Note: This is the Draft of the Author's Note from the working draft of my Commercial Space History Project. Details of the Project and my personal history in the early commercial space industry can be found at

https://www.gofundme.com/f/commercial-space-launch-history-the-unknown-story

The Project is supported primarily through voluntary contributions; your support is appreciated. James C. Bennett

The American Way of Space:

Privatization of Space Transportation as a Return to Historical Practice

The Argument. Practical spaceflight emerged in the Twentieth Century primarily in three cultural areas: Russia, Germany, and the United States of America. The fundamentals of space technology and the understanding of the extraplanetary target areas, such as the Moon and Mars, were a product of the Scientific-Technological Revolution that grew from the Enlightenment. Thus they were available to individuals of the emerging Republic of Letters regardless of nationality. However, the three aforementioned nations were sufficiently committed to the project as to support groups of researchers and implementers who, with scant government support, built and launched the first rockets that could demonstrate the potential for spaceflight.

The American Rocket Society, the German VfR (Verein für Raumschiffahrt), and the Soviet GIRD (Gruppa izucheniya reaktivnogo dvizheniya), and individuals such as Robert Goddard, Hermann Oberth, Wernher Von Braun, Konstantin Tsiolkovskii, and Sergei Korolev formulated the basics of rocketry and interplanetary flight. By the eve of the Second World War each had produced rockets of about the same size and sophistication. As the war environment unfolded, the militaries of

the respective nations, especially Germany, began studying the application of liquid-fuel rocket systems for military use.

By war's end, the demonstrated performance of the German V2 showed that orbital launch was within practical grasp. Further development of large rockets for ballistic missile applications also supported orbital space launch capabilities. These capabilities also have critical military applications for reconnaissance and communications purposes. Thus space launch was first pioneered by military organizations and, in the USA, by private contractors supporting military organizations. When it became expedient to present space launch as a civilian activity in the US, a parallel government entity, what became the National Aeronautics and Space Administration (NASA), was created to procure and operate non-military missions.

Although this structure allowed US space activity for nonmilitary purposes to proceed rapidly, as activity continued over decades transportation to space became increasingly more routine, and increasingly was conducted for private or quasi-private customers. As such, it became more of an anomaly in a country in which all other transport modes, in the air, at sea, and on land, were conducted by private for-profit entities, albeit often subsidized and regulated. Although government operators were quite aware of the limitations to what could be accomplished in space due to the very high costs of launch to orbit, and made major, well-funded efforts to lower costs of launch, these encountered little success. Different industry commentators had different explanations for the limitations, and the failure of efforts to overcome them. One school of thought, including myself, pointed out some of the inherent limitations of government action. We theorized that the introduction of market forces, even if imperfect, would set in train a series of events that would bring forth private actors able to access private capital and pursue a variety of novel approaches, the result of which would be a virtuous cycle that would lower costs substantially and enable a new and wider variety of activities off of the Earth's surface.

The following discussion is an examination of these efforts and effects, which now appear to be largely accomplishing the main purposes for which the policy reforms which enabled them were pursued. The theoretical basis which underlays this writer's analysis is a composite of several different intellectual disciplines and approaches, some of which are not common in typical discourse about space history. They derive from academic study, real-world experience in the commercial space industry, discussions with both industry veterans and academics of various disciplines, and independent study. I am also the author of several books which address issues of society, technology, and history, but are not specifically about space. Tanner Greer, one reviewer of my second book, *America 3.0* (co-authored with Michael Lotus) characterized my orientation as "state-capacity libertarianism", a term I would not disavow, but would further characterize as "with Bennett characteristics".

An Author's Journey

The first, and likely the most unique component of my orientation, is derived from my undergraduate academic major, cultural anthropology, at the University of Michigan in the late 1960s and early 1970s. My professors, most notably Marshall Sahlins and Eric R. Wolf, were major figures in a school of anthropological thought known variously as "cultural ecology" or "cultural evolution". The most famous figure of this school was Marvin Harris, whose groundbreaking analysis of the role of the cow in Indian village life argued against the idea that the "sacred cow" theology was irrational. By a meticulous study of caloric input and village energy systems, he demonstrated that foregoing dietary use of cow meat in favor of dairy-based products, combined with the practice of allowing cows to roam freely and forage plant matter of all types, was a more efficient use of resources than attempting to adopt other systems, including European practices. More broadly, the cultural-evolutionary school held that anthropology could not confine itself to ideological superstructures, but needed to examine every aspect of a culture, including its technologies, in evolutionary terms: "what does this practice do, why was it instituted, and why has it survived?"

