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Event 5: The Physics Of Earth's Tides

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Purpose

Understanding the role that forces play in producing Earth's ocean tides remains an ongoing challenge. Even though all tidal elements are known, fitting these elements together in a logical manner that is true to Nature has proved to be an elusive goal. In considering Earth's tidal events, we think there is a considerable advantage to using the Universal Physics perspective regarding the behavior of the action and reaction forces involved. With this thought in mind, let us now launch a new effort to understand the types of forces present, their characteristics, and the roles they serve while working together in causing Earth's tides. (If your interest in the cause of Earth's tides does not extend beyond a quick summary, then scroll down to paragraph 62.)

Event 5

Perhaps the best way to begin an analysis of Earth's tides is to offer a definition for tide.

Tide Definition A tide is the natural, periodic change in elevation that is occurring to portions of the matter of an object.

(2) A tide occurring to portions of Object A usually has as its beginning, gravitational forces that are being generated individually within Object A's components of matter caused by an imbalance in their operation due to their reception of gravitational energy previously emitted in Object A's direction by the myriad of individual components of the matter of distant Object B. These internal gravitational forces being generated within Object A's matter act as the cause of acceleration for portions of Object A's matter with said acceleration directed toward Object B. Of prime importance where the tides are concerned is the recognition that it is possible for different portions of Object A's matter to accelerate at different rates in Object B's direction. Development of this "different rates" recognition is key to understanding the forceful process that results in causing Earth's high tides.

(3) This investigation begins by focusing upon a space where just two objects exist, Earth as Object A and Earth's moon as Object B. Since Earth's diameter is large and its distance from the Moon is relatively short, the force-generating effect of the Moon's gravitational energy is reduced by as much as 3% as this energy expands and thereby becomes less dense while passing through nearly 8000 miles of Earth's matter, from near side to far side. Accordingly there exists a small but still significant difference in the magnitude of the action force of Moon gravitation within Earth's near side facing the Moon as compared to the lesser magnitude of average Moon gravitation force being experienced both at Earth's center of matter and also at every point on a curved average gravitational division of Earth's matter into slightly unequal near and far portions

where each such point is the same distance from the Moon's center of matter as is Earth's center of matter. This above average action force excess, present only within Earth's near side portion, is herein termed the "excess gravitation force" and is the root cause of Earth's ocean tides.

(4) Earth and the Moon, as a two body system, share a center of matter about which they both orbit. This center of matter is known as the barycenter. In our event, the Moon will present the same side toward Earth as it does now while orbiting the barycenter. But Earth will have no rotation what-so-ever as it's center of matter also orbits the barycenter. This setup will help to isolate the forces and accelerations that are responsible for Earth's ocean tides.

(5) The barycenter is an Earth/Moon orbital axis that resides about 1063 miles below Earth's near side surface. The Moon's center of matter resides on average at 238,855 miles distant from the barycenter about which it orbits in a time period of 27.32 normal Earth days. Earth's center of matter is 2901 miles deeper underground from the barycenter about which Earth orbits also in 27.32 Earth days. It is known that the force of Earth gravitation, being generated individually within the Moon's myriad of components of matter, is the acceleration/Action force responsible for causing the Moon to orbit the barycenter in 27.32 days. In a mutual manner, the force of Moon gravitation being generated individually within Earth's myriad of components of matter is the acceleration/Action force responsible for causing Earth's center of matter to orbit the same barycenter in the same elapsed time. Overall these two gravitational acceleration/Action forces, though widely separated, are equal in magnitude and opposite in direction in compliance with Newton's LAW III and Rule 8 of the Universal Physics Rules for Force & Motion. Also it is known that the Moon gravitational forces being generated within Earth's components of matter are directed toward the Moon's components, and not directed toward the underground barycenter which is merely the site of the orbital axis of the Earth/Moon system.

(6) It is also known that, on average, Earth is accelerating in a weightless manner in the vacuum of space with this acceleration directed toward the orbiting Moon. Considering our non-rotating Earth's dual high tides, Earth's ocean water is maintaining a high tide mound on Earth's side nearest the Moon plus a second high tide mound of ocean water on Earth's far side. While at first one may think that all portions of our non-rotating Earth are experiencing the same rate of Moon-directed acceleration, we find that different rates of acceleration are required of Earth's ocean waters in order for these dual high tide mounds to be maintained while slowly traveling around the non-rotating Earth in sync with Earth's and the Moon's leisurely orbit of the barycenter.

(7) The challenge here is to determine the arrangement of forces that could possibly be at work to cause different rates of acceleration for Earth's ocean waters in order for the dual high tide mounds to be maintained. After all, it is well-known and fully accepted that different objects in a vacuum accelerate at the same rate when this acceleration is powered by the internal acceleration/Action force of gravitation. By this "same rate of acceleration" recognition, Earth's water and land should accelerate through the vacuum of space at the same rate toward the Moon making high tide mounding impossible. Yet with Earth displaying dual high tide mounds, one need not abandon logic to think that the acceleration/Action forces being experienced by Earth's

water are somehow different from the acceleration/Action forces being experienced by Earth's land.

(8) Returning to the subject of Earth's near side excess gravitation force, consider that, on average, the gravitational acceleration/Action forces present at Earth's center of matter and at any point on Earth's curved average gravitational division, as previously described in paragraph (3), are at the correct magnitude to cause that portion of Earth's land and water to accelerate at the correct rate which is Earth's average rate of acceleration toward the Moon. Next consider that the land and water on Earth's far side are as much as 3963 miles farther away from the Moon than matter at Earth's center. Here on Earth's far side, the force of Moon gravitation is less than average. Yet if the actual rate of acceleration for Earth's far side matter were to truly be less than average then a large portion of Earth's far side matter would have to separate or break free from the rest of Earth. Since this does not happen, then some additional action force must be present and effective in bringing the magnitude of the total acceleration/Action force up to that required to match with the average rate of acceleration being experienced by all matter located at the average gravitational division that divides Earth into slightly unequal near and far side portions. But if this additional action force, predicted to be present on Earth's far side, is also a gravitational force then it will be of no help in explaining why the land and water located there accelerate at different rates. To be helpful in solving the "different rates" puzzle, this additional force has to be some form of Type 3 external (contact) tension force that is directed toward the Moon.

(9) Let us now consider the Moon gravitation forces present within Earth's near side, which is the side facing the Moon. Here we are as much as 3963 miles closer to the Moon than matter located at any position on Earth's average gravitational division. Due solely to the reduced distance to the Moon's center of matter, the acceleration/Action force of Moon gravitation is greater than the average force of Moon gravitation at Earth's average division. If this greater-than-average force is truly able to cause greater-than-average acceleration for Earth's near side then again some portion of Earth will be forced to separate or break free. Since this does not occur, then the next question is: "What happens to the excess force of Moon gravitation that is being generated within the components of matter of Earth's near side portion?" We are thinking that it accumulates and thereby stacks up in magnitude while traveling back, in a serial manner, through Earth's matter to become the Type 3 external (contact) force needed to tug on Earth's far side portion thereby effecting its rise to the average rate of acceleration being experienced at Earth's average gravitational division. If it does provide this external (contact) force then there should be evidence of Earth's shape being stretched out along a line drawn from the Moon's center through Earth's center. This stretching-of-Earth, if real, will serve the same role as Isaac Newton's "distended" rope that is pulling forward with an external (contact) force on the dragging stone that is equal and opposite to the external (contact) force the rope is pulling backward on the walking horse.

(10) Standing as proof of this prediction, Earth's shape is already known to stretch out along the previously described central line. Since the excess force of Moon gravitation being generated individually by the myriad of components of Earth's near side solid matter is not being terminated as it would be if it were acting as the cause of excess acceleration for Earth's near side solid matter, this excess force in the Moon's direction is free to accumulate as it is transported as an

external serial transfer tension force that passes back through Earth's solid matter to terminate in the action of forcefully raising the acceleration rate of the solid matter within Earth's far side up to the average rate of Earth's average gravitational division.

(11) For the above stated reasons, we accept that the excess action force of Moon gravitation being generated within Earth's near side portion of solid matter does end up tugging on the solid matter on Earth's far side portion. But while this excess acceleration/Action force is helping to cause an average acceleration rate for Earth's far side solid matter, we wonder if it is also doing the same for Earth's far side water? After some consideration we draw the conclusion that the accelerational effect of this external force is being only indirectly applied to Earth's ocean water through the interface of the water's friction with the ocean floor. This somewhat ineffective frictional method of force transfer serves to prevent full transfer of the acceleration/Action force required to cause the average rate of acceleration for Earth's far side water. Hence Earth's far side ocean water, that is approaching the high tide mound, is left with a lower-than-average rate of acceleration than is being experienced by the far side ocean floor. (The transfer of acceleration/Action forces to the ocean water from the ocean floor will be greater at greater depths and at its least near the ocean surface.)

(12) Consider the following event. Hold your forearm out horizontally with your palm turned up. Pour a single drop of water into your palm and then quickly pull your hand closer to your body in the horizontal direction. As you will discover, the external acceleration/Action force from your hand depends upon the same ineffective frictional method of force transfer to the water. While the water does accelerate in your direction, its rate will always be lower than the acceleration rate of your palm. The result of this lower rate of acceleration is that the water's position on your palm lags behind as it automatically shifts backward in the direction of your forward-accelerating fingers without there being present any event-causing action force in that backward direction.

