

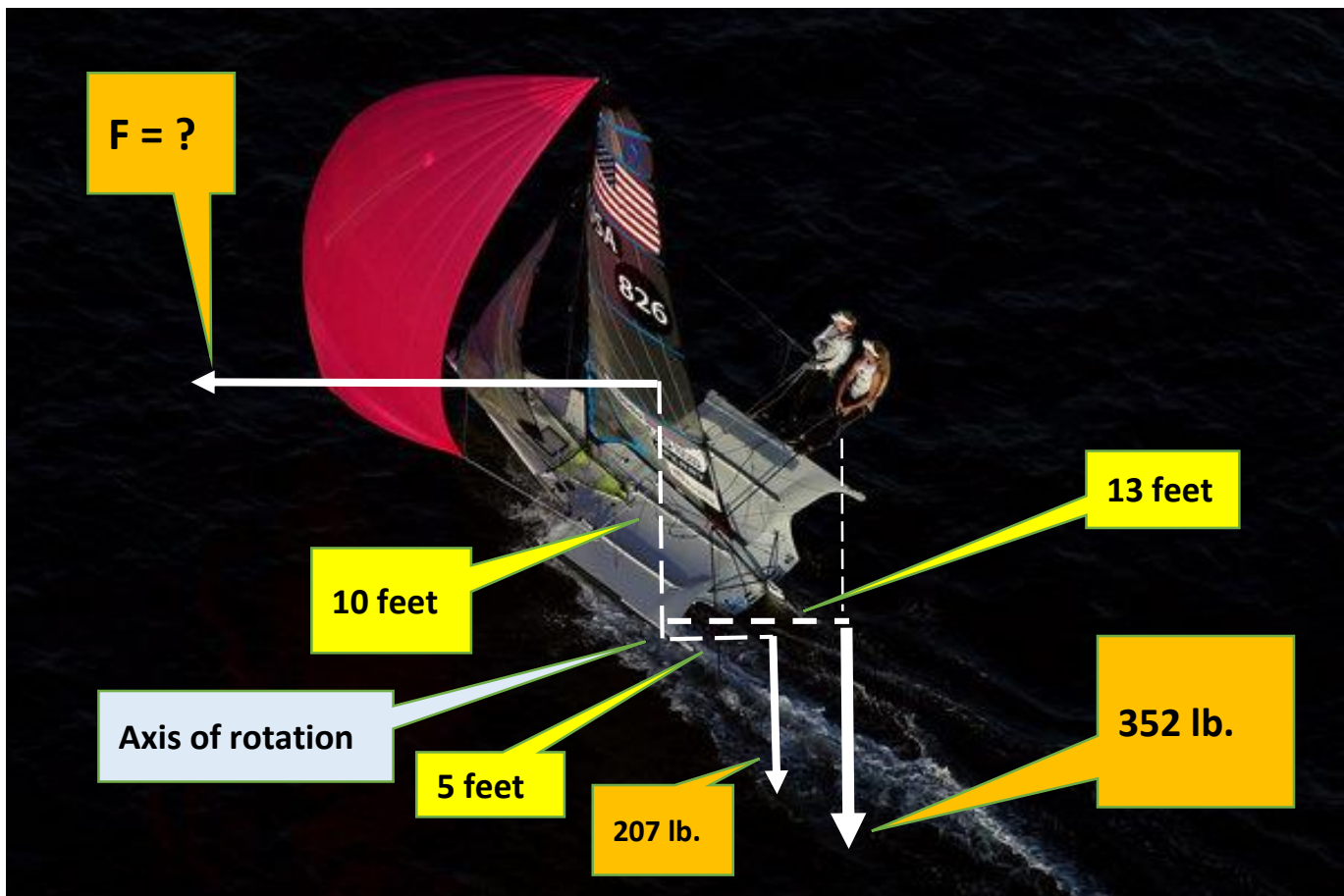
ROTATIONAL EQUILIBRIUM

Unit 15 Dr. John P. Cise ,

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With Clear Vision, Two Americans Brace for Rio's Polluted Waters

If a broken spine, two fractured ribs and a lacerated kidney did not put an end to Helena Scutt's Olympic dreaming, it should come as no surprise that she and her crewmate, Paris Henken, will sail in Rio. Last month, **Scutt and Henken became the first American sailors to qualify for the Rio Games. They will sail in a new Olympic class, the 49erFX, a high-performance skiff that looks more like a high-wire act and is open only to women.** In light of the speed and the ocean spray and the fact that competitors are suspended off the boat on trapeze wires, the 49erFX is also one of the events that will put athletes in closest contact with [polluted waters of Guanabara Bay](#).



Henken and Scutt sailed in the Aquece Rio International Sailing Regatta .

INTRODUCTION: This two person skiff-type high performance sailing dinghy had its debut at the Sydney Olympics in 2000. Stats above are from Wikipedia. Normally the two crew weight is about 352 lb. and with trapeze Harness on (as seen in above graphic) their lever arm from axis (left hull) is about 13 feet. The total hull weight is 207 lb. and center of mass line of action has a lever arm of 5 ft. (see graphic above). The lever arm (from axis of rotation at left hull in water) of Wind force on sail is seen above to be 10 ft. As you can see in the graphic above the sailboat is in rotational equilibrium and thus sum of all torques must = 0 .

QUESTIONS: (a) Find force F on sail? (b) "If" wind diminishes and only exerts a force F of 350 lbs, where must two crew move too so rotational equilibrium is maintained?

ANSWERS: (a) $F \approx 561$ lb. , (b) ≈ 7 ft. = "new" lever arm of crew to maintain sailboat in rotational equilibrium.