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Epilogue: Directions for the Future

The purpose of this work has been to illustrate why space power has become inseparable from all other forms of terrestrial power, and to assert that both by itself, and in conjunction with other forms of terrestrial influence and power, space power is necessary for the maintenance of national power.

But even provided that this argument has been successfully advanced, there remain two important, unanswered questions. First, how does a spacefaring nation attain or (in the case of the United States) maintain preeminence in space? And secondly, how does a space power use that strength for national purposes?

After all, Mahan insisted that preeminence on the sea rested upon a nation's acquisition and maintenance of a large, concentrated battle fleet. Douhet prescribed a large air force of "Battle Planes" or bombers to gain, or maintain, dominance of the air. What then is the hardware blueprint for space superiority? It is not yet weapons, nor is it any particular type of spacecraft, or any specified space-related system. For the time being, it is probably as simple as assured access. The definition of space power in the first chapter of this book is a good prescription for the near term, but time will change this prescription.

As with much of the previous discussion regarding space power, what follows focuses primarily on the United States and pertains to the current state of its national politics and economy. Most of this discussion may be applied, however, to other existing or would-be spacefaring nations as it is (1) general in nature, and (2) represents an environment that is increasingly being seen throughout the world. That is, the democratization of national politics and the merging of

national economies into a global infrastructure. For this reason, it is reasonable to assume that a future or aspiring space power will likely face many of the same concerns regarding national debate, organizational matters, economic realities, and global restrictions, that the United States faces today.

As the world's premier space power, the current preeminence the United States enjoys is due to something less than the realization of a master plan. Rather, it is more a matter of serendipity, in combination with several well-thought-out policies.

And, though its space power is unquestionable, there is great danger in the present position of the United States. That danger comes not in the form of an adversary or even competition, but rather self-contentment and self-congratulation. One of the primary reasons for the United States' present comfortable situation is the rigorous competition furnished by the Soviet Union, which provided the impetus for developing a sophisticated US space capability (bluntly, the USSR kept the US space industry "running scared" for decades). The Soviet Union has since dropped from the race, leaving its successor, Russia, to cope with an unaffordably huge space industrial base but without sufficient funds to maintain full use of its capacity.

How Can We Decide What We Must Do?

Space has been described previously in this work as an arena much more volatile and unstable than any previously known medium. Space technologies and designs have proven to be more short-lived than those of the early years of aviation. This means that policy decisions, no matter how well based upon sound reasoning, are quickly outdated, yet tend to remain in effect through bureaucratic inertia.

This means that flexibility, innovation and open-mindedness are required not only from the scientists, engineers, and technicians involved in the space program, but others as well. Government policy makers, legislators, and judges must also be made to understand that yesterday's solutions may be incorrect for today's emerging technologies.

Perhaps even more importantly, there must be an understanding that space is the wrong arena to be accommodating and willing to let nonparticipants have an important role in the development of law and policy. The impediments caused by once innocent passage in space treaties described previously are proof of the pace of change. Enthusiasm for today's, or even tomorrow's, solutions must be tempered with the knowledge that tomorrow's wrong choice was the one that seemed so obviously correct yesterday. Yet decisions cannot be avoided, and a slow, cautious approach may be as wrong a policy of space activity as may be a headlong rush.

Like the language and policies of space treaties, prescriptions for action are likely to soon become so outmoded as to be of little other than historical value in just a decade or so. Also, they are all too often prescriptions exclusively for government, which neglect the fact that though government must necessarily be part the environment that supports national space power, it is no longer the sole actor nor, perhaps, even the most important.

A list of prescribed actions would then have to include all of the contributors to space power and national security, which have been discussed in preceding chapters.

Not too long ago, an operational antisatellite capability once seemed to be an absolute requirement for the United States to counter a militaristic use of space systems by the Soviet Union. Today, a robust research program may suffice to meet a threat not currently manifest in space. This brings us back once again to the central point of this discussion. If lists and formulas make little sense, what then must a nation do to gain or maintain preeminence in space?

To begin with, there must be an understanding that space is more than a place to stage spectacularly entertaining events. We must construct a national consensus about space exploitation and about exploration for curiosity and for future exploitation. Space is a medium that requires serious, methodical exploration to develop the details of commercially beneficial discoveries.

Exploration must also include those activities that lead to a better understanding of the history of the universe, our solar system, and the development of life on our planet. By exercising the knowledge we gain from space, we do more than satiate our curiosity or provide

fulfillment on some aesthetic plane; we acquire the tools that enable us to achieve a better standard of living for the people of our nation, of our civilization, and of our planet. The expansion of space power by the United States and other nations will provide new technologies, new knowledge, new services, and eventually new resources as we extend our reach farther into our solar system.

