A Thrill Ride

Conquering Gravity

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A thrill ride of great adventure, a *Gedankenexperiment* turned engineering nightmare, awaits.

Building a tunnel through the Earth to the opposite side, say from Wausau (W), Wisconsin, not to China, but to the true opposite. Passing through the center (C) of the Earth from anywhere in the continental United States comes out in the Indian Ocean (IO). The thrill ride is powered only by gravity.

Falling down the tunnel is fraught with technical problems if reaching the other side is the objective. First, the tunnel walls must not be contacted, as the resultant loss of speed would prevent reaching all the way to the other side. Likewise, the tunnel must be a complete vacuum, to prevent loss due to air resistance. Thus the thrill rider will have to ride in a life support capsule and the tunnel width must be much larger than the capsule. For the time being, we will ignore the tremendous heat and pressure the tunnel walls must withstand, an engineering challenge of heroic proportions. *Fig.1* gives a representation of the tunnel with the picture of the Earth's surface for approximate scale.

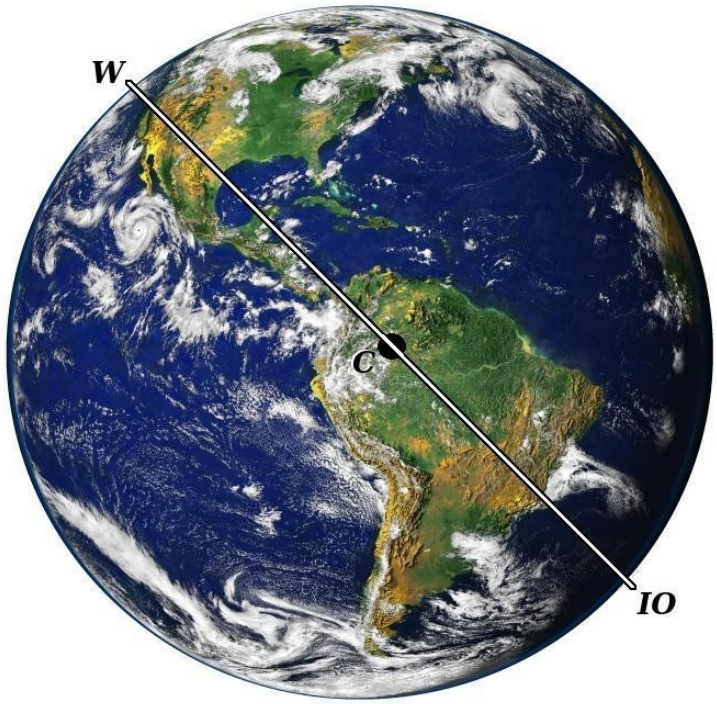

Fig. 1

Starting at Wausau, the capsule is at rest, inside the sealed tunnel terminus. Upon release over the center of the tunnel, the capsule is accelerated downward. Velocity (V) starts at zero, and acceleration (A) is at maximum at 9.8 m/sec^2 (32 ft/sec^2). As the capsule descends, the force of gravity diminishes, with less mass below and more above, until the center of Earth is reached. The acceleration

follows the curve shown in *Fig. 2*, reaching zero, then reversing direction as the capsule coasts upward toward the Indian Ocean, slowing to zero at the surface. The velocity begins at zero in Wausau, reaches a maximum at the center, then returning to zero at the surface of the ocean. The capsule then reverses direction and follows the same acceleration and velocity curves back to Wausau. That appears to be a roller coaster ride, but wait.