(13) In the same manner, due to the external nature of this excess Type 3 serial transfer acceleration/Action tension force, Earth's ocean water on the far side that is approaching the high tide mound experiences a lower rate of acceleration in the Moon's direction than the average rate now being experienced by the ocean floor underneath. This allows the ocean water to lag behind the accelerating ocean floor resulting in the automatic formation of the high tide mound on Earth's far side. Notice that here too there exists no backward-directed tidal-mound-building action force in this event for no such action force is known to exist in Nature. There does exist a myriad of backward-directed internal acceleration/Reaction support forces being reactively generated within the myriad of forward-directed accelerating components of Earth's matter. But as reaction forces, they are incapable of acting as the cause of any event. Here the role of these internal acceleration/Reaction forces is to provide equal and opposite support and termination for both the internal and external acceleration/Action forces responsible for causing forward-directed (Moon-directed) acceleration of Earth's far side matter.

(14) Now that the external-force cause of Earth's far side high tide mound is proposed, what then of the high tide mound on Earth's side nearest the Moon? Here, as much as 3963 miles closer to the Moon than Earth's average gravitational division, the acceleration/Action force of Moon

gravitation affecting Earth's near side ocean water is above average. This force is also above average for the near side ocean floor. Yet the acceleration rate of the near side ocean floor is no greater than what is average at Earth's average gravitational division since all excess (non-terminated) Moon gravitational forces being generated within Earth's near side portion solid matter are being transferred back to augment Earth's far side acceleration. This leaves Earth's near side ocean waters, being somewhat restrained by the water's friction with the accelerating ocean floor, otherwise free to respond to this above average internal force of Moon gravitation being generated within the myriad of components of matter of Earth's near side ocean water. Here a higher-than-average rate of Moon-directed acceleration is being forcefully caused by the near side excess gravitation force resulting in the forceful building of Earth's near side high tide mound.

(15) In summary, it is clear that the external serial transfer tension forces present play a major role in causing Earth's near side and far side waters to accelerate at rates different from the average rate of Earth's solid matter below. On Earth's far side, the Moon-directed external tension force causes the increase in the solid matter's acceleration rate up to average which automatically allows the ocean water to mound up on Earth's far side as the water's acceleration rate lags behind. Meanwhile, on Earth's near side, the external tension force, directed away from the Moon, holds the solid matter's Moon-directed rate of acceleration down to average while the ocean water's Moon-directed rate remains above average resulting in the forceful building of Earth's near side ocean mound. This "different rates" of acceleration for portions of Earth's water compared to Earth's solid matter at the same general location on Earth is directly caused by the different characteristics of internal gravitational forces compared to external tension forces. Moon gravitational forces affect Earth's land and water equally while tension forces applied to Earth's land have only a limited effect upon Earth's water. (By introducing the stretching of Earth, we are acknowledging that Earth's solid matter also experiences tides. Again, this stretching is due to the presence of the external tension forces above described. Invisibly, Earth's atmosphere must also mound up over the ocean tidal mounds, again due to all the same reasons as does Earth's ocean water.)

(16) Now let us perform some calculations of the forces and accelerations that are either directly causing or indirectly resulting in the formation of our non-rotating Earth's high tidal mounds. We will employ three relatively small portions of Earth's matter with each portion being an object with a mass rating of 40 million lb.m or in SI terms, 18.1 million kg which is close to 1/3 the mass rating of the carelessly-operated Titanic ocean liner. Earth Object EO1 will be positioned at Earth's near side facing the Moon. Earth Object EO2 will reside at Earth's center of matter. Earth Object EO3 will reside at Earth's far side facing away from the Moon. All three objects will remain on the line previously drawn from the Moon's center of matter through Earth's center of matter. In order to stay on this line, like the barycenter embedded deep within Earth's matter, objects EO1 and EO3 will need to magically slide sideways through the non-rotating Earth's matter as all three travel in a circular manner about the Earth/Moon barycenter as they maintain their alignment with the orbiting Moon.

(17) We will begin by embedding object EO1 into Earth's near side surface facing the Moon. Here we will calculate the above average force of Moon gravitation being actively generated

within the myriad of components of EO1's matter. During the following series of calculations, we will be using specific values plus some general understandings drawn from a number of sources including "Fundamental Astronomy", Second Enlarged Edition by H. Karttunen, P. Kroger, H. Oja, M. Poutanen, and K.J.Donner Editors; "In Quest of the Universe" Second Edition by Karl F. Kuhn; "Classical Mechanics" A Modern Perspective - Second Edition by Vernon D. Barger & Martin G. Olsson; "University Physics" Eighth Edition by Hugh D. Young; and "Conceptual Physics" Seventh Edition by Paul G. Hewitt. Of course, the specific values are subject to improvement in accuracy. Proof of concept is our goal which, if successful, will continue to remain intact even if minor adjustments of these values are made. Calculations are performed using two Microsoft Windows calculators set to scientific mode and the unique and ever-handy A.P.C. units converter including an acceleration & gravitation calculator written in compiled BASIC by Ryan and myself and available free to supporters of UniversalPhysics.org.

(18) The values below, in US units, will be used in the calculations that follow. (Please note that these values may be successfully pasted into the Windows Calculator just as they are printed below. Thus 1.61,994e+23 is accepted along with the included comma. Also when using the A.P.C. program, change the "e" for exponent to "d" for decimal.)
Mass Values
Moon mass = 1.61994e+23 lb.m (Shift the decimal 23 positions to the right for the true value.)
EO1, EO2, EO3 mass = 40,000,000 lb.m each.
Gravitational Distance from Earth Objects to Moon c/m.
EO1 - Moon   = 1,240,226,719 ft (Distance from Moon c/m to EO1 embedded in Earth's front side.)
EO2 - Moon   = 1,261,152,333 ft = 238,854.6 miles. (Distance from Moon c/m to EO2 embedded at Earth's c/m.)
Moon - EO3   = 1,282,077,947 ft (Distance from Moon c/m to EO3 embedded in Earth's back side.)

Earth/Moon Barycenter Values (common axis of orbit)
Earth equatorial radius = 3963.18 miles
= 20,925,614.3 ft
Barycenter depth below Earth's front side = 1062.54 miles
= 5,610,225 ft
Barycenter to Earth c/m = 2900.64 miles
= 15,315,389.3 ft
Gravitational Constant = 3.321998855540755e-11 using US units ft, lb.m, and lb.f. (Shift the decimal 11 positions left for the true value.

(19) Problem 1. Embed object EO1 into Earth's near side facing the Moon. Determine the Moon gravitational force being generated within EO1's matter.

force = Gravitational Constant x Moon Mass x EO2 Mass / Moon Distance2
= (3.32,199,885,554,075,5e-11 lb.f*ft2/lb.m2) x 1.61994e+23 lb.m x 40,000,000 lb.m / (1,240,226,719 ft)2

= (3.32,199,885,554,075,5e-11 lb.f*ft2/lb.m2) x 6.47976e+30 lb.m2 / 1,538,162,314,521,504,961 ft2
= (3.32,199,885,554,075,5e-11 lb.f*ft2/lb.m2) x 4,212,663,344,320.5 lb.m2/ft2
= 139.94 lb.f
(EO1 is 4.6 lb.f above average. See Problem 2 below.)

(20) Problem 2. Determine the Moon gravitational force being generated within EO2's matter, located at Earth's center. This is the average force per unit mass of all of non-rotating Earth's accelerating matter.
force = Gravitational Constant x Moon Mass x EO2 Mass / Moon Distance2
= (3.32,199,885,554,075,5e-11 lb.f*ft2/lb.m2) x 1.61994e+23 lb.m x 40,000,000 lb.m / (1,261,152,333 ft)2
= (3.32,199,885,554,075,5e-11 lb.f*ft2/lb.m2) x 6.47976e+30 lb.m2 / 1,590,505,207,031,342,889 ft2
= (3.32,199,885,554,075,5e-11 lb.f*ft2/lb.m2) x 4,074,026,272,503.934 lb.m2/ft2 1
= 135.34 lb.f
(EO2 is average)

(21) Problem 3. Embed object EO3 into Earth's far side, which is the side opposite to the Moon. Determine the Moon gravitational force being generated within EO3's matter.

force = Gravitational Constant x Moon Mass x EO3 Mass / Moon Distance2
= (3.32,199,885,554,075,5e-11 lb.f*ft2/lb.m2) x 1.61994e+23 lb.m x 40,000,000 lb.m / (1,282,077,947 ft)2
= (3.32,199,885,554,075,5e-11 lb.f*ft2/lb.m2) x 6.47976e+30 lb.m2 / 1,643,723,862,183,734,809 ft2
= (3.32,199,885,554,075,5e-11 lb.f*ft2/lb.m2) x 3942122000584.36 lb.m2/ft2
= 130.96 lb.f
(EO3 is 4.38 lb.f below average. After being raised to average, 96.8% of its acceleration/Action force is internal Moon gravitation which directly effects water while the remaining 3.2% is an external tension force which only indirectly affects water.)

(22) Next we need to check if the 135.34 lb.f being experienced by the EO2 portion embedded at Earth's center is the correct magnitude of force needed to cause EO2 to orbit the barycenter, with a 2900.64 mile or 15,315,379.2 ft radius in 27.3217 days or 2,360,595 seconds. In the process of checking, we will end up knowing Earth's average rate of Moon-directed acceleration. First we will need to know EO2's velocity about the barycenter.

(23) Problem 4: Calculate EO2's orbital velocity about the Earth/Moon barycenter.
Velocity = Orbital Circumference / Time
= 2 x Pi x Radius / Time
= 2 x 3.14159 x 15,315,379.2 ft / 2,360,595 sec
= 40.7648 ft/sec
(40.7648 ft/sec is about 28 miles/hour which reveals the leisurely speed at which Earth's axis orbits the Earth/Moon barycenter.)