The exploitation of space was, is, and will continue to be a vigorous undertaking. A country wishing to gain or maintain status as a space power must first demonstrate a willingness to commit to a space program and then follow that effort through thereafter. In the case of the United States, the major efforts of its first decade in space have been followed by relatively modest undertakings. The result has been modest achievement, especially when viewed from the heady days of early space development. Moon bases, manned missions to Mars, as well as an orbiting space station, were all envisioned to have been accomplished by the end of this century, but none came to pass. The small portion of national wealth being spent by the United States government on civil space activities today is apparently the minimum necessary to sustain modest growth.

It is always tempting to look at our current set of contemporary problems and try to put all of our efforts and treasure into mitigating poverty or disease. But those problems need time, more than attention and money, to come up with workable solutions. Investment in the future is also required.

History provides the object lesson of the Chinese “Treasure Fleet,” immense ocean-going vessels which in the early 14th Century explored what would later be called the “East Indies,” visited northern Australia, and crossed the Indian Ocean to the east coast of Africa. But back home, Chinese society never found anything worth buying from foreign barbarians, and government funding of the voyages was slashed. Instead, China diverted its resources to domestic needs such as canal construction and “ever-full” granaries, while the ships—with ocean going travel a capital offense—rotted in their harbors. A century later, Portuguese mariners, inferior to the Chinese in every sea-going skill except boldness, retraced the abandoned routes in the opposite direction, reached China, and began a centuries-long tragic confrontation between East and West.

What will we pass on to generations after us—rotting, rusty spaceships, or a bold legacy? History tells us that there is no short term fix to social ills and economic inequality. However, we can give our descendants a culture, a regulatory philosophy, and an economic infrastructure attuned to the potential of space exploitation. It will require the constant awareness, a sense that space is the future, the kind of emotional ownership that the Phoenicians, the Venetians or Victorian British are reported to have felt about the sea.

The investment required of space powers is much more than money, the real investment is an educated concern by those who understand national power and create the intellectual atmosphere to nourish the required policies. The onus is not on government officials, it is on us.

So government space programs are not the answer to how to maintain the US lead in space. In the absence of an obvious national security threat, the government will scale back national security budgets and noncritical exploratory efforts. So much is already promised to entitlement programs that little is left to invest in research and new procurement in defense and for NASA.

Industry is thus free to step to the front. It appears certain that profit will flow to innovative space solutions. With the expansion of satellite technology and applications, private capital and enterprise may become integral ingredients in international operations in space.

For example, solar power satellites may augment other public utility installations. Large space structures and space stations may constitute the skeleton, but the heart of future space operations has to be the industrialization of space, i.e., satellite applications, metallurgy, pharmaceuticals, energy, and resources from space. The industrialization of space will result in mining operations on the Moon and the asteroids, which may lead to the colonization of space. The imagination of minds who want to sell their wares to our fantasies may lead us eventually beyond the horizon of time into a future we cannot foretell.

Anticipated profits will cause a great increase in the number of commercially owned space systems, requiring government planning to protect and control commerce. Depending on the strategies and the implementation systems selected for the regulation of commerce,

additional capabilities for international coercion may also become available. For example, an ability to deny access to some small terrestrial regions by commercial earth resource imaging satellites has use in commerce regulation and international relations. The ability to refuel or bring satellites back to Earth includes the ability to inspect satellites, and to disable or seize non-cooperative assets. Many space technology experts have envisioned a greater role for the space-related contribution to national security. Without some stimuli, the technological level of national space power that now seems technologically possible, will not be achieved until sometime in the future. Without funding for further research, promising technologies will remain future possibilities.

If industry must innovate and cause the changes we expect to increase space power, then governments must provide an environment for private innovation. Governments should take a look at the treaties, agreements and regulations in effect and determine how best to protect and yet manage this most volatile of mediums.

In particular, it seems that a fitting task for governments is the growing amount of debris at low earth orbit. Another task that will require governmental action is the requirement to set up some traffic control type of organization for earth orbits. This is not yet a crisis at the end of the 20th Century, but the addition of hundreds of more satellites, the launch vehicles to put them into orbit, and the limits of the radio frequency spectrum require innovation and regulation. Governments must also carefully consider the types of international treaties and regulations being proposed. The task is to foster an environment that allows rapid, yet safe exploitation of the technologies and the opportunities of space.

Our commercial and government programs must have the freedom to fail. Modern management techniques of risk assessment, risk avoidance, and risk mitigation have provided space programs that have been, on the whole, very safe and very reliable. There is a reasonable expectation that safety and reliability can remain high. However, failure is a also good teacher.

