

THE WORLD OF 2020 AND ALTERNATIVE FUTURES

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Introduction

One of the initial tasks accomplished by the SPACECAST 2020 participants in the Air War College, Air Command and Staff College, and School of Advanced Airpower Studies was arriving at a consensus on the key features of the far future. Equally plausible, but less likely, alternate futures emerged from the study of the future in a separate and later effort. This section contains four parts describing the five forcing functions molding the future world system; sources of future world conflict; the postulated future interdependency between the military and the civil-commercial sectors; and lastly some plausible alternative futures.

The Future Operating Environment

The objective of studying the potential scope and direction of the changes to occur on the planet in the next three decades was to try to understand the key features of the operating environment of the far future. These features were characterized as "assumptions" about the future. Although the project was called SPACECAST 2020, the study's vision was not restricted to the year 2020. The assumptions and projections made are probably descriptive of the period from about 2010 to 2050.

Many of the features on the future landscape are, or will be, important to space exploitation and control. The assumptions were intended to be useful in defining the boundaries of the national security challenges the US will face. Once the challenges were understood, the capabilities required to respond to them could be described. An understanding of the required capabilities fueled the search for the technologies to satisfy them. An awareness of the need for, and the effects of, some key technologies such as super computing, data fusion, artificial intelligence, directed energy, and inexpensive space lift emerged. Descriptions of the future operating environment did not include potential changes to the roles, missions, or functions of military organizations.

Five Forcing Functions Molding the Future World

Participants believe there are five forcing functions affecting the world system: the number and distribution of people on the planet; the world's geopolitical organizations and interactions; the world's economic processes; the effects of new technologies; and the constraints imposed by the natural environment. Each of these functions will affect US space capabilities in the future.

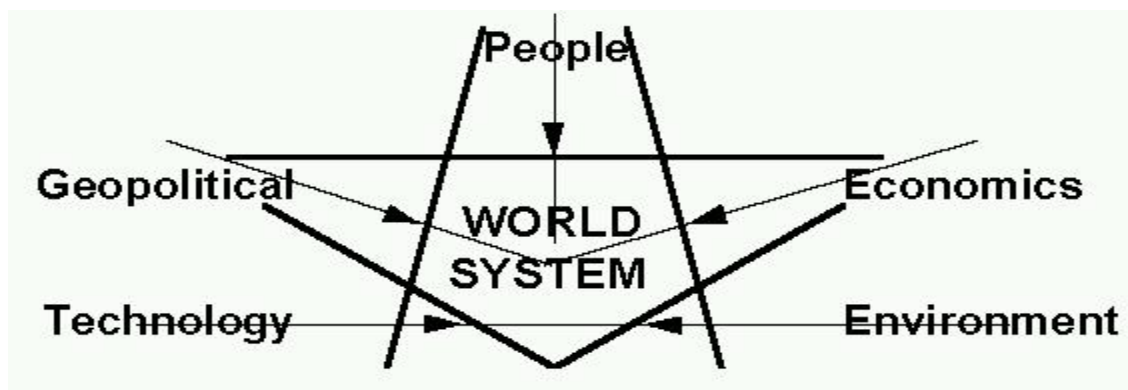




Figure 1. Forcing Functions

These forces are difficult to balance or keep in harmony because many are affected by the decisions of world leaders. In dealing with each other, the SPACECAST study participants concluded human beings have four options: they can cooperate and make the world better together; they can compete with each other, which may or may not make the world better; they can confront each other and negotiate changes to the world system; or they can fight, resulting in conflicts that might hurt or destroy the world system. Whatever the world community decides to do, the ultimate outcome depends on the character of the actors and their modes of interaction.

For the world, these actors are the states and nonstate elements (such as transnational corporations, world organizations, religious movements, or extremist groups). These actors have a military dimension and a civilian dimension, and oftentimes these dimensions are inseparable. For the US and most other post-industrialized states, this area of fusion emerges in responses in four different media: land, sea, air, and space. The SPACECAST 2020 focus was in the medium of fusion called space.

People

Based on available models, the Earth's population is projected to grow from five billion today to over eight billion people by 2020. It will probably double to 10 billion by the year 2035, unless something stops the trend, such as a worldwide plague or another form of catastrophe. The greatest growth is expected to occur in the poorest regions, primarily in the equatorial and Southern Hemisphere countries. Many of the post-industrialized states, most of which are in the Northern Hemisphere, will see a graying of society. This graying will occur due to longer life expectancies in the North made possible by medical and biomedical technology and healthier lifestyles. In contrast, less industrially developed, poorer states (especially in the equatorial regions, in parts of Asia, and in the Southern Hemisphere) will see a young society dominated by teenagers and young adults. This phenomenon will be caused by higher death rates and larger birth rates than in the North. It will be compounded by poverty and the lack of access to education and advanced medical technology.

In post-industrialized states, there will be a significant expansion of the metropolitan/suburban complex. With rapidly expanding telecommunications and information network technology, businesses will not have to be located in the cities to operate. This migration is already occurring in the US today. It will increase significantly in the future. Resulting in regional centers having common concerns (such as transportation, pollution control, and water supply) which can best be handled through regional control. Microstates, similar to Singapore and Hong Kong, may also proliferate.

The labor force, primarily in the wealthy states, will seek and achieve higher levels of individual quality of life. The semi-skilled labor force will want increased leisure time with shortened workweeks and workdays. Its members will want to live in the areas where leisure time can be enjoyed to the fullest and where they can avoid the effects of inner-city crime. Wealthy states will have an increased percentage of the permanently unemployed, probably living as wards of the states. Many of these people will be unable to ride the fast train of a high-technology, computer-oriented society.

Finally, world culture will increasingly be influenced by nonstate associations. Religious extremists of all kinds will exert great influence on human affairs without regard for national borders. Transnational corporations (such as the automotive, fashion, and entertainment industries) will influence the cultural lifestyle. Various environmental groups will aggressively seek to change government and business behavior and the lifestyle and activities of people. The concept of the state will still dominate the geopolitical arena,

even though this arena will be in great flux. New and evolving "states" will result as a consequence of wars of ethnic self-determination, migrations to avoid social discrimination, economic hardship, internal war, resource appropriation or depletion, or the impact of climate variability. The end result of this social and political flux will be more world players, more variables, and more nonlinearity in geopolitical interactions.