(24) Problem 5: Now we are ready to calculate the Moon-directed force required to cause EO2 to orbit the barycenter, 2900.64 miles distant. We will use the formula developed long ago by Isaac Newton for calculating the action force in circular events named by Newton as "centripetal force". We include division by 32 to convert the answer from the absolute force Poundal units to more commonly used lb.f units.

force = Mass x Velocity2 / Radius / 32

= 40,000,000 lb.m x (40.7648 ft/sec)2 / 15,315,379.2 ft / 32

= 40,000,000 lb.m x 1661.7689 ft2/sec2 / 15,315,379.2 ft / 32

= 40,000,000 lb.m x 0.0001085 ft/sec2 / 32 Pdl/lb.f

= 4340.13 Pdl / 32 Pdl/lb.f

= 135.62 lb.f

(25) Problem 6: You can see that the 135.62 lb.f required to cause EO2 to orbit the barycenter 2900.64 miles distant when its orbital velocity is 40 ft/sec is quite close to the 135.34 lb.f of Moon gravitation we calculate as being experienced by EO2 in Problem 2. Are you wondering what force value we will get if we treat EO2's acceleration as a linear event? The F=ma formula is also based upon Isaac Newton's work. We will need EO2's rate of acceleration which in circular events is Acceleration = Velocity2 / Radius. The answer is already calculated and underlined in Problem 5 above.

force = Mass x Acceleration / 32

= 40,000,000 lb.m x 0.0001085 ft/sec2 / 32

= 4340 Pdl / 32

= 135.625 lb.f

(26) Now that we have used three different methods to generally verify the 135.34 lb.f average force being generated within EO2's matter, let's consider how Earth's near side excess acceleration/Action force causes to exist the external tension force that acts equally in opposite directions as the final step in causing our non-rotating Earth's dual high tides. Let us take a fresh perspective of this accelerating Earth event by supposing that our three Earth Objects continue to exist at their current positions while Earth itself just magically disappears. The Moon gravitational forces be generated within each object will continue unchanged. Only now EO1 will begin moving ahead of EO2 in the Moon's direction since it is free to experience the higher rate of acceleration being caused by its 4.6 lb.f greater-than-average near side gravitation force. Meanwhile, EO3 with its 4.38 lb.f less-than-average Moon gravitation force will begin lagging behind EO2 with its average acceleration rate of 0.00,010,85 ft/sec2. How do you think we could cancel the expansion of the distances between the three Earth Objects?

(27) At the front of our three object lineup, to reduce EO1's acceleration rate down to average, one would need to exert a backward pull of 4.6 lb.f. At the rear, to increase EO3's acceleration rate up to average, one would need to exert a forward pull of 4.38 lb.f. If we could establish a mechanical connection between EO1 and EO3 then EO1's excess gravitation 4.6 lb.f would be more than enough to provide the required force needed to increase EO3's rate up to the average being experienced by EO2. As this connection is being made, EO3's acceleration will switch from being 100% caused by Moon gravitation to instead being directly caused by a combination of

internal forces of Moon gravitation and external (contact) forces being delivered through its mechanical connection with EO1.

(28) Suppose we attach one end of an 7927 mile long strand of dental floss to the back side of EO1. The strand will pass freely through an opening provided in EO2 on its way back to be tied to the front side of EO3. Since we have the use of magical powers in making Earth disappear, at the same instant of the disappearance, our dental floss strand/tow cable will be installed and properly tensioned to pull forward against EO3 with the same 4.6 lb.f magnitude of acceleration/Action force that the strand is pulling backward against EO1.

(29) The role of the strand as providing a bipole external tension force experienced by both EO1 and EO3 has already been well-described by Isaac Newton as follows:
"If a horse draws a stone tied to a rope, the horse (if I may say so) will be equally drawn back towards the stone; for the distended rope, by the same endeavor to relax or unbend itself, will draw the horse as much towards the stone as it does the stone towards the horse, and will obstruct the progress of the one as much as it advances that of the other." (Quote is from PRINCIPIA, Volume I, "The Motion of Bodies" LAW III, pages 13-14.)

(30) Think of our dental strand as Newton's rope while EO1 is the horse and EO3 is the stone. In our event, mixing in Newton's words, the tensioned strand, through the application of an external (contact) force, is pulling equally and oppositely on both objects thereby obstructing the accelerational progress of EO1 as much as it advances that of EO3. The result is that EO1 and EO3 generally share the average acceleration rate and acceleration direction being experienced by the central object EO2.

(31) Let us now restore the Moon and our three Earth Objects, along with the attached and tensioned dental strand, to the instant Earth disappeared. (This is required since in Earth's absence, the Moon no longer follows a orbital path about Earth in space.) In Problem 1, we learned that EO1, in the lead, is experiencing a Moon gravitational force of 139.94 lb.f. Without the attached strand, this force will be an internal Type 1 force as EO1 will be accelerating in a weightless manner in the Moon's direction. But with the 7927 mile long strand attached to its back side, 3% of the Moon gravitational force being actively generated within each component of EO1's matter is accumulating through the stacking-of forces effect to reach a maximum forward-directed 4.6 lb.f (pound.force) at its far side hook. Each individual forward-directed 3% portion from each component is the result of an internal Type 2 force where it is generated internally within each component of matter but, unlike a Type 1 force, is being delivered as an external pull against components beyond. This Type 2 force is also a monopole force of origination for the force begins here. (To get the most out of Event 5, consider Article IV a prerequisite.)

(32) The myriad of forward-directed internal Type 2 forces, identified above, stack up in the backward direction to reach a maximum of 4.6lb.f at EO1's back side hook. The force that collects these individual Type 2 forces from EO1's components is an external Type 3 bipole force that is responsible for collecting the full 4.6 lb.f, delivering it to the back side hook, transferring it along the entire 7927 mile dental strand to EO3's front side hook and finally stacking down as

portions of this acceleration/Action force are experienced by every single component of EO3's matter. This linear Type 3 bipole force is the same force provided by Newton's rope as the forward exterior head interfaces with EO1 component's internal Type 2 forces of gravitation and the equal and opposite rearward exterior head interfaces with EO3 component's internal Type 2 forces of acceleration/Reaction.

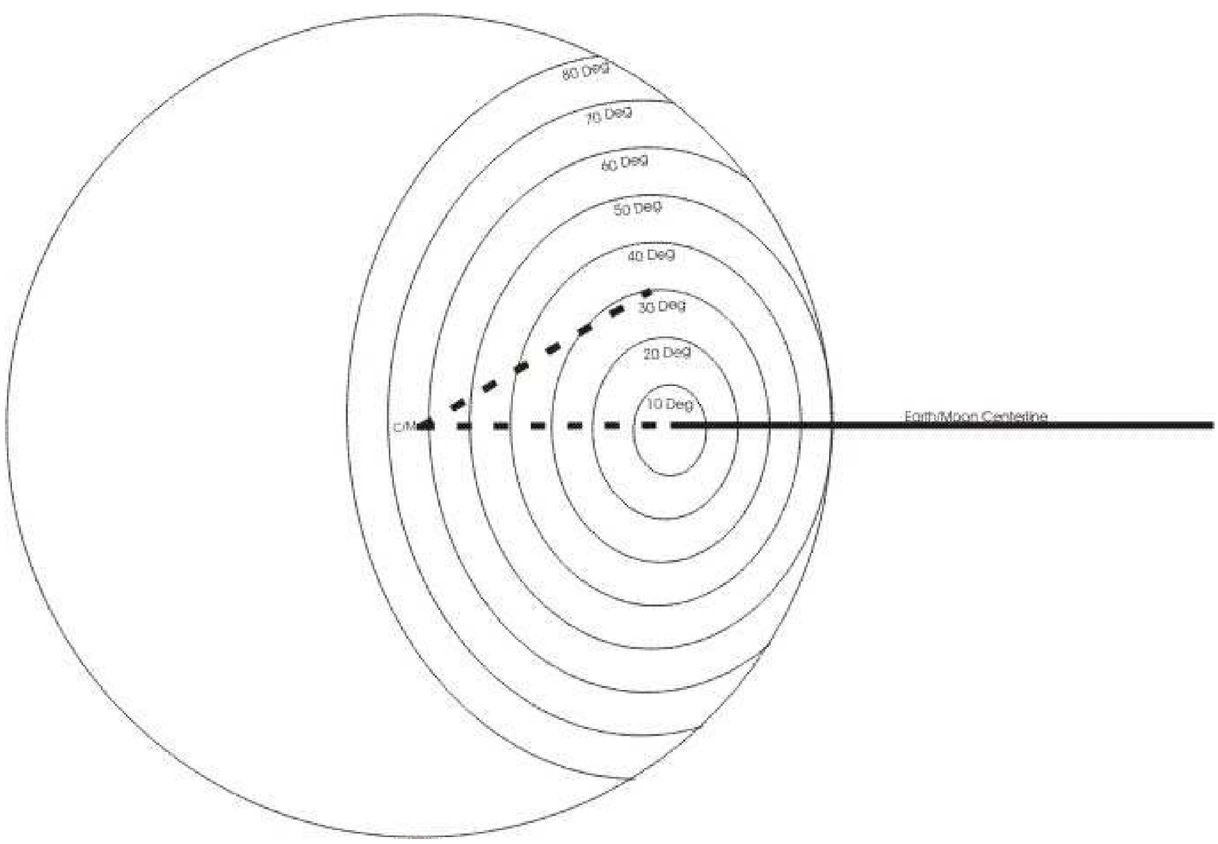
(33) Viewing this event from the action force perspective, we have a myriad of forward-directed internal monopole Moon gravitational forces of origination being sourced from within EO1's matter. A total of 97% of these gravitational forces are Type 1 as they directly cause the action of acceleration for EO1's components. The remaining 3% of Moon gravitational forces are Type 2 gravitational forces that also are internally generated but are externally collected and transferred in the rearward direction by the forward head of the external Type 3 bipole action force. The departure of this 3% portion totaling 4.6 lb.f leaves EO1 to experience just an average rate of acceleration. After being transferred back along the dental strand, the rearward head of the external Type 3 bipole force transfers this 3% force portion to EO3's myriad of components causing internal Type 2 acceleration/Action forces that increase EO3's rate of acceleration up to average while terminating in a linear manner against internal Type 2 acceleration/Reaction forces being reactively generated within EO3's forward accelerating components of matter.