This is not to encourage reckless behavior, or to deliberately seek danger in space by following shortsighted strategies. After all, nothing new is learned from the stupid mistakes, like cleaning rags in the fuel

system of a launcher, or mis-programming an upper stage. Decades of space activities have provided volumes and volumes of “lessons” which must be more efficiently transferred from those who paid for them to those who may avoid having to pay again, if they’re smart enough.

Currently the cost associated with loss of life in space is politically very high. Yet this is only a temporary phase, when annual human flights into space can be counted on one’s fingers. As access to space widens and traffic increases vastly, space accidents—even space fatalities—will transition from occasions for national mourning, to shocking news on par with an airliner crash, and ultimately to sad but quickly-forgotten tidings such as a skydiving accident or a military helicopter crash. To the extent that space activity becomes “ordinary,” the public will come to view these accidents as acceptable losses.

There will be other kinds of losses, many involving money, sometimes a great deal of money (a higher level of mature space operations will be achieved when some space firms go bankrupt—before then, they were all being too cautious). Risk avoidance also avoids revolutionary innovations; risk prevention usually results in extra cost. Great rewards are often snatched from great risk.

There needs to be a tolerance for failure in our space activities. The ability of humans to err is well known. Making each mission less costly is one way to avoid some of the pain of failure. Failures will surely happen. The technologies of space weapons, of space exploration, of other forms of space launch, will result in some sort of success after failure. Learning will result; success will surely follow. We just don’t know the form of the success.

An understanding that failure teaches is desired. This understanding will lead to a national sense of ease about failure. The shortsighted, quarterly profit sheet approach is not the correct model. The modern world is, in some respects, the product of the European Age of Discovery and the Industrial Revolution. The Europeans discovered that the world was larger than Europe through a series of adventures and mistakes. The world is richer for their mixed record of success.

National security is another matter. All spacefaring national governments want to preserve their access to space. Those countries

without a space program or space industry of their own want to receive the benefits of on-demand space services. In conflict situations, the tendency for each side to deny space support to the other side could threaten space access for all countries.

The United States and other major spacefaring nations should study the intended and unintended consequences of such actions. Weaponizing space will make space war the inevitable spillover of terrestrial conflict. The United States should use its influence within the United Nations to sponsor discussion of the adoption of voluntary limits on space-based weapons. Since some types of weapons could have more than one use, the discussion should include means to prevent the use of space-based weapons, if ever deployed, against terrestrial targets.

Such voluntary limits will not prevent the eventual weaponization of space, but it could delay weaponization by some significant period. Any delay of time when conflicts move into space works to the benefit of spacefaring nations. Unlike previous strategic theories, the building of a space battle fleet is not the first priority of space power. The use of space, and the protection of that use, is the primary directive. Eventually, weapons will be on orbit around the celestial bodies of our solar system. We must be ready with practical, working designs and the will power to protect space for our national security.

To effectively practice space control, the United States must develop the capability to know what information all satellites supporting military operations are collecting, and to whom it is being provided. This requirement is related to US concerns regarding information operations. In addition, the military must develop, along with the national policy community, a strategy for space control in time of crisis, tension, and war. This strategy should include planning to use capabilities that deny an adversary the use of space-related assets including satellites. Experience gained in war and other hostile environments, as well as the study of space operations and warfare in general, suggests that a “clean sweep” over the shortest possible time may provide sufficient “shock effect” to prevent the start of terrestrial hostilities, or at a minimum, provide the United States and its allies a significant edge in terrestrial hostilities.

The United States must plan for and rehearse military actions in space. Military space commands need innovative leadership and freedom to experiment. Through experimentation and gaming, the military can develop the strategies and tactics to win if hostilities require warfare in space. Military action in space must be routine to the military to be effective. It must be thought out, rehearsed, intuitive, and instinctive. Operational experience with weapons systems is required before operational employment doctrines can be perfected. The military must prepare by establishing the routine well before the threat forces the United States to arm its space forces.

It seems most likely that weapons will be put in orbit for one of two reasons. First, it will be because some other state has or is about to put weapons in orbit. The asymmetric advantage of a state with space-based weapons is enhanced by the apparent acceleration of the scale of time in space. The second reason is far more likely. It will be in keeping with self-defense.

The proliferation of weapons of mass destruction and ballistic missiles will drive some portions of national self-defense systems to space to gain an edge in time, and thus, effectiveness. It would seem that such an inherently sensible system could be shared with allies. Is it time to consider a Supreme Allied Commander—Space? Yet, it is well before such a command is needed, our allies might opine that we are merely being too aggressive and that we are attempting to gain their support for something they believe to be necessary. Early discussions and organizations to take our closest military alliances beyond terrestrial boundaries may enhance the appearance of a combined determination to jointly resist the use of WMD for terrorist causes.

