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Beyond 2000 - Future Military and Commercial Programs Open Opportunities for the Space Workforce of the Future[©]

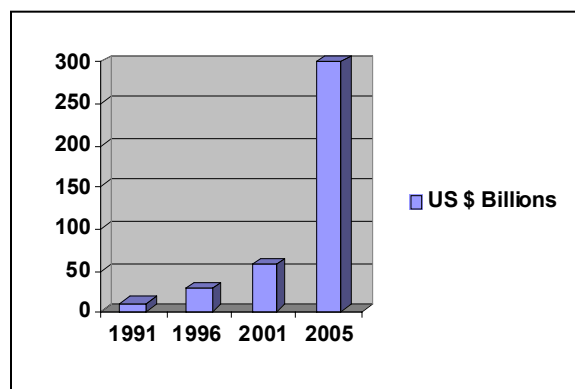
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The Space Operations profession has been expanding, for the past 4 decades at nearly the same scale, proportionally, as space itself.

Gene Roddenberry's Star Trek¹ captured the imagination and interest of several generations; many hoping to someday get a chance to work in some space related field. In 1975, a NASA study reported the proposed construction and operation of a US\$200 Billion dollar, Earth-orbiting, commercial space station with 10,000 inhabitants who's sole job would be to manufacture and operate solar-power satellites supplying Earth with energy -- generating enough revenue to pay for it's construction and continuing operation in about 30 years².

Seeing space portrayed as a routine work environment for a world of earth citizens seemed like far fetched science fiction for decades. In 1991, space was already generating US\$11.5 Billion dollars in revenue; in 1996 that jumped to US\$26.7 Billion; by 2001 it will have more than doubled to US\$57.5 Billion³.

Due to a frenzied demand and competitive fever to get services to the market, world-wide space industry revenue is anticipated to reach more than US\$300 Billion dollars, a six fold jump, by the year 2005⁴. This is being driven by new start-ups injecting their initial constellations and an estimated 1,500 plus launches scheduled between 1999 and 2005.



¹ Star Trek is a trademark and copyright of Paramount Pictures (<http://startrek.com>)

² Source, Mark Alpert (issue editor), Making Money in Space, Scientific American, The Future of Space Exploration, Quarterly, p93, Spring 1999, Vol. 10, Number 1. (<http://www.scientificamerican.com>)

³ Source, John T. Correll (Editor in Chief), A Roadmap for Space, Air Force Magazine, p23, March 1999 (<http://www.afa.org>)

⁴ AFCEA Magazine, February 1999. (<http://www.afcea.org>)

How will the military and the commercial space industry train sufficient employees for this expensive, complex, technical and risky operational environment that is out-of-this-world?

The military has already begun to feel the personnel pinch. HQ Air Force Space Command⁵ has been investigating ways it can shift space operations from officer-engineer to enlisted-operator, and in the near future consolidate operations such that a few common crews will be able, through increased automation tools, handle all DoD satellite vehicles (SVs). Some envision advanced SV technologies equipped with autonomous orbit maintenance and survivability capabilities; while other envision a dramatic shift from military systems to federally contracted or privatized space operations.

Training the employees that work in these new industries has until recently been nearly exclusively a military pipeline; whereby unskilled citizens entered military service and received very comprehensive classroom or on-the-job training; then as civil opportunities arose, they would bale out for more lucrative pay and benefits. This is still one channel for many to follow as civil space operations are continuing to draw from the DoD pool of labor. But space is no longer just a military operations environment.

Today, unlike that period between the 1950's and 1980's when the United States and Russia were the only players of significance in space, space has become big business. Now there are some thirty countries involved in space operations, with several thousand satellites in orbit. Sixteen space faring countries are currently participating in the International Space Station (ISS), under construction with a completion date some time in 2004⁶, at an estimated cost of nearly US\$80Billion.