(34) Viewing this event from the reaction force perspective, there are a myriad of rearward-directed internal acceleration/Reaction forces being generated within each component of EO3's accelerating matter. Here, 97% are in the form of Type 1 acceleration/Reaction forces that are caused by and directly interface with EO3's Type 1 a/A forces of Moon gravitation. These Type 1 acceleration/Reaction forces provide support and termination for all the Type 1 a/A forces present within EO3's components of matter. The 3% of the acceleration/Reaction forces that remain within EO3's matter are the Type 2 a/R forces that are caused by and provide support and termination for the 4.6lb.f being passed back along the dental strand. Thus EO3's acceleration/Reaction force total is to be found by combining the Type 1 and Type 2 a/R forces present. Forward in EO1's matter, all of the acceleration/Reaction forces being reactively generated within its own matter are internal Type 1 forces providing support and termination within each individual component of EO1's accelerating matter. The Type 2 forces of acceleration/Reaction being generated within EO3's accelerating components, caused by the bipole external Type 3 4.6 lb.f being transferred back along the dental strand, are themselves transferred forward along that same strand all the way to the site of the original Type 2 Moon gravitational forces located deep within EO1's matter. Their presence at any point along this Type 3 serial transfer force path may be observed by severing the path at any location and inserting a tension scale which will display the magnitude of the equal and opposite acceleration/Action and supporting acceleration/Reaction forces present.

(35) Here we have described the entire linear force journey that both deprives EO1 of 3% of its accelerational force lowering its rate to average while delivering this excess acceleration/Action force to EO3 thereby increasing EO3's acceleration rate 3% up to average. The end result is that all three of our Earth Objects accelerate at the same average rate despite the inequality of the Moon gravitational forces being experienced by each object.

(36) Ninety seven percent (97%) of EO3's acceleration/Action force is internal Moon gravitation which, if water were present, would directly cause the water to accelerate in the Moon's direction at the same rate as solid matter. The remaining 3% of the acceleration/Action force EO3 is experiencing is the external tension force provided by the dental floss strand with this contact force accelerating EO3's solid matter while leaving any water only indirectly affected by its friction with the solid matter. Thus in the real world, Earth's far side high tide is formed as the water's moon-directed acceleration is slightly below average and therefore unable to match the slightly higher average rate being experienced by the far side land below.

(37) Our next project will be to calculate the tidal forces being experienced by ocean waters at various points around Earth's near-side surface. First we will cause Earth to reappear with the three Earth Objects embedded in Earth's near side, center and far side as previously described in paragraph (17). Earth remains non-rotating while its center of matter resumes its leisurely 27.32 day orbit of the Earth/Moon barycenter. Looking back at Earth along the Earth/Moon centerline, we will first draw a circle around that centerline on Earth's near-side surface that represents every point on Earth's surface that is the terminus of a radius drawn at a 10 degree angle with the Earth/Moon centerline beginning at Earth's center of matter. Then additional radial circles are drawn every 10 degrees until the last one reaches the 90 degree angle to the Earth/Moon centerline which includes both the North and South Poles. In the calculations that follow we will repeatedly embed EO1 at some point on each radial circle to determine the tidal force experienced at that position. We will write a Microsoft QuickBasic (R) program to make these lengthy calculations fun and easy, something not possible back in Newton's time where all such calculations were laboriously performed long-hand.



(38) Start the Microsoft QuickBasic Editor (R) and enter the program below exactly as written. Be sure your printer is hooked up and turned on or you may get a "Device Fault Error" when running. Press shift/PrtSc to print the output. Or, better yet, click on the upper left icon on the Quick Basic window, select Edit and then Mark. Then highlight the text you would like to copy to the Windows (c) clipboard. While highlighted, press Enter to complete the Copy. Then you can Paste the screen printout into any Windows application.

(39)

```
10 CLS : CLEAR
20 PRINT : PRINT
30 PRINT " Earth Near-Side Tidal Force Calculator"
40 PRINT " Written by Ethan Skyler 6/12/2009"
50 PRINT
60 DEFDBL A-Z 'Sets all numerical variables to double precision
70 REM Click on QBasic upper left icon. Select Properties. Option. Display Options. Select
Window.
80 REM Font select 14. Layout Screen Buffer Size Width 80, Height 40.
90 REM Window Size Width 80, Height 40.

100 REM Earth Diameter = 7927 mi
110 REM Earth Radius = 3963.5 mi x 5280ft/mi er = 20,927,280 ft
120 REM Earth Object (EO1) = 40,000,000 lb.m
130 REM Earth Object moon gravity force (eo2mg) = 135.34 lb.f Average for all Earth's matter.
140 REM Earth/Moon C/M distance = 238,855 mi emd = 1,261,154,400 ft
150 REM Gravitational Constant = 3.321998855540755D-11 lb.f*ft2/lb.m2
160 REM moonmass = 1.61994D+23

200 CONST er = 20927280
210 CONST eo1mass = 40000000
220 CONST eo2mg = 135.34
230 CONST emd = 1261154400
240 CONST gravconst = 3.321998855540755D-11
250 CONST moonmass = 1.61994D+23

300 degrad = ATN(1) * 4 / 180 'conversion between degrees and radians.
310 raddeg = 57.29577951#   'conversion between radians to degrees.
320 distance$ = "\ \ ############,.## \ \"
330 degree$ = "\ \ ###.#### \ \"
340 force$ = "\ \##########,.###### \ \"  'To reduce decimal places, change # of #s.

400 REM  Calculate triangle T1 to determine the distance EO1 is from Earth's center of
410 REM  matter along with EO1's right angle distance from the Earth/Moon centerline.

500 PRINT " Enter Tidal Position Angle from Earth/Moon centerline (0.1-89.9 deg)"
```

```
510 PRINT " Angle is formed by following Earth/Moon centerline down to Earth's"
520 PRINT " c/m and then proceeding directly up to EO1's surface position on"
530 PRINT " Earth's near side. "
540 PRINT
550 PRINT
560 INPUT " Tidal Position Angle "; tpa
570 IF tpa <= 0 OR tpa >= 90 THEN GOTO 10: ' resets page if angle not above 0 or not less than 90 degrees.

600 REM calculate triangle T1.
610 t1aa = tpa          't1aa is angle a of triangle T1 and equal to the tidal position angle.
620 t1sc = er           't1sc is side c (hypotenuse) of triangle T1 and equal to an Earth radius.
630 t1ac = 90           't1ac is angle c of triangle T1.
640 t1ab = 90 - t1aa
650 t1sa = SIN(t1aa * degrad) * t1sc
660 t1sb = SIN(t1ab * degrad) * t1sc

700 PRINT
710 PRINT USING degree$; " T1aa = "; t1aa; "degrees (T1,  angle A)"
720 PRINT USING degree$; " T1ab = "; t1ab; "degrees (T1, angle B)"
730 PRINT USING degree$; " T1ac = "; t1ac; "degrees (T1, angle C)"
740 PRINT USING distance$; " T1sa = "; t1sa; "ft (T1, side a)"
750 PRINT USING distance$; " T1sb = "; t1sb; "ft (T1, side b)"
760 PRINT USING distance$; " T1sc = "; t1sc; "ft (T1, side c)"

800 REM calculate triangle T2 which reaches to the Moon.
810 t2sb = t1sa
820 t2sa = emd - t1sb
830 t2sc = SQR(t2sa ^ 2 + t2sb ^ 2)
840 tant2aa = t2sa / t2sb
850 t2aarad = ATN(tant2aa)
860 t2aa = t2aarad * raddeg
870 t2ac = 90
880 t2ab = 90 - t2aa

900 PRINT USING degree$; " T2aa = "; t2aa; "degrees (T2, angle A)"
910 PRINT USING degree$; " T2ab = "; t2ab; "degrees (T2, angle B)"
920 PRINT USING degree$; " T2ac = "; t2ac; "degrees (T2, angle C)"
930 PRINT USING distance$; " T2sa = "; t2sa; "ft (T2, side a)"
940 PRINT USING distance$; " T2sb = "; t2sb; "ft (T2, side b)"
950 PRINT USING distance$; " T2sc = "; t2sc; "ft (T2, side c)"

1000 REM Solve force rectangle.
1010 t3ab = 180 - (t1ab + t2aa)
1030 t3ac = 90
```

```
1020 t3aa = 90 - t3ab
1040 eo1md = emd - t1sb
1050 REM Calculate the moon gravitational force on EO1 embedded at this point.
1060 REM This force will determine the length of vector t3sc. Use this length
1070 REM to solve the force vector parallelogram yielding the upward-directed
1080 REM force (t3sa) which is least effective in causing the tides and the
1090 REM horizontal force vector (t3sb) which is the Tidal Force portion of the
1100 REM near side excess gravitation force that is most effective in causing Earth's
1110 REM near side ocean tide. We find that 44.57 degrees is the zone of the
1120 REM greatest magnitude of horizontal-directed Tidal Force.
1200 eo1mg = (gravconst * moonmass * eo1mass) / ((emd - t1sb) ^ 2)
1210 eo1gd = eo1mg - eo2mg

1300 PRINT USING degree$; " T3aa = "; t3aa; "degrees (T3, angle A)"
1310 PRINT USING degree$; " T3ab = "; t3ab; "degrees (T3, angle B)"
1320 PRINT USING degree$; " T3ac = "; t3ac; "degrees (T3, angle C)"
1330 PRINT USING distance$; " EO1md = "; eo1md; " ft (EO1 Moon distance)"
1340 PRINT USING force$; " EO1mg = "; eo1mg; "lb.f (EO1 Moon gravitation force)"
1350 PRINT USING force$; " EO1gd = "; eo1gd; "lb.f (EO1 excess gravitation force)"

1400 t3sc = eo1gd             ' Here the length of the force vector is t3's hypotenuse.
1410 t3sb = SIN(t3ab * degrad) * t3sc
1420 t3sa = SIN(t3aa * degrad) * t3sc

1500 PRINT USING force$; " T3sa = "; t3sa; "lb.f (vertical force component.)"
1510 PRINT USING force$; " T3sb = "; t3sb; "lb.f (horizontal tidal force component.)"

1600 PRINT
1610 INPUT " Calculate another Tidal Position Angle, Y / N "; in$
1620 IF in$ = "Y" OR in$ = "y" THEN GOTO 10
1630 END
```

Download a copy of the Near Side Tidal Force Calculator program by clicking Here. Once loaded into your browser, click File and then Save Page As.... Then start the Quick Basic Editor, select File, Open, double click the two dots in the Directory Box, find the folder where you saved the file and then select it to Open. Enjoy.

