

Toward a Spacefaring Civilization: An Entertainment-based Approach to Creating a Consensus for Space Frontier Formation

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This study examines how to establish a spacefaring civilization without government intervention by turning space technology development into a popular form of entertainment linked to sustainable living on Earth. The current view of the future produces an emphasis on sacrifice and austerity. In the proposed ethic, the most fundamental freedom is the freedom to leave. Our research indicates that creating a market for the good behavior of Terran civilization by promoting the freedom to leave will produce sustainability with prosperity on and off the earth. The customary way to leave a civilization as recently as 1900 was to head for a frontier, defined as an isolated region of resources without proprietors and with anonymity for new arrivals. The absence of frontiers is termed enclosure, manifesting as a constellation of symptoms in common with “isolated confined environment syndrome,” including depression, anxiety, and anger. We believe this is a fatal cocktail of emotions requiring a frontier formation response. The only accessible and fully functional frontier we see at this time is the solar system. Our postulates are that (1) enclosure results in reproductive failure of the enclosed population producing senescence followed by collapse and (2) no mitigation can happen on the required scale unless a large segment of society views space frontier formation as fun. The first premise has been tested and found to be arguably true in rodents. We propose, and are implementing, a test case for the second premise involving what we hope will be a masterful blending of science, technology, craft, and performance art.

Key Words:

space, frontier theory, consensus, enclosure, spacefaring civilization, space colonization, space settlement theme parks, isolation, confinement, environment

Introduction

Private enterprise is an institution necessarily devoted to producing something useful as determined by its customers, who trade money for value. Success is based on a consensus within a given market that whatever product or service is offered has value sufficient to warrant the customer’s continuing patronage. In a sense, people vote with their currency.

What is essential about this system is the freedom to leave any supplier for a competitor offering superior value. The more competitors there are, the greater this freedom to leave is, and the greater the power of the individual. But economic success also depends on the existence of general agreement, a consensus, about the value of the product. If the offering has unperceived significance, and it fails, individual freedom is sacrificed. Personal transportation products like automobiles, which affect one's ability to get away but have little impact on day-to-day existence in, say, a dense urban environment, are like that. Frontier formation, the creation of distant regions of resources without proprietors, is like that, too, and for the same reason: its value may not be obvious in the short term, but it will be missed when needed. Our romance with the idea of personal transportation freedom keeps the car business alive. A romance like that of the American West for a new and unoccupied frontier should do the same for space exploration technologies.

Frontiers promote limited authority, an approximation of anarchy, by leaving to nature and immediate necessity the formation of agreements among men. When those agreements are forced upon the unwilling, despotism begins. It is in that moment that options are required to avoid falling into tyranny, and those options most naturally take the form of the next village, the further outpost. Loss of population is the most effective means of limiting power. The most basic freedom is the freedom to leave. There is abundant evidence of this in American history^{1,2}.

In his first inaugural address, Thomas Jefferson called the American frontier "room enough for our descendants to the thousandth and thousandth generation." Others at the Constitutional Convention, knew, and said³, that the frontier made equality more probable because individuals could easily leave established communities to prosper elsewhere. They understood the value that this fact added to the labor of the workman: that it provided for his economic competency (in the sense of support for a family). However, they took the frontier for granted in their planning, and two hundred and twenty-five years later, their error is obvious.

This error is not without consequences. With what looks like increasing frequency, superficially normal people go berserk, attacking multiple targets with lethal force⁴ and prompting the installation of conspicuous security measures.

We all know that "rats are not people." However, laboratory animals often substitute for humans in tests of hazardous environmental factors. Their use in the study of cancer-causing and toxic chemicals is almost universally accepted. Besides that, their responses can, and do, give insight into human behavioral psychology. They are useful as models for humans precisely because their repertoire of behaviors is simpler than that of men and women, so it is easier for scientists to control the variables. This also gives us the latitude to say, when we do not like the results of

¹ Frederick Jackson Turner, *The Frontier in American History*, Robert E. Grieger Publishing, Malabar, Florida, 1985, pp. 16-38.

² Webb, Walter Prescott, *The Great Frontier*, University of Texas Press, Austin, 1951, pp. 106-107.

³ "Rather than quarrel about territory, the poor, the needy, the oppressed of the earth, and those who want land, resort to the fertile plains of our western country, the second land of promise, and there dwell in peace, fulfilling the first and great commandment.", George Washington, letter to David Humphreys, 1785.

