CENTRIPETAL FORCE PROVIDED BY GRAVITY

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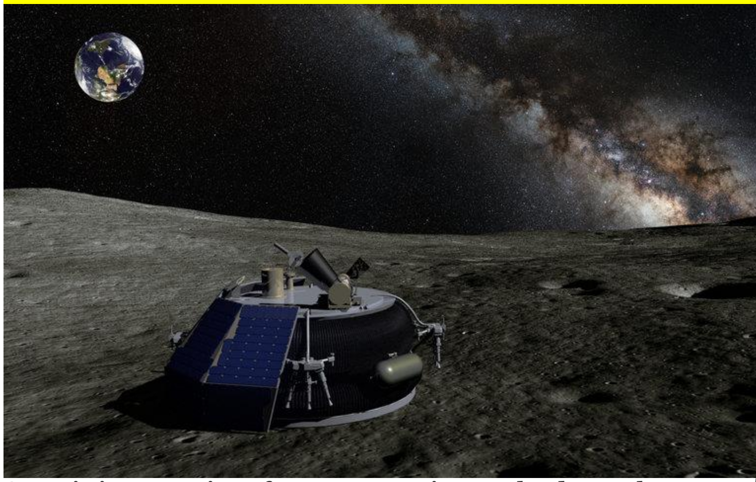
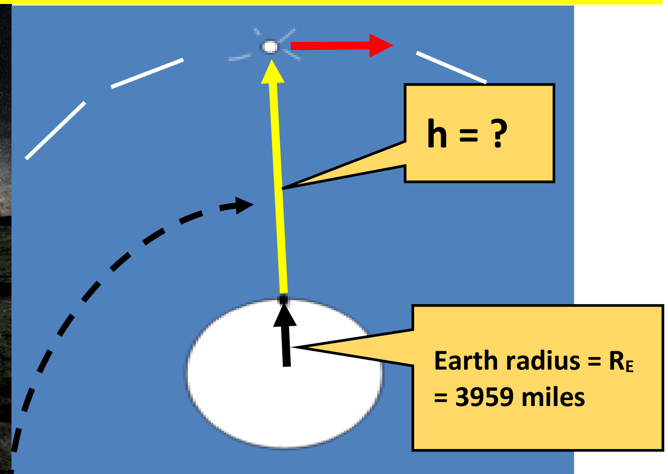
Florida Company Gets Approval to Put Robotic Lander on Moon





An artist's conception of Moon Express's MX-1 lander on the moon.

A small start-up has received the green light from the federal government to do something that NASA has not done for more than four decades: land on the moon. Moon Express, based in Cape Canaveral, Fla., announced Wednesday that it had received approval from the Federal Aviation Administration to set a robotic lander on the moon. That feat would win the Google Lunar X Prizecompetition for the first private organization to reach the moon and an accompanying $20 million reward. Approval reflects an effort to **encourage 21st-century commercial space endeavors while staying within an international space treaty written 49 years ago when outer space was a rivalry between the United States and the Soviet Union, and the idea of a start-up going to the moon an unlikely fantasy. (((At present, commercial ventures have gone as far out as geosynchronous orbit, the telecommunication satellites that fly 22,236 miles above the Earth))).** Moon Express wants to go 10 times as far, to the moon, a place where just three nations have landed: the United States, the Soviet Union and, more recently,China. The X Prizes, started by Peter H. Diamandis, an entrepreneur, seek to recreate the barnstorming prizes of the early 20th century that spurred aviation advances like Charles Lindbergh's flight across the Atlantic. The first X Prize, for the first private piloted vehicle to reach space, led to the development of SpaceShipOne, a rocket-powered plane that made two flights in two weeks in 2004 to win the $10 million prize.

INTRODUCTION: Purpose of this application is to verify geosynchronous satellites are above equator at 22,236 miles. The geosynchronous satellites MUST orbit earth at SAME period as the earth…1 day = T. To keep the satellites in orbit a centripetal force is provided by gravity…. $G\,m\,M_{EARTH}/R^2$. Here $R = R_{EARTH} + h$, where h = height above earth. $G\,m\,M_E/R^2 = m\,V^2/R$ where $V = R\,\omega = R\,2\pi f = R\,2\pi/T$, thus, $G\,\not{m}\,M_E/R^2 = \not{m}\,[4\pi^2 R^2/T^2]/R$

Thus, solving for R:

$$R = (G\,M_E\,T^2/4\pi^2)^{1/3} \qquad \text{eq. 1}$$

QUESTIONS: (a) Find the period T for a one-day orbit in seconds? (b) Find R (in meters using eq. 1) needed for geosynchronous satellite To "appear" stationary over the equator?, (c) Convert R in meters to miles?, (d) Find height h the satellite is above earth? (e) How well does computed h compare to stated in article height?

HINTS: G = gravitational constant = 6.67×10^{-11} N m²/ kg.², $M_{EARTH} = 5.972 \times 10^{24}$ kg., 3600 s. = 1 hr., π = 3.1416 , R_E = 3959 mi. 1 mile = 1609 meters

ANSWERS: (a) $T = 8.64 \times 10^4$ s., (b) 4.222×10^7 meters, (c) 26,240 miles, (d) 22,280 miles, (e) stated h & computed are close!