# CENTRIPETAL FORCE* + GRAVITY + MORE ...Unit 14

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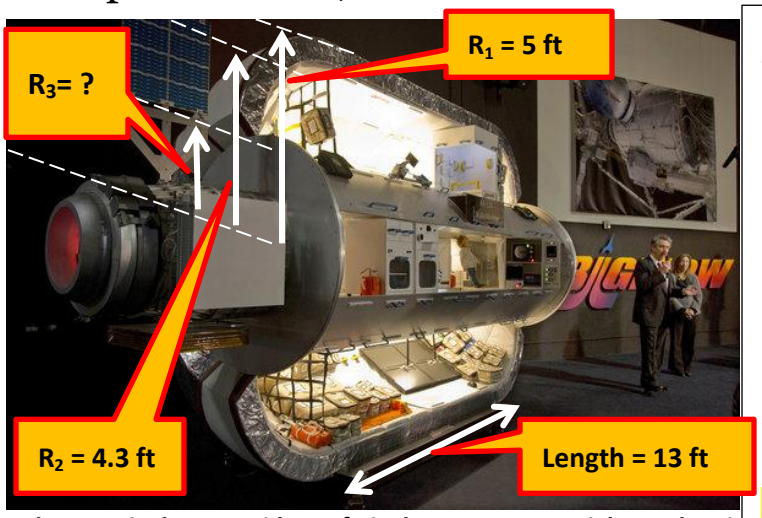
## For Space Station, a Pod That Folds Like a Shirt and Inflates Like a Balloon




**Robert T. Bigelow, president of Bigelow Aerospace, right, and Lori Garver, NASA's deputy administrator, unveiled plans for an inflatable pod to dock with the International Space Station. NORTH LAS VEGAS, Nev. — An inflatable space pod to be attached to the International Space Station in a couple of years will be like no other piece of the station.**

**INTRODUCTION: Low space orbit is under 1200 mi. The international space station(ISS) is at 200 mi. The centripetal force($mv^2/r$) needed to keep the ISS in orbit is supplied by gravity($GmM_{earth}/r^2$). Thus,**

$$mv^2/r=GmM_{earth}/r^2$$

**solving for speed(v) to remain at r(ct. of earth to ISS)**

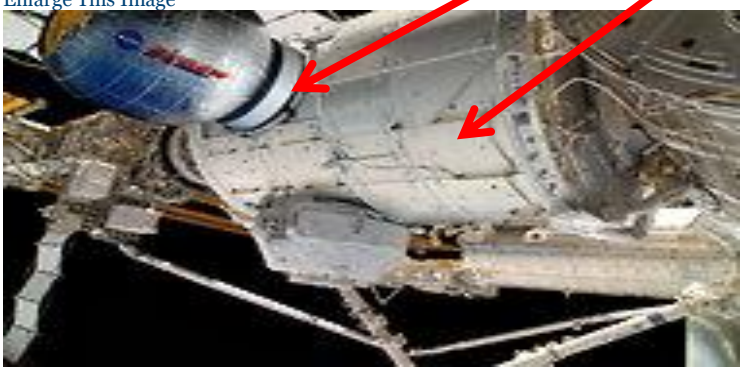
$$v = (GM_{earth})/r)^{1/2}$$

**where G = Gravitational constant =$6.67X10^{-11}$ $Nm^2/kg^2$ , $M_{earth}$=$5.97 X 10^{24}$ kg., r = $r_{earth}$ + 200 mi , $r_{earth}$ = 6350 km.**
**HINT: 1.61 km. = 1 mile , 2.236 mph/(m/s)**

**QUESTIONS: (a) Convert 200 mi to km? (b) Find r in km? (c) Find v(in m/s & mph) to stay in low orbit at 200 mi.?**

**ANSWERS:(a)320 km.,(b) 6670 km.(c)7726 m/s, 17,275 mph**

Enlarge This Image



**INTRODUCTION: The upper right graphic shows the radius($R_2$) to inner expandable wall is 4.3 ft. The useable space volume($R_3$ to $R_2$) is stated in the article to be 560 $ft^3$. $R_1$ = 5 ft is radius to outer surface of the quoted 10 ft diameter of inflatable pod. $R_2$ is radius of unusable space in center of pod. Pod length is 13 ft as stated below.**
**HINTS: $V_{cylander} = \pi r^2 L$ ,QUESTIONS: (a) Find $R_3$ cylindrical volume? That is the volume from center of pod to inner wall. (b) Since usable space is 560 $ft^3$ ($R_2 - R_3$), find $R_3$ of inner unusable space?**
**ANSWERS: (a) 755 $ft^3$ , (b) $R_3$ = ~ 2.2 ft NOTE: $R_3$ = ~2.2 ft is reasonable considering the pod graphic upper left.(-: JC**

Instead of metal, its walls will be made of floppy cloth, making it easier to launch (and then inflate). NASA said Wednesday that it had signed a $17.8 million contract with Bigelow Aerospace to build the module, which could reach the space station as soon as 2015..((( Low-Earth orbit, he said, is the "first target,"))) but larger modules could be used for stations in deep space or for habitats on the Moon. "We have ambitions to get to the Moon someday, to have a base there," Mr. Bigelow said. The fold-up, blow-up approach solves the conundrum of how to build something voluminous that can be packed into the narrow payload confines of a rocket. **The soft sides of the module, called the ((( Bigelow Expandable Activity Module))), or Beam, will allow it to be scrunched like a T-shirt in a suitcase. At the space station, it will be attached to an air lock and (((then inflated like a balloon and expanded by a factor of 10 to its full size — about 13 feet long and 10 feet in diameter, with about 560 cubic feet of space inside))).** The balloonlike structure is carefully designed not to pop. **The fabric walls will consist of several layers including Vectran, a bullet-resistant material. Even if punctured by a high-speed meteorite, the fabric does not tear.** When the Beam module reaches the space station, astronauts might go to it to seek solitude: engineers expect it will be the quietest spot there. The fabric walls absorb sound vibrations instead of transmitting them.