

The Significance of the Martian Frontier

Robert Zubrin

It was 100 years ago, 1893, at the annual conference of the American Historical Association, that a young professor of history from the then relatively obscure University of Wisconsin got up to speak. Frederick Jackson Turner's talk was scheduled as the last one in the evening session, preceded by a series of excruciatingly boring papers on topics so obscure that kindness forbids even the reprinting of their titles. Nevertheless, for some unexplained reason, the majority of the conference participants stayed up to hear him. Perhaps somehow a rumor had gotten afoot that something important was about to be said, if so it was correct, for in one bold sweep of brilliant insight Turner laid bare the source of the American soul. It was not legal theories, precedents, traditions, national or racial stock that was the source of the egalitarian democracy, individualism, and spirit of innovation that characterize America, it was the existence of the Frontier.

"...to the frontier the American intellect owes its striking characteristics. That coarseness of strength combined with acuteness and inquisitiveness; that practical, inventive turn of mind, quick to find expedients; that masterful grasp of material things, lacking in the artistic but powerful to effect great ends; that restless, nervous energy; that dominant individualism, working for good and evil, and withal that buoyancy and exuberance that comes from freedom - these are the traits of the frontier, or traits called out elsewhere because of the existence of the frontier. Since the days when the fleets of Columbus sailed into the waters of the New World, America has been another name for opportunity, and the people of the United States have taken their tone from the incessant expansion which has not only been open but has even been forced upon them. He would be a rash prophet who should assert that the expansive character of American life has now entirely ceased. Movement has been its dominant fact, and, unless this training has no effect upon a people, the American energy will continually demand a wider field for its exercise. But never again will such gifts of free lands offer themselves. For a moment, at the frontier, the bonds of custom are broken and unrestraint is triumphant. There is not tabula rasa. the stubborn American environment is there with its imperious summons to accept its conditions; the inherited ways of doing things are also there; and yet, in spite of the environment, and in spite of custom, each frontier did indeed furnish a new opportunity, a gate of escape from the bondage of the past; and freshness, and confidence, and scorn of older society, impatience of its restraints and its ideas, and indifference to its lessons, have accompanied the frontier. What the Mediterranean Sea was to the Greeks, breaking the bonds of custom, offering new experiences, calling out new institutions and activities, that, and more, the ever retreating frontier has been to the United States directly, and to the nations of Europe more remotely. And now, four centuries from the discovery of America, at the end of a hundred years of life under the Constitution, the frontier has gone, and with its going has closed the first period of American history."

Turner was unstoppable. America's greatest leaders were all men of the frontier - Washington, Jefferson, Jackson, and Lincoln, he said, and the great struggles of American history have all hinged ultimately upon the fate of frontier. The attempt by the British crown to close the frontier drove the revolution. The Civil War began in the frontier territories and it was the fight for the future of the frontier, not abstract issues of State's Rights or morality, that sent tens of thousands marching into battle at Shiloh and Gettysburg. Most importantly, Turner showed how the very character of Americans, their philosophical outlook, and their society are all based upon the frontier. The frontier creates a perpetual labor shortage in the settled areas, which drives up wages and thus technological innovation. With people in short supply, each one is valued more preciously, putting a

premium on popular education and elevating the general estimate of the human dignity of the common man. So long as the frontier exists, the factory worker back East always has another option in the West, and even if he does not choose to exercise it, he has to be treated with the respect due to someone who can quit - who works by choice, not duress. So long as the frontier is open and new fortunes can be made the establishment of a closed aristocracy is impossible.

The Turner thesis was a bombshell, which within a few years created an entire school of historians who proceeded to demonstrate that not only American culture, but the entire worldwide western progressive humanist civilization that America has generally represented in its most distilled form was the result of the Great Frontier of global settlement opened to Europe by the Age of Exploration. It was the Great Frontier that shattered the static, stultifying, irrational, dogmatic, and completely stratified world of medieval Christendom, unchaining thought, hope, and imagination to revolutionize the world.