⁴ Archer, Dale, "Mass Murders on the Rise," *Psychology Today*, July 28, 2012.

such tests, that humans and rats are different. And that is why, when ecologist John B. Calhoun passed from the scene in September of 1995, *The New York Times* noted in his obituary that his work had often met with "studied disregard." He had spent his life studying the behavior of enclosed rodents.

Norway rats confined in a space of fixed dimensions, wanting for nothing — plenty of food, plenty of water, plenty of places to live — exist in what one might consider a rodent utopia. But is it? The research to answer that question began at Johns Hopkins University in 1946 and continued into the '60s, when Calhoun, then a research psychologist at the National Institutes of Mental Health, published a report of the work in *Scientific American*⁵. What fascinated the scientist about the rats was that, confined, they developed social pathologies similar to the behavior of humans in large cities. Among the males, the behavioral disturbances included sexual deviation and cannibalism. Even the most normal males in the group occasionally went berserk, attacking less dominant males, juveniles, and females. Failures of reproductive function in the females — the rat equivalents of neglect, abuse and endangerment — were so severe that the population was reduced to a few geriatric cases who subsequently died.

It is important to understand that a comparison between Calhoun's experimental results and the behavior of dense urban human populations is flawed because density and crime are not well correlated. However, the animals in Calhoun's experiments were not just crowded together; they were prevented from leaving. There is a correlation between low income and crime, and an obvious relationship between low income and lack of mobility.

We also have the evidence of (intentional and unintentional) studies done with "isolated confined environment syndrome," with its constellation of debilitating symptoms including depression, anxiety, and anger. Typical is the experience of the eight "biospherians" confined for two years within a 3-acre simulation of a self-sustaining space colony near Tucson, Arizona. Jane Poynter, one of the participants, has documented the experience in *The Human Experiment: Two Years and Twenty Minutes Inside Biosphere 2*. By comparison, crews of approximately the same size have been together, apparently without incident, in the International Space Station for not more than about a year.

It is very clear that more research should occur to test what we say is obvious, but we have not uncovered any evidence of such work or any tendency to propose it to government funding agencies. There is a good reason for that.

Government is a monopoly on the legitimate use of force. It is (no surprise) a political animal, interested primarily in the acquisition and maintenance of power. Its first priority is arming itself, which secures its taxing authority. Its services follow the universal and immediate interests of its constituents, which are focused on risk avoidance, entertainment, and food. Leftover resources are devoted to posturing for political effect. In general, there is no motive for government to provide a harvest requiring great foresight, endurance, and courage. Capital can do this if it perceives the possibility of a profit proportional to the risk. Such a possibility has now been identified.

5 Calhoun, John B., "Population Density and Social Pathology," *Scientific American*, February 1962, Vol. 206, No. 2, pp 139-148

Origin and Purpose

Customers, including government, are already looking to private enterprise to provide alternatives to what government and other centralized sources provide with sometimes low quality, low reliability, high cost, or dubious safety.

Electric power microgrids are one response. They are being installed at military bases, data centers, hospitals, and in communities to provide what is being called “surety,” a combination of safety and reliability⁶. Evolving technology is allowing some communities in arid regions to reclaim water for both irrigation and potable reuse. Advances in the technologies of controlled-environment agriculture increasingly permit local food production to meet local needs, even in non-arable surroundings. Key technologies of interest to SpaceFarers include those that can provide energy, water, medicine, food, clothing, variable gravity, waste processing, breathable air, radiation shielding, structural elements, robots, or recycling capacity employing materials and circumstances readily available or imaginable in space. Since we are engaged in the population of space by humans, transportation from Earth becomes a pivotal art by definition. Such technologies need full consideration as elements of entertainment in a fair environment. Some fit nicely as visible parts of the fair infrastructure. Anything outrageous becomes its own form of entertainment. For example, contemplate growing humans in situ from robotically-tended embryos, like dinosaurs in the movie *Jurassic Park*. Moving embryonic tissue instead of adults across light years should greatly reduce the cost of transportation. In a similar vein, think about growing steaks and leather directly rather than producing them indirectly from cows.

