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Foundations: From Geopolitics to Astropolitics

With its long and distinguished line of adherents and proponents, geopolitics ranks among the oldest and most recognizable bodies of written political theory. Yet it has atrophied in the modern era to such an extent that while almost everyone is acquainted with the term, scarcely anyone uses it correctly and fewer can precisely define it. In the United States, for example, geopolitical events are popularly understood to be issues and actions that take place overseas. [1] The term 'geopolitical' is so broadly construed as to be meaningless. This lamentable conceptual degeneration is due almost entirely to the defeat of the Axis powers in World War II. Nazi misuse of geopolitical theory through the German school of *Geopolitik* (to be more fully described later in this chapter), as a purposeful guide and moral justification for their particular brand of racist militarism, made post-war geopolitical studies—whatever perceived merits it may have once had—an academic taboo subject.

It is not just precision in definition that eludes us. Much of the theoretical focus of geopolitics has been lost as well. To be rigorous in our definition, then, we must recognize that geopolitics embraces several research schools, including some that have been in academic hiding but many that have flourished under different terms. In a convincing argument for the resuscitation of geopolitical theory into mainstream twenty-first-century academic discourse, Daniel Deudney outlines five overlapping clusters of historically recognized geopolitical themes. [2] These include: (1) *Physiopolitics,* a type of naturalist social science that sees man's physical and political development as the product of his attempts to adapt to his environment; (2) the German school of *Geopolitik,* the most notorious of the geopolitical theories and its most regrettable; (3) *Balance of Power* politics between states, in its most recognized form the term *Realpolitik* suffices; (4) *Political Geography,* separated from geopolitics when *Geopolitik* was at its apex, dealing with the effects of manmade borders and boundaries on human activity; and (5) classical *Global Geopolitics,* which attempted to incorporate the roles of transportation, communication, and technology into a coherent view of the political world. Ultimately, Deudney advances his own model, which he terms *Neoclassical Geopolitics,* or 'structural-fimctional security materialism.' [3] He uses this model to analyze the evolution of security practices in a world of changing material conditions. Though Deudney's model is not applied directly to the problem of outer space, his analysis pervades this manuscript, and the described movement of the geopolitical toward astropolitics follows the logic at Figure 2.1 (adapted from Deudney's description and Martin Glassner's more conventional 1993 model [4]).

Since the format of astropolitics is drawn from geopolitical predecessors, some precise definitions are necessary to set the terms of the argument. Making such distinctions is not simply a semantic exercise. Identification and categorization are the keys to knowledge.

It is epistemologically essential to construct or, as is intended here, add on to an existing field of theory. Geoffrey Parker has defined *geopolitics* in its broadest connotation masterfully. He calls it ‘the study of states as spatial phenomena, with a view toward understanding the geographical bases of their power’. [5] This definition simultaneously accounts for the object (states) and format (geocentric or global worldview) of study. Moreover, it accents the pivotal focus of interest, raw power, and suggests the hard realist paradigm with its *ultima ratio* of violence as the expression of state power. Geopolitics therefore has an implicit, and, for some modern theorists, an explicit emphasis on war. [6] Perhaps more eloquent in his definition than Parker, if not more exacting, Sir Halford Mackinder has stated that geopolitics *must* have ‘o correlation between the larger geographical and the larger historical generalizations’, so as to describe ‘geographical causation in universal history’. [7]

G*eodeterminism* (or for Deudney, *physiopolitics*) is the tenet that geographic location—influenced by such factors as climate, the availability of natural resources or endowments, and topographic features including mountains, plains, rivers, and oceans—ultimately decides the character of a population and the type of government and military forces that emerge. When the military planner accounts for the largest-scale effects of geography to influence decisions on deployment of forces, *geostrategy* is invoked (in Deudney’s conception, geostrategy is most nearly associated with *global geopolitics*, and to a lesser extent, *Realpolitik*). It is important to note at this juncture that geostrategy is concerned with the worldview, and is therefore quite distinct from tactical, operational, or conventional strategic military thinking (such as the ‘Art of War’ treatises of Sun Tzu, Machiavelli, Jomini, von Clausewitz, and innumerable military field manuals [8]). Ideally, geostrategists attempt to gain a global advantage over competing states. If they are unable to accomplish dominance for themselves, they invoke geostrategy to deny the geographically advantaged state’s potential domination through their own maximization of scarce geopositional resources.

Flowing from geodeterminism are theories of the *Organic State*. In this view, the state is reified then brought to life so that comparisons between living organisms and the social and political construct can be made. Generally employed to justify expansionist or state-growth policies, and in the modern era inextricably bound to notions of Social and Cultural Darwinism, [9] when combined with geostrategy the outcome is a necessarily competitive world-view. The state and people that best adapt within their geographic niche, in other words that state which in the cauldron of war emerges triumphant, is fittest. The clear connotation is that the state that dominates the world *ought* to dominate it. Nature demands it. The most radical of these theoretical hybrids was the German school of *Geopolitik*, a fully and (perversely) morally justified action plan for the domination of Europe by the mythical Aryan race expounded in the 1920s and 1930s. [10]

From these historic tendrils, we can draw out the proposed distinctions of *astropolitics*, here defined as the study of the relationship between outer space terrain and technology and the development of political and military policy and strategy. *Astrostrategy*, following the pattern already established, is the identification of critical terrestrial and outer space locations, the control of which can provide military and political dominance of outer space, or at a minimum can insure against the same dominance by a potential opponent state. Astrostrategy is the dominant theme of Chapters 3 and 6 of this book.

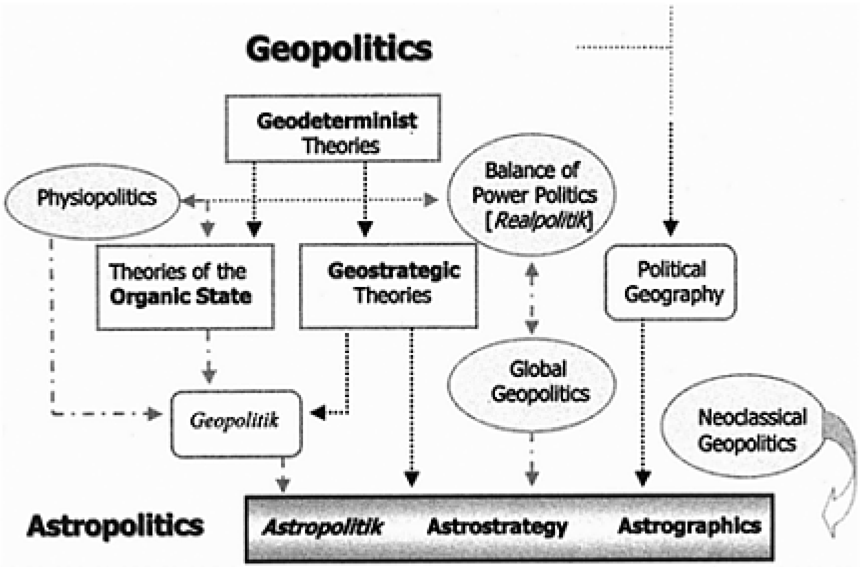

Figure 2.1: Geopolitics and astropolitices
Source: Adapted from D.Deudney and M.Glassner, *Political Geography*

Astropolitik, a term specifically chosen for its negative connotations, is identified as a determinist political theory that manipulates the relationship between state power and outer-space control for the purpose of extending the dominance of a single state over the whole of the Earth. It presumes the state that dominates space is specifically chosen by the rigors of competition as the politically and morally *superior* nation, culture, and economy. Should humanity ever drop the state-dominant model (unlikely in the near term, but probably inevitable in the long), unite as a species, and strike out for the cosmos as one people, *Astropolitik* would furnish the necessary blueprint for exploration and the moral justification for success. To be sure, one of the possibilities not discussed in depth here is how the discovery of extra-terrestrial intelligence would assuredly unite the entirety of the human race. In that event, *Astropolitik* would exchange its statist connotation and underpinnings for species-based ones. Humanity could in this manner be inspired by a modern version of manifest destiny to conquer space. Please note that *Astropolitik* is but one possible outcome of an ongoing astropolitical analysis. It is neither necessary nor inevitable; it is not sought after or desirable. But it is imperative that we never forget the insidious depths which the modern study of one subset of unbridled geopolitical theory ultimately reached, and if at all possible prevent a similar descent for astropolitics.

P*olitical Geography* is formally separated from the geopolitical emphases. It focuses instead on the man-made relationships between artificial conceptions of nation, state, and territory.[11] Political geography is therefore a subdivision of *human geography*[12] that studies the relationship between political boundaries and dynamic social and political processes. [13] It differs from geopolitics in that it does not inherently seek a nature-derived topo/geographically deterministic outcome. Artificially created human boundaries (for example, by gerrymanders) are generally far more interesting (and deterministic) to the political geographer than physical ones. In the present context, *political astrography* is the outer-space counterpart to the Earth-bound disciplines of physical and political geography. It is the description of the physical characteristics of outer space overlain with politically and technologically derived boundaries and features (such as the geostationary belt, the narrow band of space that allows a satellite in orbit to appear fixed above a given point on the Earth's equator) that is interesting. Unlike political geography, however, which claims no synergistic relationship with geopolitics, astrography is a foundational element of astrostrategy.

GEODETERMINISM AND THE ENVIRONMENT OF OUTER SPACE

The investigation of geographical influences on social and political development has been evident since antiquity. Astrodeterminism is merely the last in a logically coherent evolution of such thought. Deudney finds a reference he attributes to the Greek geographer Strabo that may be the earliest on record. [14] In his *History of the Peloponnesian War*, the Greek historian and political realist Thucydides clearly argues for natural imperatives driving the divergent developments of Athens and Sparta. [15] Its advantageous position astride natural trade routes and the agriculturally poor rocky soil of Attica compelled Athens to engage in commerce to satisfy its desire for growth. This necessitated dynamic contact with numerous and diverse cultures, in turn naturally leading to the development of a more open society, enamored with arts and education, and, of course, a maritime military proficiency. Alternatively, Sparta, located inland at the center of a fertile plain, found its desire for growth in direct competition with nearby agrarian societies. It naturally developed a martial tradition, conservative politically, and proficient in land campaigns, as it sought to dominate its neighbors and pacify its territorial holdings. Trade, the conduit for learning and wealth, and thus the foundation of a life of leisure, was unacceptable as a vocation to the Spartan warrior-citizen who spent his entire life in military training. The import of new ideas, especially the political notion of radical democracy, was a direct threat to the state, and Sparta is renowned for its conservatism and stability.

Without doubt, the geographically influenced and disparate reliance of the Athenian and Spartan civilizations on commerce and conquest shaped the character of their peoples and the structures of their states, but it is not the only determining influence we can perceive. A common theme of geopolitical theorists is the manner in which new technology is adapted to geographic imperatives, thereby becoming an intervening variable in the direct relationship between geography and politics. Although technology changes are more often associated with geostrategy, in the purely geo-determined world they also have a place, and so a brief historical excursion is inserted to make the point. In the Age of Classical Greece, the technological innovations most closely associated with changing political structures are the *hoplon* and the *trireme*.

The Age of Mycenaean Warlords (1600–1100 BCE) incorporated many of the same strategies, tactics, and organizing principles of contemporary civilizations of the ancient Near East and the Egyptian New Kingdom. [16] These were the dominant states of the period, and Greek militaries copied their successful innovations carefully. The rapid introduction and widespread distribution of bronze and then iron weapons technology created successive military revolutions throughout the Mediterranean and Middle Eastern regions. Complementary tactical and strategic innovations were developed for the introduction (and quick decline) of the chariot, followed by the rapid ascendance of the cavalry. Both horse-dependent tactics provided speed and shock unmatched on the battlefield. Horses were also quite expensive, and thus limited to the individuals who could afford to purchase and maintain them, creating a privileged class of knights who used military service as a path toward political power. [17]

In this age, war was the prerogative of kings, fought by and for the ruling elite. Most disputes between the petty aristocracies were settled in skirmishes of the nobility and their retinues, supplemented where needed by roving mercenaries. In larger conflicts, campaigns for significant territorial expansion and in defense of the same, where state survival might well be at stake, mass armies could be deployed. But arming the masses was widely recognized as a dangerous gambit of last resort. While heavily armed aristocrats were individually the most formidable element on the battlefield, they could succumb to sheer weight of numbers if the mass army's morale was high. For this reason, and usually only when desperation demanded it, the poorer classes of society could be pressed into light, unarmored, pike and shield-type infantry service, in tight though undisciplined mob formations. Training for these forces was limited, usually *ad hoc*, and specific to the battle at hand. Peasants, serfs, and slaves would of necessity be armed by the state, not having the economic wherewithal to arm themselves. They would be as lightly armed as possible, naturally, the best weapons being reserved for the nobility.

Middle-class farmers, tradesmen, and artisans were also occasionally pressed into service, but they generally equipped themselves with the highest level of armaments they could afford. This was a common and practical custom for the ancient soldier, regardless of his social or economic rank. In an age of swarming every-man-for-himself combat, each individual would be highly motivated to arm himself to the best of his ability. The alternative was to accept the state's inferior basic issue and huddle with the rest of the ill-trained mass of battle fodder, an unappealing option to any who could afford better. The well armed would have a greater chance of survival on the battlefield, and each survivor could expect to share in the available and allowable booty. The decision to purchase one's own arms was in this way not only practical, but could also be cost-effective.