The then question arises, with the end of the frontier, what happens to America and all it has stood for? Can a free, egalitarian, democratic, innovating society with a can-do spirit be preserved in the absence of room to grow? Maybe the question was premature in Turner's time, after all, even with the vanishing of the line of settlement, most of the country was still empty. In any case, a popular culture based on 400 years of frontier individualism does not die instantly, and the children of America's last generation of pioneers could take America through World War II and on to the Moon. But what of now? What do we see around us now but an ever more apparent loss of vigor of American society, increasing fixity of the power structure and bureaucratization of all levels of society, impotence of political institutions to carry off great projects, the cancerous proliferation of regulations affecting all aspects of public, private and commercial life, the spread of irrationalism, the banalization of popular culture, the loss of willingness by individuals to take risks, to fend for themselves or think for themselves, economic stagnation and decline, the deceleration of the rate of technological innovation and a loss of belief in the idea of progress itself. Everywhere you look, the writing is on the wall. Without a frontier from which to breathe life, the spirit that gave rise to the progressive humanistic culture that America for the past several centuries has offered to the world is fading. Once again, the issue is not just one of national loss. Human progress needs a vanguard, and no replacement is in sight.

The creation of a new frontier thus presents itself as America's and humanity's greatest social need. Nothing is more important, because apply what palliatives you will, without a frontier to grow in, not only American society, but the entire global civilization based upon Western enlightenment values of humanism, reason, science, and progress will ultimately die.

I believe that humanity's new frontier can only be on Mars. Why is this the case? Why for example can it not be on Earth, on or under the oceans, or perhaps in such remote regions as Antarctica? And if it must be in space, why on Mars? Why not on the Moon or in artificial satellites in orbit about the Earth?

It is true that settlements on or under the sea or in Antarctica are entirely possible, and their establishment and access would be much easier than that of Martian colonies. Nevertheless, the fact of the matter is that at this point in history such terrestrial developments cannot meet an essential requirement for a frontier, to wit, they are insufficiently remote to allow for the free development of a new society. Put simply, in this day and age, with modern terrestrial communication and transportation systems, anywhere on Earth the cops are too close. If people are to have the dignity that comes with making their own world, they must be free of the old.

Why then, not the Moon? The answer is because there's not enough there. True, the Moon has a copious supply of most metals and oxygen, in the form of oxidized rock, and a fair supply of solar energy, but that's about it. For all intents and purposes, the Moon has no hydrogen, nitrogen, or carbon (They're present in the Lunar soil in parts per million quantities, somewhat like gold in sea water. If there were concrete on the Moon, Lunar colonists would mine it to get its water out.), and these are three of the four elements most necessary for life. You could bring seeds to the Moon and grow plants in enclosed greenhouses there, but nearly every atom of carbon, nitrogen, and hydrogen that goes into making those plants would have to be imported from another planet. While sustaining a lunar scientific base under such conditions is relatively straightforward, growing a civilization there would be impossible. The difficulties supporting significant populations in artificial orbiting space colonies would be even greater.

Mars has what it takes. It's far enough away to free its colonists from intellectual, legal, or cultural domination by the old world, and rich enough in resources to give birth to a new. The Red Planet may appear at first glance to be a desert, but beneath its sands are oceans of water in the form of permafrost, enough in fact, if it were melted and Mars' terrain were smoothed out, to cover the entire planet with an ocean several hundred meters deep. Mars' atmosphere is mostly carbon-dioxide, providing enormous supplies of the two most important biological elements in a chemical form from which they can be directly taken up and incorporated into plant life. Mars has nitrogen too, both as a minority constituent (3%) in its atmosphere and probably as nitrate beds in its soil as well. For the rest, all the metals, silicon, sulfur, phosphorus, inert gases, and other raw materials needed to create not only life but an advanced technological civilization, can readily be found on Mars.

The United States has, *today*, all the technology needed to send humans to Mars. If a "travel light and live off the land" strategy like the Mars Direct plan were adopted, then the first human exploration mission could be launched within ten years at a cost less than 20% of NASA's existing budget. Once humans have reached Mars, bases could rapidly be established to support not only exploration, but experimentation to develop the broad range of civil, agricultural, chemical and industrial engineering techniques required to turn the raw materials of Mars into food, propellant, ceramics, plastics, metals, wires, structures, habitats, etc. As these techniques are mastered, Mars will become capable of supporting an ever increasing population, with an expanding division of labor, capable of mounting engineering efforts on an exponentially increasing scale. Once the production infrastructure is in place, populating Mars will not be a problem - under current medical conditions an immigration rate of 100 people per year would produce population growth on Mars in the 21st Century comparable to that which occurred in colonial America in the 17th Century. Within a century, an engineering capability could be created on Mars with the capability to literally transform the planet, if not to a fully Earth-like environment at least to the warm, wet conditions of Mars' primitive past, making a desert world into a new home for a new spectrum of descendants of terrestrial life.