Sahlins at the time I studied under him was well-known for his study of the emergence of the political state in Hawaii, which occurred during the time of the first European contact. He made the point that the records of the first voyagers, which included meticulous observers trained in Enlightenment scientific methods, was as if trained observers had been present at the formation of the Egyptian and the Middle Eastern states.

He also arrived a counterintuitive conclusion, which was that our labels of "Stone Age", "Bronze Age", and "Iron Age" implied that metallurgical progress somehow triggered, or at least was necessary for the rise of the political and social systems of their times. Yet the New World and Oceanian states - Mexico, Peru, and Polynesia — showed social organizations equivalent to Bronze Age and even Iron Age societies despite neither bronze nor iron being available. This was due simply to geology — neither the Americas not the Pacific Islands had accessible sources of tin or arsenic needed to alloy with copper to form bronze. And without bronze, those societies did not have the high-temperature forges and techniques that could be stretched to make the leap to iron. He concluded that it was population density, not metal availability, that triggered what we characterized as Bronze and Iron Age states.

The final aspect of Sahlins' work that influenced me was his fusion of Leslie White's work with the cultural ecology analysis. White was an early anthropological pioneer who was the principal founder of Michigan's Anthropology department. His school of thought reinvigorated social evolutionary analysis and gave primacy to uses and levels of energy in categorizing the evolution of social systems. Sahlins saw that this fit in very well with the meticulous energy budgets of the new school of cultural-evolutionary analysis of which he was a major figure.

Adopting this analysis, however, conflicted with the extreme anti-industrial "Carbon Calvinism" ideology that was arising at that time, and which saw all known methods of power generation as undesirable and

impermissible. All efforts were focused on the approach of decommissioning existing sources of power and rationing what uses remained. This was to me a bleak and unappealing future. It furthermore seemed to lead to an authoritarian future at best, and more likely a totalitarian future that would inevitably be needed to enforce the austerity such a state would require. This was a very depressing thought.

After a few years, I became aware of the work of Gerard K. O'Neill, and went to hear a lecture by him at Hill Auditorium on the Michigan campus in the fall of 1976. Even at this distance in time, I can graphically recall the excitement that I and most of the audience felt. At the question time afterwards, one skeptic asked, "but who would want to live in one of these colonies?", at which a substantial percentage of the audience (the hall holds around 3500 people) stood up and enthusiastically shouted "Me!" Although I was not immediately convinced regarding the feasibility of the project, the economics quoted by O'Neill, or the specifics of free space colony vs. planetary surface, I was nevertheless filled with new optimism. The important point was that the Leslie White question — "now could there be progress without continuous increase in the use of energy?" — might have a positive answer, and that human ingenuity could be applied to find ~~it~~.

Cultural-evolutionary analysis seemed to me then, and still does, to lead to the conclusion that the human race needed to expand off Earth and into the universe if we, as a species, were to retain the characteristics of openness and freedom that I valued. Therefore, it was essential that the field of space transportation succeed and lower the cost of transportation to orbit that an extraterrestrial future required. Like many followers of O'Neill's vision, I was initially excited by the promise of the Space Transportation System (i.e., the Space Shuttle) and watched its development closely. At that time I accepted the "Iron Triangle" analysis prevalent in pro-space circles, which saw the dynamic of government spending supporting contract workers who would in turn vote for pro-space representatives, who would in turn vote for appropriations for space budgets. This was considered the only way in

which development of space launchers and space systems could be funded.

However, Shuttle development lagged further and further behind schedule, flight rates grew lower, and expected cost per pound to orbit stayed higher, than originally expected. I became more exposed to free-market analyses based on the principles of Mises, Hayek, and Coase, particularly as developed by Phillip K. Salin, later my business partner in launch entrepreneurship. These stressed the limits of state funding and state action in democratic market societies.

Mises' analyses of the information theory limits of planning, Hayek's application of evolutionary approaches to technological development, and Coases' explanation of the function of the firm, and when firms are and are not effective structures all supported one conclusion: that the existing structure of space transportation was highly unlikely to produce the low-cost, high flight rate space transportation necessary to human flourishing in space. A transition to a system run primarily on market incentives and by market actors would be necessary to achieve that end.

To accomplish this would require addressing two problems: the first, how to introduce market incentives, and encourage the emergence of market actors into a field where few existed, and where many were incentivized to resist such change. The second problem was how to manage the continuing needs of government actors in space, how private space actors would relate to those government actors who would continue to remain active in space, and consequentially, what kind of policy, regulation, and structures would optimize the various needs of the players, particularly when the government as customer would continue to be a major segment of the market for the private providers.

