

# Shifting from Airports to Spaceports: An Astrosociological Model of Social Change toward Spacefaring Societies

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**[Abstract] As contemporary post-industrial societies advance, a most interesting question arises: What will be the social structures and cultures of tomorrow? The changes that initiated and sustained the space age may provide the roots for our own future. We present a model of a *spacefaring society* in which all major social institutions, the larger culture, subcultures, and human values shift away from our planet of origin and re-center on space. Under this scenario, everything from the economy to everyday activities shifts from a terrestrial to an extraterrestrial orientation. Right now, when we have just begun to take our first steps beyond Earth, such a future would be difficult to predict. Still, within the framework of astrosociology – sociology focused on human activity in space – we can develop a theoretical model of a spacefaring society as an “ideal type,” an abstraction that outlines in broad strokes how our society might eventually appear and a reference point for evaluating changes in our society over centuries to come.**

## I. Introduction

**I**N the early 1950s, when the V-2 and its variants were the only way to break the shackles of gravity, von Braun, Oberth, Kraft-Ehrlicke and other scientists teamed with artists, writers, and the media to present the public with awesome visions of our future in space. Lifelike, highly detailed renderings of magnificent interplanetary cruisers and space settlements adorned the cover of major popular magazines of the day, and television viewers were treated to enthralling animations of voyages in space. As Howard McCurdy<sup>1</sup> points out, these efforts did much to generate support for the U.S. space program, but achievements so far have never come close to the high hopes that public relations efforts aroused in the American imagination.

The 20th century saw accelerating developments in many areas of technology – transportation (from biplanes to space shuttles), communication (spark coils to cell phones) and information processing (from mechanical calculators to supercomputers). All of this prepared and strengthened the infrastructure for human activity in space. Social change in these areas and others, along with the political pressures of the Cold War, pushed the United States and the Soviet Union toward the first social conditions that put them on track for spacefaring futures. Advancements in developing societies, such as China and India, mirror this development in the 21st century.

Given that human communities date back tens of thousands of years and that even “modern societies” have been in existence for five hundred years, the mere half a century since Sputnik was launched is barely a blip on the radar of history. Still, extrapolating from such trends, one possible future for us is a society whose economy, culture and values center on space. Even as many of us have shifted from a local to a global perspective, some of us are starting to view ourselves as citizens of the universe.<sup>2</sup> If this continues, humanity may spread throughout our solar system and beyond, although these shifts would require enormous amounts of time and, to many, seem to have few practical implications for those of us who are alive today.

Astrobiology is NASA’s attempt to understand the origin and distribution of life in the universe, and our fate on our home planet and beyond.<sup>3,4</sup> Long before the term astrobiology gained ascendance, the physical and biological scientists who dealt with such issues invited the participation of social scientists and humanists, including

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anthropologists, economists, political scientists, psychologists and sociologists.<sup>5,6,7,8</sup> Astrosociology parallels astrobiology but encompasses the efforts of behavioral and social scientists to further our understanding of space exploration,<sup>9</sup> the search for extraterrestrial life,<sup>10</sup> and the protection of Earth from asteroids and comets.<sup>11</sup> More specifically, astrosociology applies sociology – quite literally, the study of society – to astrobiological issues. Following Alvin Rudoff,<sup>12</sup> the intent is to draw on sociological theory and research to help guide speculation about our future in space. Astrosociology focuses on *astrosocial phenomena*, or social and cultural patterns related to space, that is, those which express the linkage of human behavior and space.<sup>13,14</sup>

Perhaps the longest and most sustained involvement of behavioral scientists is in the area of manned space exploration. For over forty years, human factors experts, psychiatrists, psychologists, and sociologists have sought to understand individual and group adaptation to space.<sup>15-22</sup> In the early years these efforts focused on such topics as person-machine fit, conducting work under conditions of microgravity, and the managing the effects of disrupted circadian rhythms and mounting fatigue. Although this traditional human factors research continues, changes in the direction of increasing crew size, crew diversity, and mission duration have prompted extension into such areas as motivation, mental health, group dynamics, intergroup relations, and organizational contexts. Earlier conceptions, such as “psychosocial adaptation” are giving way to *behavioral health* which includes social relations:

...behavioral health is an overarching concept that subsumes psychological, interpersonal, and cultural adaptation to space. Compared with earlier formulations...behavioral health is less limited in that recognizes that effective, positive behavior depends on an interaction with the physical and social environments, as well as the absence of neuropsychiatric dysfunction. Behavioral health is evident not only at the level of the individual, but also as the levels of the group and organization. Behavioral health is an interdisciplinary field that requires contributions from psychiatry, anthropology, education, sociology, and several fields of psychology.<sup>23</sup>

Because behavioral health has implications for the individual, social groups, and notably for society, its relationship to astrosociology is quite evident as a potential specialization related to *space societies* (i.e., space settlements) and space travel. In any case, it demonstrates the need to move beyond traditional human factors analysis by involving all of the social/behavioral sciences in the study of space issues.