Mercenaries were the preferred supplement to the state's noble forces. These included skilled foot and horsed archers, seasoned warriors on horseback and as heavily armed and armored infantry, and the most elite fighters, knights, and charioteers. Although the state could supply or supplement the mercenary's armaments, these professional soldiers were combat veterans who, like other master craftsmen of their day, were expected to maintain their own specialized gear. Indeed, part of their appeal was that they brought their own weapons, often of superior quality. More important, after the battle they were expected to take their pay and go home, effectively ridding the ruler or rulers of a potential armed internal threat. For reasons of battlefield prowess and efficiency, and not least of post-war internal stability, when they could be afforded mercenaries were always preferable to armed throngs.[18]

The prime concern of early military strategists was to get this hodge-podge army to the battlefield intact, well fed and supplied. Mass armies and individual knights fought in grand melee. Once blows were exchanged, little if any battlefield organization could be discerned. The leader of each side maneuvered his force into striking distance of the enemy; all the while, ballistae and archers harried the merging forces. Battle was joined when the leader of one side or the other recognized a tactical advantage, and gave the order to charge—or when the masses of infantry and cavalry, working themselves into a seething bloodlust, could no longer be held back. Upon release of an opponent's force, the options for the receiving side were to stand fast, break, and retreat, or charge in response. In the latter event, each side attacked the other in a sudden crash, intent on overwhelming the opposing force and sending it into flight. This style of combat was undoubtedly terrifying. Discipline and morale were the sole means to overcome it and prevail.

The preceding description succinctly characterizes civilized Greek warfare in the age of the Trojan War. With the demise of the Mycenaean and Minoan civilizations, after a series of barbarian invasions by northern tribes, the Greek region entered into a profound Dark Age (1000–800 BCE). Links to the Near Eastern military tradition were severed. Greece, finding itself in a political, cultural, and military backwater, reverted to a primitive if unique style of *heroic* warfare. Impressing poorer classes into mass infantries stopped. Battles during the period were characterized by groups of aristocratic champions facing each other in single combat, and were 'fluid, free-for-all encounters in which the great aristocrats of one state dueled with those of another'.[19]

The principal change in strategy during this period was a decrease in the already poor ability to wage war offensively, or at any distance away from the politicomilitary center.[20] Defensive capacity reigned supreme as once-extensive communication and transportation nets were degraded or destroyed. Dark Age Greece, in terms of military organization and strategy, closely resembled Dark Age Europe some 1,500 years later. In this power deflation and political retrenchment, anyone with the might of arms could carve a principality from the rugged terrain of Greece. A dispersion of political authority from king to warrior-lords fragmented the ancient monarchies, and the military aristocracy grew larger as the old hereditary one declined. The lot of the Greek farmer, too poor to arm himself with the newer iron weaponry and now tied directly to the land in a feudal relationship, degenerated miserably. In this dark time the distribution of *political* power was easily discerned; it was simply held by those having their own equipment for war, and a predisposition to use it. Indeed, the very notions of Greek warrior and nobleman in this way became synonymous: 'The "nobles" of 800 BC were simply those who had weapons and horses, with experience of how to use these. With these things they were able to make lesser people obey and to ensure possession (and ultimately legal ownership) of lands and other forms of wealth in their own families.'[21] The entire Greek military structure was aligned to favor authoritarian political outcomes. 'The net result [was] that about 900 BC the individual had almost no rights, being absorbed in a totalitarian kinship group, in a system of such groups with no state and no real idea of public authority.'[22]

From this violent period of totalitarian dominance, the world's first known post-primitive democracies emerged. By 450 BCE, the poorest residents of the most powerful city-states would reach a zenith in personal rights, liberties, and responsibilities. The historical record shows that profound military structural reorganization, prompted by topographic and geopolitical realities, preceded and directly contributed to the astounding political reversal.

The heavily armored *hoplite* infantryman, operating in a closely coordinated mass formation called a *phalanx*, is the military innovation that most clearly effected this remarkable transition. Precise dating is difficult, but the phalanx formation probably developed between 750 and 650 BCE in the Greek settlements on the Aegean coast of Asia Minor. [23] The dramatic success of the new style of armaments and battle against the older methods of the mainland Persian armies ensured its spread to peninsular Greece by at least 700 BCE. The critical point to be made is that subsequent to the introduction of the hoplite phalanx, and within a remarkably short period, Greek political institutions began radical reforms. Lykurgous, founder of the Spartan Constitution, enacted his political reforms in or about 675 BCE. [24] Solon, Athenian democracy's great lawgiver, was chief magistrate beginning in 594 BCE. Although his reforms were superseded by the succession of tyrants who followed him, Solon's actions were generally reinstituted upon the return of popular government, and his reforms are generally regarded as the foundation of Athenian democracy.

By 700 BCE, the Greek world had progressed commercially and industrially so that a significant percentage of the population outside the established aristocratic kinship groups could afford to equip themselves with the best available iron weapons and bronze armor. These turned out to be the helmet, shield, leggings, and pike of the hoplite infantryman. As increasing numbers of individuals acquired not only the panoply of equipment that marked a warrior, but the retinue that carried his provisions and sustained him on marches, they began to assert themselves politically. The difference was that the hoplites asserted their claims as a group, not as individuals. Bands of well-trained and disciplined foot soldiers working in concert were able to defeat the mounted knight who so clearly represented the old aristocracies, but only if they relied upon and worked closely with each other. [25] This fusion of individuals into a coherent whole represented the kernel of the democratic ideal. The cohesion of the whole mass of men counted more than individual heroics. The Homeric Kings, who went out before their people to challenge their equals in single combat, had no place in the phalanx; pre-eminent strength, beauty, and swiftness of foot were no longer the first qualities demanded of a leader.' [26] A dominant leader was, in the age of the phalanx, a master tactician and organizer rather than a battlefield hero. The catalyst that ushered the downfall of the traditional nobility was a drastic change in warfare tactics, based on a very minor change in weapons technology.

As has already been described, combat since the Dark Age of Greece consisted of individualistic sparring. Warriors rode onto the battlefield, dismounted (the stirrup had not yet been invented, making horseback combat precarious and a blow from a rider considerably less forceful than one from a well-based infantryman), threw some javelins or other projectiles to harass and disrupt the enemy, moved quickly to engage an opposing warrior, and fought until one side capitulated or fled. The shield of the warrior had a strap at the center for battle, and a sling for carrying the protective instrument over his back, decidedly valuable in the event of a retreat.

The phalanx style of combat was entirely different. The heavily armed soldiers making up the phalanx were named after their particular shield, the round *hoplon*. An innovation in holding the shield allowed it to be heavier and integrated into the mass of the formation. The shield was smaller than previous ones, but instead of one handle it had two—one at the center for the hand and one on the side, where the arm was inserted up to the elbow. The soldier could now carry more weight in battle. The hoplon was smaller but heavier than its predecessors because it was covered entirely with metal. Previous shields, normally made of wood, were ringed with metal edges and usually incorporated a small metal disk mounted at the center front. The hoplon shield allowed a warrior to absorb an enemy's blow with the full strength of the arm, and to push with it, making it an auxiliary weapon. Conspicuously absent was a sling by which to throw the hoplon over one's back for protection in retreat. This was an intended advantage for unit morale. The only option the hoplite had to facilitate a panicked retreat was to drop his shield and run, unfettered but also unprotected. His chances of survival were maximized by his remaining in solidarity with the mass.

Another important change due to the hoplon was in its impact on coordinated drill and battlefield cooperation. The hoplon shield was small and protected only the left two-thirds of the body, leaving the right side somewhat vulnerable. The tactic employed was to march in formation with each soldier's right side protected by the overlap of the next soldier's shield. This led to an instinctive and powerful sense of reliance upon one's associates for protection, and must have added immeasurably to the hoplite warrior's sense of group loyalty. This artificial type of kinship, based on battlefield association instead of blood ties, was a powerful bond found in the military experience, and it fully transferred to civilian political relationships after battle.

Of course, if everyone is protecting the person to his left, the rightmost file had no protection but its own sword or pike, and so the formation had a tendency to drift to the right as it moved in battle. This helped bring about a sophisticated set of coordinated maneuvers to maintain control of tactics to overcome the problem. Military science was enhanced by the phalanx as doctrines for group weapons employment and movements had to be developed, tested, and employed. Properly and intensively trained groups of infantryman could use the force of combined mass to their advantage, countering the strength of any individual warrior no matter how strong or skilled. While battlefield tactics advanced considerably, the actual engagement still consisted of two sides moving toward a great collision of arms. The side that could put more force into its charge would generally prevail, and mathematical formulae were posited to maximize combined energy. The effectiveness of the phalanx was determined by its depth. While the front row was too occupied to lock arms and push, subsequent rows were not so constrained. They would heave and push on forward rows, shouting encouragement all the while. The resulting image is more that of rugby scrum than melee, a not inappropriate illustration. In this way, too, all members of the formation were necessary and valuable to ultimate victory. All members had equal responsibility for success, whatever their positions in the formation.

The phalanx owed its dominance in part to oddities of the Greek terrain and culture. Rugged mountains isolated the valley battlefields of Greece. Cavalry could not maximize its strategic movement, and so was rarely decisive. The common history, language, and culture of the Greeks tended to make warfare a relatively civilized (if somewhat irrational) institution. Battles were fought in open and flat terrain. Ambushes were unheard of. Rules of engagement were for the most part observed and maintained. But the reasons for developing the hoplite formation are far less important than the subsequent political development that was influenced by it. The key point in the rise and routinized employment of a coordinated infantry formation tactic was that group victory, not to mention *individual* safety, now no longer depended on individual prowess or courage or other heroic capacity. It depended entirely on tight discipline and *group* cohesion. The battle experience of the nobility was wasted against a determined formation of hoplites. [27]

The phalanx as a type of coordinated pike infantry tactic was not original to the Greeks, though they may have been completely unaware of its predecessors. Yigael Yadin observes that a phalanx-type formation, complete with shields and coordinated pikes, had its antecedents in Sumerian warfare. [28] The Stele of Vultures (*c*. 2500 BCE) shows a formation of soldiers marching in step behind locked rectangular shields and presenting a formidable array of joined spears. [29] That this type of formation was used is not surprising. It is a straight-forward tactical innovation that any intelligent general should have been able to design. What is surprising, given its presumed battlefield superiority over disorganized groups of individuals, is that in Sumeria, as in every other place it may have been tried before being institutionalized by the Greeks, it was quickly abandoned.

The only rational explanation for abandoning such an effective military formation is that the ruling elite of the great despotisms of the Ancient Near East could not allow the political and social upheavals associated with a phalanx-type military. In discussing the Stele of Vultures, Robert O'Connell observes: 'They are clearly people with a stake in society, the very types necessary for a style of warfare which demands that the participants fight at close range and face danger in a cooperative fashion.' [30] In Greece, there was no central imperial authority that could perceive the danger the phalanx-type formation posed to concentrated rule and effectively halt its deployment. Moreover, emerging Greek notions of *polis* citizenship, increasing as the size of the military-based aristocracy increased, helped solidify the relationship between military service and political rights.

If terrain and geopolitical imperatives influence the development of military technology, which in turn can impact the subsequent development of political structures, then technology is properly an intervening variable in the geodetermined evolution of the state. The interesting question to be posed now is, since so many states used the phalanx, why was democracy so uniquely radical in Athens? To be sure, some level of political power dispersion existed everywhere the phalanx was in use for more than a generation, and the power was dispersed directly to those who served in the formation. But Athens' infantry was no larger relative to its population than that of most other Greek city-states. What critical component added to its maximally broad diffusion of political power?

The answer lies in Athens' extraordinary reliance on naval power. While most Greek city-states had navies, Athens alone had outgrown its ability to feed itself—owing, as Thucydides explained, to its poor and rocky soil (see above, p. 16). Without trade to bring in foodstuffs and other essentials, Athens simply could not survive. In the Mycenaean and Dark Ages of Greece, military ships and fleets were used exclusively as an adjunct of supply and reinforcement. They moved troops and victuals, and were primarily trade vessels pressed into military transport service. It was the Phoenicians who developed the first war galleys. These ships were devoted solely to naval operations, but were still primarily used for transport and occasionally for maneuvering to the side of another ship for boarding. Sometime quite shortly after the development of the phalanx the Greeks perfected the *trireme*, a long and narrow multi-oared craft designed for high speed, maneuverability, and ramming. We know very little about the trireme physically, none have survived, but ancient descriptions of the craft give us a fairly good sense of its capabilities. [31] It was fast and deadly, unmatched on the seas—the trireme quickly became the Greek's naval fighting vessel of choice.

Two techniques for naval combat then predominated: boarding, in which ships would negotiate near enough to an opponent so that boards could be slung from deck to deck and hoplite passengers would engage directly in land-style hand-to-hand combat; and ramming, in which one ship would propel itself toward another, employing its heavily armored prow to crash through the opponent's hull. Both techniques required a tremendous amount of skill, coordinated rowing, discipline, stamina, and morale. Unlike trading or transport vessels, which required quality officers but unmotivated, even disinterested labor for propulsion, the trireme required highly skilled and inspired rowers to achieve a combat advantage. Just as in land combat, rabble and slaves (in this case as oarsmen instead of foot soldiers) were not as effective in naval battle as trained and highly motivated freemen. The same psychological urgings of morale and teamwork that influenced hoplites to seek democratic political institutions acted on the trireme rower, but in an even more egalitarian fashion.

Quigley notes that in the debate over which tactics were preferable in naval engagements, democrats tended to prefer ramming while oligarchs went for boarding. [32] This is in part because oligarchs believed in the superiority of the individual combatant, and boarding agreed with their view of the navy as merely a conveyance to and from battle. Theoretically critical, despite the fact that the individual hoplite was the combatant in boarding operations, the phalanx formation could not be employed in ship-to-ship battles. Hoplites fought alone, an advantage for the style of heroic warfare in vogue in pro-authoritarian military organizations. Democrats preferred ramming because it required more sophisticated rowing and maneuver, says Quigley. It thus elevated the importance of the rowers, effectively making them integral combatants and not merely a labor source. Democracies in this period were unhindered in using their abundant supply of free citizens as rowers, while oligarchies had to coerce servants and serfs, or hire mercenaries, to do their rowing for them.