P.S. You may also copy the program to your clip board and then paste it into the QuickBasic Editor beginning with the upper-left icon and then choose Edit... Paste. If all else fails and you have an hour to spare, open the Quick Basic Editor and type in the program.

(40) Let us put the Near Side Tidal Force Calculator program to work by calculating a range of tidal position angles on Earth's side nearest the Moon. Let 10 degrees be our first angle. To arrive at this angle, first draw the portion of the Earth/Moon centerline that runs from Earth's near-side surface on down to Earth's center of matter. Then, forming a 10 degree angle with the Earth/Moon centerline, draw a straight line back up to Earth's surface. When this 10 degree line

returns to Earth's near-side surface, it matters not whether it is north, south, west or east of the Earth/Moon centerline. In fact if all possible points of return at Earth's near-side surface are connected they will form a circle about the Earth/Moon centerline. In the solution of triangle T1, our Near Side Tidal Force program determines the length of this return line from Earth's c/m as T1sc with the radial distance at right angle to the Earth/Moon centerline represented by side T1sa. When our 10 degree line reaches Earth's surface, this point marks the location of the 40 million pound-mass Earth Object 1 in our first series of calculations. The Near Side Tidal Force program determines EO1's distance to the Moon's c/m for Moon gravitational calculations. It also gives us the vertical and horizontal component forces that affect EO1 at the 10 degree tidal position angle on Earth's near-side surface.

(41) The following is the complete printout for the 10 degree tidal position angle.

Earth Near-Side Tidal Force Calculator
Written by Ethan Skyler 6/12/2009

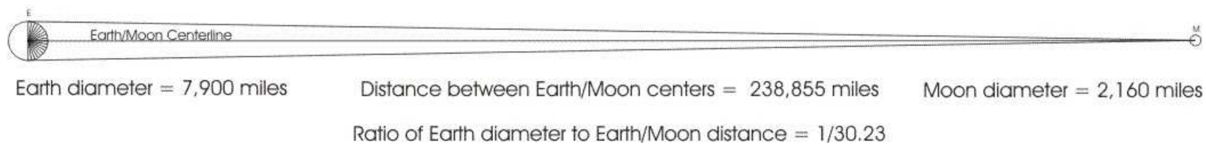
Enter Tidal Position Angle from Earth/Moon centerline (0.1-89.9 deg)
Angle is formed by following Earth/Moon centerline down to Earth's
c/m and then proceeding directly up to EO1's surface position on
Earth's near side.

Tidal Position Angle ? 10

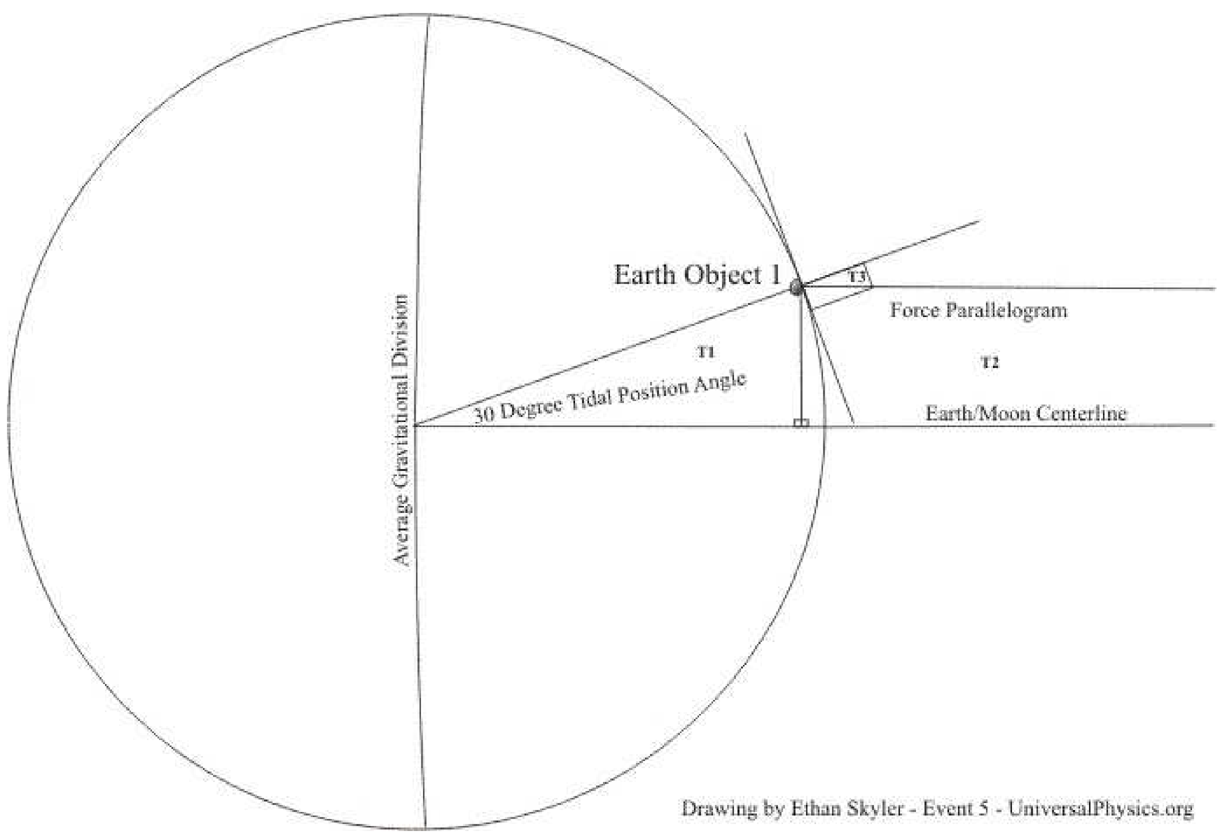
T1aa = 10.0000 degrees (T1, angle A)
T1ab = 80.0000 degrees (T1, angle B)
T1ac = 90.0000 degrees (T1, angle C)
T1sa = 3,633,984.04 ft (T1, side a)
T1sb = 20,609,347.59 ft (T1, Side b)
T1sc = 20,927,280.00 ft (T1, Side c)
T2aa = 89.8322 degrees (T2, angle A)
T2ab = 0.1678 degrees (T2, angle B)
T2ac = 90.0000 degrees (T2, angle C)
T2sa = 1,240,545,052.41 ft (T2, side a)
T2sb = 3,633,984.04 ft (T2, side b)
T2sc = 1,240,550,374.99 ft (T2, side c)
T3aa = 79.8322 degrees (T3, angle A)
T3ab = 10.1678 degrees (T3, angle B)
T3ac = 90.0000 degrees (T3, angle C)
EO1md = 1,240,550,374.99 ft (Earth Object 1 Moon distance)
EO1mg = 139.871615 lb.f (EO1 Moon gravity force)
EO1gd = 4.531619 lb.f (EO1 excess gravitation force)
T3sa = 4.460449 lb.f (vertical force component.)
T3sb = 0.799977 lb.f (horizontal Tidal Force component.)

Calculate another Near Side Tidal Position Angle, Y / N ?

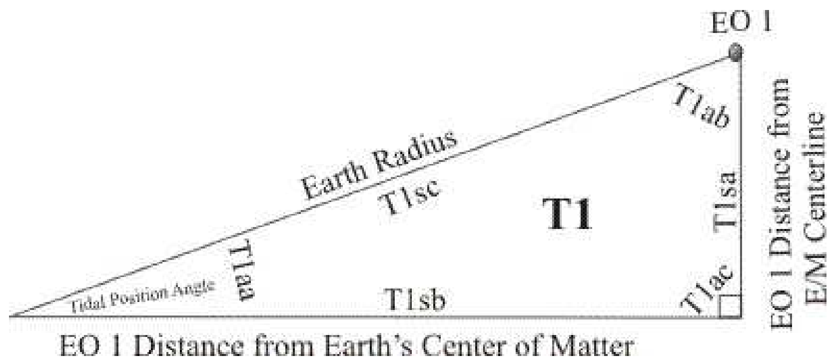
(42) Where are the locations of the three triangles being calculated by the Near Side Tidal Force Calculator? First consider the relationship of Earth to the Moon in the to-scale drawing below. As you can see, the gravitational lines drawn above and below the Earth/Moon centerline converge at the Moon and therefore are not parallel to each other. We take this convergence into account when calculating the vertical and horizontal force components represented by the adjacent and opposite sides of Triangle T3.