The development of space colony systems also impacts the existence of those who remain behind. The chief criticism of the unacceptably grim 1972 Forrester model of world dynamics⁷ was that it consisted of only one "sector," in which the entire world economy was treated as a single "lumped" system, everything averaged. However, a few years later, Peter Vajk of the University of California's Lawrence Livermore Laboratory published a better study titled "The Impact of Space Colonization on World Dynamics"⁸ with similar results for the worst case. Vajk found that predictions from a two-sector model adequately represented the output of models with as many as 10 sectors, so he settled for the simpler two-sector approach. Then he added a third sector, a space industrial infrastructure ala Gerard K. O'Neill, interacting with the terrestrial economies.

In Vajk's study, assuming an absence of space industrialization until at least 2100, the material standard of living in the industrialized countries peaks by 2000 at a level at least 10 times higher than that in the developing countries, falls to 1900 levels in both sectors by 2100 and continues to fall, albeit more slowly, after that. A downturn in the population of the developing countries in 2080 is the result of increased death rate, not reduced birth rate.

If space industrialization begins early enough, Vajk's model predicts zero net population growth in the developing countries by 2040. The population curve turns over because of a reduced birth rate derived from an improved standard of living, not because of an elevated death rate, as in the

⁶ Corum, Lyn, "Islands in the Storms," *Business Energy*, July/August 2014, pp. 10-18.

⁷ *The Limits to Growth*, Dennis Meadows, et. al., 1972.

⁸ *Published in Technological Forecasting and Social Change*, January 1976, Vol.9, No. 4.

first run. The main difference for the developed world is decreased pollution owing to the substitution of clean solar power for energy from fossil fuels. In this scenario, immigration to the space habitats consists mainly of people from the developed sector. Immigration from the developing sector almost catches up by 2100. Quality of life starts off at very high levels in the space colonies compared to either terrestrial sector. It falls to developed terrestrial levels after about 40 years due to crowding, and then climbs again.

In his 1976 book *The High Frontier*, Gerard K. O'Neill estimated 6 years and \$200 billion in then-dollars to build a first-stage self-supporting colony for 10,000. In 2014, with an order of magnitude reduction in transportation costs from the space shuttle's \$10,000 per pound to Low Earth Orbit to \$1,000 per pound, the numbers would be closer to 15 years and \$3 trillion. Breakthroughs and shortcuts are possible, but they require effort and risk-taking – not popular in Washington. For example, the development of a nuclear pulse rocket with a specific impulse of 10,000 seconds⁹ could cut transportation costs two orders of magnitude from the present, to about \$100/pound, while the propellant mass fraction (weight of fuel as a percentage of total launch weight) goes from 94% for the space shuttle to about 13% for the new vehicle. It just requires exploding hundreds of atomic bombs in the atmosphere to propel the rocket. Said that bluntly, nearly anything sounds crazy, but the math works. The barrier is consensus, not technology, and not money. The way to consensus is through the sensibilities; no one believes a true thing unless their heart believes it first. We plan to build an organization the way a child builds a life, starting with games and graduating to larger toys.

The space colony simulation concept literally requires the creation of worlds of imagination with the simultaneous application of advanced technology, but it is not alone in that. Disney World and Epcot should be considered close cousins, though lacking focus.

On a smaller scale, the Renaissance Faire phenomenon is a system of history-themed events that could be said to educate about the rebirth of Western Civilization in the 14th – 16th centuries. Ask anyone who has attended several or participated in some; Renaissance Faires are fun.

The example that comes closest to the mark in terms of goals is a child of the Defense Advanced Projects Agency (DARPA) and NASA's Ames Research Center intended to rekindle technological innovation. Its trademark is "100-Year Starship," or 100YSS for short, started in 2011 as a year-long project to encourage co-investment in space technology development.

Paul Eremenko, the DARPA coordinator for the project, said of it, "We endeavor to excite several generations to commit to the research and development of breakthrough technologies ... to advance the goal of long-distance space travel, but also to benefit mankind." Advancements from the study are imagined to have substantial impacts on DoD mission areas.