But Athens did more than tap into its free citizenry for rowers. Its extensive need for naval vessels meant it had to expand its citizen base to load its many hulls. For this reason alone, Athens became renowned as particularly adept at the art of naval battle. Athenian ships, unit for unit, were unsurpassed, and by the time of the Persian War, Athens had already developed the world's largest and most powerful combat navy. Probably some 4,000 oarsmen were needed to operate its ships. At the height of Athens' naval capacity during the Peloponnesian Wars, up to 10,000 rowers may have been trained and employed. [33] In Athens, unlike anywhere else in Hellas, the oarsmen were recognized as being as vital on water as the hoplite was on land, and were thus accorded equal privilege and political status.

The most far-reaching Athenian innovation in naval warfare stemmed from the recognition that poorer elements of society were being called on to shoulder a full share of the burden for the states' military and political autonomy, and were forced to provide a vastly disproportionate share of their personal resources in order to do so. Athens remedied the disparity by providing all citizens with a pike and hoplon, and for the first time on record paying wages for combat sailors. This was a remarkable innovation for its day, coming at a time when Athens did not and would not pay for land or sea mercenaries (still relying solely on un-reimbursed citizen volunteers to fill the ranks of its phalanxes until the ill-fated Sicilian expedition), and at a time when it had no form of compulsory military service to draft for its needs. To be sure, military participation was expected. It was a sign of vibrant political participation, but it was not mandatory. Thucydides goes so far as to have his hero Pericles say that a man who ignores politics to concentrate on personal welfare is a man who has no business in Athens. The philosophical problem was that a poor citizen living at subsistence might show the highest patriotism and desire to serve his polis, but might not have the means to arm himself and do so. All of his productive time would be spent in the pursuit of sustenance for his family. Volunteering for naval service was possible, since no armaments needed to be purchased, but to do so meant that his family might starve. With the introduction of pay for naval service (only), even the poorest citizen could now fully participate in the defense, and hence the politics, of the city-state. Indeed, pay for service became an attractive option to civilian pursuits, and many citizens were able to make more in military service than in private life. The result was that a vastly greater number of poor citizens were taking up arms and fighting for the polis than rich ones, and so gaining a proportionately greater share of political power. Not only was the fleet and its unique manning requirements a spur to democracy, it became a bulwark for it. Thucydides reports that when the Athenian Assembly panicked after the failed Sicilian expedition, and the so-called Council of Four Hundred was established to rule as an oligarchy, the Fleet refused to comply, and forced the return of democracy to Athens. After the Persian Wars, and until its subordination to the Macedonian armies of Alexander, the Athenian state was a 'sailor's republic'. [34]

Applying new technologies in familiar terrain has marked the evolution of geodeterminist and geostrategic thought, but we have just scratched the surface of variations on this theme. Before discussing the potential structural impact on political institutions of space technology and military strategy, the thread of geodeterminist theory must be followed. The Arab philosopher Ibn Khaldûn examined similar geo- and topographic features to Thucydides, and asserted that they, along with climactic variations, could be used to predict the number, size, and moral character of peoples and their governments within a given region. [35] For example, a flat open plain, like that of Mesopotamia, favored military expansion and control, thus prompting the establishment of large empires. Rugged terrain split by mountains and water made sweeping land campaigns difficult, and numerous independent states could be anticipated in this alternate environment. Contradicting Thucydides, Khaldûn argued that fertile soil and a temperate climate tended to create a population that was given over to abundance, easy living, and sumptuous architecture (Sparta was a distinct martial anomaly). Harsh climate and rugged terrain tended to instill appreciation for the soldierly arts and an independence of spirit.

Following Khaldûn's lead, Arnold Toynbee effectively represents the many geodeterminists who place climactic factors at the core of geopolitics. [36] Toynbee maintained that the existence of climactic harshness was imperative for the development of civilization, for without it people cannot be expected to toil with the purpose of overcoming their environments. A harsh winter climate forced a people to be industrious, congenial, and forward-looking, as they must work together and save for the colder months. Once ensconced in the compulsory inactivity of winter, the arts and letters would flourish as these hardy folk passed time constructively. To the contrary, he argued that an easy climate and abundant foods allowed individuals to remain socially independent, discouraged saving for the future (necessary for the development of abstract thought and hence the literary and fine arts), and thus limited intelligent discourse.

It is easy to see how the geodeterministic model leads the casual observer to see an argument of social superiority implicit in the geographically preferred society or identity group of the author. While Toynbee's analysis appears to explain the geodetermined surety of the rise of Europe and the domination of European culture, innumerable similar theories can be found in opposition. Malcolm X, for example, argued that climatic harshness made the Caucasian races cold and distant, harsh in their relationships with each other, and completely untrustworthy. [37] The advantages of a milder year-round climate in more southern regions allowed peoples of color to develop in a more socially oriented, family-friendly, and trustworthy manner. These arguments have been taken up by Leonard Jeffries, among others, and have spawned a notion of the division of humanity into 'sun' and 'ice people'. [38] Europeans, 'cold' by nature, are independent and distrustful, while Africans and other peoples of color are antithetically congenial, family-oriented and supportive. Whether intended or not, these arguments will always lead some adherents to justify the superiority of their own group on bioevolutionary grounds.

Unique to the geodeterminist milieu is Frederick Jackson Turner's thesis that the character of societies and political institutions is based on their proximity to frontiers. [39] One of the many advantages of this argument is that it does not imply racial or cultual superiority, as any individuals or peoples on or near the frontiers have certain geodetermined advantages. His proposition is argued from two directions. Frontier peoples and states of necessity have a type of dynamism thrust upon them as they struggle to overcome their environments, and engage in direct combat/competition with frontier groups of other peoples. Individuals at the center or core of the state, not directly challenged by the dangers and lack of amenities at the frontier, will not develop to their full potential. Not only are the frontier people challenged to succeed by their environment, the frontier tends to attract individuals who are risk-takers. This group of explorers, entrepreneurs, the desperate, and occasionally the criminal elements of society, are dynamic individuals who are motivated, capable, and assured. Using this thesis, Turner asserted that it was the US position on the New World frontier that so quickly transformed it from minor colony to world power. Even within the frontier state, the dynamic element of growth was always at its expanding edge.

With just these brief examples, some preliminary projections of the character of spacefaring states and societies can be conjectured. We must begin our speculation from the premise that outer space is an extraordinarily harsh and inhospitable environment. Human civilization cannot be expected to emerge there; it must be highly evolved before even the attempt at entry, much less colonization, can be made. The first foray into the astrodetermined effects of space exploration must start from the unique combination of hyper-frontier hypotheses and inhumanly harsh environments. What kind of people can be expected to go there? What characteristics will they hone, and which will they prize in their companions? What kinds of cultures and governing institutions will arise naturally, and how will they in turn affect future expansion into space?

In the near term, we can look at the results of Antarctic exploration and space station habitation already attempted. The individuals who go to these analogous locations are highly educated, rigorously trained and psychologically screened for mental toughness and decision-making skills, and very physically fit. They are the best and brightest of our pilots, technicians, and scientists. They are rational, given to scientific analysis and explanation, and obsessed with their professions. While in the confined and remote habitats of either space station or modern high-tech igloo, they value the companionship of those they work with. Living in such close proximity they must be tolerant of the views and opinions of others, but exacting in their acceptance of procedure and professional expertise, for they will rely on the actions of their few comrades for their very lives. Any mistake could mean death. Competence becomes their measure of social value. In this situation they form extraordinary personal bonds. They see themselves as having shared experiences that no one but another of their ilk could truly understand. They are a superior subset of the larger group from which they spring.

Emphasizing and solidifying this observed subgroup fragmentation in the longer term, the most salient feature of the space environment, beyond its incredible inhospitality, is the vast distance between conceivable points of interaction. These distances will drastically limit *direct* human-to-human *cultural* interaction. For example, spacefarers can be expected to quickly develop specialized jargon, colloquialisms, and gestures to facilitate cooperation as they share in experiences that cannot be adequately described to Earth-bound associates. Groups clustered in disparate outposts will quickly adapt to their distinct environments, developing habits, traits, and idiosyncrasies most efficient for their peculiar environments and for their unique functions.

As already noted, and especially as true colonization efforts get underway, only the most physically and mentally fit members of the sponsor state/ society will be sent to explore and exploit space. They will be the most capably endowed (or at least the most ruthlessly suitable, as the populating of America and Australia via penal colonies such as Georgia and Botany Bay so aptly illustrate). The radically desolate environment of space will challenge these selectively culled pioneers, continuously honing their specialized capabilities and radically altering their social relationships. It is not unreasonable to suspect that over time these selectively culled individuals will fancy themselves superior to those members of the society they left behind.

Should long-term colonization efforts be realized, these selectively recruited and experientially hardened groups can be expected to establish competent, dynamic, and powerful social and political associations, initially structured in accordance with hierarchical military organization or under the strict conformity of martial law. Unlike the harsh historical frontiers of Earth, where an enterprising and hardy soul could live and prosper alone (in the United States this frontier independence contributed to the nurturing of political liberalism), survival in space will require not only the cooperation of all individuals, but continued full and active participation by everyone. Government structure in these circumstances can be expected to take the form of a rigid if not wholly coercive militocracy, at least in its early stages. Duty and sacrifice will be the highest moral ideals. Advancement to the top of the political ladder can be expected to be based on the most rigorous standards of competence. Such a political system could even threaten the sovereignty of terrestrial governments. Some on Earth would consider the space-generated political system a utopian one to be transferred whole to perceived corrupt and inefficient terrestrial governments.

This kind of enlightened despotic takeover has terrestrial parallels already. In several twentieth-century examples, including Mexico, Nigeria, Pakistan, and Turkey, military coups have been greeted by the population at large as a relief, a welcome return of order and rule of law in a state that has become irreparably corrupt and inefficient. New junta governments promise a return to more traditional institutions as soon as the crisis is over, but the damage is done. Society is conditioned to expect external corrections when needed, and is ill prepared to find solutions within the extant political framework. Should a general feeling of governmental mistrust—based on inefficiency, incompetence, or perceived timorousness in dealing with critical issues—become pervasive, that society may look outward to its extra-terrestrial heroes for assistance. Should the space colonists recognize the potential for increasing their Earth-based financial and resource support, they may look quite favorably on requests to act as champions of the people to claim Caesarian control. Should this rather far-fetched scenario not play out, it is not hard to imagine other structural causes of enmity between on- and off-worlders. The more independence naturally asserted by future space colonizers, the greater the efforts to rein them in politically by their terrestrial controllers. As with all such efforts in the human experience, it will be resented.

It will not be just political and ideological differences that separate those who live in space and those who remain terrestrially landlocked. Physical differences between spacefarers and the Earth-bound will emerge, and be exacerbated over time. James and Alcestis Oberg have carefully described the requirements anticipated in space exploration, and make a convincing case for the rapid evolution and adaptation of humans in space. Among the earliest physical changes, for example, is an overall ‘puffiness’ of the body as blood circulates evenly in zero gravity (instead of pooling with the tug of gravity). The change is so dramatic that Soviet Cosmonaut Valeriy Ryumin, reporting from the Mir space station, said that: ‘seen in a mirror, [our faces] were difficult to recognize’. [40] Zero gravity additionally contributes to bone loss and muscular atrophy. The condition becomes so severe that astronauts and cosmonauts returning to the surface of the Earth after only a few months stay on space stations cannot walk without assistance. Breathing is labored, and these returning heroes must recline to conduct interviews. These significant short-term changes can only be intensified by the increased time frame of long-term space exploration and to the heavy exposure to cosmic radiation that is unavoidable. These regular and heavy doses of radiation will mutate genes more quickly and more dynamically than common exposure in the protected cradle of the

Earth's atmosphere. Dominant mutations in successive generations will be different than those on Earth, too, because the environment the species is attempting to overcome is different. These changes can only be forecast wildly, but that they will be significant seems assured.

The vast distances, long travel time between inhabited outposts, physical and psychological changes expected to occur, and limited direct cultural interaction, will increasingly lead, on the grander scale, to the fragmentation of political authority as humanity spreads outward from the Earth. Individuals who are years from Earth and subject to stringent and unique living conditions will eventually believe that Earth-bound citizens, whose experiences are increasingly out of touch, can no longer adequately represent their interests. The farther from Earth the facility, the longer it will take to send and receive communications traffic. Immediate decisions will have to be made, and those who can make them effectively and decisively will be natural leaders. Despite efforts at strict electronic control by Earth authorities, self-governing or semiautonomous political entities can be expected to emerge on—then command—every location that is conceptually separable. The size of the body will not matter, so long as it is self-sustaining. Planets, moons, asteroids, and large space stations will all develop a singular political authority. In time, the space-state system may come to resemble the ancient and Renaissance city-state systems of the Greeks and Italians, with a myriad of independent and unique governing units sharing a common history, past culture, and a formal common language. The teachings of Thucydides and Machiavelli may be more appropriate to this age than the modern federalist leanings of Kant and Publius. [41]

The astrodeterminist influence is not limited to space colonies and off-world speculation. It clearly has an impact on terrestrial states. For specific projections regarding the impact of astropolitics on global politicomilitary development, the eloquent and sophisticated expressions of German social historian Otto Hintze are theoretically illuminating. [42] Hintze described a relationship between reliance on *classes* of weaponry and military organization, based on the juxtapositions of natural resources and political boundaries, and the structure of government. The influence of a national reliance on sea power, for example, allowed for by geographic fortune, prompted the development of a specific kind of decentralized (conceptually liberal) government with a greater degree of individual freedom. To the contrary, reliance on land power, necessitated in continental states surrounded by other land powers, led inevitably to a more centralized or authoritative government with an emphasis on performance of individual duty and subordination to the state. The argument is reminiscent of the previous Thucydidean-derived expository on liberal Athens and conservative Sparta. The particular examples for Hintze were the naturally protected liberal seafaring states of post-Enlightenment England and the United States, and the more vulnerable authoritarian continental states of Europe, especially Prusso-Germany. The pertinent question to be posed in this line of thought is, what kind of government can be expected in a post-Cold War state relying heavily on space power for its security?

