Lecture F2 Mud: Hydrostatics
(42 respondents)

1. **Is** $C_p$ **in** Fluids **related to the** $C_p$ **in** Thermo, **such as** in $U = c_p\Delta T$? (1 student)
   This is a notation coincidence. They are completely unrelated.

2. **How do** $p_\infty$, $V_\infty$, **etc. all relate? What’s static and dynamic** $p$? (3 students)
   See the Lab-7 Lecture Notes and Mud.

3. **Why does area vary as size^2**? (1 student)
   This is just a matter of geometry. I both the length and width double, then the product length×width quadruples.

4. **Not clear what** $C_p$ **really is. It’s not intuitive.** (4 students)
   $C_p$ is one example of a dimensionless quantity, which we always seek when analyzing physical situations. $C_L$ is another example. These dimensionless quantities are always the most general and simplest way to describe and quantify a problem. For example, a full-size airplane and a wind tunnel model at the same angle of attack will have different pressures and lifts, but their $C_p$’s and $C_L$’s will be the same if only a few conditions are met, such as the $Re$ and $Ma$ are the same. This allows direct comparisons between the aircraft and the model. We will get to this in much more detail in lecture F5.

5. **Is there lift on the whole fuselage, or just the middle part between the wings?** (1 student)
   On most aircraft the bulk of the fuselage lift is on the part between the wings. The front and back of the fuselage carry very little lift.

6. **Why does** $dp/dy = \rho g$? (1 student)
   Actually, $dp/dy = -\rho g$ if $y$ is opposite to gravity as in the class example. This is just the outcome of the $dx\,dy\,dz$-volume analysis, where the pressure (buoyancy) force on the volume was set equal and opposite to the gravity force on the mass in the volume.

7. **What do you mean by “displaced” fluid?** (1 student)
   It’s the non-existent fluid that occupies the volume of the body. Or, it’s the fluid that got pushed aside when the body was placed in the fluid.

8. **In the Hydrostatic Equation, is** $\rho$ **the density of the fluid or the body?** (1 student)
   Of the fluid.

9. **Does the buoyancy of an air balloon underwater change as you push it deeper?** (1 student)
   If the volume of the balloon does not change (e.g. if the balloon was a rigid glass sphere), the buoyancy force will stay the same. However, a rubber balloon will shrink in volume as you go deeper due to the increasing ambient pressure at the balloon. So its buoyancy force will decrease with depth.

10. **What’s the difference between solid and hollow bodies in a fluid?** (1 student)
    None. The fluid behavior is unaffected by what’s inside the body.

11. **No mud** (23 students)