Mars can be settled, and the fact that Mars can be thus settled and altered defines it as the New World that can create the basis for a positive future for *terrestrial* humanity for the next several centuries.

Why Humanity Needs Mars

"We hold these truths to be self evident, that all men are created equal, and endowed by their creator with certain inalienable rights, among them life, liberty, and the pursuit of happiness..."

Declaration of Independence, 1776

"Everything has tended to regenerate them; new laws, a new mode of living, a new social system; here they are become men."

Jean de Crevecoeur, "Letters from an American Farmer," 1782

To see best why 21st Century humanity will desperately need an open frontier on Mars, we need to look at modern Western humanist culture and see what in it makes it so much more desirable a mode of society than anything that has ever existed before. Then we need to see how everything we hold dear will be wiped out if the frontier remains closed.

The essence of humanist society is that in it human beings are valued, that human life and human rights are held precious beyond price. Such notions have been for several thousand years the core philosophical values of Western civilization, dating back to the Greeks and the Judeo-Christian ideas of the divine nature of the human spirit. Yet they could never be implemented as a practical basis for the organization of society until the great explorers of the age of discovery threw open a New World in which the dormant seed of medieval Christendom could grow and blossom forth into something the likes of which the world had never seen before; something so wonderful that for 400 years millions of men and women all over the world have abandoned everything they had, traveled thousands of miles, braving incredible dangers and hardships to make themselves parts of it, and millions of others have conspired and fought, often against tremendous odds, to bring it to their homelands.

The problem with Christendom was that it was *fixed*, it was a play for which the script had been written and the leading roles both chosen and assigned. The problem was not that there were insufficient natural resources to go around - medieval Europe was not heavily populated, there were plenty of forests and other wild areas - the problem was that all the resources were *owned*. A ruling class had been selected and a set of ruling institutions, ideas and customs had been selected, and by the law of "Survival of the Fittest," none of these could be displaced. Furthermore, not only the leading roles had been chosen, but also those of the supporting cast and chorus, and there were only so many such parts to go around. If you wanted to keep your part, you had to keep your place, and there was no place for someone without a place.

The New World changed all that by supplying a place in which there were no established ruling institutions, an improvisational theater big enough to welcome all comers with no parts assigned. On such a stage, the players are not limited to the conventional role of actors, they become playwrights and directors as well. The unleashing of creative talent that such a novel situation allows is not only a great deal of fun for those lucky enough to be involved, it changes the view of the spectators as to the capabilities of actors in general. People who had no role in the old society could define their role in the new. People who did not "fit in" in the old world could discover and demonstrate that far from being worthless, they were invaluable in the new, *whether they went there or not*.

The New World destroyed the basis of aristocracy and created the basis of democracy, it allowed the development of diversity by allowing escape from those institutions that were imposing uniformity, it destroyed a closed intellectual world by importing unsanctioned

data and experience, it allowed progress by escaping the hold of those institutions whose continued rule required continued stagnation, and it drove progress by defining a situation in which innovation to maximize the capabilities of the limited population available was desperately needed. It raised the dignity of man by raising the price of labor and by demonstrating for all to see that human beings can be the creators of their world, and not just its inhabitants.

Now consider the probable fate of humanity in the 21st Century under two conditions, with a Martian Frontier and without it.

In the 21st Century, without a Martian Frontier, there is no question that human diversity will decline severely. Already, in the late 20th Century, advanced communication and transportation technologies have been eroding the healthy diversity of human cultures on Earth, and this tendency can only accelerate in the 21st. On the other hand, if the Martian Frontier is opened, then this same process of technological advance will also enable us to establish a new branch of human culture on Mars and eventually worlds beyond. The precious diversity of humanity can thus be preserved on a broader field, but only on a broader field. One world will be just too small a domain to allow the preservation of the diversity that is needed not just to keep life interesting, but to assure the survival of the human race.