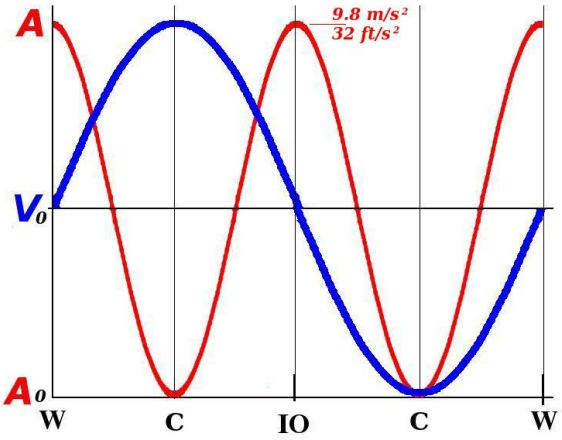

Fig. 2

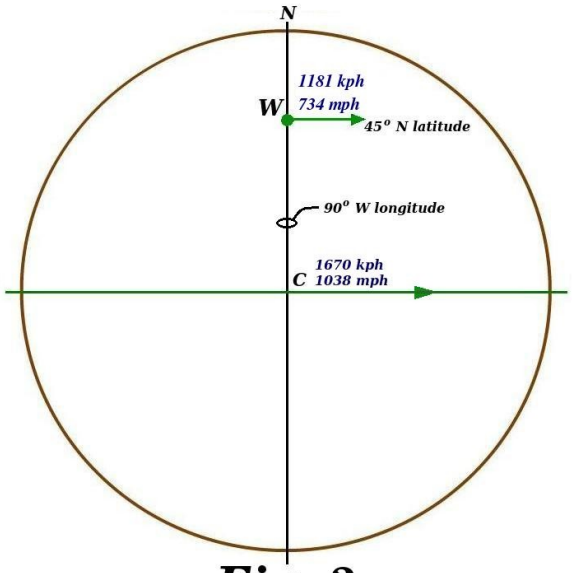

Fig. 3

Thus far we have ignored the Earth's rotation. Points along the equator are moving east at 1670 kph (1038 mph). Wausau, WI is moving east at 1181 kph (734 mph). This tangential velocity presents a vector additive to the falling velocity, see Fig. 3. Only by placing the tunnel at the North Pole-South Pole axis will there be no tangential component. The problem exists when, as the capsule proceeds downward, the tunnel's eastward velocity diminishes but the capsule's velocity doesn't. The capsule will impact the tunnel wall unless the tunnel is curved to follow the changing eastward velocity. The resultant path becomes an ellipse per Fig. 4. Depending on the latitude of the starting point, the ellipse misses the actual center of the earth, most at the equatorial starting points, less from the northern/southern latitudes. Fig. 4 demonstrates the path from Wausau. As the capsule passes the center of the earth, the greater mass of the earth is on the far side, past the center, thus imparting a westward acceleration, decreasing the eastward vector of the capsule.

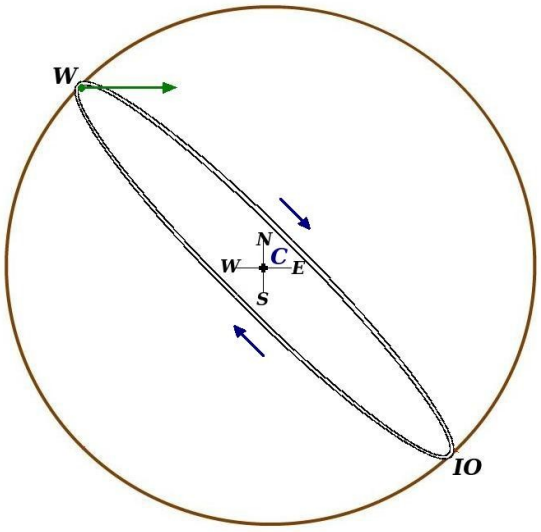

Fig. 4

Meanwhile as the capsule falls, the Indian Ocean terminus is also moving east at 1181 kph, which, viewed from Wausau appears to be moving west! While the tunnel at Wausau begins directly

down toward the center of the earth, to an off-planet observer, the capsule follows the elliptical path of Fig. 5. With all the various rotations and changes in gravity, not to mention the tidal forces of the moon, sun and even mountain ranges on Earth, the tunnel must be anything but straight. As the Earth rotates, the IO terminus is moving, making rendezvous happenstance. The return tunnel will also be curved, and moving on each successive orbit. The Earth will resemble Swiss cheese with all the curved tunnel paths, and returning to Wausau is very problematic. A thrill ride with uncertainty to match the danger.

At this point, the tunnel actually follows an orbital path about the center of the Earth, similar to objects above the earth, albeit more elliptical, with slightly differing dynamics. That said, the thrill ride, aside from the constant weightlessness and danger, is quite boring. There is no sense of acceleration like that experienced on a roller coaster. No being thrown side to side, up or down, baring a fatal impact with the tunnel wall. To occupants of the capsule there is no sense of motion, no acceleration, only free fall. The view out a window would likewise be boring except at the termini. The capsule could just as well be motionless at a remote place in space.

