# Why Aerospace Medicine is Important

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Occasionally, I am asked what motivates me to make a difference in Aerospace Medicine. Why is our field important? Here is what I think of.

Our civilization has already done some amazing things. The number of fatalities from commercial airline crashes per passenger miles flown has dropped since the 1920s from one per million miles to one per billion miles. Today, we can travel to any part of our globe within a day. The Voyager spacecraft, at 12 billion miles from Earth, is now in interstellar space; rovers and orbiters have explored all our solar system's planets, including some asteroids, comets, and, in July of this year, Pluto. Humans have been to the Moon and are currently living and working in space full time on a very successful international space station. Throughout the world, there are plans for human missions into deep space in the not so distant future. Very soon, nearly anyone with the financial means can buy a ticket and go into space on one of several commercial spaceflight carriers.

Recent fascinating medical inventions, devices, and technologies could improve the practice of Aerospace Medicine. For example, nanobotics may, at a cellular level, monitor and counter bone and muscle loss, combat cancer, and a myriad of other conditions.

The vastness of our universe is almost beyond comprehension. Our Milky Way galaxy is about 100,000 light years across. That means a spacecraft at the speed of light would still take 100,000 years to cross it. The Milky Way contains billions of stars and an estimated tens of thousands of planets. The whole known universe contains about 200 billion of these galaxies and is approximately 13.7 billion years old. Due to recent missions like NASA's Kepler spacecraft, hundreds of planets have been discovered with many more Earth-like planets than previously thought. Although conditions for life beyond Earth may be rare, in view of the extreme size and age of the universe, it is statistically very likely and in the trillions.

Advanced propulsion is in our future. Fission, fusion, matter/antimatter, and other even more sophisticated space-time fabric manipulations are potential future propulsion technologies. A current trip to Mars with existing chemical propulsion is estimated to take about 6-8 months; with fission propulsion, about 1 month; and with matter/antimatter, about 1 day (at a comfortable 0.5 G acceleration then deceleration). Imagine, your distant future relatives taking dinner trips to the moon and weekend trips to Mars. Exploration beyond our solar system could be within our reach.

*"It is difficult to say anything is impossible, for the dream of yesterday is the hope of today and the reality of tomorrow."* –Robert H. Goddard

Space medicine issues would need to be mitigated. Space radiation, microgravity, mental wellness, various pressure and gas mixture atmospheres, all can affect the human beyond Earth, especially having and raising children in these environments. We could solve some of these issues by bringing many of Earth's conditions with us (e.g., atmosphere, shielding, artificial gravity) or by terraforming our destinations into Earth-like places; but we may also change ourselves. Some estimate humans in off-Earth habitations could develop new cultural and physiological traits in as little as five 30-year generations. Beyond cultural, technological, and natural adaptations, genetic engineering may help us adjust more easily to our new homes. Eventually, Earth-humans may be different from Moon-humans who may be different from Mars-humans and even extra-solar system humans.

As Robert Lightfoot, Associate Administrator of NASA said, "I want to explore Mars, live on it, take a space plane across the U.S. in 30 minutes, go from Washington D.C. to Japan in 2 hours, own a personal aircraft car. I want to rewrite our history books for our grandchildren."

So why should humans traverse the skies, explore the oceans and space? Is it for inspirational, financial, operational, or scientific reasons? Survival insurance from an Earth-bound extinction? Expansion to greater resources? Perhaps all of these reasons; but wherever humans go, our expertise in Aerospace Medicine needs to go with them. The price of not being prepared for such activities is high and its consequences for humanity are dire. We in Aerospace Medicine can reduce that risk to facilitate a multi-environment/multi-planet civilization. Aerospace Medicine is essential to the survival and progress of our species. This is what motivates me to make a difference in our field. I can think of no other more important activity.

I hope you can join me and your fellow colleagues at our upcoming annual scientific meeting in Orlando. If you haven't already, please register now and plan to attend!

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