

**Life in Space Webcast – Q&A Section  
(Sponsored by American Public University)**

**Answers by Former NASA Astronauts, Dr. Jim Reilly and CAPT. Wendy Lawrence**

***Are there any privacy concerns when in space, on shuttle, or the ISS?***

Jim Reilly: Not really, since we respect each other's privacy and modesty. You can think of spaceflight as being similar to a camping trip. When you are out in the woods, you make an effort to make sure your friend's and/or family member's privacy and modesty is protected and that is almost exactly the same condition that we experience in space.

***Are the human wastes removed in such a way that they can be used in fertilizing onboard plants?***

Jim Reilly: Not currently, though when we do go on a mission as long as the trip to get to Mars, we will need to recycle everything. A number of experiments have been conducted on just how to do that and have been generally successful. All the water, including urine, will be recycled as will all waste products from plants and animals aboard. To be able to accomplish this efficiently will require advances in the state of our knowledge. This knowledge will, of course, be beneficial to industrial applications here on earth so you could say we would be investing in technologies for how to live more efficiently on earth.

***Does every astronaut go through flight training on a T-38? When training, do you all have to fly solo?***

Jim Reilly: We all learn to fly the T-38, and personally that was one of the most fun parts of the training cycle, which we use for training and transportation. We generally fly in pairs but the pilot astronauts can fly solo. We, as mission specialists, fly dual with one of the pilots.

***The other day I was watching National Geographic and I saw that a lot of businesses are going to set up their businesses in space. What you think about that?***

Jim Reilly: Commercial development of the orbital regime is a natural progression from the basic research and exploration that we have been conducting in our national space programs. We are at a similar stage in spaceflight as aviation was at in the late 1910s and early 1920s. This is an expensive, risky proposition laying the groundwork in knowledge that allowed Donald Douglas to design the first truly successful airliner: the DC-3. We don't have a space version of the DC-3 yet, but within the next decade, or so, I expect that there will be someone who designs and builds the future of commercial space travel that will allow us all to buy a ticket to low earth orbit.

***Is the science there regarding bone loss and radiation effects for a flight to the moon?***

Wendy Lawrence: Yes, there have been enough data collected to understand what the typical amounts of bone loss and radiation exposure would be on a flight to the moon. However, solar particle events (also known as solar flares) are unpredictable. If an astronaut were doing an EVA on the moon during a solar flare, the amount of radiation exposure could be a significant risk to that astronaut.

It also isn't known just how much gravity is necessary to maintain bone density. It could very well be that the level of lunar gravity is enough. That study remains to be done.

***If you have motion sickness on earth, are you more likely to have it in space too?***

Wendy Lawrence: Not necessarily. Unfortunately, there aren't any accurate preflight tests that can predict who will get space motion sickness. So, on your first spaceflight, you just have to wait until you get into orbit to find out how you will do!

***Is there a plan to reduce the amount of larger space junk that is out there? Or do we just wait until it falls out of orbit?***

Jim Reilly: First, orbital debris consists of two types: that which is in low earth orbit (<500 miles) and that in higher orbits. The difference is most debris in LEO will deorbit on its own in a matter of days, weeks, months, or a few years. Therefore we only need to track the stuff until it decays and reenters. A much bigger problem is the higher altitude debris. Some of that is located in orbits where it can stay a threat to other spacecraft for literally thousands of years. For example, the debris generated by the Chinese anti-satellite test a couple of years ago generated debris that will stay in orbit for as long as 1500 years and is located in orbits that will threaten communications and earth observation satellites. We need to have a comprehensive agreement that restricts the generation of orbital debris to control the proliferation of trash whizzing around the earth and threatening the satellite systems that we all use on a daily basis.

***Since the body activity changes in space, does the nutritional need change as well?***

Wendy Lawrence: From the standpoint of daily caloric needs, no, there really isn't much difference between being in space or on Earth. However, astronauts really don't receive any direct sunlight on orbit, so their vitamin D levels tend to be low. Vitamin D is necessary for the absorption of calcium. So, for the long-duration astronauts (those who spend six months on the ISS), their flight surgeons recommend that they take a vitamin D supplement on orbit.

***Can you specifically state why there is no a refrigerator on the Int. Station?***

Wendy Lawrence: Originally, there were plans to fly a food refrigerator on the space station, but it was cancelled due to budget cuts.

***What is the best course for applying to NASA for engineering at Langley?***

Jim Reilly: I'm going to assume that you are looking for guidance on career planning and I will assume that you are either planning on entering, or are in your early part of attending, a university. First, study the engineering discipline you enjoy the most as you will do well in the discipline. While in school, seek out internships at the center both in the government sector but also in the contractor sector. There are usually more opportunities available through the contractor pathway. Once you are ready for a full-time career, there is an HR opportunities website at each center's homepage. For Langley go here: <http://ohcm.larc.nasa.gov/jobs/sep/coop/>. Good luck!

