

# Analysis of Ship Collision, Intuitor.com Movie-Mini-Lab

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Name \_\_\_\_\_ Date \_\_\_\_\_

**Movie:** *Speed II: Cruise Control* (1997), Sandra Bullock, Jason Patric, Willem Dafoe

**Purpose:** Determine if the Speed II good guys would be thrown through the windshield when the ship crashes into the dock.

**Background:** As the ship moves forward it hits the dock and slows down, or in physics terms accelerates backwards. People on the ship feel like they are being pushed forward during the collision since their inertia resists changes in their forward motion. In reality they're being pushed backward by the friction force between their feet and the deck. This causes a person to accelerate backwards along with the ship. If the friction force is too low the person will slide forward relative to the ship's deck.

For a person to crash through the windshield the deck's acceleration must be so high that friction can't hold him in place. Also the person's momentum must be high enough to shatter the window and propel him through the opening. At accelerations above 1 g friction force wouldn't prevent a person from sliding. Accelerations below 0.1 g would feel like a nudge from a gentle breeze.

A ship's windshield must resist storm-driven waves and would be at least as strong as a car windshield. For a person to be thrown through a car windshield requires a high-speed collision. 10 mph (about 4.4 m/s) would not qualify as high-speed. Keep this figure in mind as you analyze the conditions when the heroes are thrown through the window.

**Special Instructions:** Estimate the ship's acceleration in g's. Begin timing when the ship hits the dock. The first mate calls out the ship's speed as it slows down. Record this below along with the time. Plot the ship's velocity vs time. Draw a line of best fit and indicate on it where the heroes went through the windshield. Acceleration is the slope of the line.

**Data and Analysis:** (To find the velocity in m/s multiply knots/hr by 0.5)

Time (sec)	Velocity (knots/hr)	Velocity (m/s)

### Values When Heroes Were Thrown Through Windshield

Time (sec)	Velocity (m/s)	Acceleration (g's)

**Conclusions:** Explain why the heroes would or would not be thrown through the windshield. Use velocity and acceleration data at the moment the heroes were thrown through the window.