The kickoff convocation on 1/11/11¹⁰ featured 29 federally-designated visionaries with diverse backgrounds, from astronomy and aerospace engineering to science fiction. The business model for the new enterprise was to include "agile funding mechanisms," such as crowd funding, making use of a relatively new rage on the Internet. An additional strategy considered was to

⁹ George Dyson in *Project Orion*, p.252

¹⁰ http://100yearstarshipstudy.com/100YSS_January_Synopsis.pdf

engage with the once-mysterious group called Technology Entertainment and Design (TED) as funders, who might be willing to create some sort of endowment for the project. The group recognized that with endowments, which call upon wealthy individuals to contribute large sums for causes they deem worthy, it is necessary to minimize the potential for embarrassment in the event that the organization fails to achieve its objectives. One mechanism for doing that might be to pair the goal of driving into outer darkness with that of preserving life on Earth through technologies of self-sufficiency. A better funding mechanism is to make the possibilities attractive enough to warrant investment.

As far as justifying logic goes, the group identified five “drivers,” including human survival, contact with other life, spiritual enlightenment, scientific discovery, and the expansion of an emotional understanding about the Earth’s role as cradle of humanity. Note that profit is absent from the equation.

Among other things, the program was to use “social involvement to create a world view of hope,” and a blockbuster movie, within five years. Within ten years, it was to simulate life with computer code, something that sounds vaguely related to an ongoing (since the ‘90s) study of biotic interactions and global change¹¹, but could also be taken to mean a simulation of the impact of frontiers and enclosure (the absence of frontiers) on life forms generally. The development of a space-worthy closed life support system is another priority for the ten-year timeframe, as is the development of faster-than-light communication using quantum entanglement. The latter technology could be the basis of telepresent space probes, a 20-year objective, enabling humans to explore asteroids, the Oort cloud, and planetary surfaces with the immediacy of being there instead of having to wait seconds to hours for light to make the two-way trip. Clearly, it would also facilitate medical advances like remote surgery using human-operated robots called “teleoperators” over cosmic distances. Within 30 years, the Starship effort would expect to see the introduction of “non-propellant propulsion,” an expression that may be taken as a non-copyrighted description of Star Trek’s warp drive. Another generational objective is to reverse the current trend toward scientific illiteracy. And that’s as far as the visionaries can see for now, and about as much as anyone can expect to get done in a single meeting.

The starship study is over, but the work continues under the direction of Dr. Dorothy Jemison, a globalist leader and a former U.S. astronaut, who won a \$500,000 DARPA grant to carry on. “100YSS” holds conferences and sells memberships. So far, it does not do entertainment. That is because there are difficulties.

Unlike a Renaissance Faire, the SpaceFarers vision has no fixed point of reference, no “history” to guide the vision, which is that of a space fantasy film set that converges on reality as patrons realize they are looking at existing technology in an immersive thematic setting. None of that excludes “Renes” from participation in an Alien Landscapes theme park. Fair is Faire. Star Fleet landing parties and Doctor Who’s tardis turn up at Renaissance faires. The important thing is that the overall theatrical effect is different enough to appear alien to patrons.

¹¹ Kareiva, Peter, Kingsolver, Joel G., and Huey, Ramond B. (ed.); Biotic Interactions and Global Change, Sinauer Associates, Inc., 1993, Sunderland, Massachusetts

In *Space and the American Imagination* (Smithsonian History of Aviation Series, 1997), author Howard McCurdy observes that grand visions maintain their charisma until a gap develops between public expectations and what is delivered. But what if it were possible to maintain the essential truth of the grand vision within an entertaining fantasy? What if that fantasy intersects the course we are already on, the “sustainability” course, in a way that reveals its essential correctness and leads people to an epiphany? The people who will be drawn to build Alien Landscapes and its intermediate projects will be those who, as McCurdy says, “have the skills to involve an otherwise inattentive audience through the power of imagination.”

Limiting consideration to theme parks, with their deliberate attention to an experience different from the educational function of museums, we find that existing facilities fall into two categories typified by Space World in Japan and Epcot in the U.S.

The Space World theme park in Fukuoka Prefecture, Japan attracts about a million visitors a year with its themed roller coaster rides and displays. It includes a Space Camp created under a licensing agreement with the U.S. Space Camp Foundation. Opened in 1990, it is very much a creature of the spaceflight capabilities of that era.

Disney’s Experimental Prototype Community of Tomorrow (Epcot), with 11 million visitors a year) is about everything “tomorrow.” Its focus is general, touching on spaceflight only tangentially.

Alien Landscapes and its sub-projects are focused on one thing: space colony simulation with technologies that are useable now to create small, self-sufficient communities on Earth. It has a much narrower focus than Space World or Epcot, and a “feel” that is about the same as a Renaissance Faire, except for the technology.