One of the precedents I began to consider was the way in which some of these questions have been handled in other similar domains in the past. *The Command of the Ocean*, N.A.M. Rodger's work on British seapower was particularly useful, as was Peter Hugill's *World Trade Since 1431: Geography, Technology, and Capitalism*. England, and later

the United Kingdom, possessed at least from late medieval times a strong private sector and a relatively less intrusive public sector compared to its Continental peers. Yet despite this relatively small public sector, from late Stuart times onward its Navy was strong, well-managed, technologically superior to its competitors, and an effective instrument of state power. It also managed to be a major customer for British industry. For example, it was, in the centuries preceding the Industrial Revolution proper, the largest buyer of iron in England for its cannon requirements, without distorting the marketplace significantly. This created a virtuous circle, as the demand for fuel for iron production began to deplete English forests, thus accelerating the transition to coal. This in turn stimulated the coal shipping traffic from northern English mines, increasing employment of sailors and expansion of shipbuilding capacity.

Being a sea power without a large land army establishment in peacetime, much of its spending on defense went to dual-use facilities such as dockyards, while the impressment obligation, although much reviled, allowed sailors to work for the private sector in peacetime, serving only in war. Continental workers in contrast were often tied up in service in the army for a substantial part of their peak earning years, or in construction of elaborate forts, barracks, and arsenals, which had little civilian use.. Although these examples are hardly a detailed template for modern times (flogging would probably not be an acceptable disciplinary practice) they do show that a defense force, a thriving commercial sector, and intermediary institutions can be complementary.

These sources were useful to me in my regulatory and policy work, whose ultimate aim was to coax the US space sector away from its dependence on the Iron Triangle system and to shepherd in a system with market incentives shaping technology development and a mutually supportive system of private and state actors, the latter primarily in defense and science, exploration, and the precursors of space settlement in a manner consistent with the American political system, and the culture in which it operates.

It was my conviction from the start that American efforts would best be conducted in a manner consistent with the American social and political system, and the culture in which it operates. Many space advocates pointed to Soviet, Chinese, and European social models as examples for the US to follow. I began to delve more deeply in the history and anthropology of America, the English-speaking world, and global civilizations to determine why those systems delivered the results they did, and to what extent they were suitable for the US to copy. Most particularly useful was David Hackett Fisher's *Albion's Seed*, which examined the cultural templates of the different cultures of the British Isles and their impacts on the parts of North America they settled.

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More central was my engagement with the Cambridge School of anthropology, and its leading proponent Alan Macfarlane, now Professor Emeritus of King's College, Cambridge. His work from *The Origins of English Individualism* through *The Making of the Modern World* and subsequently argued convincingly that there was a deep, long-standing cultural divide between England and its English-speaking offspring, including the USA, which altogether have become known as the Anglosphere, and Continental Europe and in general the rest of the world. Although American exceptionalism is real, and demonstrable statistically, it is nested within a broader Anglosphere exceptionalism — a distinction that eludes and misleads many commentators. As a result of my reading, I began a long correspondence with Professor Macfarlane, which continues today, and which has resulted in some of my writings being cited by him in subsequent books.

Macfarlane's work was in particular instrumental in confirming my initial suspicions that blindly copying European, Asian, or other industrial policy measures was unlikely to be successful in ensuring the success of the next phase of US activity in space. There is an "American

Way of Space", and despite the fact that we pursued other models for the first several decades with only mixed success, the American Way of Space that is now emerging is consistent with the deep roots of our culture — one that may spread, in myriad different variants through time and the universe.

Regarding Colonization. A number of tropes continue to recur in discussions of space activity, and particular in discussions of human space settlement. These include references to the emergence of life from the oceans to the land, to the dispersement of humans from their place of origin to the whole planet, to the experiences of Polynesians or Europeans migrating to new lands, and to the building of the transcontinental railroads of North America. These tropes are often stated rather simplistically, but, when the realities are examined more deeply, they are not fundamentally wrong. Some of these realities are examined in the course of this history. One of the principal ones is the question of colonization in its most basic sense.

An anthropological viewpoint also has shaped my attitude regarding the human colonization of spaces beyond Earth. "Colonization" has recently acquired a somewhat negative valence because of its association with the European colonization of Asia, Africa, and the New World in the last half-millennium. This is not entirely unjustified. Much science fiction of the early 20th century depicted human colonization of extraterrestrial spaces that followed this pattern. Heinlein's Future History series, for example, depicted Mars inhabited by an ancient, wise, but declining race, while Venus was inhabited by a preliterate race of simple-minded natives — both extensions of late 19th century stereotypes of Asian and African cultures, respectively.

