

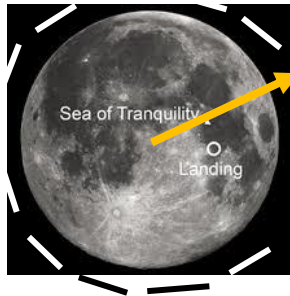
CENTRIPETAL FORCE FROM GRAVITY Unit 14 & 8

Dr. John P. Cise, Professor of Physics, Austin Com. College, Austin, Tx. jpcise@austincc.edu & New York Times November 7, 2017 by Richard Goldstein. Dedicated to all the American Apollo Astronauts in 1960s & 1970s.

Richard Gordon, Astronaut Who Reached for Moon (1969) and Very Nearly Made It, Dies at 88



Richard Gordon, center, with Charles Conrad, left, and Alan Bean, aboard the U.S.S. Hornet, an aircraft carrier, after their spacecraft splashed down.



INTRODUCTION: Gordon commanded the command module Yankee Clipper from 60 miles above moon surface in 1969. The other 2 Apollo Astronauts went to Lunar surface in lunar lander. The radius of moon is 1079 miles. Gordon did 45 orbits of moon over 89 hrs. (3.7 days). Gravity provides centripetal force. $G m M/R^2 = m v^2/R$, $v = R\omega = 2\pi R/T$, thus

Solving for $M = [4\pi^2/6.67 \times 10^{-11}](R^3/T^2)$, Kepler's 3rd. Law.

QUESTIONS: (a) Find R from center of moon?, (b) Find period T of lunar orbit?, (c) Find mass of moon? See below for Hints and Answers.

Richard Gordon, who undertook what became a harrowing and abortive spacewalk in a 1966 NASA mission, then orbited the moon three years later, but never achieved his dream of walking on the lunar surface, died on Monday at his home in San Marcos, Calif., near San Diego. He was 88. His death was confirmed by NASA. **Mr. Gordon piloted the command module ((Yankee Clipper)) during its orbit of the moon in November 1969** while Mr. Conrad and his fellow Apollo 12 astronaut Alan Bean carried out the first extensive moonwalks, four months after the pioneering Apollo 11 mission that sent Neil Armstrong and Buzz Aldrin to the moon. After taking photos of the moon's topography to scout tentative landing sites for future missions, **Mr. Gordon performed docking maneuvers, allowing his fellow astronauts to return to the capsule in the ((lunar lander)) that had descended from it.** "The name of the game as far as I was concerned was to walk on the moon, and at that time I was relegated not to do that," **Mr. Gordon told a NASA interviewer in 1999 when asked if he was disappointed that he had to remain 60 miles above the lunar surface after having come so far.** "I had a job and a function to perform," he continued. "And I was happy for them, that they were going to get to do that." Mr. Gordon's fellow astronauts advanced the exploration of the moon with their treks on its surface, the setting up of experiments and the collection of lunar rocks. Richard Francis Gordon Jr. was born on Oct. 5, 1929, in Seattle, the eldest of five children of Richard Sr., a machinist, and his wife, Angela, an elementary school teacher. **He majored in chemistry at the University of Washington and graduated in 1951.** He then became a Navy aviator, graduated from flight-test school and was selected as a Gemini astronaut in October 1963. Alan Bean, one of Mr. Gordon's fellow Apollo 12 astronauts, devoted much of his life after his NASA career to painting. **One of his artworks solidified a bond** between Mr. Gordon and his fellow crewmen, notwithstanding his disappointment over never having



"The Fantasy," a painting by Alan Bean. From left, Mr. Conrad, **Mr. Gordon** and Mr. Bean. "It's called 'The Fantasy,'" Mr. Gordon said "He's got one of all three of us standing on the lunar surface."



HINTS: 1620 m. = 1 mile

ANSWERS: (a) $R = 1139 \text{ mi.} = 1.845 \times 10^6 \text{ m.}$, (b) $T = 1.978 \text{ hrs.} = 7120 \text{ s}$
(c) $M_{\text{MOON}} = 7.33 \times 10^{22} \text{ kg.}$

COMMENT: NASA & Wikipedia give moon mass as $\sim 7.35 \times 10^{22} \text{ kg.}$
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