Method

Developing the logic behind the approach, here is a specification for a commercial space colony simulation project starting from scratch:

- Scaleable, starting with a stage small enough to continue indefinitely with limited resources, but capable of unlimited growth through diversification within the governing concept
- Serves immediate terrestrial needs
- Creates an environment that is immersive, realistic, and comfortable for patrons
- Provides a path to space colonization by incremental development of needed technologies, either directly or by promoting the efforts of others as a test site, marketing venue and/or a point of sale
- Flexible to admit new revenue streams.

John Spencer’s *Space Tourism: Do You Want to Go?* (Apogee Books, 2004), especially Chapter 6, “The Simulation Frontier,” is a unique compilation of facts, thoughts and hopes about an

industry not quite in its infancy. Although nearly everyone by now has heard of the sojourns of private astronauts on the International Space Station (at \$20 million to \$40 million a seat) and of Richard Branson's Virgin Galactic suborbital flight offerings (at \$250,000), the nature of space-themed adventure attractions is less well known because they do not make the news.

Spencer gives an overarching summary of what he calls "The Experience Age" and "The Experience Economy," discusses what he considers to be its essentials, and details his personal experiences with them as a space architect.

Results

Space-themed simulations are known to work well with audiences. The same is true of immersive simulations from other eras¹².

The author's experience with space-related entertainment began in 1980 with employment at Martin Marietta Aerospace's Vandenberg Air Force Base facility, testing software for the new space shuttle. That summer, and every summer until space acquired a more global perspective, a few veterans and enthusiastic newcomers, kids and parents, businessmen and visionaries celebrated the golden age of American space exploration with anything they could find ... films, displays of old Apollo hardware, models, guest astronauts, slide shows, balloons, and imagination.

In a typical example, a "Camp Fire Astronautics" adjunct of Camp Fire Boys and Girls began a campaign of decorating the local library with space art. They were soon joined by the Western Spaceport Museum and Science Center and the local chapter of the American Institute of Astronautics and Aeronautics (AIAA). Camp Fire kids operated a local theater, donated for the occasion by a supporter, showing *Star Trek* reruns and classic space movies. The Museum and the AIAA rounded up nationally known speakers and organized a space art competition.

Space Week, as it was called, was an awakening for the children who participated. One who was failing in mathematics returned to school the following year at a normal level because of her experience making change in the box office of the Lompoc Theatre. Another, who had never done more than the minimum in school, exceeded all expectations with her report on rockets. All learned the value of teamwork and doing more than their job, just like the crews, in space and on the ground, that took the ships of Apollo to the moon and brought them home again.

But a human success does not a financial success make. Space Week was fun, and it was constructive, but it had no business model.

Biosphere 2 did. In 1994, what was billed as a simulated space colony with a closed life support system for eight humans had a hotel overlooking the 3-acre glass-and-steel space frame structure. For a price, you could vacation there, take classes, do projects, or just look around. The business model was not a success. It was not just that Biosphere 2 was in an awkward location, 30 miles north of Tucson over narrow roads, invisible from the highway, with nothing to mark its

¹² Spencer, John, *Space Tourism: Do You Want to Go?*, Apogee Books, Ontario, Canada, 2004, pp. 142-144

presence except a street sign that said “Biosphere 2” (meaning, for all anyone knew, that the little town of Biosphere was 2 miles that away). Management was so secretive that no one knew a thing about what was going on. The press was hostile. In fact, if it weren’t for bad publicity, Biosphere 2 would have had no publicity at all.

When Columbia University took over in 1996, it added technological innovation and intellectual property management to the revenue stream. For reasons unknown, or at least un-discussed, that didn’t work out. New management under the University of Arizona mainly serves the redistributive culture of grant-getting. It makes enough from tours and memberships to support limited television advertising about “Big Science.” With 100,000 visitors a year at twenty dollars a head (for those who pay), it does not cover its \$4 million annual operating costs.

Alien Funsclapes, one of SpaceFarers’ early experiments, didn’t make a profit, either. It featured clips and ship models from a science fiction film under development. It had great food (anyway, the “anti-gravity truffles” were great). It had art vendors with alien-appropriate wares and a modest gate fee. Not enough. Lessons learned:

- (1) Advertising has to be focused on the target audience, which in our case was local. We used chiefly Internet advertising, which was not focused enough.
- (2) We needed to attract more vendors and a greater variety of products, more of them technical curiosities. Our limited efforts failed to convince most potential vendors that there would be a large enough crowd to produce a profit for them. It turned out they were right.
- (3) The gate fee may have been a bad idea, at least in the beginning.
- (4) We may have rushed things a bit.
- (5) Familiarity with the venue is important. You have to know how places appear at various times in order to use them properly.
- (6) The alien name tags delighted guests.
- (7) It helps to develop a following before the event. We want to be perceived as doing good.

