Story 1: On September 23, 1999 NASA lost the $125 million Mars Climate Orbiter spacecraft after a 286-day journey to Mars. Miscalculations due to the use of English units instead of metric units apparently sent the craft slowly off course -- 60 miles in all. Thrusters used to help point the spacecraft had, over the course of months, been fired incorrectly because data used to control the wheels were calculated in incorrect units. Lockheed Martin, which was performing the calculations, was sending thruster data in English units (pounds) to NASA, while NASA's navigation team was expecting metric units (Newtons).

Problem 1 - A solid rocket booster is ordered with the specification that it is to produce a total of 10 million pounds of thrust. If this number is mistaken for the thrust in Newtons, by how much, in pounds, will the thrust be in error? (1 pound = 4.5 Newtons)

Story 2: On January 26, 2004 at Tokyo Disneyland's Space Mountain, an axle broke on a roller coaster train mid-ride, causing it to derail. The cause was a part being the wrong size due to a conversion of the master plans in 1995 from English units to Metric units. In 2002, new axles were mistakenly ordered using the pre-1995 English specifications instead of the current Metric specifications.

Problem 2 - A bolt is ordered with a thread diameter of 1.25 inches. What is this diameter in millimeters? If the order was mistaken for 1.25 centimeters, by how many millimeters would the bolt be in error?

Story 3: On 23 July 1983, Air Canada Flight 143 ran completely out of fuel about halfway through its flight from Montreal to Edmonton. Fuel loading was miscalculated through misunderstanding of the recently adopted metric system. For the trip, the pilot calculated a fuel requirement of 22,300 kilograms. There were 7,682 liters already in the tanks.

Problem 3 - If a liter of jet fuel has a mass of 0.803 kilograms, how much fuel needed to be added for the trip?

Problem 1 - A solid rocket booster is ordered with the specification that it is to produce a total of 10 million pounds of thrust. If this number is mistaken for the thrust in Newtons, by how much, in pounds, will the thrust be in error? (1 pound = 4.5 Newtons)

Answer: 10,000,000 'Newtons' x (1 pound / 4.448 Newtons) = 2,200,000 pounds instead of 10 million pounds so the error is a 'missing' 7,800,000 pounds of thrust…an error that would definitely be noticed at launch!!!

Problem 2 - A bolt is ordered with a thread diameter of 1.25 inches .What is this diameter in millimeters? If the order was mistaken for 1.25 centimeters, by how many millimeters would the bolt be in error? Answer: 1- inch = 25.4 millimeters so 1.25 inches x (25.4 mm/ 1 inch) = 31.75 millimeters. Since 1.25 centimeters = 12.5 millimeters, the bolt would delivered 31.75 - 12.5 = 19.25 millimeters too small!

Problem 3 - In order to calculate how much more fuel had to be added, the crew needed to convert the quantity in the tanks, 7,682 liters, to a weight, subtract that figure from 22,300 kilograms, and convert the result back into a volume (liters).

7,682 liters x (0.803 kilograms/ 1 liter)= 6,169 kg
22,300 kg – 6,169 kg = 16,131 kg
16,131 kg x (1 liter / 0.803 kilograms) = 20,088 liters of jet fuel.

Between the ground crew and flight crew, however, they arrived at an incorrect conversion factor of 1.77, the weight of a liter of jet fuel in pounds. This was the conversion factor provided on the refueller's paperwork and which had always been used for the rest of the airline's fleet. Their calculation produced:

7,682 liters x (1.77 pounds/liter) = 13,597 which they interpreted as kilograms but was actually the fuel mass in pounds! Then they continued the calculation:

22,300 kg – 13,597 'kg' = 8,703 kg
8,703 kg ÷ 1.77 = 4,916 liters ….so they were actually 15,172 liters short of fuel!