Geopolitics

The world will be multipolar, with states loosely organized in regional confederations. The European Community, the Asian Pacific Economic Community, the Organization of Petroleum Exporting Countries, the Organization of American States, and, now, the trading confederation resulting from the passage of the North American Free Trade Agreement are all current examples of this emerging phenomenon. The US will remain a global power far into the twenty-first century because of its wealth, technological superiority, military power, and ability to build consensus among other states. Other great regional centers of power will arise to include Germany--especially if the European Community becomes a strong entity--as well as Japan, China, and perhaps Brazil and Russia.

Nonstate entities will continue to exert great influence. Transnational corporations, criminal and extremist elements, burgeoning private voluntary organizations, and nonstate-based political groups will overtly or covertly seek to play a major role in national and international policy decisions. The role of national governments will become more inwardly focused, concentrating on the welfare needs of their populations and leaving more of the world community concerns to a stronger United Nations or regional associations.

Economics

The world's gross domestic product (GDP) will double by 2020, assuming an average annual growth rate of 3.2 percent for the planet as a whole. The US will remain the world's largest national economy, but its percentage of the world's GDP could be less than the current level of about 22 percent. Trade agreements will become increasingly more important than state-to-state military alliances and treaties. There will be a strong belief that economic security is more important than military security. Because of the likelihood that transnational corporations will be linking the world's economies, international and national security will become interdependent and almost inseparable. The largest GDP growth is expected in the Asian-Pacific area. The twenty-first century will be the "Century of the Pacific."

Technology

High-speed, high-volume telecommunication technology--coupled with orders-of-magnitude increases in computer speed, storage, and capacity--will make possible the development of vast, interactive computer information data bases that are globally networked. With this technology integration, the vast knowledge of the world could be brought to the individual sitting at his or her own home computer. Adding virtual-reality technology, an individual at home could have the sense of being in another location, interacting visually with other individuals and doing things with them, without ever leaving the comfort of the computer chair. Microminiaturization of computer chips and nanotechnology, coupled with artificial intelligence, will revolutionize product development and greatly expand the use of robotics in daily life.

Information technology and supercomputing will facilitate understanding of the genetic architecture of life forms. By 2020, the world will be engulfed in the beginning of a genetic engineering revolution. This new technology will be used to improve our quality of life and medicine, as well as increase the food supply; however, it will also trigger many moral issues.

There is great promise that economical alternative sources of energy will be developed which will lessen the need for fossil fuels. New sources may come from cold fusion and the new hydrogen technology, as well as

vastly improved chemical and solar batteries. Technological research and development could harness energy from the sun by the way of orbiting energy-converter satellites. The satellites could capture the full force of the Sun's radiation, convert it to microwave energy, and transmit the energy via a directed beam to a power distribution point on Earth, where it is reconverted to electricity. Several benefits, including a cleaner environment and a nearly unlimited electric fuel supply, could be realized from this type of technological development.

Technological change will continue to be exponential. With advanced tools; increased creative opportunities; and continuing growth in discovery, storage, and dissemination the rate of change may be more rapid than at any other time in human history.

Environment

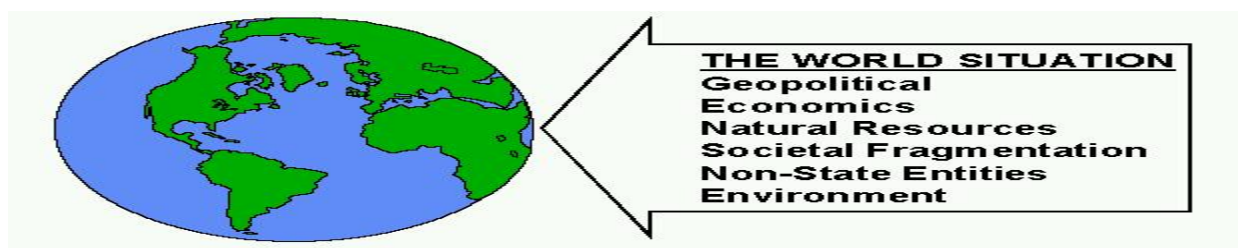
The last forcing function shaping the world system is the environment. As the Earth's population grows, the stress on the environment will grow. Past civilizations have undergone forced migrations because of their abuse of the Earth's biomass, primarily from overcultivation and lack of land conservation. With the growth of the population being the highest in poorer countries, there will be significant increases in environmental pollution in these areas. This will further decrease the quality of life of poor states and reduce the available biomass for population consumption.

The average weather for a region will see increasing variability due to human-induced changes in the environment, such as extensive irrigation, overcultivation allowing more dust to enter the atmosphere, increasing carbon dioxide levels in the atmosphere, and increased cloudiness due to air pollution. Some regions may experience extreme climate changes, which could impact the water and the food-producing capability of a region.

The depletion of natural resources will continue to be a concern as the population grows. Most critical will be the availability of fresh, uncontaminated water. A severe drought lasting several years can throw a region into chaos and force the migration of large numbers of people. Wealthy regions will be able to overcome these situations, but poorer regions will have much more difficulty. Contamination of fresh water will continue to increase, especially in the poorer countries. Populations migrating to find food, water, or a more hospitable environment will, in turn, force other environments out of balance.

Future Sources of World Conflict

The future world will not be balanced. The cause of this imbalance will be a significant gap between the "haves" and "have-nots" or "have-lesses" of the world. Large portions of the world will become very high-tech, more materialistic, and somewhat selfish. Wealthy countries will seek increased levels of comfort for their people and will strive for the gain of wealth through the control of knowledge. These countries will make attempts to help the poorer regions, but these attempts will often be ineffective. The populace of wealthy states will resist personal self-sacrifice. People will be very cautious of entering into any venture that may adversely affect their personal well-being. This means they will be more reluctant to support national policies if they believe they will adversely affect their pocketbook and if long-term personal benefits cannot be perceived.