Discussion and Conclusions

“Selenite Embassy” is a work in progress to address the deficiencies of our earlier project. The venue we choose is a local non-profit children’s park with an existing following which we hope to build on. There will be no vendor fee. There will be no gate charge. All income, an agreed-upon fraction of vendors’ profits (not revenue), will go to the park. We are taking our time and looking at crowd funding as a possible way to reduce risk.

The selection of a children’s theme park is significant. Children are professional explorers. For them, everywhere is an alien landscape. Adults often lose the exploration edge as they mature, but that alone does not explain why the need for space colonization is not obvious to everyone.

As a permanent home for large numbers (billions) of humans, the earth has undeniable limitations. People are ready for a planetary exodus, but space exploration technology is so overrun with jargon-spouting supersalesmen on the hunt for government financing that most onlookers are immediately turned off. The technology is boring, the road long, the intermediate steps unclear, the leading actors uncharismatic, the motivation suspect, and opportunities for personal engagement absent. Space technology is a closed enterprise to almost everyone who would be expected to pay for it. There is no good answer to “what’s in it for me?” There is no “space colonization for the rest of us,” to paraphrase Apple Computer’s marketing slogan.

Expert opinions are in conflict. If you can’t get a straight story from academia, supposedly the ultimate arbiter of Truth in our culture, where can you get one? The truth: Like most people, academics tend to reason in accordance with their economic interests. Astronomers and planetary scientists see themselves as immediate losers if humans get serious about entering space with “their” government money, so they paint space as a terrifying vacuum devoid of resources and filled with hazards¹³. Space colonization advocates take an opposing view when trying to fund their technology projects. There will be no consensus from academia.

So where is the consensus to come from? We imagine that the patrons of the Alien Landscapes theme park will have the psychic energy for exploration, willing and able to push on to the horizon, and then to the next one. They will have an interest in personal space exploration or an interest in everything. They will be people of talent and vision seeking opportunity, interaction, laughter, and escape from the ordinary. Many will be seekers of technology and ideas for their own projects.

Philosophically, the more thoughtful adults will be on the hunt for clarity about the future of Spaceship Earth and its passengers, especially themselves. They will be looking for alternatives to permanent sacrifice and seeking a path to success and a way to contribute.

That’s who SpaceFarers’ Alien Landscapes will have to satisfy to earn their trust and support. It will have to answer the needs of vendors and patrons, and of those whose projects intersect ours, people like film-makers and hoteliers, research scientists, technologists, and the agronomists who provide locally-grown, fresh food for the park and demonstration agricultural projects for visitors.

We will count Alien Landscapes a partial success when we fulfill what we believe is our potential for profits of 16 million in 2014 USD on revenues of 326 million in the third year of operation, growing to 342 million on revenues of 703 million in the 10th year. Anyone who recalls what it will cost to build a first self-sustaining space colony will realize that we need our vendors to realize substantial profits as well and that our investment-capable patrons see a business case for exploiting the energy and material wealth of the solar system.

Siting possibilities exist in abundance, with limitations and restrictions imposed primarily by governments. We could hollow out a mountain. We could haunt old lava tubes and other geologic oddities. We could build inside abandoned manufacturing complexes in the Midwest. We could assume operations of the existing Biosphere 2. We would need to find and apply

¹³ This one happens to be from my alma matter:
<http://physics.ucsd.edu/do-the-math/2011/10/why-not-space/>

environmental control technologies appropriate to the venue; the more extreme the environment, the more costly, but also the more interesting. One of the mistakes we've seen Renaissance fairs make is to set up shop in urban parks to be "accessible." Nothing undermines the sense of another time and place than the appearance of concrete walkways in a 16th-century simulation.