Without the opening of a new frontier on Mars, continued Western civilization faces the risk of technological stagnation. To some this may appear to be an outrageous statement, as the present age is frequently cited as one of technological wonders. In fact, however, the rate of progress within our society has been decreasing, and at an alarming rate. To see this, it is only necessary to step back and compare the changes which have occurred in the past 30 years with those that occurred in the 30 years preceding and the 30 years before that. Between 1903 and 1933 the world was revolutionized; cities were electrified, telephones and broadcast radio became common, talking motion pictures appeared, automobiles became practical, and aviation progressed from the Wright Flyer to the DC-3 and Hawker Hurricane. Between 1933 and 1963 the world changed again, with the introduction of color television, communication satellites and interplanetary spacecraft, computers, antibiotics, SCUBA gear, nuclear power, Atlas, Titan, and Saturn rockets, Boeing 727's and SR-71's. Compared to these changes, the technological innovations from 1963 to the present are insignificant. Immense changes should have occurred during this period, but did not. Had we been following the previous 60 years technological trajectory, we today would have videotelephones, solar powered cars, maglev trains, fusion reactors, hypersonic intercontinental travel and regular passenger transportation to orbit, undersea cities, open-sea mariculture, and human settlements on the Moon and Mars. Even more indicative of technological decadence than the nonappearance of these innovations, is the fact that a fundamental advance in technology in an area basic to the total process of production that was already emerging in 1963, namely nuclear power, has been blocked in its implementation by political forces dedicated to preserving the technological status quo, in the process raising technophobia to the status of a fashionable political and philosophical creed.

It is important to understand this. The widespread introduction of commercial nuclear power in the Western world was not stopped by the small groups that duel with the industry in public hearings and courtrooms. Whatever one might think of the pluses and minuses of nuclear power, the fact remains that the anti-nuclear activists have only been allowed to have their way with commercial nuclear industry because the world's dominant financial institutions currently hold the mortgages on literally trillions of dollars worth of coal, oil and gas reserves, all of which would be severely devalued should a replacement source of energy come on line. Such investments have caused these financial institutions

and their governmental allies to develop a preference for stagnation in energy technology that is extremely difficult to overcome. Indeed, nuclear technology is only supported by the powerful in the Western world today for the decisive military applications of nuclear weapons and nuclear submarines - in the case of deployment of such instruments no advice from Sierra Club is requested. Analogous paradigms hold true in other important areas of the economy, so that practically the only areas where notable technological progress is occurring currently is in products such as home computers that do not compete directly with previously well established industries. As the interlocking of terrestrial institutions of political and economic power becomes ever more intimate and incestuous in the 21st Century, this trend towards technological stagnation can only deepen.

Unless of course, there is an alternative uncontrolled domain that drives progress from the outside, and this is what the Martian Frontier will provide. Consider a nascent Martian civilization: its future will depend critically upon the progress of science and technology to which the colonists will therefore enthusiastically contribute. Thus just as the inventions of produced by the "Yankee Ingenuity" of frontier America were a powerful driving force on world-wide human progress in the 19th Century, so the "Martian Ingenuity" born in a culture that puts the utmost premium on intelligence, practical education, and the determination required to make real contributions will make much more than its fair share of the scientific and technological breakthroughs that will dramatically advance the human condition in the 21st. A prime example of where this is likely to occur is energy production. Mars does have one major energy resource that we do currently know about; deuterium, which can be used as the fuel in nearly waste-free thermonuclear fusion reactors. Earth has large amounts of deuterium too, but with all of its existing investments in other, more polluting, forms of energy production, the research that would make possible practical fusion power reactors has been allowed to stagnate. The Martian colonists are certain to be much more determined to get fusion on-line, and in doing so will massively benefit the mother planet as well. Fusion power will also lead to fusion propulsion, making possible spaceships that will carry hundreds of passengers and thousands of tons of payload rapidly back and forth between Earth and Mars, thus accelerating the rate of colonization and opening up the possibility of emigration to Mars to more and more people. Not only would such technology cause travel times between Earth and Mars to shrink from months to weeks, but travel times to the outer solar system would be reduced from years to months, and even voyages to the stars could become possible on a time scale of decades instead of millennia. Thus by acting as a driver on technology, the Martian Frontier can become a gateway to the practically infinite hinterland that lies beyond.