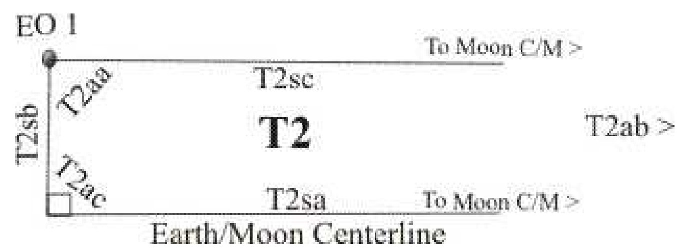
(43) Consult the drawing below that shows the locations of the three triangles on Earth. Note that Earth Object 1 is tangent to Earth and shares one corner in each of the three right-angle triangles.



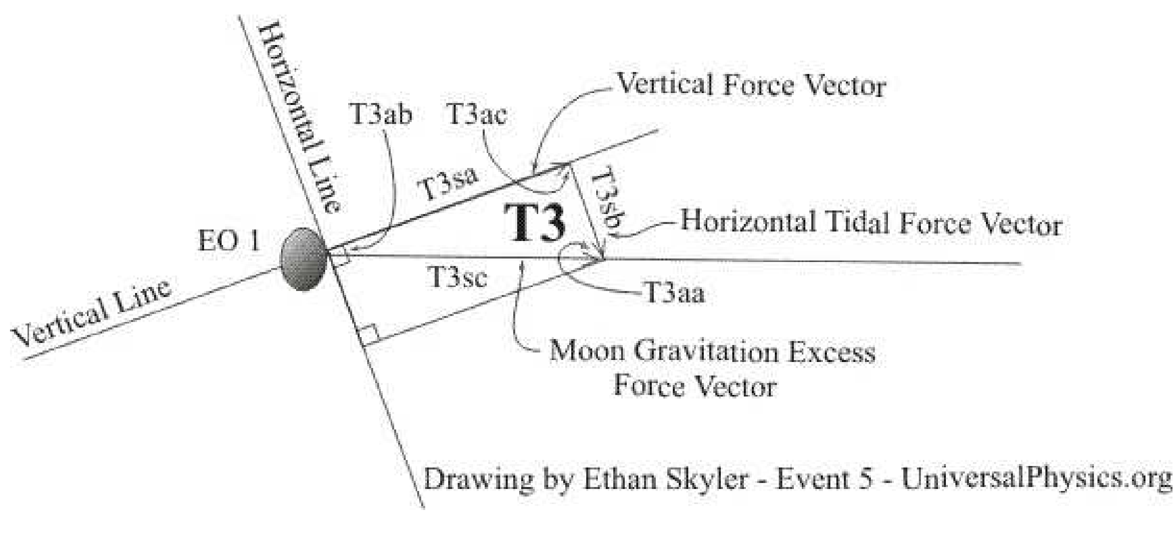
(44) In triangle T1 we set the tidal position angle at 30 degrees so all three angles are known along with the hypotenuse which is equal to Earth's radius. Side T1sa is shared with triangle T2. Side T1sb is used to determine the magnitude of Moon gravitation being experienced by EO1.



(45) Shown is Earth's end of triangle T2. We know the length of T2sb and can determine the length of T2sa along the Earth/Moon centerline. Then, with Pythagoras's help, we can determine the length of the hypotenuse, T2sc. Then the tangent of T2aa is calculated.



(46) Our third triangle is one half of a force parallelogram (rectangle in this case) which reveals the vertical component force and more importantly, the horizontal component tidal force that together make up EO1's near side Moon gravitation force. Angle T3ab equals 180 degrees minus the sum of angles T1ab and T2aa borrowed from our first two solutions which also reveals angle T3aa. Gravitational calculations reveal the length of Earth's near side excess gravitation force vector T3sc. The vertical and horizontal vector lengths are revealed with the horizontal vector T3sb representing the direction and magnitude of Earth's Near Side Tidal Force present. Our three solutions are complete.



(47) While Earth's ocean tides have as their root cause Earth's near side excess gravitation force which, in the 10 degree tidal position angle calculation listed above, is EO1gd at 4.53 lb.f, notice that only a small percentage of this relatively small force, the T3sb horizontal component force of 0.8 lb.f, is serving as the near side tidal force by helping to force ocean water horizontally in the direction of the Earth/Moon centerline. Decreasing the Earth weight of the ocean water by a ratio of 1 over 9 million as does the vertical component T3sa, will, by itself, have only a small effect on the elevation of Earth's ocean waters. Therefore, we will assign the term "tidal force" solely to the horizontal component force, T3sb. This means that only a portion of the near side excess gravitation force acts as the tidal force and then only on Earth's side nearest the Moon.

(48) Next let us proceed by recording the T3sb horizontal force component for each tidal position angle from 10 to 80 degrees.

angle	horizontal tidal force	excess gravitation force (near side only)
10 deg =	0.80 lb.f	4.53 lb.f
20 deg =	1.50 lb.f	4.32 lb.f
30 deg =	2.01 lb.f	3.96 lb.f
40 deg =	2.27 lb.f	3.49 lb.f
50 deg =	2.25 lb.f	2.91 lb.f
60 deg =	1.96 lb.f	2.24 lb.f
70 deg =	1.43 lb.f	1.51 lb.f
80 deg =	0.74 lb.f	0.75 lb.f

(49) At the 10 degrees angle, the vertical component of the excess gravitation force is high in magnitude at 4.53 lb.f yet the horizontal tidal force component is low at 0.80 lb.f. Then at the 80 degree angle, the horizontal component of the excess gravitation force is in the right direction yet low in magnitude since it's location on Earth is so close to the average gravitational division which again leaves the horizontal tidal force component low at 0.74 lb.f.

(50) Next we will determine the tidal position angle with the greatest tidal force.

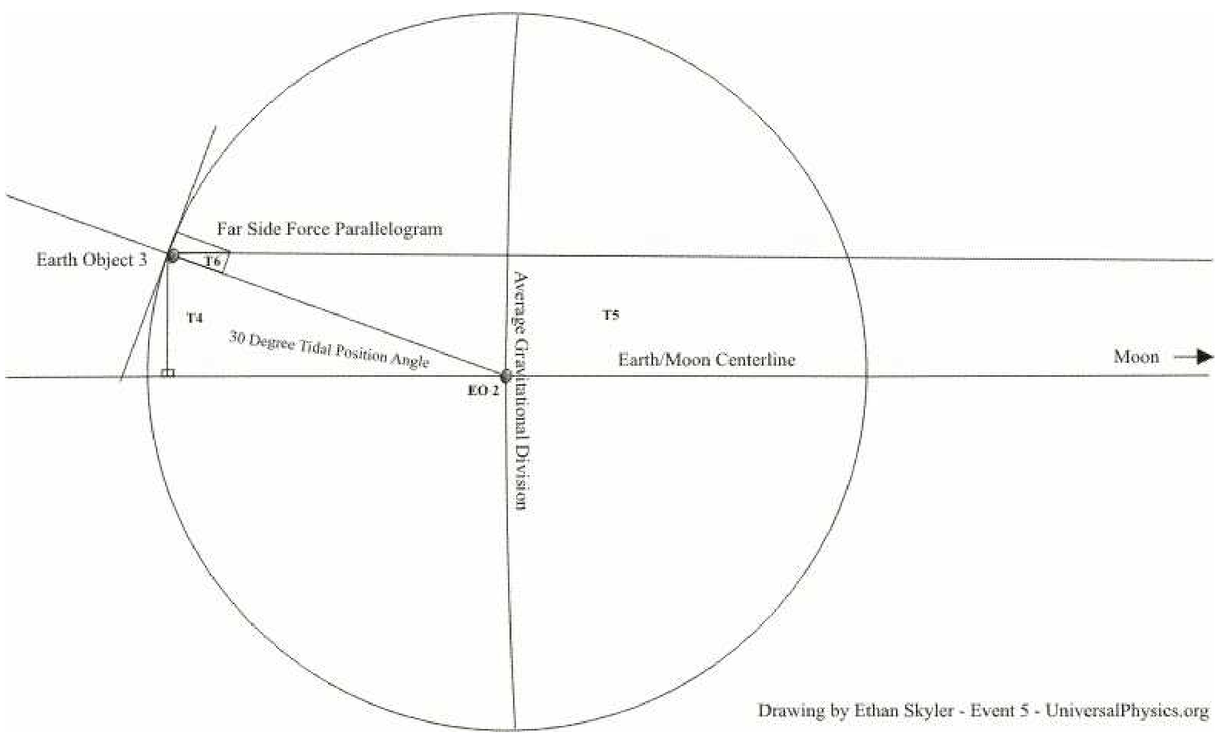
angle		horizontal tidal force
44.30 deg	=	2.2986.38 lb.f
44.31 deg	=	2.298639 lb.f
44.32 deg	=	2.298639 lb.f >
44.33 deg	=	2.298639 lb.f
44.34 deg	=	2.298638 lb.f

(51) Unlike on Earth's near side, there is no tidal force present to act as the cause of Earth's far side high ocean tide, which instead results from the ocean waters experiencing lower-than-average-rates of Moon-directed acceleration compared to the overall average rate of Moon-directed acceleration being experienced by Earth's solid matter. Thus there is present no tidal force for us to calculate as the direct cause of Earth's far side tidal effect. "Yet the thing is not altogether desperate", to quote an ever-hopeful Isaac Newton. There is insight to be gained by calculating the magnitude of the "missing force" that if present would supplement the Moon's gravitational force already present so that jointly they could act to cause Earth's far side ocean water at that position to accelerate at the average rate already being experienced by Earth's solid

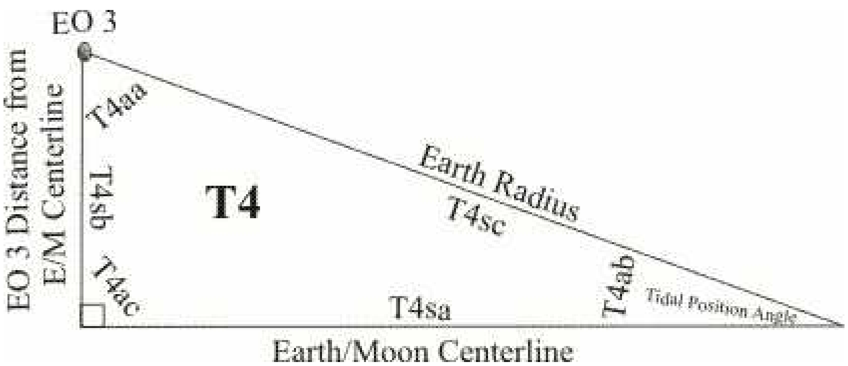
matter. If present, this "missing force" would effectively cancel the far side tidal effect for that position on Earth's surface. By calculating the magnitude of this "missing force" at various locations on Earth's far side surface, we will likely be exposed to the explanation as to why the far side tidal effect varies in a manner that is comparable to the variations of Earth's near side tidal force.