The conventional approach to theme park siting is to choose a location with an existing transportation infrastructure suitable for access by automobile. While an option, that strategy is self-limiting, makes for expensive real estate, and damages the quality of the experience. Our favored approach incorporates parking for staff, vendors, and business visitors only, probably underground. Patrons will access the site using urban parking and a purpose-built transportation system connecting the colony with at least one urban hub. The system may serve other purposes, but its primary use will be to access the park. We are working on concepts that will saturate the transports with simulation technology, making access an adventure in itself. Themed shopping will be available at the transportation hubs free of charge for those who currently lack the resources to pay for the full ride or who wish to test the experience before investing. Those with a residence on-site will have free access to all amenities, including the vendors who maintain the systems that service their homes.

Using Disney's Epcot as representative of the anticipated business volume of the Alien Landscapes theme park at maturity, and assuming an annual traffic at maturity of 11 million (the same as Epcot in 2009) our cash flow projections are based on ticket prices of only \$25 to \$35, about the same as a Renaissance fair and far less than the usual cost of similar attractions (about \$100).

For our calculations, we assume the cost of parking will be parking at \$10 per space (typical for amusement parks), with an average three occupants per vehicle.

In addition to ticket sales, revenue sources include the leasing of space in the park to vendors at a rate equal to 6% of sales.

Mission simulation activities will begin in the fourth year. These are anticipated to involve ten to twelve individuals paying \$10,000 per week (\$1500 per night) to live inside a simulated Biosphere 2 "apparatus", wearing the uniform and carrying out their choice of loosely scripted missions involving scientific investigation, engineering functions, documentation (photography) and exploration of the alien landscape in specially-designed all-terrain vehicles and space suits. Additional revenue from this service is \$5.2 million per year in the fourth year, expanding annually.

During this time, construction of a residential community near the park will have begun. It will be a walled retreat with water, wastewater, solid waste, power, and environmental control systems based on technologies used at the park to maximize sustainability, as in any space colony. Residences may be leased on a long- or short-term basis and are maintained by the park. About 1000 such residences are planned in three phases, with each leasing for about \$20,000 per month.

The project described above is a large and acknowledgedly expensive undertaking. We believe we are looking at around \$2 billion over 10 years. Even so, our cash flow analysis shows a profit beginning in year three.

Starting with the ongoing retail web site, AlienLandscapes.biz, we see ourselves moving into small, one-or-two-day events like Selenite Embassy, a project of subscale Alien Landscapes prototypes with revenues going to a non-profit that owns facilities interesting to work in and a beginning network of volunteers on which to build a full-time staff when we are ready.

After that, or simultaneously with it, come selected experimental business elements of the Alien Landscapes park that require greater investment. One example: a frontier dinner theater that features films (old and new) about frontiers, old and new, from the golden age of sail and before that to the final frontier and beyond, served with dinner in a complex of movable soundproof walls.

Within the space colonization theme exists diverse opportunity to test and market technology such as mobile power generation and storage, all-terrain ground transportation, robotics, 3-D holographic art, personal air transportation, and even space propulsion via “toy” demonstrators within the park. A fireworks dispenser levitated by a laser-powered hovering rocket (tethered for safety) would be an example of the latter. We expect that film crews will express interest in a presence at the park, and we will be rigged to accommodate that, on the “street” or behind the scenes.

As always, the greatest barriers to building consensus are the human ones. Even communicating the opportunities involved can be a challenge. People tend to have fixed and historic notions of what their potential is because of the much-lauded “common sense” imposed by current social and educational values. The result is that humans miss a lot. Building the future is like inventing a trade. There’s no school for it unless companies like SpaceFarers provide such schools.

Of course, there is a catch. Only people who are not slaves to “the way things are” can respond appropriately. People who are not in thrall to the status quo might be described as intelligent nonconformists. Open-minded, they have made themselves comfortable with differences among people and places. They are natural pioneers.

With perseverance and the right help, we believe success is virtually inevitable, at least as inevitable as the continued existence of human civilization. Our chances are certainly better with commerce than with what we are doing now: relying on a government with no stock in doing the right thing to do the right thing. We regard the 100-year Starship Project as official acknowledgement of the accuracy of our perception.

Acknowledgments

We have stood on the shoulders of giants, so many that we are hesitant to name the few that are prominent in our recollection for fear of slighting worthy individuals. Nevertheless, and hoping that readers will refresh our memory where it fails, we wish to acknowledge the contributions of visionaries like Konstantin Tsiolkovsky, Wernher von Braun, Gerard K. O’Neill, Krafft Ehrlicke,

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