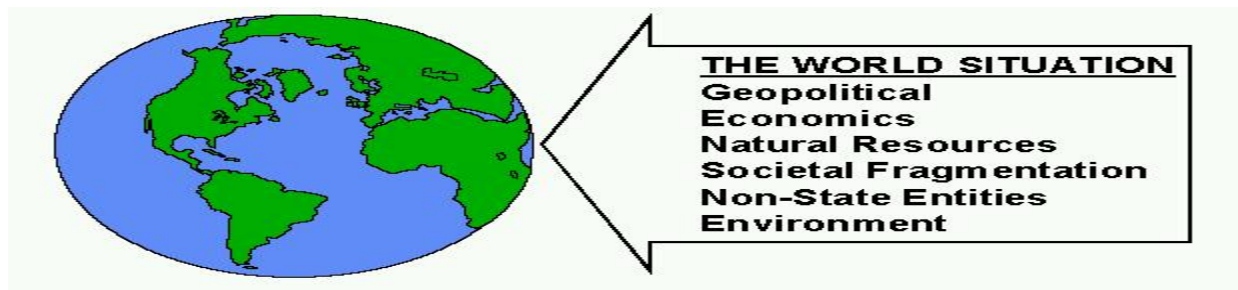


Figure 2. Issues Shaping World's Situation; Potential Sources of Future Conflict

A crisis in values may also occur due to the rise in individualism caused by the immense access to information technology and the pursuit of happiness of the wealthy labor force. Public concerns, such as education, transportation, law enforcement, and medical care, may conflict with the individual's desire to pursue wealth. This force will affect other areas in the future.

In the US the *will* and *character* of the American society will provide strong influence for US space control and exploitation. *Americans will support a more vigorous space program only if they see economic benefits coming to them personally and/or if the space program protects the state and their way of life from a perceived threat.*

Traditional sources of conflict, such as territorial ambition, regional rivalries, and ancient ethnic or religious hatreds will not go away. Other factors may become even more important in the twenty-first century. The increased prominence of economics in national security could also increase its role as a source of conflict. The belief that economic security underpins and is more important than military security will grow. Rivalry between economic blocs will spark conflicts, some of which may become wars. The gaps between the rich and poor will grow, as will the tension between the groups. Because of these shifts, rich countries are not likely to invest in space unless there is a benefit to economic as well as military security. Space investment for national security will, therefore, need to have commercial applications to be viable. Countries which cannot afford to invest in space for either commercial or national security purposes may be among the "have-not" countries of the twenty-first century.

Resource limits may lead to competition and perhaps conflict. Those who "have-not" or "have-less" may come into conflict with those who "have." Resource management leveraging monitoring from space could help to alleviate some of these resource problems. The fragmentation of societies and the differences between racial, ethnic, religious, political, or special-interest groups will cause conflicts within states and between states. New states will arise out of wars of ethnic self-determination. Today's "family" of 170 to 180 states will increase to perhaps as many as 250, with most new states forming along clan, tribal, or ethnic lines in the regions of Eastern Europe and Africa. This proliferation of states and groups on earth will present an additional monitoring problem for the US. More space systems will be required to be aware of and perhaps influence world events.

In the twenty-first century, states will not become irrelevant or obsolete. However, the number, influence, and power of nonstate actors will continue to increase. The number and power of criminal, ethnic, and religious groups will also increase. Extremist factions will continue to exist. Air, sea, and land piracy, smuggling, trafficking in outlawed goods, blackmail, theft of information, industrial espionage, technology sabotage, and other activities will bring states into conflict with nonstate groups. Armed force, violence, and terrorism used by nonstate groups will continue to pose a threat to states. Weapons of mass destruction and the means to deliver them will proliferate. The global situational awareness provided by space forces can help with understanding the movement and activities of these hostile state and nonstate groups. Above and beyond the inherent advantages of monitoring the activities of single states, global situational awareness can help us stay ahead of nonstate groups by identifying linkages between the separate terrorist or other "cells"

scattered around the world.

Environmental noncompliance, including violation of nuclear and hazardous waste disposal agreements and the violation of water rights, will be sources of conflict. Sensitivity to environmental threats will make world powers willing to use coercive means up to and including force to bring environmental dangers under control. The sovereignty of states in the future will include their perceived right to clean air and water. Multispectral systems will be essential for global monitoring of the environment. States will use space systems to fix blame and liability on violators.

Future Interdependence between the Military and Civil/Commercial Sectors

There is an area of fusion or overlap between the range of civilian and military responses to the new world, specifically in the medium of space. States with affordable and as-required access to space will have commercial and military advantages over those who do not. The great powers will remain great in the next century only if they have assured access to space.