Space corporations offering services and products which are a direct spin-off of earlier military space operations, are now revenue streams for investors seeking higher rewards than just building and putting satellites in space for the military. Large corporations⁷ such as LockheedMartin⁸, Boeing⁹, Hughes¹⁰, Motorola¹¹ and conglomerates such as Globalstar Telecom¹², Iridium¹³, Teledesic¹⁴, DirecTV¹⁵ and DirecPC¹⁶, USSB¹⁷, and others such as American Mobile Satellite¹⁸, ViaSat¹⁹, Orbcom²⁰, and CD Radio²¹ are listed on the Stock Market²².

⁵ HQ Space Command (<http://www.spacecom.mil>)

⁶ Tim Beardsley, Staff Writer, The International Space Station: A Work in Progress, Scientific American Presents, Spring 1999, Vol. 10, No. 1 (<http://www.scientificamerican.com>)

⁷ Lockheed Martin, Boeing, Hughes, Motorola, Globalstar Telecom, Iridium, Teledesic, DirecTV and DirecPC, USSB, and others such as American Mobile Satellite, ViaSat, Orbcom, and CD Radio are all trademarks, salesmarks, or registered names of the respective owners.

⁸ Lockheed Martin (<http://www.lmco.com>)

⁹ Boeing (<http://www.boeing.com>)

¹⁰ Hughes (<http://www.hughes.com>)

¹¹ Motorola (<http://www.mot.com>)

¹² Globalstar Telecom (<http://www.globalstar.com>)

¹³ Iridium (<http://www.iridium.com>)

¹⁴ Teledesic (<http://www.teledesic.com>)

¹⁵ DirecTV (<http://www.directv.com>)

¹⁶ DirecPC (<http://www.direcpc.com>)

¹⁷ USSB (<http://www.ussb.com>)

¹⁸ American Mobile Satellite (<http://www.ammobile.com>)

¹⁹ ViaSat (<http://www.viasat.com>)

²⁰ Orbcom (<http://www.orbcomm.com>)

²¹ CD Radio (<http://www.cdradio.com>)

²² Charlie Vestner, Satellite Stocks, "The Sky's The Limit", Individual Investor Magazine, June 1998. (<http://www.iionline.com>)

These companies routinely offer space based services providing bent-pipe and direct broadcast capabilities for data, voice, and television communications to other corporations in associated industries as well as personal paging and cell phone services to individuals.

Since these services and products are available on a global scale literally hundreds of thousands of jobs are being created in this fifty year old -- new commercial space business arena. Because these are commercial ventures, employees are being sought that not only have space experience but a strong business sense as well.

On-the-Job-Training (OJT) - No Longer Sufficient:

Although military and civil space operations will continue, through the 21st Century, to compete for the technical individuals to operate and sustain the ground and space segments, a whole new generation of space-business savvy individuals is being sought.

Developing the next generation of commercially competitive space employees will require more than just on-the-job-training. These new employees must have business, operations and technical know-how.

The next generations of space professionals is coming from a broad spectrum of experience and range of prior work environments and are somewhat invisibly being integrated into our daily lives. *Don't believe it?* Look around today, we already have science fiction and screen writers, movie producers, actors, aerospace contractors, direct broadcast television, CD-radio, paging, tele- and data-communications, GPS receiver manufacturers, surveyors, forest rangers, farmers, taxi-drivers, commercial and private pilots, NASA²³ and Jet Propulsion Laboratory scientists, stock brokers, college professors, and tens of thousands of others already working in space professions for very good wages and living Gene Roddenberry's future.

Space technologies have become so pervasive most Americans don't realize their television show, newspaper, or telephone calls are transmitted via satellite, until one fails to provide the service, as tens of millions of pager customers realized in 1998 when a Paging Satellite experienced an on-board transponder failure, and service was disrupted.

Companies such as OnStar²⁴ are using the Global Positioning System (GPS)²⁵ space signal to provide radio navigation²⁶ and other consumer services through their space spin-off technology. Not only do they provide navigation capabilities, but can track a stolen car, provide near pin-point location services to auto-repair and emergency assistance personnel trying to help you on-the-road, and provide information over your cell phone about the nearest gas station, restaurant, motel, ATM machines or hospital.