Because evolution has been such a fruitful concept in biology, it is tempting to think in terms of “societal evolution.” But from the sociological perspective, social change tends to be cyclical – maintaining forward momentum, stalling, falling into reverse gear, resuming progress and so forth relative to any anticipated end state. In fact, no guarantee exists for continuation of progress or the resumption of progress once it is lost. Only with the benefit of hindsight is it possible to identify with reasonable certainty the length of a given cycle, plateaus, and inflection points. But if incipient trends appearing during the first half century of space exploration continue, small groups in space will be supplemented by communities and entire societies, and some of these societies may endure for extended periods of time. Sociology helps inform us about individuals and small groups but comes into its own dealing with larger social units such as communities and societies where other fields tend to lose force. The application of sociological theory, method, and evidence provides a useful tool for thinking about space settlements, the search for extraterrestrial life, and our long-term prospects for survival.<sup>24</sup> The last point requires a strong focus. Qualms about common social problems such as crime and poverty are important, of course, but they pale in comparison to some of the spaceborne threats to Earth that may harm humanity and disrupt social life.

Regarding the prospects for space settlements, it serves us well to remember that the social environment is just as important for survival as the physical environment (i.e., the proper functioning of the habitat).<sup>25</sup> If we plan to live in space, we must replicate social systems in artificial environments constructed in extraterrestrial locales. Arguably, a society’s experience with such efforts will accelerate its prospects for becoming a spacefaring society due to its developing relationship with these settlements. In essence, *interplanetary* relations will develop, as argued by Pass,<sup>26</sup> making the impact of space that much more influential and relevant to social and economic patterns that exist in societies on Earth.

## II. Utopias and Ideal Types

Utopias and idea types represent entirely different concepts. The first describes a desired “perfect” society. The latter describes a description of a “typical” social organization of a specific type of social structure. It may focus on an entire social system, as in the present case, or it may describe a part of a social system such as a bureaucracy or other social structure.

### A. Utopian Limitations

Much of the writing about societies in space has a utopian flavor. That is, visionaries assure us that we will leave our problems behind as we re-establish ourselves in space. Rapidly advancing technologies will keep us healthy, productive, and in good spirits and new social orders will eliminate poverty, discrimination, and war. As

“the final frontier,” space has been likened to the American west in the 19th century, a vast untapped reservoir of resources which offers salvation for hordes of emigrants from crowded, poverty-stricken, stagnant parts of the world. However, unlike the American west (which now includes some of America’s most populous states), the final frontier is endless and will never close. Robert Zubrin, for example, has developed exciting lists of economic, social, and personal advantages to emigration to the high frontier.<sup>27</sup>

Utopian views of communities in space include huge, uncluttered spacecraft; spacious orbiting platforms, architecturally stunning lunar bases with panoramic views. The luxurious space colonies envisioned by Gerard K. O’Neill<sup>28</sup> certainly have a utopian flavor, and utopian overtones are inescapable in Marshall Savage’s Millennial Project which promises, through the shrewd use of resources, novel technology and ingenious social arrangements to help us “colonize the galaxy in eight easy steps” within the next thousand years.<sup>29</sup> Other writers have identified themes of salvation in the conquest of space. The best and brightest Americans – the astronauts – soar to the heavens where they seek perfection and redemption among the stars.<sup>30</sup>

Apart from when these are pressed upon us by the reality of upcoming missions, rarely, if ever do we find realistic discussions of the challenges and difficulties associated with life in space that are unavoidably characterized by a high reliance on high technology and therefore susceptible to equipment malfunctions and crop failures. Today’s real space stations look like dragonflies rather than pinnacles or aesthetic achievement.<sup>31</sup> Their interiors are cramped, rather than spacious, cluttered rather than highly organized, dirty rather than clean, and crews survive because of improvisation as well as plan. Ambient noise levels approximate those one would expect in riding in an old-fashioned rear-engine VW bug, there is little or no privacy; and the air contains food particles and flecks of spittle, and is pungent with the aroma of unwashed bodies.