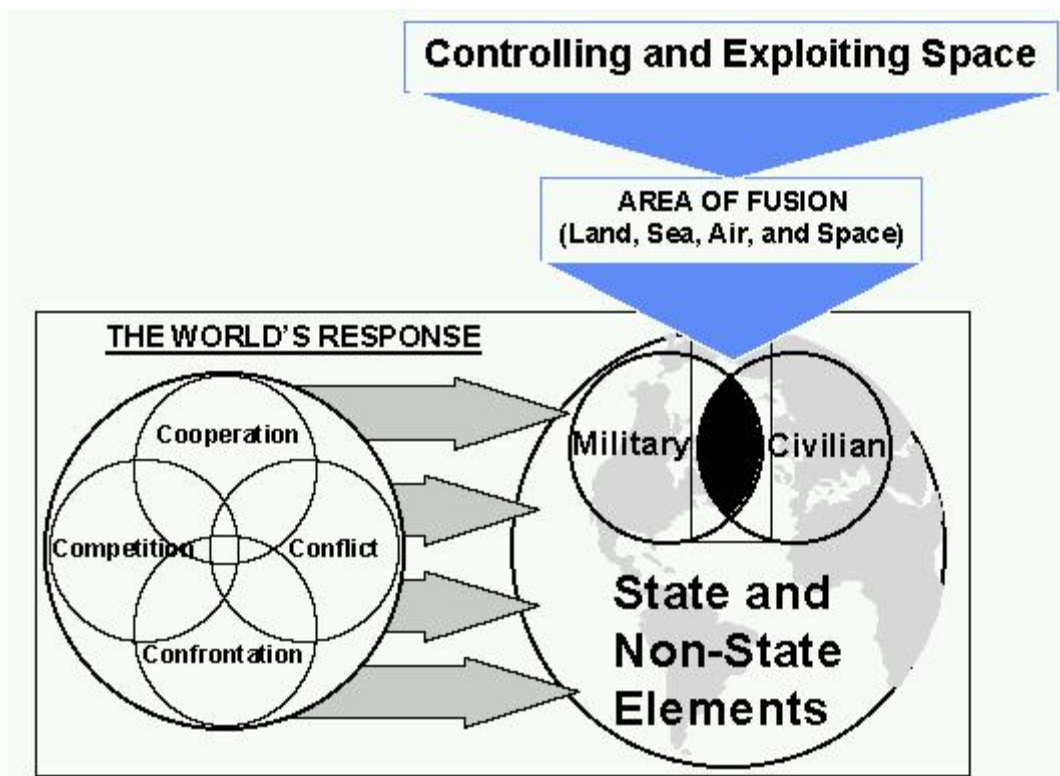


Figure 3. Controlling and Exploiting Space

The world will see orders of magnitude improvements in many areas. Lightweight materials and improved propulsion technology will give the US and other states affordable access to space. Artificial intelligence systems, supported by supercomputers, will use fused information derived from space systems to automatically generate threat forecasts, courses of action, and best responses for consideration by human decision makers. Onboard supercomputers, improved sensors, and satellite proliferation caused by reduced lift costs will make space systems less dependent on ground infrastructures for tracking, telemetry, and satellite control. Directed-energy weapons can permanently or temporarily disable satellite functions and will probably be the preferred antisatellite weapons technology for wealthy states.

As the US proceeds into the next century, resource constraints may cause civil, commercial, and military space activities to converge with increasing military use of civil/commercial space applications. Distinctions

between military and commercial space systems will continue to erode. An increased number of military systems will be military only because of the ways in which the military manipulates, fuses, and uses the data provided by commercial systems. The military will cooperate with and rely on the private sector to provide more or most of its space capability for computing, communications, navigation, weather, and Earth resources sensing. Many scientific activities will also be useful for commercial and military purposes. Exploiting these synergies could help develop technologies and operational concepts for national security applications. Civil remote sensing for national security purposes will continue.

Resource limitations may provide opportunities for cooperation between the Department of Defense and nonmilitary space organizations. On the commercial side, these activities or industries will benefit from the same advances in compact supercomputers, affordable lift, improved sensors, and directed-energy data transmission, as will the military. If economic security is seen to underpin military security, the success of these activities or industries will be necessary to guarantee America's place as a world power in the next century.

Affordable, as-required spacelift could provide the US as much surveillance; navigation; and command, control, and communications capabilities as it requires. It could also provide space systems that give the decision makers instantaneous awareness and virtual presence anywhere on the planet. Affordable lift could also give combatant forces small, commander-launched and controlled combat space systems for information warfare, electronic combat, precision weapon guidance, target identification and illumination, and up- and down-linking with unmanned aerial vehicles. Wealthy countries will consider their space infrastructure part of their sovereign territory and will develop robust antisatellite and advanced satellite defense technologies to protect it. Superiority in speed, position, and information will be the keys to dominance in combat environments. Much of this technology will be proliferated, however, and many states will have a deployed or breakout antisatellite capability.

Because of national dependence on space-derived information, space surveillance and control will become as important as airspace or sea-lane surveillance and control. An international body could assume more responsibility for space surveillance and satellite deconfliction operations. Coalitions of the great states may also operate space-based equivalents of the airborne warning and control or joint surveillance target attack radar systems to allow continuous observation of the Earth's surface to detect and deter hostile military activities.

There are other specific areas in which international cooperation in space could occur. With more and more states entering into the space arena, the need for deconfliction of orbits will increase. Orbital space debris is an increasing hazard to our activities in space. Debris in orbit, some of which is too small to be tracked by Air Force Space Command, presents a potentially lethal threat to space operations and has made some desirable orbits unusable. States need to seek a way to cooperatively control and collect space debris. Also hundreds, perhaps thousands, of asteroids travel in orbits that intersect the Earth's orbit. Some have struck the earth in the past and left large craters. Others have come very close. Action should be taken to increase the world's capability to detect and define the orbit of the asteroids as well as to deflect or destroy those asteroids predicted to impact earth.

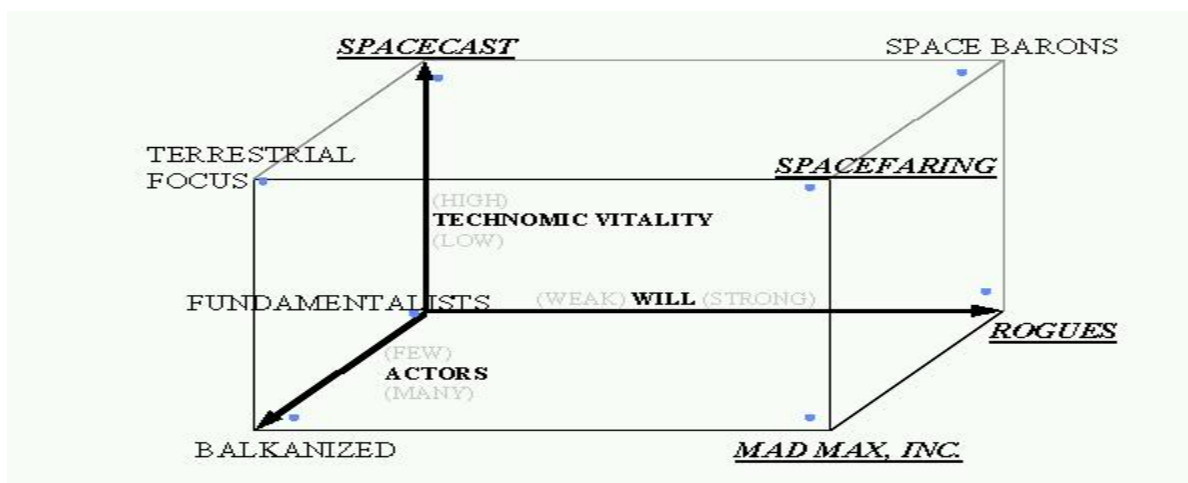
With the expected proliferation of nuclear weapons and delivery systems, there would be a need to deploy defensive systems capable of protecting important areas of operations by detecting theater, national, and international missile launches. States or nonstate elements could subscribe to the protection service. If economic interdependence is an expected characteristic of the future, cost-sharing partnerships should also be expected.

