

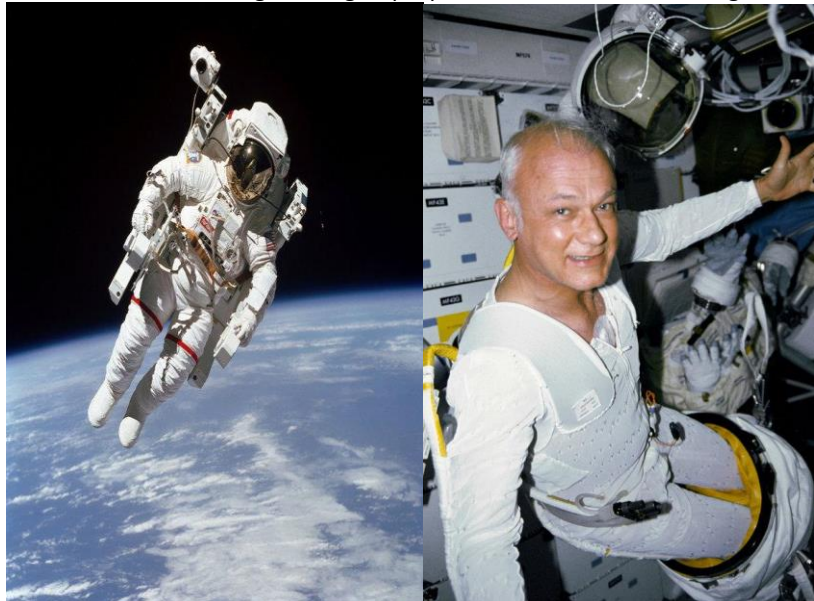
CENTRIPETAL FORCE

Unit 14 , Dr. John P. Cise, Prof. of Physics, Austin Com. College, Austin Tx. USA

jpcise@austincc.edu & NYTimes Dec. 23, 2017 by Matt Stevens. Dedicated to Stephen McLandrich, Also earned a Engineering Degree as Bruce M.

Bruce McCandless, First to Fly Untethered in Space in 1984, Dies at 80

Bruce McCandless using a nitrogen-propelled manned maneuvering unit in February 1984 for the first untethered spacewalk



INTRODUCTION: Gravity supplies centripetal force to keep McCandless & Shuttle in orbit 170 miles above earth. $(GmM_e/R^2) = m v^2/R$
Where $R = r_{\text{EARTH}} + 170$ miles, $G =$ gravitational constant $= 6.67 \times 10^{-11} \text{ N m}^2/\text{kg}^2$,
 $M_{\text{EARTH}} = 5.972 \times 10^{24} \text{ kg}$, $r_{\text{EARTH}} = 6371 \text{ km}$.

QUESTIONS: (a) Convert 170 miles above earth to m. ?, (b) Find R(distance from center of earth to McCandless's 1984 space walk)?, (c) Find speed of orbit (article says close to 17,500 mph) of McCandless & Shuttle as he walked in space in 1984. Find v in m./s. & mph ?, (d) Find how close Your computed v is to stated 17,500 mph?

HINTS: 1.609 km./mi., 2.237 mph/(m./s.)

Bruce McCandless, the first person to fly untethered in space, whose journey into the dark void above Earth was preserved in a famous photograph, died on Thursday. He was 80. NASA announced his death [in a statement](#) on Friday but did not provide more details. **Equipped with a bulky backpack, two dozen tiny jet thrusters and two bottles of nitrogen gas to fuel them, Mr. McCandless took his maiden voyage in February 1984.** It was captured in an image of a man in a white space suit floating against a backdrop of the great black abyss. A front-page article in [The New York Times](#) called Mr. McCandless's ascent "a spectacle of bravery and beauty." Mr. McCandless and another astronaut, Robert L. Stewart, the **nearby shuttle — 17,500 miles an hour**). "That may have been one small step for Neil, but it's a heck of a big leap for me," Mr. McCandless joked at the time, in reference to comments Neil Armstrong made after taking the first human step on the moon in 1969. **One of 19 people selected by NASA to become astronauts in April 1966, Mr. McCandless, a former United States Navy captain,** would play a role in Mr. Armstrong's famed moonwalk only three years later. Mr. McCandless, in mission control, was one voice the world heard communicating with Mr. Armstrong and Buzz Aldrin during their Apollo 11 mission. At one point, Mr. Armstrong remarked that their view of the moon was "really spectacular" and "worth the price of the trip." Mr. McCandless floated free in space at the age of 46. That 1984 mission had various technical objectives, but it was **((Mr. McCandless's inaugural spacewalk that captured the hearts and minds of those about 170 miles below))**. The Times described Mr. McCandless as "a puffy white gingerbread man" floating above the continental United States. "This is neat," he said, before peering down. "Looks like Florida. It is Florida!" he exclaimed, remarking later that the panorama "really is beautiful." During his second space shuttle mission, in 1990, Mr. McCandless helped deploy the Hubble Space Telescope. By the end of his career, he had logged more than 300 hours in space, including four hours in a manned maneuvering unit, according to his [NASA biography](#). Bruce McCandless II was born on June 8, 1937, in Boston into a family of high-ranking Naval officers. He graduated from Woodrow Wilson Senior High School in Long Beach, Calif., and received a bachelor of science degree from the Naval Academy in 1958. He later earned two master's degrees — **one in electrical engineering from Stanford University** and another in business administration from the University of Houston at Clear Lake City

ANSWERS: (a) height above earth = 440.109 km., (b) $R = 6.811 \times 10^6 \text{ m}$., (c) $v = 7.65 \times 10^3 \text{ m./s}$. or 17,113 mph, (d) close, only 2.2% difference