Whether in upstate New York, the heart of Utah, or the entirety of Soviet Russia, utopian societies have never quite lived up to expectations and there is no reason to expect something different in space. Today, space is the province of a small, highly selected, and superbly trained group of consummate professionals. These high achievers are among society’s best. If space industrialization and tourism continue, however, there will be relentless pressure to “lower the bar” so that more and more people qualify to live and work in space. Additionally, in the interests of economy, rather than undergoing years of preparation, laborers, technologists and tourists will have only minimal training before launch. The powerful legal and public relations apparatus that enables NASA to protect the mythic image of “the right stuff” will not extend to workers and tourists. Like societies on the Earth, societies in space will have a seamy side or develop an *underlife*: that is, become riddled with problems that societies can suppress but not eliminate. These social problems include substance abuse, illicit sex, black market trading, theft, violence, racism, as well as full panoply of crimes and misdemeanors.<sup>32</sup>

## **B. Definition of an *Ideal Type***

A sociological *ideal type* is not to be confused with an ideal (as most people think of it) or a utopia.<sup>33</sup> In sociology, an ideal type refers to an abstraction, a mental model, a logical extension of a theme or trend which expresses an extreme or ultimate state. In sociology, a type is ideal in the sense that it exists in the imagination in the form of an idea. It is not necessarily “good” (as in the sense of utopia) nor is it necessarily “bad” (as in the case of a dystopia). As it is based in theory rather than empirical fact, an ideal type is “pure,” that is, uncontaminated by other types of society. For example, as an ideal type, a capitalistic society would have no elements of communism, nor would a communist society contain a hint of capitalism. In reality, of course, one finds welfare within capitalistic societies and entrepreneurship within communist societies, although different societies – such as the Canada and Cuba – may approximate one ideal type more closely than another.

Max Weber<sup>34,35</sup> developed the concept of *ideal type* as an analytical construct while conducting his classic research on bureaucracies. It is an abstraction that serves as a measuring stick against which existing conditions can be compared. Thus, ideal types are useful as reference points or benchmarks for evaluating actual societies. Constructing an ideal type of spacefaring society, or a “typical” set of spacefaring conditions, would reveal how much our present society falls short, overall, or in specific areas. Certain parts of a particular society, for example the economy, may begin to exhibit new characteristics that reflect qualities unique to a spacefaring ideal type before other parts, such as education or religion, fall in line. In this particular exercise, the authors must *create* the parameters as spacefaring societies do not yet exist in our contemporary world. We hypothesize that these characteristics will typify a theoretical spacefaring society based on reasoned extrapolation from non-spacefaring social conditions. They do not represent the characteristics of an “ideal” spacefaring society in the sense that we *desire* them to exist. Rather, we *anticipate* them to exist based on current conditions.

### III. Spacefaring Societies

As an ideal type, a spacefaring society is one that has made the transition from its home planet to space. If it becomes spacefaring at all, a society will become spacefaring when its social structures (including major institutions) and culture revolve around space.

That is, a unique set of social conditions typify a spacefaring society. Every major institution is highly involved in some way with carrying out space policy as a high priority, and thus space law is well developed. A space-based economy flourishes, for example. Astrosocial phenomena are highly pervasive and vital for the society's survival. Space issues are intertwined in a multitude of ways into the everyday social interactions taking place in subcultures, social groups, organizations, and institutions. The larger culture reflects the importance of astrosocial phenomena through their incorporation as highly important values, strong norms protecting them, and their omnipresence in a space-dominated material culture.<sup>36</sup>

*Material culture* is defined as the physical manifestations produced by the ideas found in a society's culture. Spaceports represent an excellent example of material culture in the context of space exploration.

It is important to emphasize once again a spacefaring society is not intended to be a utopia. For example, military or corporate authoritarian regimes are potentially compatible with a spacefaring social structure just as a peaceful liberal democracy could approximate this ideal.<sup>37</sup> Human beings have been unable to create utopian conditions throughout their history, despite ongoing attempts to do so.