Alternative Futures

The discussion above was an outline of the future, as the SPACECAST 2020 participants saw it. In the process of brainstorming and consensus building, the participants identified a creative and fertile "rogue set." During the preparation period of the study, members were exposed to diverse speakers, who shared visions of a large number of alternative futures. It was important to develop and assess SPACECAST 2020 concepts and technologies within the context of alternate future worlds to highlight high-leverage ideas and to debunk risks. SPACECAST 2020 did that with a group of eight individuals from the SPACECAST 2020 team, led by Colonel Jae Englebrecht of the Air War College and supplemented by external assistance from the Futures Group. The Futures Group is an international strategy and consulting firm assisting in strategic planning and scenario development for corporations. Together this SPACECAST Alternative Futures Group developed scenarios, alternate futures or alternate worlds, terms used relatively interchangeably. Scenarios, intended for use as background for planning and assessing alternate strategic courses of action, are descriptions of future conditions. They describe a plausible evolution of important events and trends and present a range of possibilities central to an organization and its mission. Scenarios are not forecasts of what will be. They are ways to capture the breadth or range of future challenges and opportunities.

To build scenarios leading up to alternate futures, the group considered which "drivers" of strategic planning interest to the US would dominate the world. The group considered over 60 potential drivers, some of which included: political and economic actors in power centers; organizing principles of actors; the future vulnerability of data, hardware and transmission; terrorist disruption and disruptive potential; the degrees of cultural commonality and continuity that could be envisioned in the world; technology diffusion and proliferation; US competitive capability; interest groups and constituents; population growth in developing countries; the nature and extent of military alliances; political instability in the third world; centralized or decentralized power distribution; the relative economic strength of the US; the availability of energy and natural resources; the size of the US defense budget; the degree of regionalism; the degree of global economic integration; the degree of conflict; global economic capability; political and social will as it relates to space; biogenetic threats or havens; insufficient incentives to be involved in space; public infatuation with space; the locale in which military activities will take place; the type of weaponry available; and, world economic conditions. These drivers were later grouped by affinity as the planner brainstormed to decide what were appropriate factors to consider for the alternative futures scenarios. Three dimensions emerged: the number of actors playing a role in space; the will of the actors to use space; and the technological and economic vitality of the actors, or their "technomic" capability. Varying these dimensions to their extreme (few to many, weak to strong, low to high) yielded eight alternate futures.

The SPACECAST Alternative Futures Group identified these different worlds and named them. The group decided there were four alternative futures most relevant for planning purposes. These were a Spacefaring world, a Rogue's world, Mad Max Incorporated world, and a Space Baron's world. These were worlds in which more space activity or more desire to be involved in space were deemed most relevant or interesting for planning purposes.



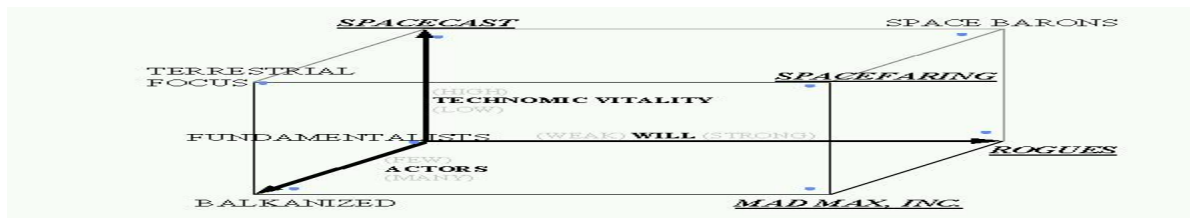


Figure 4. Alternate Worlds of 2020

The group noted that the Space Baron's world was very close to the SPACECAST 2020's most likely future. Scenarios were built for each of the worlds. These were internally consistent and included a plausible history logically connecting the future world with the present one. An examination of the four worlds allows awareness of the key features of many plausible future operating environments.

Spacefaring World

The first world is a Spacefaring world, a world in which there are many actors with a strong desire to be involved in space and with high technomic vitality representing the capability to be involved in space. Prior to 2020, there will be advances in communication and information interconnectivity and success of the Global Agreement on Trade and Tariffs (GATT), leading to a highly interdependent global village. The few remaining rogue states that may have inhibited development and spread of space and technological activity will have been swept away by dual waves of *glasnost* and economic activities. The competitive atmosphere among states and transnationals had leading to the early development of advanced space-launched methods, and cheap, reliable spacelift have become available from a variety of sources, which might include states and corporate barons. This fierce competition extends into the economic realm and into space, but it has developed in a fairly friendly and non-conflictual manner. As these events unfold, the military increasingly assumes the role of policeman and space-traffic controller. The entertainment and education industries respond to these developments by increasingly using space as a setting for both entertainment and education, continually sparking the imaginations of populations worldwide.