(52) To calculate the far side "missing force", we will need to solve a second set of 3 triangles, T4, T5 and T6. During this process, we will embed Earth Object 3, now composed entirely of sea water, at various tidal positions on Earth's far side ocean surface. Think of EO3 as a giant water balloon with just enough air inside to keep it floating on the ocean surface. Earth is still non-rotating while its center of matter continues its leisurely 27.32 day orbit of the Earth/Moon barycenter. To maintain the constant tidal position angle being calculated, EO3 will have to magically slide sideways as previously described in paragraph (16).

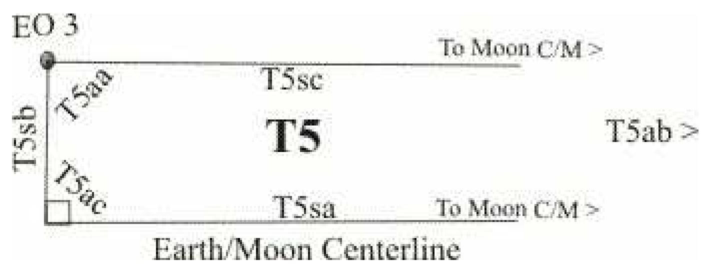
(53) The drawing below displays the far side location and relative size of the three triangles whose solutions will provide the magnitude of the horizontally-directed "missing force" for every tidal position angle from 0.1 to 89.9 degrees. Understand that unlike the tidal force we calculated using the Near Side Tidal Force program, this "missing force" is not real. It does not exist. Were it to exist, then EO3 would accelerate in the Moon's direction at the same average rate being experienced by EO2 located at Earth's c/m. This same-rate-of-acceleration for EO3 at every far side position would effectively cancel Earth's far side tidal mounding. Calculating the magnitude of the "missing force" will complete our understanding of the cause and symmetry of Earth's dual tides.



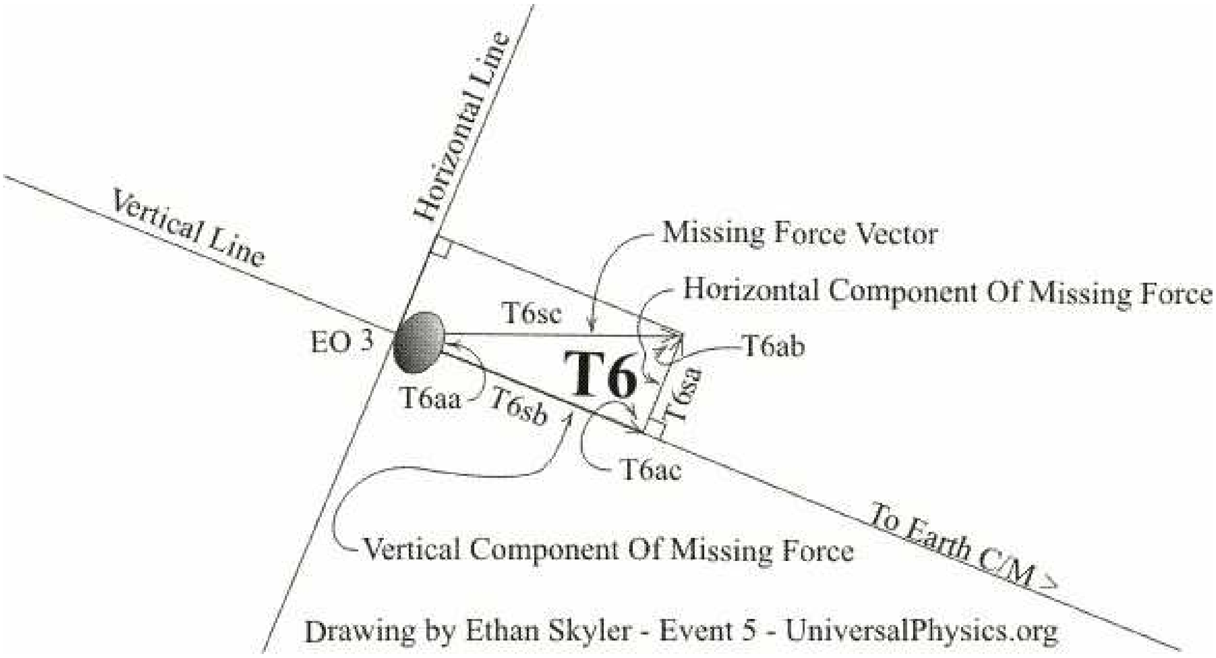
(54) First up is triangle T4, similar to triangle T1 on Earth's near side. Of interest are the lengths of sides T4sb and T4sa which together allow us to calculate the magnitude of the Moon gravitation being generated within EO3's now watery matter.



(55) Next we need to solve the hypotenuse of triangle T5 (T5sc) which is drawn directly from EO3's c/m to the Moon's c/m. The length of this line will be used to calculate the magnitude of Moon gravity present within EO3's matter at its far side position.



(56) We now have enough information to solve the "missing force" triangle T6. Our goal is to learn the length of T6sa for that fact will indicate how much extra force in the horizontal direction is required in order for EO3 to not participate in any tidal bulging or movement away from its current position on Earth's far side.



(57) As before, start the Microsoft QuickBasic Editor (R) and enter the program below exactly as written. Be sure your printer is hooked up and turned on or you may get a "Device Fault Error" when running. Press shift/PrtSc to print the output. Or, better yet, click on the upper left icon on the Quick Basic window, select Edit and then Mark. Then highlight the text you would like to copy to the Windows (c) clipboard. While highlighted, press Enter to complete the Copy. Then you can Paste the screen printout into any Windows application.

