

PROFESSOR: When we take complex things and break them into smaller pieces, we find out that we know a lot more about things than we think.

[MUSIC PLAYING]

Now let's take this box, ORCA I and create damage below the waterline which I've indicated right here.

[MUSIC PLAYING]

As we can see, we've damaged ORCA I right here. Now let's put ORCA I in the water and see what happens.

[MUSIC PLAYING]

[WATER GLUGGING]

The ORCA I sank due to the weight of the added water. But what if the ORCA I contained cargo or oil or even people? Now let's take ORCA II and do the same thing.

[MUSIC PLAYING]

So, we can see that ORCA II did not sink, although it is sitting at an angle towards the bow. So why didn't ORCA II sink? As easy as it sounds, this simple demonstration is essential to the design of huge, complex ships.

Ships that are responsible for carrying about 90% of all our stuff. As naval architects, how do we design ships carrying our stuff to make it into port safely and not sink? Well, why don't we find out?

[MUSIC PLAYING]

Here we have ORCA I and ORCA II from before. Although ORCA I and ORCA II don't engage in international trade, they behave just as a 1,000 foot container ship would. Now let's take a

look into ORCA I. We can see that there's nothing in it, it's just a box.

But if we look at ORCA II we can see that it's subdivided into these watertight compartments by these transverse watertight bulkheads. Now what that means, is if we were to damage this ship right here, water would only flow into this compartment. It would not go into this one, this one, or this one. That would cause the ship to be angled or trimmed in the water, but it would not cause the ship to sink completely.

We refer to ORCA II as being subdivided. And we can see subdivision in many of these ships' plans. It is unclear when subdivision first started being used in ships. But accounts of 5th century Chinese trade ships indicate that water would be able to enter the vessel, without sinking. So let's find out why this happens.

Let's imagine a barge divided into 10 equal compartments. One of them springs a leak from damage. Since the ship is subdivided, only the first compartment floods and the ship remains afloat, protecting both its people and cargo. Although the added water causes the ship to trim, it still has enough buoyancy to return to port for repairs.

[MUSIC PLAYING]

Ships still sink, though. It's both expensive and impractical to try to design the unsinkable ship, especially when these ships will never see that amount of damage. That's why as naval architects we use computer programs to help us out with subdivision.

Computers make it easy to simulate certain damage cases in practically no time. With different software, we can damage certain compartments and see how the ship responds to it. This gives the naval architect a good idea of what parts to improve on the ship, if any. So even though ships seem like these intricate, complex things, they're really just based on principles that we all already know.

[MUSIC PLAYING]