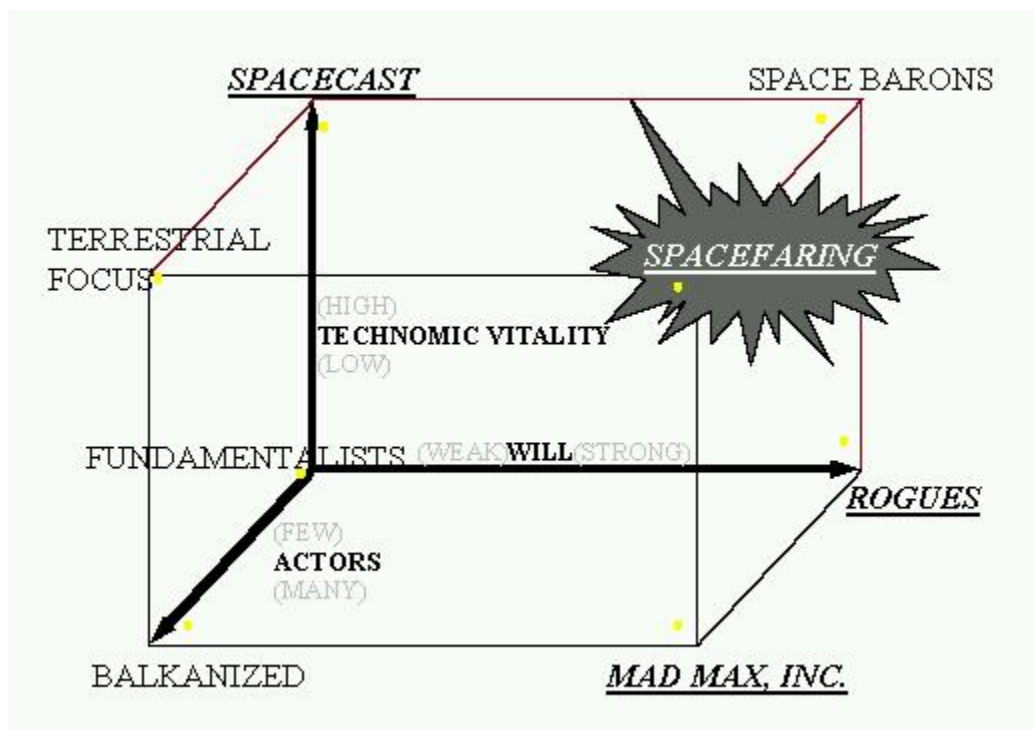


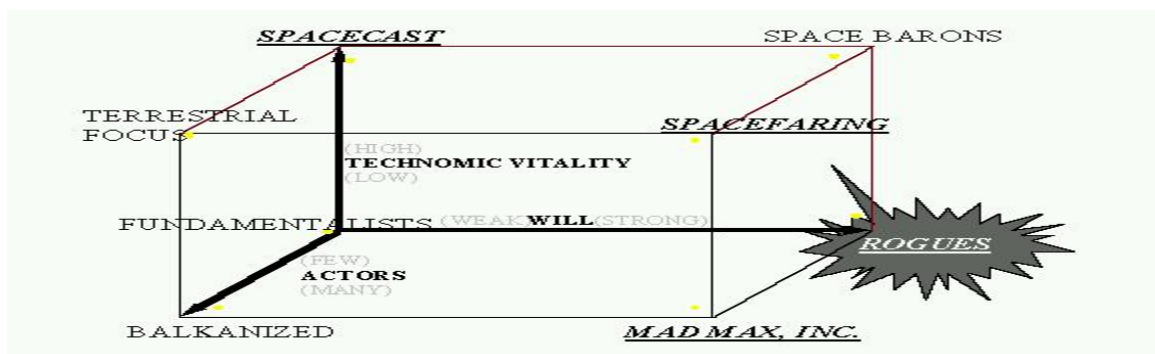
Figure 5. Spacefaring World

The features of this Spacefaring world are characterized by their dimensions; that is, many actor's, technomic vitality, and strong will all result in high involvement in space. Specifically, the government is one of many actors in the Spacefaring world where individuals, transnationals, and supernationals are all highly active and competitive within a stable interdependent environment. A Spacefaring world is characterized by free trade and a global industrial policy. Space investment is an economic reality with wide economic opportunity available to many. Global technology proliferation is a character and feature of this world, with space surveillance, communication, and cellular information nets proliferating. Energy is cheap and prolific, and advanced propulsion systems are available. Education is global. Cheap information technology is available for many. A strong will and desire to be in space is characterized and motivated by great economic opportunity and growth. Actors are interested in some cooperation in planetary defense. High imagination is another feature encouraging involvement. Space visionaries and entertainers and space tourism are standard features of this world. Political leadership encourages such growth, and its encouragement is evidenced by an adherence to space law and strong space constituent groups to encourage continued activity. The decentralized structures in this world are supplemented with sophisticated social service and social support services.

A Spacefaring world has unusual implications for the nature of space activity and the nature of the military role in space. In this world, space activity is proliferated, global, and expanding and the military is involved across the board, even though the militarization of space is limited. Counterforce activity is rated low when compared to other worlds. Many military activities are related to deconfliction and potential planetary defense. Logistics activities carried out by the military is rated low, in large part because this function is performed by other enterprises. Monitoring or reporting has a moderate requirement for the military use, but much of this activity is dual-use and will be expanding in both military and civilian sectors. The civilian and government role in space is very high, while the level of commercial involvement will be rated very high. Commercial lift is abundant and available and cost per pound for lift is cheap. Humans are common in space in this world. In fact, there are discussions and initial activity toward hotels and space stations in space. While the Spacefaring world has interesting implications for the US and the US military in space in the world of 2020 and provides a useful background for planning purposes, other alternate futures would present highly different and unique challenges.

Rogue's World

The second alternate future developed was called the Rogue's world. This is a world in which there were few actors with a desire to be in space and limited technological and economic capability, but the will of some actors to be involved in space will be very high. The history leading up to this world might be a failure of GATT, spawning an era of neoprotectionism and a world economic downturn. Advances in communication and information interconnectivity failing to overcome deep-seated prejudice and traditional cultural barriers. Fundamentalist and extremist Islamic states becoming closed, highly controlled societies in a quest for cultural purity. More than one Rogue state developing reliable indigenous spacelift, a demonstrated antisatellite capability, and a willingness to violate space law. This perceived threat brings renewed US emphasis on space defense and an increased military role in space.