The latter part of the 20th century saw a pronounced shift towards globalization: recognition that nations on Earth are economically interdependent, and some breakdown of barriers that separate different nations. These shifts in the direction of larger communal and sociopolitical units have been accompanied by an increase in the numbers of people that are defined as "like us" and hence accorded "insider" or favored treatment.<sup>38</sup> Over millennia, views have shifted from "other people are not like us" to "other people are like us" – although as current events in the Mideast reveal, this transition is by no means complete. Still, some analysts suggest that we are beginning to look beyond sovereign rights to human rights, beyond national security to human security, and beyond national interest to planetary interest.<sup>39</sup>

If spacefaring societies begin to develop on the Earth, then their economies will hinge on space mining and manufacturing, extracting greater amounts of power from the Sun, space tourism, and other promising activities. Our society's major institutions- economy, politics, education, religion, and the family – will reflect a broader orientation which includes Earth, the Moon, Mars, and perhaps our entire solar system (and eventually beyond). Our culture – technology, symbols, and values – will reflect this new stance. We may find remnants of today's terrestrially-dominated culture on Earth, but this will be only a side show that helps reveal the richness and diversity of human subcultures. It will be important in the same sense that the subcultures of the French Quarter in New Orleans or the Barrios in Los Angeles are useful for understanding humanity today.

### IV. Characteristics of an Ideal Type of Spacefaring Society

Consider a continuum ranging from the distant past to the distant future. The extremes are clouded in the mists of time. Given an atmosphere that allows a clear view of the heavens and our visual apparatus, it is difficult to imagine a time when our progenitors gave no thoughts to the heavens. Indeed, records from the earliest times suggest that early religions revolved around "sky gods" and we know that ancients observed celestial events to make practical decisions, for example, to migrate or to plant crops.<sup>40</sup> Discoveries that accelerated about hundred years ago showed that the universe is far larger than anyone had imagined.<sup>41</sup> As a practical matter, our continuum starts roughly fifty years ago, when we became *space capable* with the launch of the first manned satellites, and stretches forward to that time when we become *spacefaring*, when our society's structure, culture, and institutions include orbiting satellites, the Moon, and neighboring planets.

#### A. Economy

In a spacefaring society, economic activity depends upon space-based resources – minerals, energy, tourist destinations. The value of terrestrial resources will be assessed in terms of their utility for living and working in space. People will think of "the economy as a whole" as dependent on conditions throughout the solar system. A spacefaring society will find itself dependent on space-based resources for its survival. If we become a spacefaring society, we will look at the space economy in the same way that we look at the global economy today and based on interlinked activity on Earth and in space. Space would be viewed as a natural extension of the Earth as our home planet becomes evaluated as part of a larger system. Of course, local economic activity will remain important, even as regional pockets of prosperity and recession are important right now. Generally, it is economic institutions that lead the way with government close behind and other institutions – education, family, and religion – tagging along.

## **B. Governance**

Presently, the highest dependable level of governance is at the level of the nation state; higher levels (such as the European Market and the United Nations) exist, but their control is intermittent and spotty. If terrestrial societies develop into spacefaring nations, the ultimate authority will be an overarching political system that includes our entire solar system or perhaps galactic neighborhood, and that trumps all lower (less encompassing) political organization, although certain rights might be reserved for individual planets or nation states. In essence, however, a spacefaring society develops first at the level of nation state. Once several societies make the necessary commitments and the corresponding transitions, then an overarching political system becomes possible. A major impetus for the transition of a nation-state to a spacefaring society may well involve the growing appeal of spaceborne resources as terrestrial resources continue to dwindle. The increasing importance of space policy can serve as an important indicator of movement toward a spacefaring orientation. Trends in this area necessitate watching, including the activities beyond the level of nation state as reflected by the United Nations.

## **C. Education**

In a spacefaring society, education will encourage perspectives that extend beyond Earth. Education in astronomy, planetary science, and the politics, culture, and psychology of life in space will be as common as mathematics and civics today. The well-educated person will be exposed to off-world peoples and cultures just like today's students study in foreign lands. Engineering and trade schools will prepare people to work in space. Courses in biological and social sciences will have substantial extraterrestrial components, as will literature and art. Tomorrow's internet campuses will offer courses in everything from hospitality management for managers of orbiting hotels through operating industrial facilities on the Moon to space art.

Educational institutions may need to prepare generalists to serve in sparsely populated areas. For example, a small team at a remote location on Mars may not be able to support a physician but could support someone who can provide occasional medical and dental care while fulfilling their primary assignment in biological research. Those who live on the Earth without any desire to travel into space will nevertheless need to view space as an integral aspect of their social reality. They will need to expose themselves to a broader occupational training curriculum that includes the intricacies of commerce on a much larger scale than we experience in contemporary societies.

