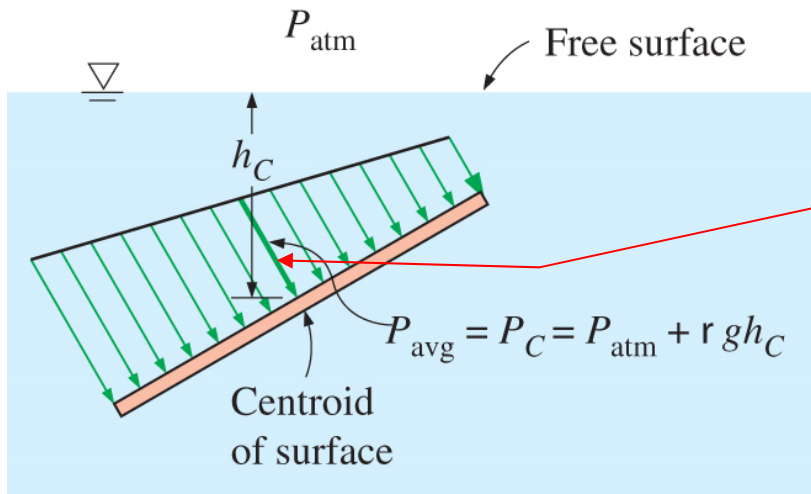
Liquid surface, open to air pressure P_0 (P_0 is usually P_{atm})

The **centroid C** is the mathematical center of the plate's area. We calculate the average pressure at the centroid.

However, the resultant pressure force acts not at C , but at CP , the **center of pressure**.

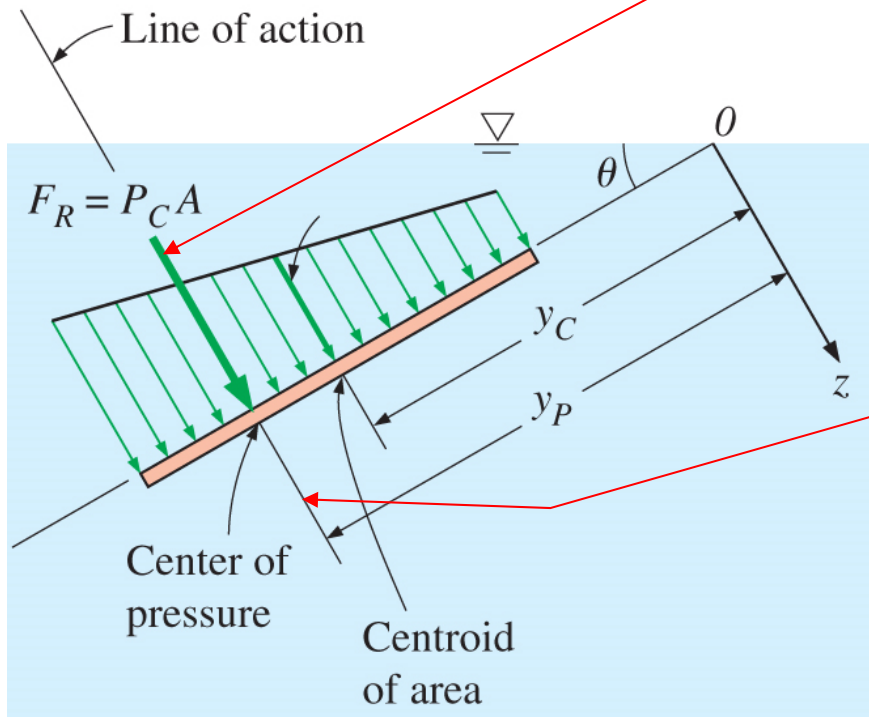


Because pressure increases as you go down in the liquid, the "pressure prism" is thicker towards the bottom, and therefore, the center of pressure CP is located *below* the centroid C .



Average pressure P_{ave} is easy to find – it is simply the pressure at the centroid C of the plate's surface area.

(See the text, Fig. 3-31, for centroids of many common shapes.)



The resultant force F_R on the face of the plate is equal to the pressure P_C at the centroid C times the area of the plate. I.e.,

$$F_R = P_C A$$

But, F_R does *not* act at the centroid!

The line of action of the resultant hydrostatic force passes through the center of pressure CP and acts perpendicular to the plate