However, the word "colonization" in biology refers to a fundamental characteristic of all life, namely, the tendency for each species to expand its range to its available limits, until one or another factor — change of habitat, competition, or change of external environment stops expansion. We have observed this process when volcanic activity creates new islands by flow of lava into the sea, as in Iceland, Hawaii,

and other places. The volcanic rock cools, and before too long sea and air conveys seeds and spores to colonize the rock, and in turn attract birds and other animal life, until a full ecology thrives.

Humans, using the term broadly to include our Neanderthal and Denisovan cousins, have been colonizing Earth for hundreds of thousands of years. Unlike most biota, we have used additional tactics and strategies to expand our range. These fall into three broad categories, which are mutually reinforcing and usually work in parallel. The first, which we share with all life, is genetic adaptation. The second, which we share with all life that has a nervous system, is behavioral adaptation. When embedded in a set of behaviors that are passed down over multiple generations, they become culture, which is largely confined to human species. The third is a very specific kind of culture we call technology, the purposeful manipulation of our external environment to the benefit of our species.

These three strategies have allowed humans to colonize a number of worlds already, and will likely be used to colonize more worlds, this time off of Earth.

By "world" I mean a habitat that can support a permanent, reproducing, population of our kind. A baseline world is one in which such a community can be sustained and expand to its limits by humans, as they were when they first evolved from predecessor species, with no technology. By that I include the absence of fire, tools, weapons and clothing. Our baseline world was (as current theorized) the African savannah. We could live without freezing, run down and kill game to eat, and forage, and defend ourselves adequately to maintain population numbers. All this could be done with behaviors common to many other animals, which could be passed down largely by instinct.

Gradually we developed the ability to maintain fire, manufacture stone and wood tools and weapons, and pass down detailed information about plants, animals, and toolmaking, and coordinate hunting. This allowed

expansion of range beyond the savannah. The entire coastal tropical range of Eurasia all the way to Indonesia was colonized.

At the same time, adventuresome members of the species began exploring the temperate zones, probably seasonally at first, and eventually overwintering. This required the invention of clothing and the learning of new species of plants and animals. Skin, which had evolved dark shades to minimize excess ultraviolet exposure in the tropics, evolved to lighter shades (as currently theorized) to minimize such damage, and possibly assist the synthesis of vitamin D.

Some features of human colonization of this planet's many worlds demonstrate how successive waves of colonists used different elements of our strategic toolkit to adapt to the same challenges. Very high-altitude habitats like Tibet and Bolivia were hard for baseline humans to adapt to, due to the lessened oxygen, which led to a high miscarriage rate. Gradually, genetic evolution bred humans adapted to these conditions. In the Tibetan case, some theorize it was a consequence of interbreeding with Denisovans. When Spanish settlers came to the highlands of Peru and Bolivia, they did not have these genetic adaptations. They responded by behavioral adaptations. High-status Spanish women took to temporarily relocating to the lowlands while pregnant. Lower-status Spanish men adapted by marrying Bolivian women, giving the genetic adaptation to their offspring. Finally in modern industrial times some adapted by technological fixes, including medications and supplemental oxygen, while modern transport technology made temporary relocation cheaper and easier.

Similar adaptations occurred in high-latitude Arctic habitats. Northern peoples traditionally adapted genetically with extreme-cold tolerance, with technological adaptations including extreme-cold clothing, and with behavioral adaptations including techniques for hunting seals and whales. People from lower latitudes adapted eventually with heating and building technologies, adopting Arctic clothing styles like parkas, and in some cases by intermarriages with Arctic peoples.

It is likely that successful extraterrestrial human colonization will continue to use a mixture of all three strategies to adapt to new environments and expand the range of the human species. Genetic adaptation might be speeded up by genetic engineering, and could help deal with issues such as radiation tolerance, or substantial differences in gravity. Intermarriage with locals is unlikely unless cosmic panspermia theory turns out to be correct. Technological adaptation is likely to be the principal strategy, although behavioral adaptation will certainly be a factor.

It is highly unlikely that intelligent alien life will be discovered in the foreseeable future, at least close enough to our solar system to be an obstacle to colonization. There are such an enormous number of unclaimed star systems within our local area that what we could learn by knowing aliens would be worth far more than whatever planetary real estate they might own.

We have nothing to fear from colonization. It is what we have always done. The lure of the open frontier is primordial. Denying it may be fatal to our natures.

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