Astrosociology will likely become an increasingly important multidisciplinary field if only due to the probability that societies are indeed transforming their social and cultural structures in new ways that reflect spacefaring characteristics. Even the average citizen will need to understand the social and cultural changes taking place. Astrosociology will attract students from a variety of natural and social/behavioral disciplines to study the connections between space and society as these changes occur.

## **D. Family**

A spacefaring society might embrace a variety of family structures including many that are rarely encountered today. In some locations, reproduction will be frowned upon because it will overtax dwindling supplies or because of a heightened possibility of birth defects. Views on homosexuality may be relaxed in locations that require strict population control. In sparsely populated areas, large numbers of children may be useful to help gain a new foothold on the final frontier. Polygamy or group marriages may be supported in order to produce the necessary offspring. At some outposts, people may take "provisional" partners and families that are abandoned and forgotten after they return to Earth. Although we cannot describe a spacefaring family in sharp detail, this nuclear economic and reproductive unit is likely to be quite different from that of today. And while family structures off the Earth must make the types of adjustments described above, those who remain on the Earth will need to adjust their own values and attitudes to support these forms of social change. Otherwise, disagreements over acceptable family structures between social groups in societies on Earth and those in space may become sources of conflict.

## **E. Religion**

Religions provide people with cosmological worldviews and a set of moral principles.<sup>42</sup> Although for many people the scientific worldview is replacing the religious worldview, which critics believe is based on supposition and myth, religion persists because it caters to people's spiritual needs and, in the case of ritual, promotes a sense of solidarity and community.<sup>43-46</sup> Religion persists because for many people it provides a set of functional principles – a blueprint for actions – that works.<sup>47,48</sup> It does not matter if the rationale or the principles themselves strike outsiders as fantastic or ridiculous.

Traditional religions placed Earth at the center of the universe and elevated man above all other living things. These percepts have been challenged repeatedly by discoveries in astronomy and biology.<sup>49,50</sup> The first of these is the revolution that began when Copernicus discovered that, rather than living in a geocentric universe, we live in a

heliocentric solar system where Earth orbits the sun. We were further displaced following successive discoveries which showed that we orbit a mediocre sun in a somewhat remote part of an incredibly immense universe. The Darwinian revolution, which provided a strong non-creationist view of humanity and suggests that we are continuous with other animals, further stripped us of our self-styled privileged status.

In a spacefaring society, traditional religions may be recast in less geocentric and anthropocentric ways. Sjord Bonting<sup>51</sup> has argued that Jesus is a “Cosmic Christ” who died to atone for the sins of all beings, everywhere, throughout the universe. Steven J. Dick<sup>52</sup> has proposed a new religion, “cosmotheology” based on the laws of nature and accommodating a universe full of life, both terrestrial and extraterrestrial. Others have suggested that space exploration itself has become a substitute for religion, a contemporary mechanism for fulfilling ancient spiritual needs.<sup>53</sup> Rather than look for supernatural beings, some of us now look for benevolent extraterrestrials to provide spiritual and moral leadership and help eliminate poverty, crime, and disease.<sup>54,55</sup> If churches (i.e., religious groups) as we think of them all but disappear, there will be replacements that offer coherent worldviews and moral advice, and help satisfy our needs for spiritual development and a sense of community.

Whatever forms it takes, religion is an institution that has every likelihood of continuing in spacefaring social structures, though the increasing impact of space may contribute to (1) adaptations by existing religious groups to new astronomical/cosmological findings and (2) the spawning of cults inspired by space (e.g., *Heaven’s Gate* linked to the appearance of Comet Hale-Bopp in 1997). Social conflict may develop among those religious organizations that attempt to hold onto traditional dogmas that somehow support anthropocentrism and those that adapt to new scientific findings which seek to place humanity in its rightful perspective. Such a schism may well develop between religious groups in terrestrial and extraterrestrial human societies. This is yet another reason to make the distinction between spacefaring societies and *space societies* (i.e., settlements).

## V. On the Way to a Spacefaring Society

A *space-capable society* is defined as a nation that can reach space on its own accord such as the United States or Russia.<sup>56</sup> Contemporary nations with this capability are in the early phases of development of spacefaring conditions. The extent to which a space-capable society is transformed into a spacefaring society depends on a confluence of many factors. On the one hand, there are forces that encourage movement towards the ideal type. These include our inquisitive and exploratory nature, the lure of space-based resources, potentially unlimited room for population growth, and protection from major asteroid impacts and other potentially extinction-level events. On the other hand there are counter forces that slow or retard our movement to the stars. Here we count the lethality of outer space, exorbitant costs, our inability to develop a long term perspective, and political turbulence. In addition, there are wild cards that could affect the transformation. For example, a nuclear holocaust could make space exploration impossible, or indisputable evidence of past life on Mars could lead to crashed human reconnaissance missions. Or, breakthrough technology could reduce the cost or risk of venturing vast distances into outer space.