The critical difference between naval and land military power, it seems reasonable to aver, is in their ability to project force and to occupy territory. Though Hintze does not deny the notion directly, there is nothing inherently democratizing about boats, nor authoritarian about boots. Rather, navies are excellent tools for outward force projection, but have very limited capacities for occupying and garrisoning territory. Land forces, especially infantries, are strongest in prepared defense roles and are the historical force of choice for occupation and control of territory/population missions. The latter role is virtually indistinguishable from civil police authority employed for internal oppression. It is this facile transference, from external military defense to internal political protection, that is so conducive to authoritarian government and makes ground forces so historically anti-democratic. [43] This oversimplification can be only broadly generalized. Numerous other factors are necessary for specific projections of how a military force will impact political institutions. [44] Nonetheless, the generalization is useful, and intriguingly heuristic. Hintze did not envision the political impact of air and space forces, but we can make some extrapolations based on his arguments.

Space forces have the theoretical potential for maximal power projection (as platforms for kinetic or laser energy weapons or with mass-destruction payloads; see Salkeld and Karras for now classic early assessments [45]) but virtually no near-term capacities for terrestrial occupation. As such, a state reliant on space forces for the bulk of its defense could be expected to have a more democratic or liberal character than it otherwise would, following the analogy of the navy-reliant state. Air forces, too, should be more liberalizing than armies, but the ability of air forces to inject troops into hostile areas and their requirement for erecting and maintaining numerous staging bases, makes them an arguably less democratizing/liberalizing structural variable than space forces, and perhaps even than navies. In addition, the *direct* support that air forces can provide to armies to enhance civil pacification further limits their democratizing/liberalizing influence. Even without weapons in space, as is the current precarious condition, space-based military support missions enhance the capacities of land, air, and sea forces to accurately engage and destroy targets worldwide. The inference that space forces or a space-reliant military would necessarily enhance liberal democratic government is thus compromised. Still, the inability to occupy territory or (currently) inject troops into territory and act directly in a police role means that the Hintzian paradigm should hold, and such states will have a more liberal character.

Yet a further projection for the Space Age seems prudent. Perhaps the more pertinent issue is the prevalent focus of current military space missions. They are not for territorial occupation and pacification, but they are clearly appropriate for police-state control. Intelligence surveillance and information gathering, a legitimate tool of military operations engaged in external war making, is also a customary tool for internal law enforcement operations. If the high-technology capacities of space-based intelligence support satellites are transferred to domestic police activities, potential for abuse is clearly present. [46] Just as satellites act as a battlefield force-multiplier, in the role of civil oppression, they can be equally effective, and equally repressive.

GEOSTRATEGY AND ASTROSTRATEGY

The direction and tenor of geodeterminist theories in the realm of astropolitics is not here definitively declared and is open to much speculation. The intent is simply to identify heuristic parallels. Traditional grand geostrategy, which adapts emerging technologies to practical knowledge of the face of the Earth, is not so provisional or ambiguous. It is the most intuitively applicable of the primary categories of geopolitical theory to the realm of outer space and the most pivotal to this text. In order to clarify the parallels, and to prepare and animate the astropolitical model described in Chapter 3, a brief survey of informing historical geopolitical grand strategists is essential; the following made significant contributions in their eras, and continue to extend their influence in the age of astrostrategy.

The influence of emerging *technologies* on geography, in essence the practical shrinking of the Earth, is the foundation of the geopolitical strategists' thought. An early proto-geostrategist who fully grasped this relationship was German economist Friedrich List. Edward Earle Mead writes: 'The greatest single contribution that List made to modern strategy was his elaborate discussion of the influence of railways on the shifting balance of military power.' [47] List recognized that the full incorporation of this new transportation technology would fundamentally alter the political relations of the major powers. He saw a national rail network as the cement of German unification, changing the strategic position of Germany from beleaguered battleground of Europe to a defensive bulwark operating with the advantages of interior lines. Before the railroad, Germany had to maintain separate armies in east and west (and occasionally south). With the railroad, military power could be transferred quickly from front to front as needed. Germany's potential enemies could not similarly move Russian armies quickly to France, for example, and Germany would realize the advantages of economy of force. The military importance of rail power that List described in 1833 was overwhelmingly validated with the north's victory in the American Civil War, and most emphatically so in the spectacular German success in the Franco-Prussian War. Ultimately, List's early views became the foundation of the rail-dominated 'timetable strategy' of World War I. [48]

Rail power has no clear parallel to space power with the exception that, as a new transportation and information technology, space asset deployment surely has the potential to alter the political and military relationships of the traditional world and regional powers. In a sense, control of a global space network gives the previous advantages of interior lines—quick redeployment of military assets, efficient monitoring of all fronts, and not insignificantly, a nationalistic sense of unification—from what has traditionally been seen as a classic exterior line position. This is an ongoing debate in the emergence of communications and information 'spatial environments', which may soon attempt to engage the cyber-realm in similar geopolitical terms. Here, the distinction between the classic interior lines position, as provided by proponents of a high-capacity fiber-optic communications network, and what is viewed in this analysis as the new astropolitical dominance of a space-based electromagnetic network, highlights the value of a neo-astro/geopolitical debate. Fiber optics provide enormous data-transmission capacity but limit the user to hardwired access. Space communications are more expensive and require much higher maintenance, but do not limit the user location nor the target coverage. Fiber optics are potentially more secure (arguable, as they can be tapped into at any point) but can be targeted for disruption by conventional materials (simply cut the line). Space-based communications require sophisticated encryption techniques for security, and can be limited by electronic jamming, but currently they are extremely secure physically. Finally, a central switching station can control fiber optics, and it is this capacity that has major Hintzian ramifications for the state.

An authoritarian state would much prefer a land-based, fiber-optic network for transmitting data and information than a broadcast one. All information passed could be routed through a central screening station, and even the Internet could be scrupulously monitored. A space-based transmission network could not so easily be constrained, and information dispersion would be impossible to control. Such a network enhances the military forces of democratic states, whose missions are outward in focus and require force projection support. A fiber-optic support network would be extremely useful for a military that is set for point defense, inwardly focused with a primary design of territorial occupation, and maximized for a secondary police support role.

Sea power predates rail power most assuredly, and advocates of strong navies were evident long before List, but the first true *geostrategic* (global-scale) advocate of sea power was the American naval officer Alfred Thayer Mahan. Mahan believed maritime power was the key to great power status, and that this power was to some extent geodetermined. His monumental maritime studies, published under variations of the title *The Influence of Seapower Upon History*, were enormously popular, and his ideas influenced US, British, German, and Japanese foreign policy. [49]

Mahan began his argument with the premise that a state endowed with geographic position allowing for both the concentration of naval forces and, when appropriate, their dispersion, was paramount in the modern state power equation. Having an opinion similar to List's, Mahan saw that the ability to quickly retract forces for defense of the state and then move them out to prosecute offensive action was the characteristic of such naval powers as ancient Athens and contemporary Britain that allowed them to rise to dominance in their respective eras. Of course, in order to press this capability, the maritime state must be endowed with a suitable 'frontier' seaboard, studded with 'numerous and deep harbors' combined with ready access to the open ocean, and 'a population proportioned to the extent of the sea-coast which it had to defend'. [50] In the realm of astrostrategy, Chapter 3 will show there are analogies to a suitable frontier 'coast' in space, and that instead of harbors, the spacefaring nation must be endowed with (or have access to) effective land-based launch, monitoring, and control sites.

Such advantageous physical features alone would not ensure the seafaring state had the tools necessary for naval dominance, however. The character of a nation's people must also be specially endowed. They must, at the very least, be appreciative of the value of sea-based activity, if not wholly immersed in it. They must be commercially aggressive, rational profit-seekers who recognize the potential bounty of sea trade, and who through hard work and persistence will achieve wealth from it. [51] This maritime citizenry will form the peacetime commercial fleet, gaining the skills and experience necessary to make a vast national reserve for mobilization in conflict, and at all times supporting through their taxes and other contributions the vibrancy of the sea-based national enterprise. The government, too, must be outfitted with appropriate institutions and political office-holders ready and able to recognize and take advantage of the state's position and attributes. Such a national character is evident in the potential for success in space endeavors as well. All spacefaring nations have attempted to tap into a national fascination with space exploration, if not directly manipulate their populations with promises of vast profit and adventure. The citizenry of the spacefaring state must be willing to sacrifice earthly comforts for unspecified gains in the exploration of the unknown, be committed to scientific endeavors and willing to hand over a large share of their income to the taxes necessary to support expensive long-term space projects, have a great interest (bordering on fetish or worship) in space developments and advances, and be tolerant of unavoidable failures, mishaps, and setbacks. With an energized and psychologically prepared populace, the inevitable tribulations necessary to enter into and then dominate space are bearable.

Mahan further saw the sea as a ‘wide common, over which men may pass in all directions, but on which some well-worn paths [emerge for] controlling reasons’. [52] These controlling reasons were predicated on the efficient movement of goods, and the geography of the Earth provided natural corridors of trade. The state that could control these corridors would realize such enormous commercial benefits that through its subsequent wealth it would dominate other states both militarily and politically. Crucial to his theory was a discussion of *chokepoints,* globally strategic narrow waterways dominated by point locations. It is not necessary, Mahan argued, for a state to have control of every point on the sea to command it. In fact, such a strategy would be worse than useless. The military force required would drain every scintilla of profit from trade, not to mention every able-bodied seaman more usefully engaged in commerce. Instead, a smaller but highly trained and equipped force carefully deployed to control the bottlenecks of the major sea lanes would suffice. These bottlenecks were easy to spot on a global map, and Mahan identified seven of them: the straits of Dover, Gibraltar, and Malacca, the Cape of Good Hope, Malta, the Suez Canal, and the St Lawrence Seaway. Later geostrategists would expand the number to include the Panama Canal, Tsushima, the Skaggerak, and the Cold War ‘GI-UK gap’ (the ocean narrows between Greenland, Iceland, and Britain) among many others. Naturally, a competitor state could avoid most of these chokepoints by simply ‘sailing the long way around’ them, but in doing so the inefficiencies of lost time and additional fuel consumption would make goods less competitive commercially, and could be the difference between winning or losing the war where timely troop deployments are critical. Thus, control of these few geographically determined locations would guarantee dominance over global military movement and world trade to the overseeing state.

For the United States, Mahan advocated the establishment of naval bases at strategic locations (including Hawaii, the Philippines, and some Caribbean islands) and the construction of a canal linking the Pacific and Atlantic Oceans. He further asserted that the United States should follow the imperial model of Britain, which had prevailed in its hegemonic struggle with France because it had funneled its resources into sea power. Britain’s rise to dominance was assured for two primary geopolitical reasons. First, as an island nation Britain did not have to incur the expense of maintaining a large land army so long as its navy was adequate for coastal defense, and second, because it had an unimpeded ability to concentrate its naval forces in defense. To many military strategists of the period it appeared that France had a material geopolitical advantage in that it possessed excellent access to both the Atlantic Ocean and Mediterranean Sea, then the world’s two richest regions of maritime trade. France was stymied, however, by its dual needs to maintain an enormous land army to defend itself from hostile encroachments (draining off resources that could have been spent in maritime activities) and to split its

Figure 2.2: Mahanian, Cold War, and oil, commerce chokepoints

Note: Mahanian chokepoints: Dover, Gibraltar, Malta, Alexandria, Suez Canal, Strait of Malacca (Singapore), St, Lawrence Seaway Cold War chokepoints: GI-UK Gap, Tsushima, Bering Strait, Kuriles, Denmark (Skaggerak) Oil chokepoint (US Energy Information Administration): Bab-el-Mandab (Yemen), Bosporus (Turkish Straits), Strait of Hormuz, Russian Oil and Gas Export Piplines/Ports, Strait of Malacca, Suez Canal and Sumed (Suez-Mediterranean) Pipeline

maritime force between the two naval operations areas. Because it did not have control of the critical chokepoint (Gibraltar) that linked the Atlantic and Mediterranean, France could not concentrate all of its naval capacity when necessary in war. It needed two complete, expensive, independent—and therefore numerically deficient—fleets.

At the time, Mahan observed that the United States had both the British advantage of inaccessibility and the French problem of maintaining separate fleets. Its relative military isolation across the vast oceans—Canada and Mexico were neither serious nor imminent threats—had allowed it to develop industrially and commercially without the enormous and economically inefficient expense of a large land army to protect itself. Its potentially lucrative and dominating ready access to both Atlantic and Pacific Oceans was mitigated, however, by the time-consuming chore of a practical circumnavigation of the globe—all the way around the South American continent—in order to join the forces of the separate fleets. Therefore, the United States had to maintain fully independent and functionally redundant Atlantic and Pacific fleets to adequately defend its coastline, and these forces could be combined only at great national peril. For this reason, to follow the British precedent of constructing the Suez Canal to link the Mediterranean and Indian Ocean navies, Mahan advocated in the strongest possible terms a US-controlled canal across the isthmus of Panama.

Mahan's analysis was brilliant and convincing. If a *natural* chokepoint did not exist, it was possible and obviously beneficial in some cases for the forward-looking state to create one, and in the process eliminate a source of potential weakness. Moreover, this particular undertaking would alter the world's existing trade routes. Asia to Europe trade could be as efficiently accomplished through the US-dominated route as through the existing trans-African ones. Not only would world power relations be tipped in favor of the precociously emerging United States, it would force the then-isolationist tendencies of the public and politicians to change to internationalist ones, for a trans-Panamanian canal would immediately bring the 'interests of the other great nations, the European nations, close along our shores'. [53]

Mahan believed that the United States had luxuriated in its vast internal resources for too long. So many material goods, so much new land had been available as Americans followed their manifest destiny to settle the continent that the United States had not heretofore needed to involve itself in world affairs. But the days of practical autarky were coming to an end, and it was past time for the United States to take its place among the great powers. The altered geopolitical reality necessitated by the artificial change of an isthmus canal would force the United States away from its internal focus and out of its international slumber. In this complicated world of diplomatic intrigue, if it were to retain control of its political destiny, the United States would have to build and maintain a strong and responsive navy.