The parallel between the Martian frontier and that of 19th century America as technology drivers is, if anything, vastly understated. America drove technological progress in the last century because its western frontier created a perpetual labor shortage in the east, thus forcing the development of labor saving machinery and providing a strong incentive for improvement of public education so that the skills of the limited labor force available could be maximized. This condition no longer holds true in America, in fact far from prizing each additional citizen, immigrants are no longer welcome here and a vast "service sector" of bureaucrats and menials has been created to absorb the energies of the majority of the population which is excluded from the productive parts of the economy. Thus in the late 20th Century, and increasingly in the 21st, each additional citizen is and will be regarded as a burden. On 21st Century Mars, on the other hand, conditions of labor shortage will apply with a vengeance. Indeed, it can be safely said that no commodity on 21st Century Mars will be more precious, more highly valued, and more dearly paid for than human labor time. Pay rates will be higher on Mars, workers will be treated better, and public education will be driven much harder than ever was the case on Earth. Just as the example of 19th Century America changed the way the common man was regarded and treated in Europe, so the impact of progressive Martian social conditions will not only be felt on Mars. Put

simply, a new standard will be set for a higher form of humanist civilization on Mars, and viewing it from afar the citizens of Earth will rightly demand nothing less for themselves.

The frontier drove the development of democracy in America by creating a self-reliant population which insisted on the right to self-government. It is doubtful that democracy can persist without such people. True, the trappings of democracy exist in abundance in America today, but meaningful public participation in the process has all but disappeared. No representative of a new political party has been elected president of the U.S. since 1860, neighborhood political clubs and ward structures that allowed citizen participation in party deliberations are gone, as are the camp meetings and torchlight election parades. With a re-election rate of 95%, the U.S. Congress is about as susceptible to the people's will as the British House of Lords, and regardless of the will of Congress, the real laws, covering ever broader areas of economic and social life, are increasingly being made by a plethora of regulatory agencies whose officials do not even pretend to have been elected by anyone. Judges are still elected in many places, but the elections generally feature little public involvement, so that rather than representing any concept of justice as understood by the public, the judicial system has come to function largely as an autonomous legal caste. Clearly, if it is not to continue its ongoing degeneration into sham, democracy in America and elsewhere in western civilization needs a shot in the arm. That boost can only come from the example of a frontier people whose civilization incorporates the ethos that breathed the spirit into democracy in America in the first place. As Americans showed Europe in the last century, so in the next the Martians can show us the way away from oligarchy.

There are greater threats that a humanist society faces in a closed world than the return of oligarchy, and if the frontier remains closed in the 21st Century we are certain to face them. These threats are the spread of various sorts of anti-human ideologies and the development of political institutions that incorporate the notions that spring from them as a basis of operation. At the top of the list of such pathological ideas which tend to spread naturally in a closed society is the Malthus theory, which holds that since the world's resources are more or less fixed, population growth must be restricted or all of us will descend into bottomless misery. Malthusianism is scientifically bankrupt and all predictions made upon it have been wrong, because human beings are not mere consumers of resources. Rather we create resources by the development of new technologies that find use for them. The more people, the faster the rate of innovation, and this is why contrary to Malthus, as the world's population has increased, the standard of living has increased, and at an accelerating rate. Nevertheless, in a closed society Malthusianism has the appearance of self-evident truth, and herein lies the danger. Because if the idea is accepted that the world's resources are fixed, then each person is ultimately the enemy of every other person, and each race or nation is the enemy of every other race or nation. The inevitable result is the creation of tyrannical regimes to restrict population growth, such as that now prevailing in China, or worse, the development of Nazi style genocidal governments as various populations become convinced that their vital self interest requires the elimination of those other races that are allegedly competing with them for the world's finite resources. Only in a universe of unlimited resources can all men be brothers.

It is not enough to argue against Malthusianism in the abstract, such debates are not settled in academic journals. Unless people can *see* broad vistas of unused resources in front of them, the belief in limited resources tends to follow as a matter of course. Unless the frontier is re-opened, the probability is high that humanity will create hell for itself in the 21st Century.

Is the world that humans live in changeable or is it fixed? Are we the makers of our world or just its inhabitants? In a society that is growing into a frontier the creative role of humans is self-evident, and the dignity of man is raised accordingly. Nineteenth century Americans,

building cities, draining swamps, and digging canals could have no doubt as to humanities role as improvers of creation. Today much of what they saw as progress is cited by many as environmental destruction. Despite abundant scientific evidence that evolution is intrinsic to nature, a belief is spreading that nature as it is at the moment is sacrosanct, and that humans should not have the right to change it. An open frontier on Mars would not merely restore the 19th Century American humanist views in such matters, it would raise it to unprecedented heights, because in the process of terraforming Mars we will not merely be taming a wild world, but bringing a dead one to life. What greater affirmation of the positive nature of the human creative spirit could there be?