(58)

```
10 CLS : CLEAR
20 PRINT : PRINT
30 PRINT " Earth Far-Side Tidal Effect Calculator"
40 PRINT " Written by Ethan Skyler 11/01/2009"
50 PRINT
60 DEFDBL A-Z 'Sets all numerical variables to double precision
70 REM Click on QBasic upper left icon. Select Properties. Option. Display Options. Select
Window.
80 REM Font select 14. Layout Screen Buffer Size Width 80, Height 40.
90 REM Window Size Width 80, Height 40.

100 REM Earth Diameter = 7927 mi
110 REM Earth Radius = 3963.5 mi x 5280ft/mi er = 20,927,280 ft
120 REM Earth Object (EO1, EO2, EO3) = 40,000,000 lb.m
130 REM Earth Object 2 Moon gravity force (eo2mg) = 135.34 lb.f Average for all Earth's
matter.
140 REM Earth/Moon C/M distance = 238,855 mi emd = 1,261,154,400 ft
```

```
150 REM Gravitational Constant = 3.321998855540755D-11 lb.f*ft2/lb.m2
160 REM moonmass = 1.61994D+23

200 CONST er = 20927280
210 CONST eo3mass = 40000000
220 CONST eo2mg = 135.34
230 CONST emd = 1261154400
240 CONST gravconst = 3.321998855540755D-11
250 CONST moonmass = 1.61994D+23

300 degrad = ATN(1) * 4 / 180 'conversion between degrees and radians
310 raddeg = 57.29577951#
320 distance$ = "\ \ ############,.## \ \"
330 degree$ = "\ \ ###.#### \ \"
340 force$ = "\ \##########,.###### \ \"

400 PRINT " Enter Tidal Position Angle from Earth/Moon centerline (0.1-89.9 deg)"
410 PRINT " Angle is formed between the Earth/Moon centerline extended beyond Earth's c/m"
420 PRINT " and an Earth radius proceeding directly up to EO3's surface position on"
430 PRINT " Earth's far side. "
440 PRINT
450 PRINT
460 INPUT " Tidal Position Angle "; tpa
470 IF tpa <= 0 OR tpa >= 90 THEN GOTO 10: ' resets page if angle not above 0 or notless than
90 degrees.

500 REM Calculate triangle T4 to determine the distance EO3 is from Earth's
510 REM center of matter plus EO3's distance from the Earth/Moon centerline.
520 t4sc = er 't4sc is side c, the hypotenuse of triangle T4 and also an Earth redius.
530 t4ab = tpa 't4ab is angle b of triangle T4 and also the Tidal Position Angle
540 t4aa = 90 - t4ab 't4aa is angle a of triangle T4.
550 t4ac = 90 't4ac is angle c of triangle T4.
560 t4sb = SIN(t4ab * degrad) * t4sc
570 t4sa = SIN(t4aa * degrad) * t4sc

600 PRINT
610 PRINT USING degree$; " T4aa = "; t4aa; "degrees (T4, angle A)"
620 PRINT USING degree$; " T4ab = "; t4ab; "degrees (T4, angle B)"
630 PRINT USING degree$; " T4ac = "; t4ac; "degrees (T4, angle C)"
640 PRINT USING distance$; " T4sa = "; t4sa; "ft (T4, side a)"
650 PRINT USING distance$; " T4sb = "; t4sb; "ft (T4, Side b)"
660 PRINT USING distance$; " T4sc = "; t4sc; "ft (T4, Side c)"

700 REM calculate triangle T5 which reaches to the Moon's c/m.
710 t5sb = t4sb
```

```
720 t5sa = emd + t4sa
730 t5sc = SQR((t5sa ^ 2) + (t5sb ^ 2))
740 tant5aa = t5sa / t5sb
750 t5aarad = ATN(tant5aa)
760 t5aa = t5aarad * raddeg
770 t5ac = 90
780 t5ab = 90 - t5aa

800 PRINT USING degree$; " T5aa = "; t5aa; "degrees (T5, angle A)"
810 PRINT USING degree$; " T5ab = "; t5ab; "degrees (T5, angle B)"
820 PRINT USING degree$; " T5ac = "; t5ac; "degrees (T5, angle C)"
830 PRINT USING distance$; " T5sa = "; t5sa; "ft (T5, side a)"
840 PRINT USING distance$; " T5sb = "; t5sb; "ft (T5, side b)"
850 PRINT USING distance$; " T5sc = "; t5sc; "ft (T5, side c)"

900 REM Solution of the force triangle T6 yields the downward-directed
910 REM component of the Missing Force that would be least effective in
920 REM preventing a far side tidal mound from occurring. Also yielded
930 REM is the horizontal component of the Missing Force that, if present,
940 REM would be most effective in preventing far side tidal mounding.

1000 REM Solve Missing Force rectangle.
1010 t6aa = t5aa - t4aa
1020 t6ac = 90
1030 t6ab = 90 - t6aa
1040 eo3md = t5sc

1100 REM Calculate the moon gravitational force on EO3 (eo3mg) embedded at
1110 REM this point. Subtracting eo3mg from the average Moon gravitational
1120 REM force experienced by EO2 at Earth's c/m (eo2mg) yields the
1130 REM Missing Force eo3mf.

1200 eo3mg = (gravconst * moonmass * eo3mass) / (t5sc ^ 2)
1210 eo3mf = eo2mg - eo3mg

1300 PRINT USING degree$; " T6aa = "; t6aa; "degrees (T6, angle A)"
1310 PRINT USING degree$; " T6ab = "; t6ab; "degrees (T6, angle B)"
1320 PRINT USING degree$; " T6ac = "; t6ac; "degrees (T6, angle C)"
1330 PRINT USING distance$; " EO3md = "; eo3md; " ft (Earth Object 3 Moon distance)"
1340 PRINT USING force$; " EO2mg = "; eo2mg; "lb.f (EO2 Average Moon gravity force)"
1350 PRINT USING force$; " EO3mg = "; eo3mg; "lb.f (EO3 Moon gravity force)"
1360 PRINT USING force$; " EO3mf = "; eo3mf; "lb.f (EO3 Missing Force)"

1400 t6sc = eo3mf
1410 t6sb = SIN(t6ab * degrad) * t6sc
```

```
1420 t6sa = SIN(t6aa * degrad) * t6sc

1500 PRINT USING force$; " T6sb = "; t6sb; "lb.f (vertical Missing Force component.)"
1510 PRINT USING force$; " T6sa = "; t6sa; "lb.f (horizontal Missing Force component.)"

1600 PRINT
1610 INPUT " Calculate Another Far-Side Tidal Position Angle, Y / N "; in$
1620 IF in$ = "Y" OR in$ = "y" THEN GOTO 10
1630 CLS
1640 PRINT : PRINT : PRINT : PRINT : PRINT "                    Press Any Key To End..."
1650 END
```

Download a copy of the Far Side Tidal Effect Calculator program, TIDEFAR1.BAS, by clicking Here. Once loaded into your browser, click File and then Save Page As.... Then start the Quick Basic Editor, select File, Open, double click the two dots in the Directory Box, find the folder where you saved the file and then select it to Open.

P.S. You may also copy the program to your clip board and then paste it into the QuickBasic Editor beginning with the upper-left icon and then choose Edit... Paste. If all else fails and you have an hour to spare, open the Quick Basic Editor and type in the program.

(59) The following is the complete printout for the 10 degree tidal position angle. First see that EO3's Moon gravity (eo3mg) is less than EO2's average Moon gravity (eo2mg). The difference is the EO3 "missing force (eo3mf). Notice how the horizontally-directed component (T6sa) of the "missing force" is small in magnitude since only a small horizontal force is needed for EO3 to hold its position, relative to the Earth/Moon centerline, thereby preventing it from contributing to tidal mounding.

```
                Earth Far-Side Tidal Effect Calculator
                 Written by Ethan Skyler 11/01/2009

Enter Tidal Position Angle from Earth/Moon centerline (0.1-89.9 deg)
Angle is formed between the Earth/Moon centerline extended beyond Earth's c/m
and an Earth radius proceeding directly up to EO3's surface position on
Earth's far side.

Tidal Position Angle ? 10

T4aa = 80.0000 degrees (T4, angle A)
T4ab = 10.0000 degrees (T4, angle B)
T4ac = 90.0000 degrees (T4, angle C)
T4sa = 20,609,347.59 ft (T4, side a)
T4sb = 3,633,984.04 ft (T4, Side b)
T4sc = 20,927,280.00 ft (T4, Side c)
T5aa = 89.8376 degrees (T5, angle A)
```

T5ab = 0.1624 degrees (T5, angle B)
T5ac = 90.0000 degrees (T5, angle C)
T5sa = 1,281,763,747.59 ft (T5, side a)
T5sb = 3,633,984.04 ft (T5, side b)
T5sc = 1,281,768,899.02 ft (T5, side c)
T6aa = 9.8376 degrees (T6, angle A)
T6ab = 80.1624 degrees (T6, angle B)
T6ac = 90.0000 degrees (T6, angle C)
EO3md = 1,281,768,899.02 ft (Earth Object 3 Moon distance)
EO2mg = 135.339996 lb.f (EO2 Average Moon gravity force)
EO3mg = 131.020406 lb.f (EO3 Moon gravity force)
EO3mf = 4.319591 lb.f (EO3 Missing Force)
T6sb = 4.256076 lb.f (vertical Missing Force component.)
T6sa = 0.738025 lb.f (horizontal Missing Force component.)

Calculate Another Far-Side Tidal Position Angle, Y / N ?

(60) Now it is time to calculate a range of far side tide-canceling EO3 horizontal "missing force" components. This should give us an idea of what allows for Earth's far side tidal mounding to be similar in symmetry to the tidal mounding on Earth's near side. The near side tidal force horizontal component values are included for comparison. Notice that the near side values are slightly greater in magnitude. Perhaps this is a help in explaining why Earth's near side tidal mounds are generally greater in magnitude than Earth's far side counterpart.

Far Side Missing Force horizontal component	Near Side Tidal Force horizontal component
10 deg = 0.74 lb.f	10 deg = 0.80 lb.f
20 deg = 1.39 lb.f	20 deg = 1.50 lb.f
30 deg = 1.88 lb.f	30 deg = 2.01 lb.f
40 deg = 2.15 lb.f	40 deg = 2.27 lb.f
50 deg = 2.17 lb.f	50 deg = 2.25 lb.f
60 deg = 1.93 lb.f	60 deg = 1.96 lb.f
70 deg = 1.45 lb.f	70 deg = 1.43 lb.f
80 deg = 0.80 lb.f	80 deg = 0.74 lb.f

(61) Finally we will determine the tidal position angle where the greatest magnitude of the "missing force" horizontal component is required to prevent tidal mounding. The near side results are included for comparison.

angle	Far side horizontal "missing force" component
45.65 deg	2.195077 lb.f
45.66 deg	2.195078 lb.f
45.67 deg	2.195078 lb.f
45.68 deg	2.195078 lb.f >
45.69 deg	2.195078 lb.f
45.70 deg	2.195077 lb.f

angle		Near side horizontal tidal force component
44.30 deg	=	2.2986.38 lb.f
44.31 deg	=	2.298639 lb.f
44.32 deg	=	2.298639 lb.f >
44.33 deg	=	2.298639 lb.f
44.34 deg	=	2.298638 lb.f

Summary

(62) Moon gravitation is the fundamental cause of Earth's dual ocean tidal mounds. This internal attractive force is above average within Earth's near-side matter, average at Earth's center of matter and below average within Earth's far side matter. The above average tidal force within Earth's near side ocean waters causes an above average accelerated shift in the direction of the Moon effecting the formation of Earth's near side tidal mound. Meanwhile, Earth's solid matter accelerates in the Moon's direction at but one average rate. Excess Moon gravitation present within Earth's near side solid matter is transferred as an external tension force back through Earth's solid matter to effect an increase in the acceleration rate of Earth's far side matter up to average. This external tension force has less effect on Earth's far side ocean waters allowing them to lag behind with a reduced rate of acceleration resulting in the formation of tidal mounding on Earth's far side.

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Authors's Commentary:

Event 5, "The Physics of Earth's Tides", presents the Universal Physics perspective regarding the exact cause of Earth's dual ocean tides. This tidal analysis is original and published for the first time on June 17, 2009 at UniversalPhysics.org. Our understanding the exact role that forces play in causing Earth's dual tides has been on hold since Newton's time, awaiting improvements in our understanding of; 1) the four types of force; 2) the inseparable roles of the acceleration/Action and acceleration/Reaction forces, and; 3) the manner in which Moon gravitation can directly and indirectly cause both internal gravitation and external tension forces to exist within Planet Earth. These three advancements are key to unlocking the mystery of Earth's dual tides. These understandings are investigative tools exclusive to Universal Physics.

Thanks for your help, encouragement and support,

Ethan Skyler