Such an organization could discuss the problems of debris propagation in low earth orbits and could be the agency of choice if a means to lessen the quantity of debris were developed and fielded. Likewise, a combined military command might be the logical operator of the supporting sensors, management displays, and communications for an orbital control agency, perhaps under UN auspices. Among the alliance of advanced states, only the United States has a military space command at present. Would the addition of allied members to the policy process make them better partners in the future?

Educators in the United States have done a great job of exciting students about space subjects. Almost every major university has some type of space-related curriculum. Primary and secondary teachers excite their students about science by using space systems and scientific discoveries as teaching tools. Spacefaring nations and those who would benefit from space-based services send their students to schools in the United States.

This student and educator interest is one of the more sure proofs of the value of space power. There seems to be a consensus, based upon instinct, that space, and its sibling, information technologies, will be very important to the future. However, reality often lags expectation and imagination. It is this cold dose of reality that ends interest for many eager students. The impact of Sputnik upon the US educational system resulted in an increase of science studies and science degrees. Not only space will benefit from a successful revitalization of wide interest in the sciences and mathematics—not only for the handful of students who will enter technical careers, but for the broad mass of future citizens who will be voters and customers relative to space issues.

For the United States in particular, space power can be maintained if the dream of the founding fathers is maintained. Americans need a dream. We have an opinion of ourselves as providing a responsive and honest government: government of, by and for the people. We see ourselves as an example for the rest of humankind to follow. We enjoy freedom; life, liberty and the pursuit of happiness. We developed our West, kept the Western Hemisphere free of new imperialism, and led the fight against the succession of totalitarian regimes that appeared in the 20th Century.

For the majority of us, our parents and forebears came across oceans to settle this country, enduring great hardships. Many more new Americans are crossing oceans or deserts to be part of this country. As the descendants and heirs of those adventurous people, it is only fitting that we should fulfill their heritage by continuing the expansion of our species into space.

In 1893, a young history professor from the University of Wisconsin named Frederick Jackson Turner delivered the last talk of an evening session at the annual conference of the American Historical

Association. In seeking to explain so much that we all find commendable about American culture—the egalitarian democracy, individualism, and spirit of innovation—Turner’s insight centered on the existence of the Western Frontier.

“To the frontier the American intellect owes its striking characteristics,” Turner asserted. “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.”

Turner continued, “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...”

Frontier cultural influences still echoed in American society for several more generations, but some observers now bemoan their weakening influence and seek to explain current US social ills to be a consequence of the loss of the frontier. On the Internet Web Page of the “Mars Society,” a private group that advocates human settlement of the planet Mars, they put it this way: “Currently we see around us 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. 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: 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 die.”

Perhaps the space enthusiasts overstate the stakes, but maybe not. History teaches that there is no inherent advantage—geographic, ethnic, philosophical—that guarantees future success to any nation, except by the exercise of successful cultural patterns. Every generation needs to evaluate its parent culture’s history, identify and extract the traits responsible for success, modify them as modern conditions require, and then apply them with the same energy and passion that former generations did.

We have the great gift of yet another period when our nation is not threatened; and our world is free from opposing coalitions with great global capabilities. We can use this period to take our nation and our fellow men into the greatest adventure that our species has ever embarked upon. The United States can lead, protect, and help the rest of mankind to move into space. It is particularly fitting that a country comprised of people from all over the globe assumes that role. This is a manifest destiny worthy of dreamers and poets, warriors and conquerors.

In his last book, *Pale Blue Dot*, Carl Sagan presents an emotional argument that our species must venture into the vast realm of space to establish a spacefaring civilization. While acknowledging the very high costs that are involved in manned spaceflight, Sagan states that our very survival as a species depends on colonizing outer space. Astronomers have already identified dozens of asteroids that might someday smash into Earth. Undoubtedly, many more remain undetected. In Sagan's opinion, the only way to avert inevitable catastrophe is for mankind to establish a permanent human presence in space. He compares humans to the planets that roam the night sky, as he says that humans will too wander through space. We will wander space because we possess a compulsion to explore, and space provides a truly infinite prospect of new directions to explore.

Sagan's vision is part science and part emotion. He hoped that the exploration of space would unify humankind. We propose that mankind follow the United States and our allies into this new sea, set with jeweled stars. If we lead, we can be both strong and caring. If we step back, it may be to the detriment of more than our country.