Today, with the demise of the Cold War, the United States has the luxury of reducing its land, sea, and air forces, and channeling monies and efforts saved into its space activities. Whether it will do so voluntarily remains to be seen, and in the current political climate increased funding to space is not only dubious, but it must compete with perceived domestic spending priorities. For activists in either camp, the budget is seen as a zero-sum game; more money for me looks like less money for you. Still, while the ideological battle continues, the funding commitment issue may be spiraling out of the control of domestic preferences. The United States may find itself unable to avoid its newfound international space responsibilities and global commitments, many of which may not have been foreseen. For example, the United States military's Navstar/GPS navigational satellites were deployed to enhance its military power, as a force-multiplier, in the jargon of the military. The subsequent utility of these assets to global commercial navigation, communication, and above all commerce, has made them an indispensable world asset. The United States military now finds itself in the curious position of having to maintain a network of satellites that contributes billions of dollars to the world economy, and should it fail to be maintained, would have global civilian negative ramifications. [53] The creation and maintenance of global space-based communications and navigation systems, clearly a modern parallel to artificial technological chokepoints as the world becomes increasingly reliant on these assets, has brought the interests of other states 'close along' our (astropolitical) shores. The United States must be ready and prepared, in Mahanian scrutiny, to commit to the defense and maintenance of these assets, or relinquish its power to a state willing and able to do so.

Finally, Mahan argued for a guided national subjugation effort in support of the coming global role of the United States. He advocated the establishment of overseas bases at specific intervals to act as coaling and repair stations. The range of ships and natural interests of the state geographically determined their spacing. Without these bases, US war and trade ships would ‘be like land birds, unable to fly far from their own shores’. [55] Two of the bases advocated were Hawaii and the Philippines, crucial to US control of the Pacific trade routes. A network of carefully placed stations could guarantee that US trade and war ships would never be out of range of a friendly depot, hence never at the mercy of foreign largesse for their success. In similar fashion, the astro-strategist should advocate the establishment of colonies or outstations for space exploration and exploitation. These stations could be used to stockpile fuel and other resources (especially life suport and spare parts), and could extend the life and range of space enterprises. These bases will all be astrographically and technologically determined (see model output in the next chapter).

Britain’s rise to power came, Mahan believed, because ‘she had exploited her location across the sea routes’ of Europe. [56] Since the efficient movement of goods and capital in the nineteenth century was a factor of sea capacity, the nation or nations that controlled the most modern navies and the world’s critical chokepoints could dominate the lanes of commerce, and thus the economic lifelines of an increasingly interdependent globe. A modern astrostrategist can and should make similar arguments. In space there are specific orbits and

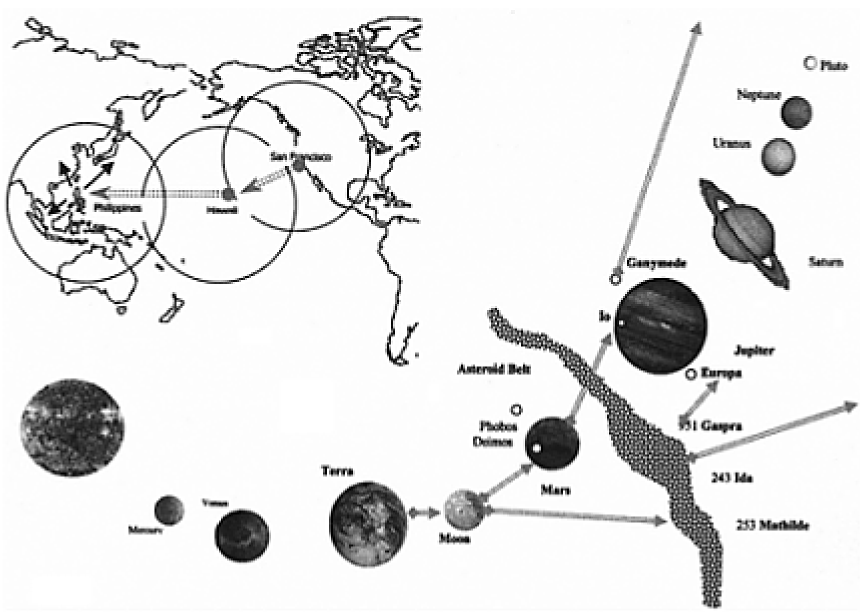

Figure 2.3: Mahan’s Pacific strategy and Cole’s ‘stepping stones’ to space

transit routes that because of their advantages in fuel efficiency create natural corridors of movement and commerce. Space, like the sea, can potentially be traversed in any direction, but because of gravity wells and the forbidding cost of getting fuel to orbit, over time spacefaring nations will develop specific pathways of heaviest traffic. Each of these pathways, identified later in the astropolitical model as Hohmann transfer orbits, can be shown to have or to be in themselves critical chokepoints. The state that most efficiently occupies or controls these positions can ensure for itself domination of space commerce and, ultimately, terrestrial politics.

Mahan's influence was and is extraordinary, but the most memorable of the geostrategists was undoubtedly Britain's Sir Halford Mackinder. Mackinder acknowledged the historical importance of sea power on the rise and demise of the great powers, but foresaw the end of naval dominance with the advent of the railroad. This emerging capacity would allow the efficient consolidation of the enormous Eurasian landmass, an area he referred to first as the *geographic pivot of history* and then as the world's *heartland*. [57] This huge potential state would form an impregnable land power that could not be defeated from the sea. In time, the vast natural resources of the heartland state would allow it to gain access to the sea and to construct a navy that, for sheer numbers alone, could overwhelm the peripheral sea powers. Inevitably, the world would be a single empire ruled from its natural core.

The key dynamic was the change in transportation technology, and the importance of military mobility. When the horse was domesticated and bred to allow for the unnatural weight of a rider, the primacy of cavalry emerged. [58] Add to this the development of the stirrup, which for the first time provided horse-mounted soldiers with the leverage necessary to give a lance or sword thrust the same striking power that infantry warriors could achieve on foot, and the medieval dominance of chivalric knights and the central steppe 'hordes' was assured. Grand improvements in sailing technologies allowed the seafaring states of Europe to encircle the central heartland and efficiently patrol its borders, shifting power to and fro as necessary to contain the potential of the mighty interior. With the advantages of the new maritime technologies, the efficiency and speed of sea movement effectively canceled the prior cavalry-based advantage of interior lines enjoyed by the Tatars and other notable steppe raiders. The advent of steam power and its application to both the railroad and waterborne transportation had the counterintuitive effect of initially accelerating this naval dominant condition, as the first short-range railroads and river steamboats simply fed goods and supplies that were hitherto inaccessible into coastal ports for oceanic commerce. [59] As the railroads grew to transcontinental scope, however, Mackinder saw that the balance of power was shifting back again to land, specifically to the heartland.

Mackinder's worldview divided the globe into three primary regions: the Eurasian core that comprised *heartland* or pivot area; the *inner crescent* made up of the marginal regions around the heartland's periphery (including Western Europe, the Middle East, Indian subcontinent, and most of China); and the *outer crescent*, those regions separated from the heartland and inner crescent by water (including the entire Western Hemisphere, Britain, Japan, and Australia). Each area had a geographically determined role in global affairs. More convincingly, the theory seemed to validate Britain's accepted role as the 'balancing' state in the nineteenth-century multinational diplomatic classic balance of power era known as the Concert of Europe. Via deft and often clandestine back-stage political maneuvering, the British ensured that none of the great powers of its era would gain enough power to dominate the others. It was a bold, though heavily criticized strategy, as Britain forged and broke alliances as needed to preserve its notion of political equilibrium in Europe.

Figure 2.4: Mackinder's worldview

Until the railroad, sea power's advantage was its virtual monopoly on force projection over the world's most efficient trade routes. Railroads, Mackinder reasoned, would fundamentally alter the global equation and allow the land-based powers of Eurasia to regain the dominance they held when cavalry reigned supreme. Mackinder believed the history of civilization was in fact a cyclical tale of alternating dominance by land and sea powers, and that a change to land dominance was currently underway. The heartland, impervious to deep power projection from the sea and endowed with the resources necessary to build a monolithic military force, eventually would consolidate under a single state that could conquer the world. The outer crescent powers were natural allies who could retard the development of the heartland power by maintaining strict control of the sea and encouraging continuous warfare among the fragmented heartland and inner crescent states to prevent them from turning their capacities outward. Absolutely critical to the outer crescent states was the preemption of the formation of a powerful eastern European state, the presumed gateway to the heartland. Mackinder saw the flat, open northern plain as a natural highway to the vast potential of the heartland. It had to be kept fragmented at all cost, for: 'Who rules East Europe commands the Heartland. Who rules the Heartland commands the World Island. Who rules the World Island commands the World.' [60]

Crucial to Mackinder's strategy for Britain was the notion that if a state desired control of global affairs but could not physically occupy the critical keys to geodetermined power, *then it must deny control of those areas to its adversaries*. To the astrostrategist the parallel is all too obvious. The vast potential resource base of outer space is presumably so enormous, effectively inexhaustible, that any state that can control it will ultimately dominate the earth. To many of his contemporaries, in contrast, Mackinder's theories appeared overly simplistic and one-dimensional, and contained significant discrepancies and shortfalls. But they were not ignored, and follow-on geopolitical theorists both positively modified and negatively criticized them. [61] Dutch-born Nicholas Spykman faulted Mackinder on two primary points: (1) he overemphasized the potential power of the heartland, and (2) the dynamic between land power and maritime power was oversimplified. After 1920, when he came to the United States, Spykman began to believe that the United States, not Britain, would have to accept the mantle of leadership and become the balancing state in modern world politics. As early as 1942, when his basic argument from *America's Strategy in World Politics* was published on the front page of the *New York Times,* Spykman maintained that the concern of the United States should be with the end of the then ongoing conflict, and the resultant peace. [62] The complete defeat of Germany would not be welcome if it had the effect of swinging the European balance of power irrevocably to the Russians. Spykman slightly modified Mackinder's model. He called the Eurasian landmass the *world island*. He then identified the edges of the world island, essentially those Eurasian states that had ocean access, as the *rimland*. The rimland was vulnerable to both land and sea power and so by necessity must rely on both types of forces for survival. World power balances were, according to Spykman, influenced by the alliances *within* the rimland and *among* rimland and heartland/outer crescent powers. For the most part, Spykman's was only a revision of Mackinder's theory. In imitation, he even replaced the now famous Mackinderian dictum with his own: 'Who controls the Rimland rules Eurasia. Who rules Eurasia controls the destinies of the World.' [63]

Harold and Margaret Sprout criticized Mackinder for his reliance on a faulty perception of the world based on the distortion of Mercator map projections. [64] Hans Weigert (among many others) felt Mackinder's theories were rendered quickly obsolete as he failed to account for the growing influence of air power. [65] Robert Strausz-Hupé complained that both Mahan's and Mackinder's theories were overly deterministic, and preferred to downplay geography's role in the status of strategic influence. [66] The fact that criticisms and modifications continue to be made attests the power of Mackinder's theories, however. As recently as 1990, Saul Cohen modified the basic model to account for 'gateway states…uniquely suited to further world peace…in geopolitical regionality'. [67] Gateway states are 'located largely along the borders of the world's geostrategic realms and its geopolitical regions', including the Baltic states in East Europe; Tibet, Kashmir, and North Burma in South Asia; and Quebec in North America. [68] These states could be the flash points for future war, but more likely, in his view, because of the recognized precarious positions in the geopolitical environment by statespersons of the great powers, they will be the globally managed start points for a lasting peace.

The previous discussion shows the rich body of theoretical literature devoted to geopolitical thought, which makes its precipitous decline after World War II all the more curious and noteworthy. Geopolitics is perhaps the most adept body of international theory when it comes to dealing with *systemic* change, and geostrategists have been remarkably prescient in their ability to project the effects of a specific new technology on the extant state system. In the twentieth century, the pace of technological change was breath-taking, and the geostrategists weighed in all along the way. H.G.Wells, for example, was one of the earliest to recognize the coming revolution in military doctrine and tactics with the arrival of the combustion engine and the automobile, and was able to heavily influence British strategy prior to World War I. Of note is Wells's description of the impact of the 'land ironclad', a mobile fortress that was much larger than, but essentially the harbinger of, the modern armored tank. [69] The impact of the land ironclad, he prophesied, would do more than change the way battles were fought; it would restructure the military forces that employed them. Defensive trench positions would be nullified. The mass armies the world then had would dwindle, becoming smaller and more professional as the training required for soldiers to master the skills necessary to apply the new technologies became a lifetime effort. States that failed to adapt would quickly find that large-scale drafts of foot soldiers would be ineffective against the land ironclads, and would quickly decline in state and military power. Wells's projections turned out to be inaccurate, as the giant land ironclad (as large as a battleship) was never deployed. But the logic was consistent with armored warfare as it eventually developed and overcame the defensive-dominant trench warfare practices of the day. In his theorizing, Wells became last century's first advocate of geostrategic change due to the arrival of a new technology. Many others followed, most of them enamored with the growth of air and then missile power.

The first of these was Giulio Douhet, an Italian Air Marshal who wrote extensively of the coming air power revolution in modern warfare. Though his vision was far-reaching, even he didn't recognize the full impact of this new dimension on the battlefield. Douhet insisted, for example, that 'aerial bombardment can never hope to achieve the accuracy of artillery fire'. [70] Despite the fact that aircraft were essentially unimpeded by the Earth's surface features (a critical change in the evolution toward astropolitics), they were limited in their operations by critical *air operations routes*, which required precisely located takeoff and landing fields and effective maintenance and repair facilities at major hubs. Douhet identified three of these air routes for Italy, one along the Po Valley and two more along the east and west coasts of the peninsula. [71] Douhet insisted warfare maps should portray these routes along with overlays of concentric circles, or range arcs, identifying the operational ranges of deployed aircraft at terrestrial bases.

