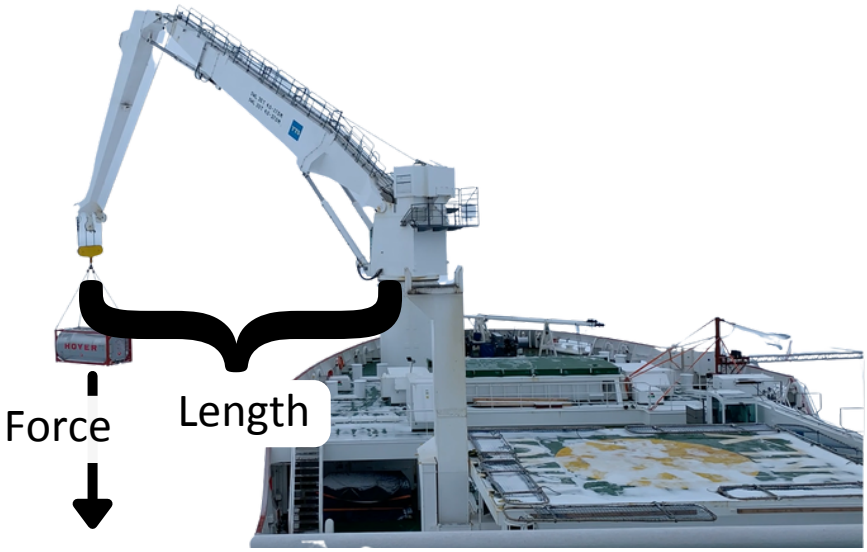
REACH THE WORLD

Breaking the Ice



One of the ways that the S.A. Agulhas II breaks the ice when it's stuck is by lifting a heavy container and swinging it back and forth. The rotational force that this creates is known as torque.

Where T = torque, F=force, and L = length

$$T = F \times L$$

Oh no, the S.A. Agulhas II got stuck in ice! The ship's captain, Captain Bengu, needs your help to free the ship.

Remember: Torque is the force used to rotate the body of the object.

Scenario #1

1) Captain Bengu needs a torque of 460,000 pound-feet to free the ship. If Captain Bengu uses the crane to pick up a container that weighs 20,000 pounds, how far out, in feet, should he swing the container with the crane?

Master of the S.A. Agulhas II, Captain Knowledge Bengu
(Credit: Esther Horvath/National Geographic)

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Scenario #2

The S.A. Agulhas II's crane gets stuck at a length of 20 feet!

2) If Captain Bengu still needs a torque of 460,000 pound-feet to free the ship, how heavy of a container does he need to swing on the crane?

After a few hours, the Weddell Sea's gyres push the ship, causing it to get stuck in 6 feet of ice.

3) The ship needs 520,000 pound-feet of torque to free itself. If Captain Bengu picks up a 15,000 pound container and swings it at a length of 28 feet, will the ship have enough torque to free itself? If not, what would you do to help free the ship?