***My interest is specifically in infectious diseases. What do you see as potential countermeasures to long term spaceflight?***

Wendy Lawrence: Studies have shown that the immune systems of astronauts are suppressed on orbit, and countermeasures are already in place to address this. Typically, crews are in quarantine about 7-10 days before launch and their contact with other people is very limited. Also, equipment and supplies that launch on the spacecrafts (Shuttle, Soyuz and Progress, for example) are cleaned and sanitized before being loaded on the vehicle.

***Why couldn't a vacuum chamber be used to keep food fresh?***

Wendy Lawrence: It would depend on how the chamber is designed. If the chamber is designed in a way that the astronauts have to repressurize it every time they want to get something out of it, then that wouldn't be very practical. It might be possible to use a device similar to the "food saver" devices that seal food in a plastic bag (after removing all of the air). But, you still would probably want to either freeze or refrigerate the food.

***Are the "cosmic rays" we hear about in the news part of the radiation Captain Lawrence is talking about?***

Jim Reilly: They are a portion of the radiation. "Cosmic rays" are radiation components that are sourced from outside our solar system. The majority of the radiation we see is from our own sun and they can be seen as the aurora at the north and south magnetic poles.

Wendy Lawrence: Most likely, when someone uses the phrase "cosmic rays", they are really referring to galactic cosmic radiation which is the background radiation of space. Galactic cosmic radiation is a continuous flow of very high energy and high mass particles. These particles range from protons to the nuclei of hydrogen and iron atoms.

***Is there a possibility that the Space Shuttle program will be extended in light of the Presidential budget cutting out plans to return to the Moon?***

Wendy Lawrence: That is unlikely since contracts have already been put in place to shut down the program.

***Do military branches other than the Navy and Air Force take part in the space program?***

Jim Reilly: We actually have representatives from all branches of service including the Coast Guard.

***Is there a possibility of low gravity plant growth on a moon base?***

Jim Reilly: Absolutely! In fact, tests of lunar soil from the Apollo missions have indicated that plants will grow very well in that soil. The good news is we have found the indications of water in the lunar regolith (soils) and with that we can certainly build greenhouses on the moon that would supply oxygen and food to a lunar science base when we get to that point.

***Will the work that has been done so far on the Constellation program be able to be used such as the capsule and rockets in future programs?***

Wendy Lawrence: Yes, I'm confident that the work done thus far will be incorporated into future programs. For example, during the development of the Orion spacecraft, much more modern technology (as compared to the shuttle) was used, specifically in the flight cockpit. So, I'm sure that the knowledge that engineers gained in doing this will be used again.

***What is the effect of living in space on red blood cell counts? Are there any unexpected changes in the biochemical profile of blood that are interesting?***

Wendy Lawrence: Yes, there are effects on both red blood cells and plasma volume. Measurements have shown that plasma volume is reduced by 17% on the first day in space. Red blood cell mass also decreases. The combined losses of plasma volume and red blood cell mass result in an approximately 11% reduction in total blood volume.

***Do lengthy stays at the space station compress the spine enough to make the astronaut shorter? And, if so, do these effects reverse when they return home?***

Wendy Lawrence: Actually, without gravity acting directly on your spine on orbit, your spine lengthens. Usually, I'm 1.5 inches taller in space. Sadly, that only lasts about 1-2 hours after landing.

***It's frustrating when people ask me why I'm pursuing space when the Constellation Program just got cancelled. Where do I start with that? I have to provide some response.***

Jim Reilly: It is indeed a challenge but what I tell people is the President's budget is only a plan at this point. Congress can weigh in with modifications/additions and if the public wants changes through their legislators, we can help shape those changes.

***I thought that I would ask a fun question. Tell us something about being up in space that you haven't told anybody else?***

Jim Reilly: I wanted to see the stars while on an EVA (spacewalk) and I left my lights off to let my eyes adjust. What I saw were stars that didn't twinkle as they appear here (no atmospheric distortion) and they had different colors. Most stars appear blue-white on the ground due to atmospheric filtering. In space, with no atmosphere, the stars are pink, yellow, orange, white, light blue and even some that are almost red. It was a real "gee whiz!" moment.

***What kinds of illnesses are frequently experienced by living in space and immediately after return?***

Wendy Lawrence: Just like some people get sea sick when they are on a boat, astronauts get "space motion sickness". This is caused by astronauts' no longer experiencing gravity. The symptoms typically are nausea and vomiting and last a day or two. Unfortunately, astronauts also experience this motion sickness after returning to Earth.

***How many hours of exercises do astronauts have to do in a day?***

Dan Soschin: About 2 hours per day, six days a week.

***How do women deal with their monthly issues in this environment?***

Wendy Lawrence: Basically, the same way that they do on Earth -- things work the same.

***My homeschooled children have asked me, how can the surface of the sun be on fire, or burn without the presence of oxygen in space?***

Jim Reilly: The sun is not really burning but it is fusing atoms of hydrogen into helium which releases a lot of energy which we see as light and heat. The same thing occurs in a hydrogen bomb which also generates a lot of heat and light in one big explosion. The sun is doing this continuously.

***Are you using the oxygen slower?***

Jim Reilly: Actually we use the oxygen at a slightly higher rate since we are working fairly hard.

View the entire webcast online at: <http://www.studyatapu.com/web-cast/space>.