US Army Air Corps General Billy Mitchell accepted Douhet's view that air bases represented vital centers of military operations, and believed his role was to extend theory into practice. [72] Mitchell professed that in the new Air Age Alaska had surpassed Panama as a strategic focus for the United States, since aircraft based in this region could maximize their radius of action against potential foes. [73] His bombastic and irascible personality eventually got him court-martialed (for conduct unbecoming an officer), but Mitchell was posthumously revered in the United States Air Force for his foresight, when events and the course of World War II seemed to prove many of his assertions.

Russian-born Alexander De Seversky was a practical engineer (he invented the first fully automatic bombsight) and a businessman (he founded Republic Airlines), but is best known for his powerful advocacy of a massive commitment to air power as the backbone of US strategic defense. De Seversky was the first geostrategist to use an azimuthal equidistant map (a polar view which limited the distortions of traditional Mercator projections) to show how physically close the Eurasian landmass is to North America. [74] By drawing air range arcs over the United States and USSR, he identified uncontested regions as *areas of dominance* and regions of overlap as *areas of decision*. [75] De Seversky's influence was widely persuasive, and became the policy foundation for the construction of the DEW (Defense Early Warning) radar line across northern Canada and

Figure 2.5: Geopolitik superstates

Alaska to monitor former Soviet Union strategic forces.

As the Air Age gives way to (or at least coincides with) the Missile Age, much work is being done on the geopolitics of nuclear war. Lawrence Freedman points out that the lack of actual nuclear campaigns has not inhibited the development of nuclear strategy. [76] The first theorists considered nuclear weapons simply bigger bombs for established strategic bombing uses. Political and economic centers now become legitimate (and with missiles, highly vulnerable) targets of military planning. With the devastation apparent with Hiroshima and Nagasaki, theory quickly became politicized. The cutting-edge strategists devoted their efforts not to winning wars, but *avoiding* them. The technology became one that was uniquely paradoxical. No nation that could afford nuclear power could afford not to develop nuclear weapons. But once deployed, no nation could afford to use them.

As US dominance of the geostrategic realm took hold, Colin Gray asserts that the notion of balance of power became strained. Americans had never been comfortable, he argues, with the amoral necessity of separating foreign and domestic policy in a world of hostile states. The 'sustaining myth' of US superpower is that the United States is 'blessed and divinely commissioned' to transform the world in its own image, and the horror of nuclear power had been opportunely placed in its benevolent hands. [77] Perhaps only Americans, sure in their righteousness, could have developed the nuclear strategy of paradox so fittingly and simply called MAD (Mutually Assured Destruction), alternately praised as the strategy of deterrence that prevented World War III and reviled as the psychologically cruel and horrific 'balance of terror' that frightened two generations of the Cold War. MAD was the perverse logic that spawned 'contingently irrational' academic discussions of 'doomsday machines', 'launch on warning' (LoW) of attack, 'mad boat captain' scenarios, and 'nuclear brinksmanship' strategies that held the world hostage to superpower demands. [78]

To summarize the entire panoply of counterintuitive nuclear theorizing in support of MAD is impossible in this framework. It is necessary, however, to understand the conflicting, even diametric forces that contribute to *Astropolitik*. To illustrate the span of competing nuclear theory, and to extend nuclear theory to the realm of outer space, three of the most perplexing dilemmas in the use of nuclear weapons are discussed: centralized versus decentralized control, the logic of the First Strike Advantage (FSA), and counterforce versus counter-C^3I (Command, Control, Communications, and Intelligence) strategy.

The first issue centers on physical control of weapons operations. The desirability of quick and assured response to deter a nuclear first strike necessitates decentralized release authority and quick, relatively simple prelaunch procedures. On the other hand, the calamitous risk of premature or imprudent use of holocaust-scale weaponry demands tight centralized control and time-consuming, redundant-verification pre-launch procedures. [79] This dichotomy of means has been described as a positive versus negative control option, as a ‘perversely interlocking’ choice between increased or decreased capacity to gather information, and as a preparation for war initiation versus war termination (‘there is no military point in deploying safety devices that so complicate a weapon’s firing sequence that it may fail to function when a legitimate need arises and authorized permission is given for its use’, and, on the other, ‘C^3I structure must also facilitate war termination’). [80] The options appear totally diametric, and a compromise solution may never be fully satisfying. Nonetheless, during the Cold War the United States (and probably the Soviet Union) attempted to straddle the fence, employing various control strategies for differing nuclear forces. Control varied by three broad categories: (1) weapons deployed outside the United States not under the sea—generally tactical nuclear weapons; (2) air and missile forces under the Strategic Air Command (SAC); and (3) the Navy’s sea and submarine-based weapons. [81] Weapons in the first category are the most tightly controlled, since they are most susceptible to accidental use or misuse, conventional or terrorist attack, and hostile government action. A surprise attack would probably render them useless, as release authority for these weapons would have to be predelegated. [82] The SAC Commander had authority to raise readiness and to independently launch his bomber force to prevent its destruction on the ground. However, authority for bomber or ICBM (intercontinental ballistic missile) counter-strike was withheld prior to confirmation of hostile attack, and was precariously dependent on fragile communications systems. Navy assets of the third category had the least centralized control because of their unique communications requirements and relatively safe operating environment. [83] Insurance against premature or accidental launch was maintained by a positive control system in which ‘three to five officers, including the Captain’ had to simultaneously perform enable and launch procedures. [84]

Ideally, tight control should be practiced in peacetime, providing the maximum assurance of safety. In a crisis or war situation, control is released to multiple decision centers and pre-launch procedures would be relaxed. This dual system has two primary faults. First, coupling the dissemination of control with rising international tension clearly could serve to increase the possibility of inadvertent war—tightly coupled systems ‘are notorious for producing overcompensation effects’. [85] The military response to heightened world tension is to heighten readiness. [86] As readiness increases, tensions increase, producing a spiraling decision matrix that can take on a life of its own, complete with full tautological rationality. Second, tight control during peacetime increases vulnerability to surprise attack. In a pure ‘bolt from the blue’ surprise attack on

Washington, it is doubtful the President could escape. [87] Even if the Commander-in-Chief were able, miraculously, to get aboard the Advanced Airborne National Command Post (AABNCP), the disruptive nuclear environment could frustrate any attempt to control a retaliatory strike. [88] Though most analysts, military and civilian, are confident that a surprise attack is highly improbable, the sheer improbability of the event increases its probability of success. [89]

In outer space, assets that are farther from control centers will of necessity receive less control than assets in near Earth orbit, due to communications time lags. For manned space, the distinction is more critical. Emergencies cannot be addressed with multi-minute electromagnetic delays due to distance or electromagnetic shadows due to planetary and solar interruptions. This increased autonomy for manned missions will have short-term astropolitical effects and longer-term astrodeterminist ones. For military platforms, the logic holds. Spacecraft with military missions, especially unmanned ones (for example, the proposed 'Brilliant Pebbles/Brilliant Eyes' kinetic kill vehicles envisioned in the Strategic Defense Initiative's (SDI) anti-missile shield) will of necessity work in a threat environment that may preclude constant monitoring and contact. The probability that a computer or other mechanical error will cause an unauthorized or unintended malfunction/unauthorized attack increases in accordance with Murphy's Laws the less the system is under direct control. To provide increased autonomy increases the potential for unauthorized or disastrous uses of the platform, while on the other hand increased control increases the response time to deal with genuine emergencies or crises.

The second issue for study is drawn from the obvious maxim that the side striking first receives an incomparable military advantage. FSA is so compelling that analysts routinely pointed out the value of a 'preemptive' attack in the event that one power suspects the other of preparing a first strike. [90] In nuclear combat, the luxury of striking first guarantees the aggressor the use of any or all weaponry, the advantage of full, uninterrupted C^3I for coordinating the attack, and a full range of target selection. Moreover, it is always possible that the victim would opt not to retaliate, and instead sue for peace. Such a fanciful vision is one of the few scenarios that allow for nuclear victory. Another possibility is that the first strike would leave the victims so weakened they could not retaliate, even if they wished to do so.

Studies of vulnerability have long shown C^3I to be the weak link of nuclear deterrence, leaving the guaranteed retaliatory capacity of nuclear forces less potent in fact than in theory. [91] During the Cold War, the United States and Soviet Union took different approaches to limiting command vulnerability. The former relied on mobility and human redundancy, whereas the latter relied on hardened bunkers and anti-ballistic/anti-air defense systems. Still, C^3I is subject to a variety of direct and collateral nuclear damage, including explosive blast, nuclear radiation, thermal radiation, electromagnetic pulse (EMP), Transient Radiation Effects on Electronics (TREE), and radioactive fallout. Additionally, C^3I is vulnerable to conventional warfare—military overrun/direct attack with conventional weapons; unconventional attack, such as sabotage and terrorist action; radio electronic combat including jamming, interception, and deception; and miscellaneous dangers to include natural phenomena, human error, and equipment failure. [92]

The terrain of space is essentially the unseen topography of gravity wells and electromagnetic emissions. Vulnerabilities in space forces will be categorized as in orbit (direct attack on spacecraft), on the ground (vulnerability of support facilities including launch and control, production, and monitoring sites to nuclear, conventional, or guerrilla attack, and espionage), and in electromagnetic transit (specifically the control up and data down links to disruption, jamming, and interception of data streams). The full ramifications of these vulnerabilities are discussed in greater detail in Chapter 6. For now it is enough to make the analogy that realist nuclear theory and *Astropolitik* are enmeshed, and the latter is an outgrowth of the former.

Finally, in discussing comparable analyses, C^3I's vulnerability makes it a prime candidate for first-strike targeting. Disabling an enemy by destroying the ability to control the weapons at its disposal is counter-C^3I, or, more colorfully, decapitation. Targeting the weapons themselves is a counterforce strategy—to maintain the analogy, dismemberment. A dismemberment attack is desirable because, in theory, it would eliminate the enemy's ability to retaliate, but would leave in place an authority structure which is capable of negotiating terms of surrender. A decapitation attack is desirable because, in theory, it would eliminate the enemy's ability to coordinate or even commence a retaliatory strike. The C^3I structure is vastly more vulnerable than nuclear weapons in hardened bunkers or on mobile platforms on the ground, in the air, or under the sea, however. A complete loss of C^3I is therefore more likely than a complete loss of forces. The major drawback of the decapitation strategy is that if the enemy were able to retaliate, via a launch-on-warning or launch-under-attack tripwire command structure (the 'doomsday device'), there would be no legitimate government authority with which to negotiate war termination. The result could be global suicide.

The dichotomy is generally associated with selective escalation and massive retaliation. The latter requires no battle management and the former is heavily taxing on C^3I systems. Given the extraordinary number of nuclear devices available today, a massive strike probably could not eliminate a nuclear power's entire nuclear force. In this age of overkill, even a few bombers and submarines spared from the initial salvo could cause unacceptable devastation to the aggressor in a second-strike retaliation. The C^3I structure, if preserved intact, could direct those remaining forces to the most efficient and destructive (and potentially appropriate) retaliation. Eliminating the C^3I structure would require fewer missiles, and would leave a larger retaliatory force. Without guidance, these weapons would be spasmodically (and massively) unleashed on targets of opportunity, most likely population centers.

Herein lies the greatest paradox. In order to increase options, enhance flexibility in targeting, allow for controlled escalation and de-escalation, and provide for the possibility of war termination before global catastrophe, the initiator and retaliator must agree or conspire not to attack the other's command and control infrastructures. [93] Both sides realize the need to 'spare the enemy's [C^3I] so that authorities can reach political agreement and military control in order to terminate the conflict'. [94] Nonetheless, 'command vulnerability encourages decapitation attack', and the all-or-nothing gambit encourages surprise attack. [95] General Robert Herres, former Commander of US Space and Vice Chairman of the Joint Chiefs of Staff, wrote, 'Imagine the incentives during crisis for launching [an] attack that might annihilate the national leadership and devastate command structures before they could recognize an attack was even coming.' [96] Verl

Stanley and Phillip Noggio concur that C^3I warfare 'makes it possible to seize the tactical initiative, cripple the enemy's command and control system, and thereby defeat his forces'. [97]

Given the possibility that even a limited sortie of nuclear weapons is an attempt at decapitation, and with full understanding of the FSA advantage, the nation under attack has very few options. [98] If one assumes that both sides are evenly matched in terms of destructive capability and each side's intelligence and warning networks would detect any hostile missile attack, analysis suggests only two options: surrender or massive retaliation. If the victim gives up, the war is over. If the victim decides to absorb the attack, the risk of losing C^3I and the ability to launch a coordinated or in-kind response is too great. The optimum recourse is to launch as many weapons as possible in a retaliatory strike before control of them is lost. The aggressor, aware of the victim's quandary, cannot logically launch a limited first strike. Knowing that massive retaliation is a distinct possibility, the aggressor must attempt to destroy as much as possible of the enemy's retaliatory capacity in the first blow, thereby limiting any second-strike damage that may be forthcoming. Logically, since the victim cannot respond with a limited retaliation, and, knowing this, the aggressor cannot rationally initiate nuclear war with a limited strike, limited nuclear war is not possible. This is not to say limited nuclear war is inconceivable, it is to say that it will always be preempted by general war. MAD logic is impeccable.

The dilemma of tight versus loose control cannot be solved; at least it has not been solved here. The dilemma only adds to uncertainty in the nuclear environment. Tight control could lure an opponent into attempting a surprise decapitation strike. Loose control is a dangerous mess, and it is only a matter of time before an accidental or unauthorized launch tests the tolerance of the superpowers. Neither strategy decreases the likelihood of war. If that notion translates into a pessimistic inevitability, then the side that strikes first has the advantage, and FSA places a hair trigger on the arsenals. The logic of decapitation suggests first strike should be against enemy C^3I, but if the strike is successful, there may be no one left to negotiate surrender. The war may never terminate. Ultimately, given the probability of massive retaliation in any nuclear conflict scenario, limited war is not a practical possibility.

