

# The Space Based Civilian Workforce: What are their jobs, what is their training and where will they come from

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## Abstract

This paper is driven by the likelihood that as humans start to work in outer-space, that these civilian space farers will not resemble the astronauts of today, but more closely resembles the workforce here on earth. This paper will identify some likely human-tended space commerce opportunities, focusing on those in low earth orbit (LEO). This presentation has refrained from identifying Lunar based, Martian based or other exo-Earth commerce opportunities, beyond LEO, mostly because these commercial opportunities are too ill-defined at this point in time. These commercial opportunities will create a need for a space-based workforce that will more closely resemble the workforces here on earth than the astronaut community currently servicing space vehicles and structures.

## I. Introduction

To gain an insight into future jobs in space, be it in free flying locations or on surfaces, we first need to review the types of missions and purposes that various space faring enterprises are planning or even conceiving. We examine both government and private industry plans, missions and goals. And we also infer or extrapolate certain follow-on or subsequent missions and goals to try to fill out one possible view of a long term vision for jobs in space. The focus of this paper will be to look at deployment/installation, operations, maintenance and disposal of various systems that will support these various missions/goals and which require (or should require) some human assistance, intervention or other attention.

## II. Just what are the potential jobs in space?

We can start with the US government and NASA. We know about the Vision for Space Exploration (see NASA ref) and from this we can infer certain 'on orbit' jobs and possibly some jobs related to activities on or near the Moon. While NASA has a large focus on autonomous and robotic systems, there are likely to be a need for some amount of human support for operations and for maintenance activities. In the early days of the deployment of any robotic or autonomous systems, it is likely that human 'attendants' will be desired or even required in support of many of these NASA systems that will support their Vision, mostly in case something goes wrong. It is reasonable to think that NASA is already considering human support to Low Earth Orbit (LEO) transition and transfer activities as systems that are launched from the Earth are reconfigured and transformed into Lunar transportation systems. In addition, as these NASA systems (and other international government systems) expand their missions, there is likely to emerge a need for certain infrastructure services (e.g. fuel depot). As these infrastructure services emerge, these again will initially require human 'attendants' even for those that are designed with maximal autonomy.

If we look at other government's plans/missions, we can see additional potential for humans in the loop. There currently is a huge presence of government satellites in various Earth orbits and as technology improves, it is likely that these government satellites will be designed for repair and refurbishment. Initially, these 'serviceable' features will be limited and done robotically. But there is every reason to expect that as satellites continue to be designed for repair/refurbishment, that an on-orbit servicing industry will emerge. As satellite servicing capabilities expand, it is likely that these on-orbit servicing services will support other than just satellite systems.

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Lastly, by looking at commercial interests, plans and enterprises, we can identify an even more robust set of human jobs. Space tourism is likely to be one of the first privately run commercial enterprises in LEO (and beyond) and as these tourists plan to spend more than a few hours/laps in LEO, a need for lodging and other amenities will surface. Privately run LEO hotels will require a staff not unlike that at any high end hotel here on Earth. And while the size of the staff is likely to be smaller and more cross-disciplined in skills, such a workforce will rapidly emerge. And as these and other commercial space enterprises expand to LEO, the Moon and beyond, along with various international government efforts, there is likely to emerge a set of 'infrastructure' services needed to handle the increased traffic and activity in LEO, and eventually beyond. Capabilities such as 'air traffic control', and associated traffic controllers, will emerge in LEO as various international government and private enterprises do business in space. While it will be a challenge as to who will fund, develop, deploy and operate/maintain these infrastructure services, there can be no question that these infrastructure services will require some amount of human workforce to support them.

### **III. What are the required skills of these space workers?**

While the systems that will be deployed and operated in space will continue to be designed, developed and tested by the various collections of engineering skills, mostly here on Earth, the individuals chosen to go into space to operate, maintain and repair these systems will be individuals with technical skills such as A/C repair, materials fabrication/repair, hydraulics and mechanical skills. And there will also be a growing presence of 'service industry' type of skills needed, such as hotel clerks, chefs, cleaning crews, trash haulers, hydroponics gardeners, etc. Many of these individuals will likely need to be multi-skilled, not unlike the days of the covered wagon trains heading westward in the USA. Many of these individuals will be trained in junior colleges, community colleges, technical institutes and the 'trades' apprenticeship programs.

### **IV. Conclusion**

It is time to start thinking of the types of educational and training programs necessary in order that this future civilian workforce will be ready and standing by, as their jobs start to emerge from increased traffic going into space. I think that we can safely say, "Space: Not just for rocket scientists, anymore!!".