The Never Ending Renaissance

"We have come recently to boast of a global economy without thinking of its implications, of how unfortunate we are in finding it. It would be more cheering if news should come that by some freak of the solar system another world had swung gently into our orbit and moved so close that a bridge could be built over which people could pass to new continents untenanted and new seas uncharted. Would those eager immigrants repeat the process they followed when they had that opportunity, or would they redress the grievances of the old Earth by a new bill of rights...? The availability of such a new planet, at any rate, would prolong, if it did not save, a civilization based on dynamism, and in the prolongation the individual would again enjoy a spell of freedom....

"It would be very interesting to speculate on what the human imagination is going to do with a frontierless world where it must seek its inspiration in uniformity rather than variety, in sameness rather than contrast, in safety rather than peril, in probing the harmless nuances of the known rather than the thundering uncertainties of unknown seas or continents. The dreamers, the poets, and the philosophers are after all but instruments which make vocal and articulate the hopes and aspirations and the fears of a people.

"The people are going to miss the frontier more than words can express. For four centuries they heard its call, listened to its promises, and bet their lives and fortunes on its outcome. It calls no more...."

Walter Prescott Webb, "The Great Frontier," 1951.

Western humanist civilization as we know and value it today was born in expansion, grew in expansion, and can only exist in a dynamic expanding state. While some form of human society might persist in a non-expanding world, that society will not feature freedom, creativity, individuality, or progress, and placing no value on those aspects of humanity that differentiate us from animals it will place no value on human rights or human life as well. Such a dismal future might seem an outrageous prediction, except for the fact that for nearly all of its history most of humanity has been forced to endure static modes of social organization, and the experience has not been a happy one. Free societies are the exception in human history, they have only existed during the four centuries of frontier expansion of the West. That history is now over, the frontier that was opened by the voyage of Christopher Columbus is now closed. If the era of western humanist society is not to be seen by future historians as some kind of transitory golden age, a brief shining moment in an otherwise endless chronicle of human misery, then a new frontier must be opened. Mars beckons.

But Mars is only one planet, and with humanity's power over nature rising exponentially as they would in an age of progress that an open Martian frontier portends, the job of transforming and settling it is unlikely to occupy our energies for more than three or four centuries. Does the settling of Mars then simply represent an opportunity to "prolong but not save a civilization based upon dynamism?" Isn't it the case that humanist civilization is

ultimately doomed anyway? I think not. The universe is vast; its resources, if we can access them, are truly infinite. During the four centuries of the open frontier on Earth, science and technology have advanced at an astonishing pace. The technological capabilities achieved during the 20th century would dwarf the expectations of any observer from the 19th, the dreams of one from the 18th, and seem outright magical to someone from the 17th. The nearest stars are incredibly distant, about 100,000 times as far away as Mars; yet Mars itself is about 100,000 times as far from Earth as America is from Europe. If the past four centuries of progress have multiplied our reach by so great a ratio, might not four more centuries of freedom do the same again? There is ample reason to believe that they would. Terraforming Mars will drive the development of new and more powerful sources of energy; settling the Red Planet will drive the development of ever faster modes of space transportation. Both of these capabilities in turn will open up new frontiers ever deeper into the outer solar system, and the harder challenges posed by these new environments will drive the two key technologies of power and propulsion ever more forcefully. The key thing is not to let the process stop, for if it is allowed to stop for any length of time society will crystallize into a static form that is inimical to the resumption of progress. That is what defines the present age as one of crisis. Our old frontier is closed, the first signs of social crystallization are clearly visible. Yet, progress, while slowing, is still extant; our people still believe in it and our ruling institutions are not yet incompatible with it. We still possess the greatest gift of the inheritance of a four hundred year long Renaissance, to wit, the capacity to initiate another by opening the Martian frontier. If we fail to do so, our culture will not have that capacity long. Mars is harsh, the people who settle it will need not only technology, but the scientific outlook, creativity, and free-thinking individualistic inventiveness that stand behind it. Mars will not allow itself to be settled by people from a static society; those people won't have what it takes. We still do. Mars today waits for the children of the old frontier, but Mars will not wait forever.

Like an aircraft moving down a runway, western civilization used the freedom afforded by the open frontier to accelerate itself to takeoff speed. The end of the runway has now been reached. If our journey is to continue, we must now take courage and fly.