Aerospace: How Aeronautics and Astronautics are Defined – Gravity Discussion

Yup, I'm torturing you with gravity now. Why? Because one, gravity affects everything we do in life and two, it is because of gravity that we need to build mechanical vehicles to reach the sky and space.

Gravity is a natural phenomenon by which all things with mass or energy are brought toward (or in the direction of) one another. After completing his own experiments, Galileo determined that gravitational acceleration (or speeding up) is the same for all objects. However, he did hypothesize air resistance as the reason that objects with less mass fall more slowly in an atmosphere.

Isaac Newton's Theory of Gravitation (or the inverse-square law of universal gravitation) states: The strength of the gravitational field at any given point above the surface is equivalent to the planetary body's mass and inversely proportional to the square of the distance from the center of the body.

Okay, great. What does it mean though? It means that, using the Equator as our example (and the presumption that this idea has already been extensively tested throughout history), the gravitational field is weakest at the Equator for two reasons:

1. Centrifugal forces caused by Earth's rotation
2. Points on the Equator are furthest from the center of the Earth (therefore implying that the Earth is not, in fact, perfectly round (important) – rather it is more squat than wide)

One of Newton's Laws of Motion that is discussed quite frequently is the Third Law. This law states that the Earth itself experiences a force equal in magnitude and opposite in direction to that which it exerts on a fall. So, imagine a basketball is Earth and you drop it from a height. If the basketball does *not* bounce, it means that the Earth and the basketball simultaneously apply the same force toward one another once they meet and therefore stop the momentum of falling. It also gives one's imagination a gruesome picture if some human falls from a height. Ew.

Albert Einstein, on the other hand, had a more modern view of gravity. His Equivalence Principle states that all objects fall in the same way and that the effects of gravity are indistinguishable from certain characteristics (i.e., air resistance, electromagnetic field) of acceleration and deceleration.

To determine general relativity (the geometric theory of gravitation), you begin with the Equivalence principle. The principle therefore equates free fall with inertial motion and describes free-falling inertial objects as being accelerated relative to non-inertial observers on the ground. Einstein's idea was that spacetime (a four-dimensional continuum that uses the three (3) dimensions of space and time in a model) is curved by matter instead of a force applied. This would therefore indicate that free-falling objects are moving locally straight paths in curved spacetime. These locally straight paths are called geodesics. If a force is applied to an object, it would deviate from the geodesic.

The Einstein Field Equations – 10 concurrent, non-linear, differential equations – are used to determine the presence of matter and the curvature of spacetime. This is where the 'geometry' comes from. And that, as they say, is that on gravity.