College Degree Programs:

²³ NASA (<http://www.nasa.gov>)

²⁴ OnStar Corporation (<http://www.onstar.com>)

²⁵ NavStar Global Positioning System (GPS) (<http://www.laafb.af.mil/smc/cz/homepage>)

²⁶ Steve Dye (gpsyves@aol), OnStar, Satellite Times, p74, April 1998 (<http://www.grove.net/~grove/hmpgst.html>)

Many individuals desiring to make career changes are seeking college and university²⁷ programs where they can learn the basic principles of: the space environment; orbital mechanics; space craft design; bio-astronautics; as well as contract management; systems integration; decision support system; space law and policy; engineering and technical management; program management; international law, finance and marketing; data- and tele-communications; and, electronic commerce²⁸.

Not only do institutions of higher learning need to recognize this growing profession, but also need to respond rapidly by designing and delivering specialized education programs²⁹ and environments -- such as distance and adult learning. With the rapid development in space spin-off technologies³⁰ new studies such as telemedicine³¹, Earth resource management and mining, Earthimagery³², weather observation, with specialized, simulated training. In the next 100 years, manned missions back to the moon and on to Mars³³ may become common-place and will require tens of thousands of well educated technical program managers, space operations managers, contract administrators, systems integrators, decision support system technicians, launch and payload specialists, e-commerce managers³⁴, and many other new positions requiring specialized training³⁵ taught by practicing professionals from today's growing space industries.

21st Century Learning Environments:

Due to the rapid development of new computer aids, it would not be unrealistic to forecast that within the next decade we'll see virtual learning environments become common place. Imagine walking into an empty room, not too dissimilar to a holodeck³⁶ aboard Voyager³⁷, placing a lightweight pair of goggles on, and stepping into the operational environment of the International Space Station orbiting some 300 miles above the Earth. Since space is still a very risky³⁸ and expensive environment³⁹, virtual training tools will allow Earth-bound adult learners to be placed in space environments along side their space-based teammates for OJT. These virtual classrooms will allow the luxury of working (virtually) alongside the experienced individual they will eventually replace once their tour of space duty is scheduled.

²⁷ Webster University offers a Master of Science in Space Operations - with two tracks leading to Engineering and Program Management specialties. (<http://www.websteruniv.edu> and <http://www.home.att.net/~SpaceWeb>)

²⁸ Robert K. Ackerman, Digital Handshake Characteristics - Defense Electronic Commerce, Signal Magazine, p. 17, March 1999 (<http://www.afcea.org>)

²⁹ Webster University (<http://www.websteruniv.edu>)

³⁰ <http://www.nasa.gov>

³¹ The Association of Telemedicine Service Providers (<http://www.atasp.org>)

³² Microsoft Terraserver in cooperation with Russian Space (<http://www.terraserver.com>) Terraserver is a trademark of Microsoft Corporation (<http://www.microsoft.com>)

³³ Mars Society (<http://www.marssociety.org>)

³⁴ Webster University is developing a new e-commerce degree program focusing on global marketing and exploitation of advanced technologies. (<http://www.websteruniv.edu>)

³⁵ Webster University, Space Operations Management, Master of Science degree program. (<http://www.websteruniv.edu>) and (<http://home.att.net/~SpaceWeb>)

³⁶ Holodeck is a trademark of Paramount Pictures. (<http://www.startrek.com>)

³⁷ Voyager is a trademark of Paramount Pictures. (<http://www.startrek.com>)

³⁸ Bryan Burrough, Dragonfly - NASA and the Crisis Aboard Mir, Harper Collins Publishers, 1998 (<http://www.harperaudio.com>)

³⁹ Making Money in Space, Scientific American, The Future of Space Exploration, Quarterly, p93, Spring 1999, Vol. 10, Number 1. (<http://www.scientificamerican.com>)

Many of the defense department branches are conducting their own virtual reality prototype projects such as the Navy Research Lab⁴⁰ (NRL) and the Air Force's Advanced Research Projects Lab⁴¹ (ARPA). Their goals are multi-faceted - to reduce training costs, improve technology transfer and knowledge retention, gain strategic superiority over any enemy of the United States and maintain Peace. Humans are visual creatures and as such, prior studies using multi-media training have clearly shown that training time can be reduced by as much as 20-50 percent and knowledge retention increased from 15-80 percent. Training simulators have been used for decades to train ship captains, train drivers, airline and military pilots, the astronauts, and employees on the assembly lines.