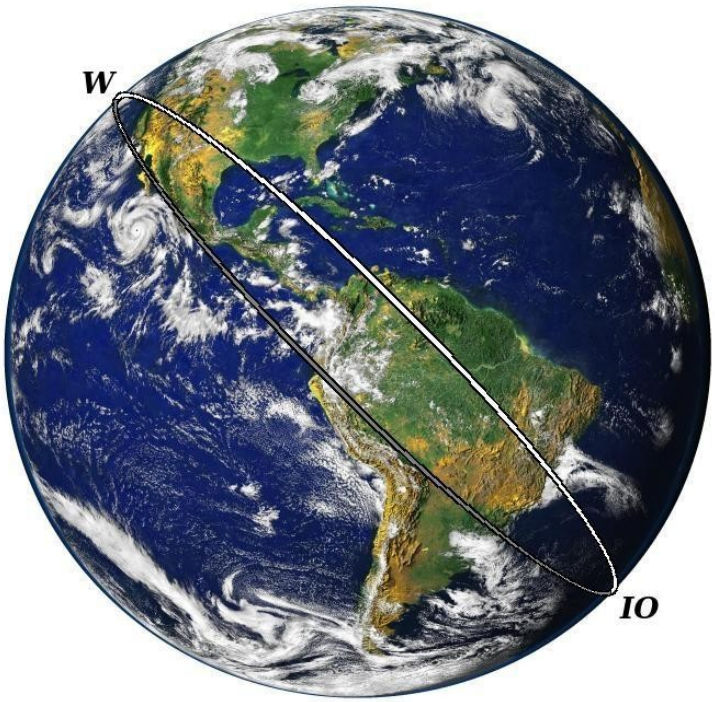

Fig. 5

To the observers watching from Wausau the capsule seems to accelerate down, then slow, then accelerate back. Up and down, like a yo-yo. To an observer on the moon, the capsule merely orbits below the surface of the Earth. To the observers in the capsule, the rest of the Earth seems to gyrate back and forth like a huge yo-yo. To the capsule and its occupants, *there is no gravity or acceleration involved*. The on-board accelerometer registers zero.

The capsule is following a straight path through curved space. This is true, of course, for objects in orbit above the Earth. Objects passing by the Earth at greater than orbital velocity also follow a curved path without experiencing any gravitational tug. Tidal effects, if detectable at all, are merely the differences of the curved paths of one part of the passing/orbiting object vs. another part. Objects passing at less than orbital velocity will enter an elliptical orbit about the center of the Earth, and stay there until the surface of the Earth comes up to meet them.

The perception of a force “pulling” down, gravity, is a result of inertia. Inertia makes objects try to follow a “straight” path, which in the vicinity of a large mass (or any mass) is a curved path. Objects *already* occupying that path repel other objects through the electromagnetic repulsion of electrons. That repulsion pushes objects *away* from the path with an acceleration away that is perceived as gravity. In other words, the electrons in your chair are pushing the electrons in your butt away from the path.

Einstein demonstrated the weakness of Newton's gravity theory when the light from distant stars was shown to bend while passing close to the sun. Specifically, Newton's formula (1.) below says that

the ***F***orce is equal to the ***G***ravitational constant times the product of the two ***m***asses involved divided by their separation ***r***adius squared. When one of the masses belongs to light photons, that mass is zero, and the product of the two masses is thus zero, making the ***F***orce equal to zero. Newton's other formula (2.) below shows that if the ***F***orce is zero, so is the product of the ***M***ass and ***A***cceleration. While the ***M***ass need not be zero, the ***A***cceleration must be zero even if there is any ***M***ass. If ***A***cceleration is zero, the ***F***orce is zero regardless of ***M***ass. Newton's formulas work extremely well in everyday situations, but are slightly inaccurate. Einstein's General Relativity corrects that inaccuracy and has been proven correct.

1. $F=G\frac{m_1 m_2}{r^2}$

2. $F=MA$

This scenario can be viewed as a different approach to the classic Newtonian and Einsteinian definitions of gravity, except that this approach does not require some mysterious force pulling objects together. Conventional physics considers gravity the weakest (by a factor of the 43rd power) of the four known forces (including the strong, weak and electro-magnetic). Centrifugal force doesn't exist, it is a perceived result of inertia and the radial inward acceleration. This scenario suggests that gravity not only is not a force, but *doesn't even exist*. The perception of gravity is a result of the curvature, or compression, of space itself caused by mass. The fact that space is compressed by any mass requires some sort of phenomenon, but it is improper to call it a force, because it causes no acceleration, only the distortion of empty space. Objects at rest, or moving along a trajectory, continue until some force accelerates them in some direction. When the curvature of space is enough to overcome the electro-magnetic force, objects proceed to an orbit much closer to the center of mass, commonly called a neutron star. When the curvature is even greater, even light orbits the center, a so called black hole. Einstein has demonstrated that gravity is not a force and that space is curved. Space is not flat, there is curvature to space, with unaccelerated mass following the curvature, that eliminates the need for a force called gravity.

This paper does not make any new theory of gravity, only a new interpretation.

Fun Irrelevant Numbers

Time from **W**ausau to **I**ndian **O**cean : 45+ minutes.
Maximum relative speed (passing the center of the earth): 33,700 kph (20,945 mph),
(9.36 kps) (5.8 miles/sec).
Miss the center of the earth (½ perigee): 449 km (279 mi.). Apogee: 12750 km (7920 mi.).

These numbers are latitude dependent and ignoring hundreds of other minor variables, but the whole adventure is impossible anyway.