It is therefore not logical to design a C^3I system for survivability and endurance. It is also self-defeating. Such a C^3I system, perceived by its owners to be effective, would remove the requirement for guaranteed retaliation, and thus *decrease* the logic of deterrence. An enemy might be more tempted to try a decapitation attack based on the rational assumption that, with the tripwire removed, a successful anti-C^3I barrage would indeed render retaliation improbable. Improved crisis and wartime C^3I, by increasing the potential for controlling response, decreases the credibility of deterrence since it forces a rational decision-maker to order the irrational act of nuclear retaliation. [99] An enhanced C^3I system capable of extended battle management would be an irresistible target. Since a decapitation strike would inevitably lead to general, not limited, war, to build such a system is not cost-effective. Deploying an expensive C^3I system designed for a war that will never be fought, and that by its very existence increases the potential for the war that *could* be fought, is a bad option.

Astropolitics contains all of the classic elements of geostrategy just outlined. List's logistical transportation net, Mackinder's pivot area, Mahan's choke-points, strategic narrows, and lanes of commerce, Douhet's and Mitchell's vital centers and avenues of attack, DeSeversky's spherical modeling, and the multitude of nuclear theorists' contrary logic all have counterparts in outer space. Before completing the transfer of these ideas to the astropolitical model, a final line of geopolitical thought must be considered for inclusion. At the very least, it cannot be ignored.

ORGANIC STATE THEORY, *GEOPOLITIK*, AND *ASTROPOLITIK*

Geodeterministic theories perhaps inevitably led to the exploration of a political theory of natural selection. As such, they fall into the general category of Social Darwinism, replete with the misquoted theory of survival of the fittest. Once perverted, this transforms the individual or group from having a natural capacity for dominance to having a moral *duty* to dominate.

Friedrich Ratzel, nineteenth-century geographer and biologist, was heavily influenced by the work of Charles Darwin. In his classic *Political Geography,* he compared the state to a living organism and made a biological analysis of government. [100] The organic state analogy was not new with Ratzel, Machiavelli made similar analogies almost 400 years earlier, but Ratzel's observations were far more systematically defined. Ratzel's most notoriously influential work was *Der Lebensraum* (literally translated as 'Living Space'), in which he claimed organisms adapted to the space they occupied. [101] In what was clearly a Darwinist notion, Ratzel claimed that human culture groups, *acting* as organisms, attempted to colonize the space around them. If successful, they expanded their living space, or area of domination. Whether he intended it or not, German political theorists would adapt the idea of *Lebensraum* as the scientific basis for a racist plan of imperialism. [102]

Rudolf Kjellen, a Swedish political scientist, carried the analogy to its extreme, and declared unequivocally that the state *was* an organism. *Geopolitik* was one of five components, or 'organs' of the state, that included: *Kratopolitik,* the government structure; *Demopolitik,* the population structure; *Sociopolitik,* the social structure; *Oekopolitik,* the economic structure; and *Geopolitik,* the physical structure. [103] Kjellen insisted the dynamic state would grow and consume the weaker states around it. In doing so, the state achieved *autarky,* or national self-sufficiency. Ultimately, he believed, only a few large states would remain. One of these superstates, the greatest of all would be a European composite controlled by Germany.

For astropolitics, the analogy seems suitable. A common perception of humanity's reach for the stars is that it is simply the next logical advance of the evolution of species. Mankind has filled and dominated the biological niche that is Earth and must now expand beyond these confines and spread to the cosmos. Whether the impetus is survival from ourselves (escape to another habitable place before we ruin this one with environmental or nuclear holocaust), overpopulation (the biological safety valve of space colonization), wealth maximization (the search for ever-cheaper raw materials and abundant energy), or a new interpretation of manifest destiny, humanity's push toward the stars is portrayed as inevitable. Indeed, evolution may naturally reach its own economy of scale. One possible vehicle for manned space exploration, self-contained mobile ecosystems designed for multigeneration long-distance travel, is an abstract magnification in the evolution of life. I.M.Levitt and Dandridge Cole have argued that this kind of concentration of living organisms is the next evolutionary step beyond multicelled organisms. [104] With the soon-to-be-realized mapping of the human genome, combined with startling advances in the process of miniaturization, an alternate model can be envisioned. Strands of human DNA with incubating material can be sent to every star system conceivable. Upon reaching its final destination hundreds of millennia hence, a sensor looking for the most suitable environment guides the micro-pod to landing and begins the process of creating new humans. The analogy here is more flora than fauna, as the human colonization of space might better resemble the broadcasting of spores.

Organic state theories seem to lead unavoidably to notions of Social Darwinism, more so even than the geodeterminist ones discussed earlier. The argument follows along the lines that states or peoples who are capable of expanding, not only will do so, they *ought* to do so. They owe it to themselves and to the rest of the world. Ability to expand is *prima facie* evidence of naturally mandated political and social superiority, implying an absolute *right* to expand. Such reasoning can lead to abuses of power.

A state that successfully colonizes in outer space will undoubtedly extract pride from the accomplishment and probably will realize enhanced resources, spinoff technologies, and military power as well. If it uses that accomplishment, or the increase in wealth it can expect from so doing, as a normative justification for dominating or oppressing others, then the dictums of *Astropolitik* are invoked. To illustrate, a geopolitical tangent that carried the outputs of geostrategy and organic state theory to *one* logical conclusion was Professor General Karl Haushofer's School of *Geopolitik*. Adherents combined geopolitical determinism and geostrategy to create a unique form of *applied* geopolitics that ultimately became the embodiment of plans for a new German empire in Central and Eastern Europe that was *destined* to expand as far as its inevitable military power allowed. [105] For Haushofer and his disciples, *Geopolitik* was the 'master plan' of German resurgence, the manual that foretold 'what and why to conquer, guiding the military strategist along the easiest path to conquest'. [106] Although Haushofer attempted to legitimize his school by collecting veritable mountains of pertinent data, and in 1924 founded the academic monthly *Zeitschrift für Geopolitik* to profess the new *science* of geopolitics, his contributions were hardly scientific. [107] The failure was in collecting data to conform to a preestablished hypothesis rather than to test it. Physical traits that corresponded to Germanic peoples were *a priori* evidence of superiority. If Germans had higher foreheads than, say, Slavic people, then higher foreheads were clearly signs of superior intelligence. If, as it turned out, Africans had larger head circumference on average than Germans, then head circumference was not associated with intelligence. If German women were on average larger than Asian women, this was clear proof of their physical robustness and superior mothering/nurturing capacity.

The *Geopolitik* School was primarily geared toward awakening the forces of nationalist expansionism in the German populace via a propaganda campaign emphasizing Kjellen's notion of *Lebensraum;* literally, biological living space. *Lebensraum* in this view was a curious mixture of national mythology and pseudoscience. [108] It dictated that the state, as the *living* representative of its collective population, required space in order to thrive. So long as the state-organism expanded, it was healthy. If it ceased vigorous expansion it was bound to wither and die.

In this formulation, the German school was unable to project a *permanently* peaceful condition of global, autarkic superstates as Kjellen had done. Eventually, the superstates would clash and only one would survive—most likely the German-led state because of its natural resource abundance and preferred geographic position. For its part, the extreme version of *Astropolitik* must conclude that the state ultimately filling the biological niche that is Earth must continue its expansion or grow weak and susceptible to the internal diseases (social unrest, political fragmentation) that infect it. The healthy world-state will spill over into outer space and continue its *physical* expansion.

G*eopolitik* became the vessel of proof that the German nation and the German peoples were the geographically preferred successors to the Eurasian landmass. Should a parallel vision ultimately permeate the social theories of space exploration, *Astropolitik* could easily be perverted into a cosmic manifest destiny for human domination of the stars. We must remain ever wary of such powerful and emotive demagoguery.

Haushofer may have been personally uncomfortable with racist theory, but his ‘confused fatalism acted directly on Hitler through [his] pupil Rudolf Hess. Germany was called on to claim the mission of world leadership in the interest of preserving the [German] race’. [109] Hess had stirred the future Fuhrer with a prize-winning essay, which he wrote as his *Geopolitik* master’s thesis, entitled ‘How Must the Man be Constituted Who Will Lead Germany Back to Her Old Heights.’ [110] Indeed, certain passages in Hitler’s *Mein* Kampf appear directly inspired by Haushofer through Hess. [111]

Not inconsequentially, Haushofer’s students based their plan for world domination on the basic tenets of Mackinder’s dictum. Domination of Eastern Europe would provide Germany with access to Russia. Control of Russia would provide access to the vital Heartland. With the resources of Russia feeding the voracious industry of Germany, the fall of Western Europe was assured. World or global domination, the final logical step, was not in the immediate plans of the German school, however. Following Kjellen, these adherents of *Geopolitik* projected the rise of five roughly equivalent superstates, each controlled by the dominant culture in that sphere. These states would be located in Europe, North America, and Central, East, and South Asia. Germany was expected only to dominate and control the Eurasian superstate. In the final analysis, the Eurasian region was the most amply endowed of the five. Since the German people and culture were the products of this favored region with characteristics that made them physically, intellectually, and morally superior to all other races—Germano-Europe’s power would naturally outpace that of the other regions. In classic Social Darwinian fashion, the lesser regions would be consumed. But this was a matter for later generations. To make the theory more palatable to Germans and (somewhat) less threatening to non-Aryans, the later ambitions of world domination were downplayed.

Of note, *Geopolitik* panregionalism may have been heavily influenced by nineteenth-century US foreign policy. The German plan was in fact publicly referred to as ‘a Monroe Doctrine for Europe’. [112] Reversing the intent of Monroe, who argued against the intrusions of outside influences in the Americas, the German adherents of *Geopolitik* increasingly claimed the right of non-interference from outsiders in their imperial ambitions in Europe. These Haushoferians claimed that just as the US had a natural right to dominance in its natural sphere of influence, Germany should legitimately claim and defend its own geopolitically determined rights and territories.

With the defeat of the Axis powers, *Geopolitik* and, for the most part, geodeterminist theories of state power were thoroughly discredited. The line of geopolitical reasoning here identified as geostrategy continued to flourish, however, and the advocates of new technologies have continually made modifications to popular or practical geostrategies. It is on this basis, the tremendous practical value of incorporating new technologies into the logic flow of the geopolitical paradigm, that an ongoing effort to restore geopolitical thought to academic respect is ongoing.

NOTES

1. A common misuse of the term, somewhat justified by the input received from the nightly news on television. I once heard a national anchor begin a report on allegations that Russian President Boris Yeltsin was ill, possibly from a drinking problem, with, 'In geopolitical news tonight…'.
2. D.Deudney, 'Geopolitics and Change', in M.Doyle, and G.J.Ikenberry (eds), *New Thinking In International Relations Theory* (Boulder, CO: Westview Press, 1997), pp. 93–9.
3. Ibid., pp. 99–100.
4. M.Glassner, *Political Geography* (New York: J.Wiley, 1993).
5. G.Parker, *Western Geopolitical Thought in the Twentieth Century* (New York: St Martin's, 1986), p. 1.
6. See particularly C.Gray, *The Geopolitics of the Nuclear Era: Heartland, Rimlands, and the Technological Revolution* (New York: National Strategy Information Center, 1977); *Maritime Strategy, Geopolitics, and the Defense of the West* (New York: National Strategy Information Center, 1986); *The Geopolitics of Superpower* (Lexington, KY: University of Kentucky Press, 1987); and 'The Influence of Space Power upon History', *Comparative Strategy,*Vol 15, No.4 (1996), pp. 293–308. See also P.O'Sullivan, *Geopolitics* (New York: St Martin's Press, 1986). Some theorists focus on the antithesis of war—peace—when applying geopolitical principles to their work. See, for example, D.Deudney, *Whole Earth Security: A Geopolitics of Peace* (Washington DC: Worldwatch Institute, 1983).
7. H.Mackinder, *Democratic Ideals and Reality: A Study in the Politics of Reconstruction* (New York: Henry Holt, 1919), p. 190.
8. Numerous titles exist. Those identified here include Sun Tzu, *The Art of War,* transl. S.B.Griffith (Oxford: Oxford University Press, 1972); N.Machiavelli, *The Art of War,* translated E.Farneworth (New York: Da Capo Press, 1990); H.Jomini, *The Art of War,* translated G.H.Mendell and W.P.Craighill (Westport, CT: Greenwood Press, 1972); and C.von Clausewitz, *On War,* transl. J.J.Graham (New York: Barnes & Noble, 1956). A solid overview is provided by M.Van Creveld, *The Art of War: War and Military Thought,* ed. J.Keegan (New York: Cassell, 2000).
9. See M.Hawkins, *Social Darwinism in European and American Thought, 1860–1945: Nature as Model and Nature as Threat* (Cambridge: Cambridge University

Press, 1997). Although he does not use the term, E.O.Wilson's remarkable wide-ranging book, *Consilience: The Unity of Knowledge* (New York: Vintage/Random House, 1998), discusses the epigenetic foundations of such a notion (see Chapter 7, 'From Genes to Culture', pp. 136–77).