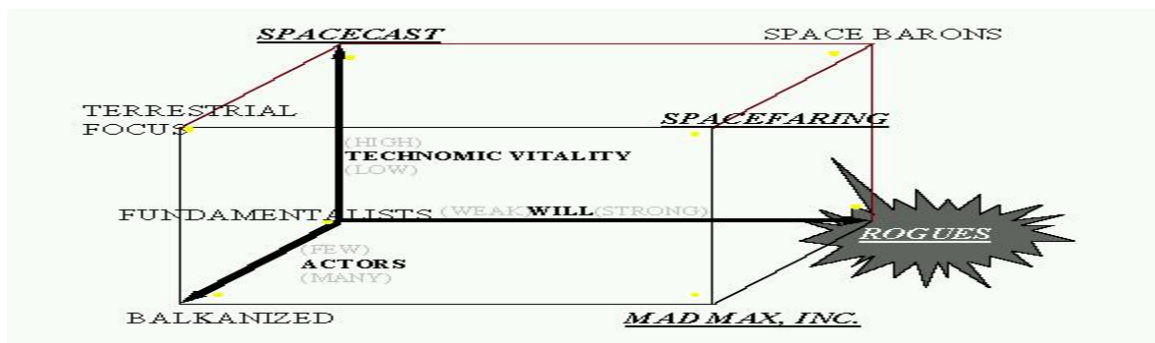


Figure 6. Rogue State(s) World

The features of this world are characterized by its dimensions: a few actors, low technomic vitality, and a strong will for involvement by some. The actors in this world are principally states and political actors. For example, some might have a totalitarian or a highly ideological state, and these Rogues will be seeking influence. There will be few entrepreneurs in this world, and it will be characterized by shifting alliances. The low technomic vitality will be characterized by tiered shifting economies, protectionism, and embargoes against the Rogues. These Rogues will be willing to sacrifice domestic needs to preserve national security and to receive the prestige associated with space activity. The technologies they will rely on will essentially be indigenous technology, and this world will have limited or little advanced propulsion. The propulsion and lift existing will be mainly military. Information in this world will be expensive and dispersed. Fiber optics will be controlled by the state as it attempts to control information to its population. Its population will be educated in an irregular fashion. The state might be motivated by a threat from some ideological or religious adversaries. These adversaries might have weapons of mass destruction in space. The perceived high value associated with space resources will provide strong incentives to protect space assets against a perceived threats. Political leadership will be key both in causing the Rogue state to take its position as well as to produce a response from the US. The nature of space in the Rogue's world will essentially be limited, but it will be perceived to be critical. The military's role in space will be on the rise. Counterforce potential will be very high, particularly with the development of ASAT. The military's logistics role in space will be moderate. Its role in monitoring and reporting will be high. The relationship between civilian and government activity will be weak and the amount of activity will essentially be low. The level of commercial activity is rated low. The cost per pound of lift will be slightly more expensive than is envisioned today. Spacelift will be government dominated. There will be no or limited human activity in space.

Mad Max Incorporated World

The Mad Max Incorporated world is a world characterized by many actors with a strong desire to be in space, but actors who are limited by very low technomic vitality. This world is very conflictual. The Mad Max Incorporated world history is characterized by a small nuclear exchange (not involving the US) and a resultant environmental nightmare occurring in South Asia. A devastating earthquake in California decimates the US economy and leads to mass internal migration. Post industrial states increasingly shift to social programs, environmental cleanup, disaster relief, and a complex internal regulatory environment. Multinational corporations, are quicker to recover than states, fill the void by privatizing many other former public sector tasks. Corporate and individual economic concerns lead to decreased clout for states and a further rise of multinational corporations. Many military forces, including space assets, were increasingly made available to the highest bidder in order to sustain their activities.

Space actors in this world are essentially corporations. Governments in the Mad Max World have become welfare states or welfare guardians. The highly regulatory environment with complex political and legal interconnectivity forces corporations to transcend the geographical constraints of government. The low technomic vitality is characterized by the continuous shifting of internal corporate resource allocations as

companies move money from state to state to meet their needs. Trade is moderate, and corporations are pursuing profits while states are focused on domestic needs.

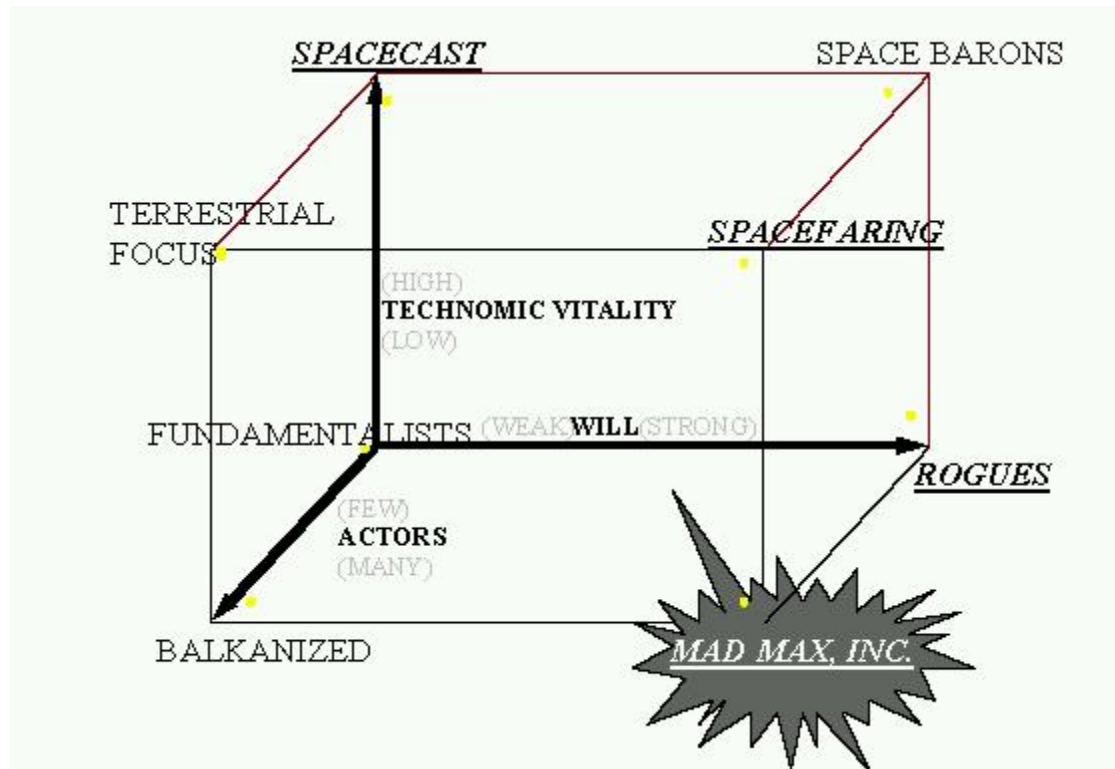


Figure 7. Mad Max, Inc. World

Technology and proliferation are irregular. There is limited advance propulsion, but some corporate lift. Information is irregular. States provide basic information, but sophisticated information nets abound. Information security is a prime value for corporate economic purposes. Education is provided by the state in its basic form, but corporate educational and training, or feudal universities, are developing in the Mad Max world. These actors are motivated to provide a corporate haven from the regulations in space. Resource and energy opportunities in space are driving the actors' activity. While wide-scale political and social space vision has been lost and corporations are seeking a niche in space, political leadership is being domestically focused on the tasks of welfare and protection of the environment.

The nature of space in the Mad Max world takes a commercial focus with military activity decreasing. Counterforce activity is very low and, to the extent that it exists, is chiefly corporate. Military logistics is very low and is commercially driven. Monitoring and reporting is moderate with dual uses, between government and military on the one hand and corporate business on the other. Civilian government roles are low to moderate. There is low civilian government activity versus high commercial activity. The cost per pound for lift is lower than it is today and is essentially commercial. The potential for humans in space is moderate in the Mad Max world.

