

FIT TO FLY

an aeromedical column by Dr. Petra Illig

Medical Guidelines for Space Tourists

I know this isn't particularly related to Alaskan aviation, but the topic of space tourism is increasingly coming up on my radar screen, and I find it an incredibly interesting subject. I recently attended a "Humans in Space" conference in Austria, and it brought out the space groupie in me again. I promise to come back next time to an aeromedical topic more likely to be useful to the GA pilot. In the meantime, I hope you find this article interesting.

Within the next handful of years, commercial space travel, at least at a suborbital level, will open up for nearly any individual who has the financial means to purchase a ticket to ride. So far the only commercial space tourists have been adult men who had undergone extremely extensive medical evaluations by the Russian space agency prior to selection. Two men have flown, and a third is currently being evaluated. * Among those that have been turned down is the rock singer Justin Timberlake.**

Subsequently these 2 men spent the next few months engaged in intensive physiological and operational training in Star City (the Russian equivalent of Johnson Space Center in Houston) and were being turned into cosmonauts. They were being prepared for several days in microgravity on board the Russian segment of the International Space Station. They would be subjected up to 7 G's, possibly endure severe space motion sickness, and be expected to perform some tasks. Mostly, though, they were required to stay out of the way of the "real" astronauts. (It was purported that NASA required Dennis Tito to sign a breakage agreement and to agree to stay away from the US segment of the ISS.) The Russians rely so heavily on the income from these super wealthy space tourists that some cosmonauts actually threatened to boycott their NASA training if Mr. Tito was not allowed to fly. It seems somewhat ironic that the former communists are now heavily involved in the commercial side of space, yet our own capitalist country has been very slow to embrace such an expression of the American dream. To be able to be counted among the elite 600 or so astronauts and cosmonauts around the world is worth \$20 million to a select few.

Certainly the future of commercial space travel does not lie along the same path. This next generation of space tourists will consist primarily of upper income middle-aged men (and to a lesser extent, women) with substantial disposable income but little time for preparatory training. Many will come with a list of medical problems, some of which they do not yet even know they have. If the price of a flight and the time involved in training would come down, then there would be many more people who would sign up.

Presently there are a number of small companies involved in developing suborbital flight infrastructures for commercial space tourism. These companies are toying with various flight profiles which are the basis from which potential medical guidelines need to be considered. In general these flights at first will be of relatively short duration, most likely under an hour with only a few minutes' exposure to microgravity. Passengers will be exposed to relatively low G-forces, on the order of 2-4.5 and sea level (or at least departure ambient) cabin pressures. There will be little, if any, requirements to act independently such as emergency egress activities. Some companies might offer a flotation experience, which would require additional training in removing and then re-attaching the seat restraints. There should not be any need for personal protective equipment, although some companies are developing spacesuits as part of their program.

Further down the road will be designs for longer vacations such as orbiting hotels. We are still a few generations away from long-distant space flight for tourists, such as to Mars. There have been some publications in the aerospace medical literature on this topic, but only by giving rough

guidelines and suggestions.

What, then, should the medical standards for these new up-and-coming space tourists be, and who should oversee this activity? Currently the state of understanding of the medical aspects of space flight is limited to the study of incredibly healthy and strong adults. Nothing is really known about the effects of space flight of any kind on people with significant medical problems, nor such normal physiological states such as pregnancy. Scientists really don't know much about the effects of the space environment on the ordinary person.

In order to make decisions about potential space passengers' health, some assumptions need to be made based on the state of the industry. For the foreseeable future, these flights will be similar to the recent flights of SpaceShipOne: low G's gentle ride up, a few minutes of weightlessness up at the top at 100 km, an incredible view of earth, probably some nausea and maybe vomiting, a fast return flight, and a firm landing back where you started from. For the healthy adult, a few days of orientation including gentle centrifuge training and a brief health check should be all that is needed to prepare for such flights. In such a profile, even people with a significant physical disability, such as paralysis or blindness, should not be excluded from this trip as long as they can physically safely occupy a seat. However, individuals with a serious medical or psychiatric illness that is not stable should be excluded. Cases like this would include people with uncontrolled seizures, unstable heart disease, or severe anxiety. On the other hand, individuals with terminal illnesses should be allowed to fly, as long as they are otherwise fit to fly, and not likely to succumb of their illness during the flight. Of course, a myriad of psycho-social problems related to isolation need to be solved before any long term flights can be engineered.

That actually leaves a lot of people out there who can fly. Within the parameters of such simple and short "shirt-sleeve" suborbital flights, it seems that most adults who are healthy enough to drive should be able to be space tourists.

Whether or not the future of commercial space travel will extend to the realm of long duration flight, such as to Mars, depends entirely of course on the economic environment at the time, but also requires a real understanding of what happens to normal people, not just physically fit astronauts, during such extended flights. For the long haul traveler, many serious physiological problems must be overcome, such as dealing with the considerable amount of muscle and bone lost due to the lack of gravity. There are a lot of fluids in the body that are shifted about as well which can create havoc in people with circulatory problems. Space engineering has not yet been able to provide a viable spacecraft that creates its own artificial gravity.

As far as regulation, the FAA is actually staying out of it for now. They have requested input from professional organizations such as the Aerospace Medical Association, which has made some very general recommendations. It is hoped that the industry will regulate itself in this regard, with each individual company setting up its own medical guidelines and screening procedures, dictated by current knowledge and good common sense. What is not regulated will be managed by the attorneys. It is to the companies' advantage to have some sort of reasonable medical screening and physiological training program for their customers.

When space tourists start flying regularly, we will learn more about how the normal, relatively untrained human responds to various levels of space conditions. We will be able to learn whether it is safe for people in special medical situations to fly, such as pregnant women, and what, if any, the limits of age on either end should be. I believe that the legal community will develop more stringent standards than the government would, and the industry will need to support the kind of research needed to increase and refine our understanding.

Virgin Galactic is planning to be flying by 2008, and is already taking deposits. Are you ready to be a Space Cowboy?

* Dennis Tito (USA) age 60, Soyuz TM-32, April 2001

Mark Shuttleworth (S. Africa) age 27, Soyuz TM-34, April 2002

** Errata: Lance Bass, not Justin Timberlake