This will not be an alien experience since most of the employees working in these new space operation environments will be of a generation⁴² who grew up with large screen, direct broadcast TV, Sony Playstations⁴³, interactive learning, virtual reality games⁴⁴, and the Internet. Having this side-by-side training will ensure knowledge gained on-orbit and operational experiences are transferred to the new space technician prior to their ever having been in the space environment, unlike what was experienced by American Astronauts aboard Mir⁴⁵ when it experienced several near destructive crises⁴⁶.

Yesterday's Science Fiction is Tomorrow's Classified Ad:

With space enterprises such as Iridium recently going operational with its global cell phone and paging services, and Teledesic, flush with fresh funding, and ready to launch and operate a constellation of 288 data-communication satellites to provide global, wireless, and internet connectivity -- the future of commercial space operations is growing faster than any average American citizen watching Star Trek -- Voyager⁴⁷ beamed down to their living room from Geostationary orbit can realize.

This is no longer science fiction, it is today's global, competitive, business environment, the stock market as well as a growing, global, employment opportunity for many willing to learn so they can earn a better than average wage **beyond 2000**. For those who are ready to get the right education and make the moves as opportunities open to gain ground floor experience, Space is a place waiting for them to fill the void.

⁴⁰ Naval Research Lab (<http://www.nrl.navy.mil>)

⁴¹ Advanced Research Projects Lab (<http://www.arpa.mil>)

⁴² Gerald M. Hoffman, Technology Payoff - How to Profit with Empowered Workers in the Information Age, New York, NY, Richard D. Irwin, 1994

⁴³ Playstation is a trademark of the Sony Corporation (<http://www.sony.com>)

⁴⁴ Virtual Reality games and simulators can be experienced at a number of locations, example Dave & Buster's, a national adult game experience franchise. (http://biz.yahoo.com/prnews/990128/tx_dave_bu_1.html)

⁴⁵ Russian Space Station Mir (<http://38.201.67.70/history/shuttle-mir/ops/crew>) and the Russian Space Agency in English (<http://www.rka.ru/english/eindex.htm>)

⁴⁶ Bryan Burrough, Dragonfly - NASA and the Crisis Aboard Mir, Harper Collins Publishers, 1998 (<http://www.harperaduio.com>)

⁴⁷ Star Trek and Voyager are trademarks of Paramount Pictures (<http://www.startrek.com>)

The Author:

Mr. William C. Hoffman, Jr. is an adjunct professor and faculty coordinator for Webster University, Colorado Springs Metropolitan Campus. A former USAF officer, he was assigned to HQ NORAD, HQ AF Space Command, and the System Integration Office (SIO) for over ten and one-half years. He managed the US\$3B global secure communications technical architecture supporting the Integrated Tactical Warning/Attack Assessment (ITW/AA) system.

He has taught graduate space and computer courses since 1983, and manages a faculty of nearly 40 practicing professionals in Space Operations, Space Systems Management, Computer Science, Computer Resources and Information Management, and Telecommunications Management graduate programs. He has been instrumental in establishing Webster University's premier Space Programs and is working to take them across the Internet.

He is employed by ARINC Incorporated, and is currently the lead system engineer, supporting SMC Det 11/CZGA, on the Global Positioning System (GPS), Ground Control Segment (GCS), replacement program. There he is the senior member of a team of twelve engineers and analysts over seeing and advising the GPS Joint Program Office, Ground Control Segment Program Manager, on the replacement of the entire GCS from a legacy main frame environment to a distributed, open systems, environment. He specifically provides technical engineering and acquisition management support.

He is a member of the Air Force Association, Institute of Navigation, National Space Society, and Planetary Society.

He has earned an MA in Government Acquisition and Procurement Management; an MA in Space Systems Management; and will receive an MS in Computer Science - Distributed Systems in May 1999. Mr. Hoffman is pursuing a Ph.D. in Applied Management and Decision Sciences with a specialization in Technology Integration through Walden University.

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