### A. Forces that Promote a Spacefaring Society

In examining these promotional forces, one may separate them into two distinct, though artificial categories: push forces and pull forces.<sup>57</sup> Push forces cause a population or portion thereof to move away from a particular area. In the present context, it refers to moving from the Earth into outer space. Pull forces are attractive phenomena that lure individuals and groups into space.

First, humans have been characterized, quite fairly, as “exploring animals” as we have expanded into every ecological niche on Earth and stand poised to enter space.<sup>58</sup> Simple curiosity, a hope to find greener pastures, and applications of the tools of science to gain reliable knowledge about the universe and our place within it all contribute further to space exploration. Space exploration, starting with astronomy, seems to be a cultural universal – for once societies have the scientific and technical capacity to carry it out it then expands as new technology becomes available (e.g., rockets).<sup>59</sup> These types of conditions represent pull forces.

Second, there is the lure of space-based resources: solar energy that might be harvested by orbiting facilities and then beamed to Earth; mining asteroids, moons, and planets, and space commerce including manufacturing and tourism. These abundant but not yet attainable resources become increasingly attractive as we strip our home planet of its own resources. As Earth’s resources dwindle and population soars these resources are likely to become increasingly powerful motivators to move us beyond our home planet. Space resources and space program assets can contribute toward the mitigation of social problems on the Earth.<sup>60</sup> These are actually push forces because they push individuals and groups away from our home planet where our problems seem intractable. Solutions in space become increasingly attractive in comparison.

Third, space offers room for the expansion of human populations far beyond any numbers that can be supported on Earth. This is another push force. Although it is expensive and very difficult to settle, the abundant availability of space may make it possible to accommodate unlimited population growth. Generally, it is the bold and the brave – explorers and the military – that break new ground. Traditionally, people who work the land and the merchants, teachers, physicians, and other people who support them come later.

Fourth, human dispersal beyond Earth protects the human species and legacy against obliteration. Dispersed throughout the solar system, humanity can survive cataclysmic events such as major asteroid or comet impacts. Because ensuring the survival of the human species is an attempt to solve a social problem, it is a push force. Already we have launched “space time capsules” that will leave evidence of our existence and traces of our culture.<sup>61</sup> These include the *Pioneer* and *Voyager* probes bearing greetings from Earth, and radio messages beamed to the stars. Something like a powerful BBC or Voice of America, such broadcasts may or may not alert distant civilizations to our presence and culture. In any case, we are *pushed* into our solar system in an effort to disperse our gene pool and prevent our species from extinction.

## **B. Forces that Deter Spacefaring**

Danger and expense are the most obvious deterrents to spacefaring. Even simple accomplishments in space require extraordinary investments. Constructing a railroad is not a good analogue – this can be done in segments or “small bites” whereas achieving orbit is all or nothing. Space represents a frontier that is inhospitable to human life. Expansion into space will require the construction of the livable environment – whether in the form of spacesuits, vehicles, or habitats – in addition to the “railroad.” Obviously, this type of commitment is unprecedented in human history. In other words, humanity has never extended itself *permanently* into a new environment where it is impossible to survive without constant life support. In all past endeavors, settlers could breathe the air of their new environment! It makes the prospect of expansion into this frontier even more daunting because humans need to construct megaprojects while encumbered by spacesuits and other life-sustaining artificial environments. Arguably, this requires greater resolve than in all past expansionary efforts.

A second problem is that apart from a few enthusiasts, people have little or no ego investment in space. Indeed, prospects for personal involvement seem to have diminished significantly since the politically motivated space race of the 1960s. Many people consider space exploration and settlement as laudable goals, but because only a small number of elite individuals venture into space, they do not see space travel as personally relevant. Not they, their children, nor their grandchildren are likely to go into space. After World War I, barnstormers and clever advertising on the part of incipient airline companies popularized the idea of commercial aviation. A five dollar ride in a war surplus Jenny fighter and advertisements that showed airline passengers that looked just like everyone else built enthusiasm for commercial airlines. The reality that space is for “right stuff” super-achievers and multimillionaires has reduced the public’s ego-involvement in the space program.<sup>62</sup> This “right stuff” mentality must give way to mainstream participation; perhaps this will occur if space tourism becomes more popular and affordable.