Space Baron's World

The fourth alternative future developed was called the Space Baron's world. Space Barons are individual entrepreneurs involved in space. According to the plausible history leading to the Space Baron's world a single nuclear incident occurs prior to 2020, but states avoided World War III. States continually shift from military to economic competition. Increasingly, wealthy northern countries form several pragmatic alliances and consortia widening the gulf between "have" and "have-nots." High-tech alternate terrestrial options such as fiber optics slow the drive to develop advanced space systems. The lack of political will to be in space

opens the window to Space Barons such as Motorola, Microsoft, and CNN (Cable News Network).

The features of the Space Baron's world are represented by few actors, high technomic vitality, and moderate to low will to get involved in space. The players are states and corporate space barons. The US will dominate such a world but will not have a monopoly. The technomic vitality is represented by regional and transnational economic blocks. Space money will be subject to budget cuts, and military/civilian dual-use activities and projects will be important for conserving limited financial resources.

Technologies will be moderately proliferated, some advanced propulsion technology will exist, and information will be characterized by increasing local area networks. Education will increasingly integrate computers to assist in tasks. Will and involvement will be characterized by few states concerned about security threats, and a few space barons seeking economic niches and profits. Imagination will not evoke space images or encourage space exploration. Political leadership will be divided between an earth and a space focus. The social structure will essentially be democratic and multipolar.

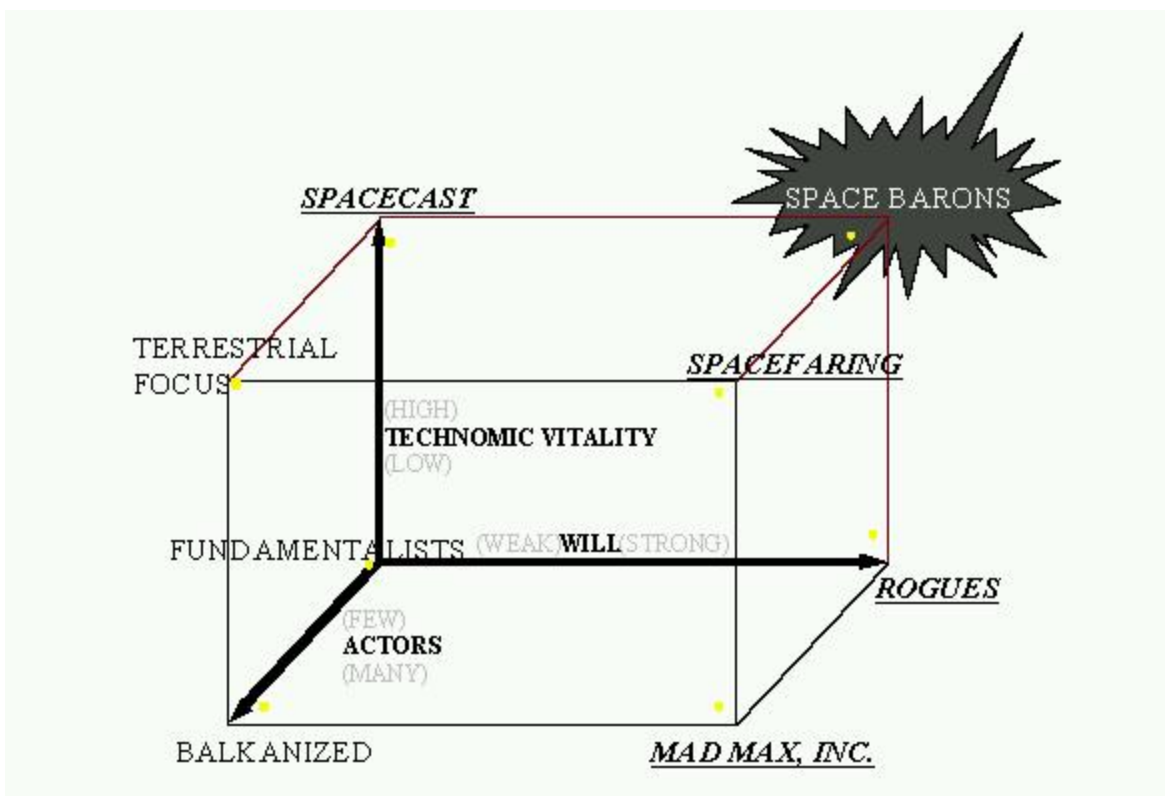


Figure 8. Space Barons

Military activity will support space logistics, counterforce, and monitoring and reporting from space, but all will be limited. Counterforce activity force will be limited. Logistics activity will be very limited, except for the space barons. Monitoring and reporting will be chiefly a military task. The level of civil government activity will be low. The level of commercial activity will be moderate. In terms of lift, the cost per pound will be slightly cheaper than today but no breakthrough in lift technology will be envisioned producing a need for cooperation between civil and military sectors. The potential for humans envisioned in our most likely future is low.

It is important to note the differences between the SPACECAST 2020 world and the Space Baron's world. Each world will lead to different space architecture's. If Space Barons dominate space development, research and development will produce systems designed without concern about hostile conditions and high vulnerability to attack. In addition, in a Space Baron's developed world, potentially there will be degraded US intelligence and communications caused by reduced abilities to collect against noncooperative targets. The

principle difference between the most likely SPACECAST 2020 future and a space world dominated by Space Barons will be who owns the space architecture.

Conclusion

SPACECAST 2020 teams used the different proposed futures to enrich their concepts, even though the SPACECAST 2020 concepts were not constrained by the above assumptions. The intention was to describe what the participants believe it will take for America to continue to control and exploit space. Thus, each of the future space world scenarios served as a vehicle for testing the concepts and capabilities having emerged from the SPACECAST 2020 studies. In this way, neither the technologies nor the social, economic, political, or military constraints and opportunities were developed in isolation. The constructs emerging were therefore more robust and viable than they otherwise would have been. The papers that follow, including the "Operational Analysis," used these futures to help develop and appreciate capabilities and to assess their utility across a range of plausible futures. By looking far ahead, SPACECAST participants have come to appreciate that we need not resign ourselves to being victims of the future. We can help shape the future we desire. The papers that follow describe creative ways by which we can shape the future.



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