Short-term perspectives interfere with major societal change. Transformation from a space capable to a spacefaring mode of subsistence is a massive undertaking where progress will be measured over scores, hundreds, perhaps thousands of years. Relying on a series of small, incremental decisions will delay, perhaps completely frustrate, movement towards the ideal spacefaring type. One of the reasons that the International Space Station took longer to build and cost more than expected was that each year the plan was revised to meet fluctuations of interest in the US Congress. Long-term plans are hard to implement in democratic societies where the political wind shifts every two years and there are constant reshufflings of priorities.<sup>63,64</sup>

Finally, even under the best of circumstances there remains the possibility of a major change of heart. Illustrative here is the experience of the Chinese whose huge sailing junks went to most corners of the Earth before the Europeans had established themselves as intercontinental sailors.<sup>65</sup> Having explored distant continents and begun opening valuable trade routes, political changes at home led to the abandonment of the fleet and an almost hermit-like existence before China remerged on the international scene hundreds of years later.

## **C. Mileposts**

If we compare the two endpoints – space capable and spacefaring – it might be tempting to think of it as a so-called “paradigm shift” – that is, *everything* would seem different to us after some sort of rapid transition. In reality, the shift is necessarily gradual. We suggest that a number of events or “mileposts” would signify movement towards the ideal type. These signs would not necessarily appear in an invariant order. For example, would commercially viable space activity precede our first trip to Mars? It is very unlikely. Still, these mileposts represent a rough sequence of events marking movement along the continuum. (The mileposts in Table 1 below are listed in the approximate order of their anticipated manifestations over time).

**Table 1. Mileposts Signifying Movement Towards a Spacefaring Society**

1. First successful unmanned satellite.
2. First manned satellite.
3. Robotic missions to moon and nearby planets.
4. Robotic interstellar missions.
5. Scientific search for extraterrestrial life.
6. Manned mission to Moon.
7. Manned space station.
8. Permanently manned space station.
9. Space tourism.
10. Limited production characterized by cost ineffective space manufacturing.
11. Manned mission to Mars.
12. Commercially viable space tourism.
13. Asteroid mining.
14. Permanent presence on Moon.
15. Permanent presence on Mars.
16. People commit to “life time” (one way) space missions.
17. Private sector involvement in space surpasses public sector involvement; governments lead exploration efforts but private interests follow.
18. Spaceports and spaceport/airport hybrids outnumber traditional airports.
19. Political system adapted for outer space constituencies.
20. Center of economy moves from Earth to space.
21. Off-world population becomes political majority.
22. Manned interstellar travel.
23. Humans in space become a numeral majority.
24. Government relocates to extraterrestrial capitol and Earth is reduced to the status of a present-day nation state.

#### **D. Scenarios for Earth**

It is by no means assured that societies on Earth will make a transition from a space-capable to a spacefaring orientation; that is, a shift from airports to spaceports. This would involve the buildup of a new facet of material culture. Interestingly, the number of spaceports *does* seem to be increasing around the world. Actual projects and proposed ones include the Mojave Spaceport (CA), Spaceport America (near Truth or Consequences, NM), The Oklahoma Spaceport, the Christmas Island Spaceport (Australia), Spaceport Sweden, and Spaceport Singapore. We have become space capable so recently that we must be very cautious about extrapolating long-term trends. From today’s perspective, humanity’s progress in space has been somewhat uneven, marked by spectacular achievements (the Apollo Program) and frustrations (the loss of two space shuttles, the protracted birthing pains of the International Space Station). Although people are generally supportive of space exploration, very few are making direct contributions.

One scenario is that Earth will never make the transition to a spacefaring society. This could reflect limitations in our technology, which make it either impossible or too expensive to develop a space-based economy, or it could reflect a lack of political will. Competing priorities on Earth might cloud the advantages of expanding into space or, by the time we feel compelled to do so, resource depletion may make it impossible to achieve. Or, the transition might be terminated forever by a sudden cataclysmic event such as a nuclear war, asteroid impact, or pandemic.

A second scenario is that our society will progress from space capable to spacefaring but that this will involve many fits and starts and require extraordinary periods of time. Generations of enthusiasts who believe that “if we start right now we can be on Mars within twenty years” will come and go. Still, if humanity is able to work around the depletion of terrestrial resources (for example, by tapping space-based resources) and evade true global catastrophes over the millennia, we might develop spacefaring societies and ultimately become a spacefaring species on the global scale.

The third scenario is that our society will move rapidly towards the idea type; but here, too, we must consider the time scale. Major, enduring societal change rarely occurs “overnight.” Switching a light on or off is not the appropriate image for systemic change; rather, it is more like the changing of the tides where extended observation is required to detect results. Nevertheless, conditions might break well for the transition. Examples include

international competition to establish a base on the Moon, new technologies that lower the cost of lifting large payloads into orbit, and a minor asteroid impact that reminds everyone of the advantages of dispersal beyond Earth. But even under this scenario, progress is likely to seem glacial. Here, it is worth noting that hundreds of years passed between the discovery of North America by northern Europeans and their first permanent colonies in Massachusetts and Virginia.

## VI. Conclusion

In this article, we apply our backgrounds as social scientists to our present situation as a space-capable society and a possible transition to a spacefaring society whose structure, culture, and institutions reflect human populations dispersed throughout the solar system. With this paper we hope to engage the interest of our professional colleagues and remind people from other fields that societies are complex, multidimensional entities that rarely match optimistic projections. Unlike the sparkling images presented in so many discussions, real societies in space – like real societies on Earth – are likely to have a “dark” or underside. After all, our initial foray into space will involve the transference of contemporary social systems and their cultures, including both positive and *negative* attributes, since this is all we know.

We considered the prospects that ours will become a spacefaring society. Societies do not necessarily evolve like organisms nor do they inexorably progress to an imagined end state. Rather, social change is cyclical, marked by fits, starts, and turnarounds all of uncertain duration. Our society’s future depends on a complex interplay of technology, economy, politics and cultures. It is not possible to guess how closely we will approximate a spacefaring society, but it is possible to identify markers that let us gauge change in this direction. Our space-capable society may attain unmistakable characteristics of a spacefaring society in a few hundred years, in millennia, or never.

Regardless of the long-term result, there is value in this exercise. Postulating of an ideal type of spacefaring society can serve to instigate astrosociological theory and research activity that results in a better understanding of our potential future outcomes, as well as a better understanding of our present and short-term social and cultural patterns related to space. Tracking long-term progress towards this theoretical ideal is difficult without the proper preparation and perspective. We will recognize progress if it occurs as we pass markers leading toward a spacefaring future only if we have to awareness to look for them.

Even now, the present provides us with newly-emerging patterns that require greater understanding. For example, space advocates want to instigate change. They always yearn for more rapid progress than society would provide without their pressures. They would transform our contemporary social and cultural conditions into a spacefaring orientation tomorrow if they could. Will space advocates accelerate progress? For the bulk of the general public, in contrast, successful missions to Mars or Saturn (as examples) may bring about short-term, though intense, interest, but the willingness of average citizens to pay for future missions remains lukewarm at best. Despite current trends, public support may wane even more than we experience today or it may skyrocket due to some catalyzing event such as an actual or near miss by an asteroid. Astrosociologists will need to monitor both the effectiveness of space advocates and the mood of the general public as the 21st century unfolds in order to identify potential positive and negative trends vis-à-vis the spacefaring society ideal type.

In contemporary society, the privatization of space – apart from the traditional aerospace corporations – is gaining momentum. Space entrepreneurs possess different long-term goals and short-term objectives than national space agencies such as NASA. In fact, the latter are now encouraging participation of the former in future missions. Additionally, we are indeed witnessing a spurt in the planning and establishment of private space enterprise around the globe. Will this shift from airports to spaceports continue? Nontraditional elements in societies are building new forms of *material culture* (that is, the physical elements that a society constructs due to important ideas in its culture). Private companies are constructing their own rocket technologies and offering services such as zero gravity flights and potential space tourism opportunities. What do such trends indicate? Are they markers or false starts? Even the near future requires ongoing scrutiny.

Astrosociological research will prove necessary to determine the nature of these types of new patterns and track them against the mileposts and characteristics of the ideal type of spacefaring society over time. At any time, any particular society may shift into a spurt of exceptional growth of *astrosocial phenomena* (i.e., social and cultural patterns related to space), just as it may enter a period of stagnation or reversal. We need to remain cognizant of such changes, as societies benefit when they can recognize and manage (as best they can) potentially positive trends.

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