10. Excellent sources are A.Dorpalen, *The World of General Haushofer* (New York: Holt Rhinehart, 1942) and V.Veit, *The German People: Their History and Civilization from the Holy Roman Empire to the Third Reich* (New York: Alfred Knopf, 1946).
11. R.Mellor, *Nation, State, and Territory: A Political Geography* (New York: Routledge, 1989).
12. H.Wiegert, *Principles of Political Geography* (New York: Appleton-Century-Crofts, 1957).
13. S.Brunn and E.Yanarella, 'Towards a Humanistic Political Geography', *Studies in Comparative International Development*, Vol. 22, No. 2 (1987), pp. 223–38.
14. Deudney, 'Geopolitics and Change', p. 91.
15. Thucydides, *History of the Peloponnesian War*, ed. and transl. R. Warner (New York: Penguin, 1954). A recent overview edited by R. Strassler, *The Landmark Thucydides: A Comprehensive Guide to the Peloponnesian War* (New York: Free Press, 1996), is an excellent companion text.
16. A.Ferrill, *The Origins of War: From the Stone Age to Alexander the Great* (London: Thames & Hudson, 1985), pp. 91–4.
17. R.E.Dupuy and T.Dupuy, *The Encyclopedia of Military History: From 3500 BC to the Present* (New York: Harper & Row, 1970). Hans Delbrück plainly asserts the primacy of cavalry is 'a factor contributing to the development of a patrician class' (see H.Delbrück, *History of the Art of War: Within the Framework of Political History*, Vol. 1, transl. W. Renfroe (Westport, CT: Greenwood, 1975), p. 256).
18. For a fuller discussion of the role of military force structure on political institutions, see E.Dolman, 'War and (the Democratic) Peace', *Citizenship Studies*, Vol. 4 (2000), pp. 117–48.
19. Ferrill, *Origins* of War, p. 99.
20. C.Quigley, *Weapons Systems and Political Stability: A History* (Washington, DC: University Press, 1983), p. 271.
21. Ibid., p. 276.
22. Ibid., p. 273.
23. See A.Snodgrass, 'The Hoplite Reform and History', *Journal of Hellenic Studies*, Vol. 97 (1977), pp. 84–101.
24. W.G.Forrest, *A History of Sparta: 950–192 BC* (London: Hutchinson, 1968), pp. 55–7.

25 This observation is evident in the 'uncommon superiority of the knights over bourgeois and peasant infantry before the latter are trained and accustomed to being grouped together in tactical units', Delbrück, *History*, Vol. I, p. 257.

26. J.K.Anderson, *Military Theory and Practice in the Age of Xenophon* (Berkeley, CA: University of California Press, 1970), p. 13.
27. Quigley, *Weapons Systems*, p. 281.
28. Y.Yadin, *The Art of Warfare in Biblical Lands: In Light of Archaeological Study,*

Vol. I (New York: A.Knopf, 1963), pp. 134–5.

29. Also called the Vulture Stele, see T.Watkins, ‘The Beginnings of Warfare’, in J.Hackett (ed.), *Warfare in the Ancient World* (New York: Facts on File, 1989), p. 20.
30. R.O’Connell, *Of Arms and Men: A History of War, Weapons, and Aggression* (Oxford: Oxford University Press, 1989), p. 36.
31. J.S.Morrison and J.F.Coates, *The Athenian Trireme: The History and Reconstruction of an Ancient Greek Warship* (Cambridge: Cambridge University Press, 1986).
32. Quigley, *Weapons Systems*, p. 299.
33. Based on a calculation of 200 rowers per trireme, with a maximum of 500 Athenian triremes in service at the height of the Peloponnesian Wars.
34. S.Andreski, *Military Organization and Society* (London: Routledge & Keegan Paul, 1954), p. 69.
35. I.Khaldûn, *The Muqaddimah: An Introduction to History,* transla. F.Rosenthal (Princeton, NJ: Princeton University Press, 1989): 49–70.
36. A.Toynbee, *A Study of History* (Oxford: Oxford University Press, 1956).
37. See A.Haley and Malcolm X, *The Autobiography of Malcolm X* (New York: Ballantine, 1964), pp. 162–8.
38. See L.Jeffries, *Dr Jeffries Speaks: War Against the Black Race* (New York: A&B Books, 1998). Criticism of Jeffries’ work can be found in S.Howe, *Afrocentrism: Mythical Pasts and Imagined Homes* (London, Verso, 1999).
39. F.J.Turner, *The Frontier in American History* (New York: Holt, Rinehart & Winston, 1962).
40. J.Oberg and A.Oberg, *Pioneering Space: Living on the Next Frontier* (New York: McGraw-Hill, 1986), p. 17.
41. The latter pseudonym refers to James Madison, Alexander Hamilton, and John Jay, anonymous authors of *The Federalist Papers*.
42. O.Hintze, *The Historical Essays of Otto Hintze,* ed. and transl. F.Gilbert (New York: Oxford University Press, 1975). For a compatible argument, see also A.Vagts, *A History of Militarism: Romance and Realities of a Profession* (New York: W.W.Norton, 1937).
43. The phalanx analogy described earlier fits this paradigm. Although clearly a ground force, in implementation it is not useful for occupying or pacifying territory. Its supremacy reigns on the battlefield only. In defense of point locations such as cities, the soldiers are removed from their tactical formation and dispersed.
44. E.Dolman, ‘War and (the Democratic) Peace’, p. 123.
45. R.Salkeld, *War in Space* (Englewood Cliffs, NJ: Prentice-Hall, 1970); and T.Karras, *The New High Ground: Strategies and Weapons of Space Age Wars* (New York: Simon and Schuster, 1983).
46. For a similar exposition of these views, see E.Dolman, ‘Military Intelligence and the Problem of Legitimacy: Opening the Model’, in M.Manwaring and A.Joes (eds), *Beyond Declaring Victory and Coming Home* (Westport, CT: Greenwood, 2000); also published with minor revisions as ‘US Military Intelligence and the Problem of Legitimacy’, *Journal of Small Wars and Insurgencies,* Vol. 11 (2000), pp. 26–43.

47. E.E.Mead, 'Adam Smith, Alexander Hamilton, Friedrich List: The Economic Foundations of Military Power', in P.Paret (ed.), *The Makers of Modern Strategy: From Machiavelli to the Nuclear Age* (Princeton, NJ: Princeton University Press, 1986), p. 254.
48. See B.Tuchman for the best exposition of this view, *The Guns of August* (New York: Macmillan, 1962).
49. Mahan's influential body of work in this period includes *The Influence of Seapower Upon History: 1660–1783* (Boston, MA: Little, Brown, 1890); *The Influence of Seapower Upon History: The French Revolution and Empire, 1793–1812* (Boston, MA: Little, Brown, 1892); *The Interest of America in Seapower, Present and Future* (Boston, MA: Little Brown, 1898); *The Problem of Asia and Its Effect Upon International Politics* (Boston, MA: Little, Brown, 1900).
50. Mahan, *The Influence of Seapower* (1890), pp. 35, 44.
51. Ibid., pp. 50–9.
52. Ibid., p. 25.
53. Ibid., p. 33.
54. This phenomenon was pointed out to me by M. Jennison in, 'The "Civil"-ization and Internationalization of Satellite Navigation', a paper presented at the *Sixth Biennial Conference on the Law Relating to National Security Activities in Outer Space*, in Colorado Springs (March 1994).
55. Mahan, *The Influence of Seapower* (1890), p. 83.
56. J.Keegan, *The Price of Admiralty: The Evolution of Naval Warfare* (New York: Viking, 1989), p. 110.
57. First in H.Mackinder, 'The Geographical Pivot of History', *Geographical Journal*, 23, 4 (1904), pp. 421–44; the latter reference in Mackinder's widely read book, *Democratic Ideals*.
58. Mackinder, 'Geographical Pivot', p. 430.
59. Ibid., p. 434.
60. Mackinder, *Democratic Ideals*, p. 150.
61. Well synopsized in J. Dougherty and R. Pfaltzgraf, *Contending Theories of International Relations: A Comprehensive Survey*, 4th edn (New York, Longman, 1996), pp. 144–72.
62. Cited in B.Blouet, *Halford Mackinder: A Biography* (College Station, TX: Texas A&M University Press, 1987), p. 273.
63. N.Spykman, *The Geography of Peace* (New York: Alfred Knopf, 1944), p. 43. See also N.Spykman, 'Geography and Foreign Policy', a two-part series in the *American Political Science Review*, Vol. 32, No. 1 (1938), 28–50 and in Vol. 32, No.2 (1938), pp. 213–36; and *America's Strategy in World Politics* ([1942] Hamden, CT: Archon, 1970).
64. H.Sprout, 'Geopolitical Hypotheses in Technological Perspective', *World Politics*, Vol. 15 (1963), pp. 187–212; and H.Sprout and M.Sprout, *The Ecological Perspective on Human Affairs: With Special Reference to International Politics* (Westport, CT: Greenwood Press, 1979).
65. H.Wiegert, 'US Strategic Bases and Collective Security', *Foreign Affairs*, Vol. 25, No. 2 (1947), pp. 250–62.

66. R.Strausz-Hupé, *Geopolitics: The Struggle for Space and Power* (New York: Putnam and Sons, 1942).
67. S.Cohen, 'The World Geopolitical System in Retrospect and Prospect', *Journal of Geography,* Vol. 89, No. 1 (1990), pp. 2–10.
68. Ibid., p. 10.
69. H.G.Wells, 'The Land Ironclads', *Selected Short Stories* ([1901] Harmondsworth: Penguin, 1958), pp. 85–112. See also H.G.Wells, *Anticipations of the Reaction of Mechanical and Scientific Progress Upon Human Life and Thought* (New York: Harper, 1902).
70. G.Douhet, *The Command of the Air,* transl. D.Ferrari ([1921] New York: Coward, McCann, 1942), p. 62. See also P.Meilinger, 'Giulio Douhet and the Origins of Airpower Theory', in P.Meilinger (ed.), *The Paths of Heaven: The Evolution of Airpower Theory* (Maxwell AFB, AL: Air University Press, 1997), pp. 1–40.
71. Ibid., pp. 88–90.
72. A.Hurley, *Billy Mitchell: Crusader for Air Power* (Bloomington: University of Indiana Press, 1964): 81–3.
73. W.Mitchell, *Winged Defense: The Development and Possibilities of Modern Air Power—Economic and Military* (New York: Putnam, 1925).
74. A.De Seversky, *Victory Through Air Power* (New York: Simon & Schuster, 1942); see also A.De Seversky, 'The Twilight of Seapower', *American Mercury,* Vol. 52 (1941), pp. 647–58; and P.Meilinger, 'Alexander P.de Severskey and American Airpower', in P.Meilinger (ed.), *The Paths of Heaven: The Evolution of Airpower Theory* (Maxwell AFB, AL: Air University Press, 1997), pp. 239–78.
75. A.De Seversky, *Air Power: Key to Survival* (New York: McGraw-Hill, 1951).
76. L.Freedman, 'The First Two Generations of Nuclear Strategists', in P.Paret (ed.), *Makers of Modern Strategy: Machiavelli to the Nuclear Age* (Princeton, NJ: Princeton University Press, 1986), p. 735.
77. C.Gray, 'Strategy in the Nuclear Age', in W.Murray, M.Knox, and A.Bernstein (eds), *The Making of Modern Strategy: Rulers, States, and War* (Cambridge: Cambridge University Press, 1994), p. 581.
78. See E.Rhodes, *Power and MADness: The Logic of Nuclear Coercion* (New York: Columbia University Press, 1989), for an immensely thought-provoking overview.
79. T.K.Meyers, *Understanding Weapons and Arms Control: A Guide to the Issues* (Washington, DC: Brassey s, 1991), p. 104.
80. Respectively, P.Stares, *Command Performance: The Neglected Dimension of European Security* (Washington DC: Brookings, 1991), p. 3; M.Van Creveld, *Command in War* (Cambridge: Cambridge University Press, 1985), pp. 269–74; and D.Ball, *Can Nuclear War Be Controlled?* (London: Adelphi Papers, 1981), pp. 7–9.
81. P.Stein and P.Feaver, *Assuring Control of Nuclear Weapons: The Evolution of Permissive Action Links* (Lanham, MD: University Press of America, 1987), pp. 62–76; and Meyers, *Understanding Weapons,* pp. 101–4.
82. Donald Latham, Assistant Secretary of Defense for C3I, cited in T.Coakley, (ed.), *C3I: Issues of Command and Control* (Washington, DC: National Defense University, 1991), pp. 144–5. 'In our judgment, [one] errs on the side of safety, reasoning that I would rather not have the systems be able to work than just have an

absolutely uncontrollable situation. In the case of artillery shells, if I couldn't get word through, they couldn't be used.'

83. Meyers, *Understanding Weapons*, p. 104.
84. Stein and Feaver, *Assuring Control*, p. 72.
85. P.Bracken, *The Command and Control of Nuclear Forces* (New Haven, CT: Yale University Press, 1983), p. 55. See also Stein and Feaver, *Assuring Control*, p. 62; and K.Gottfried and B.Blair (eds), *Crisis Stability and Nuclear War* (New York: Oxford University Press, 1988), p. 86; there is 'an obvious potential for friction as priorities shift'.
86. R.Garthoff, *Deterrence and the Revolution in Soviet Military Doctrine* (Washington DC: Brookings, 1990), p. 122. Garthoff cites Victor Kortunov, 'Disastrous Relapses into a Policy of Strength' (July 1980).
87. R.Betts, *Surprise Attack* (Washington, DC: Brookings Institution, 1982), p. 251.
88. Ball, *Nuclear War?*, p. 5.
89. D.Ford, *The Button: The Pentagon's Strategic Command and Control System* (New York: Simon & Schuster, 1985), p. 233. Ford cites a Pentagon source saying 'at least nine out of ten people in the military planning system—and I'm talking about the hawks—[feel] that strategic war wouldn't occur'. Bracken, *Command and Control*, p. 71, says a 'bolt-from-the-blue' attack has been so derided it is no longer given much credit. In such a setting, where defense planning has atrophied, 'it just might work'. More credibly, 'the vulnerability to surprise attack in peacetime increases because of the checks and balances intended to prevent accidental war'.
90. Gottfried and Blair, *Crisis Stability*, pp. 83–4; Bracken, *Command and Control*, p. 47, 'Soviet military exercises actually estimate the point that the United States issues orders to use nuclear weapons and then preempt before such an action can take place.'
91. Betts, *Surprise Attack*, p. 231. The author also correctly points out that this vulnerability may *increase* deterrent value. The enemy must assume that some low-level authority has been arranged in case of a confirmed nuclear attack to ensure retaliation. And on p. 252, 'Uncertainty is a prop to deterrence credibility'
92. Meyers, *Understanding Weapons*, pp. 131ff; Ball, *Nuclear War?*, pp. 9ff.; and S. Cimballa, *Uncertainty and Control: Future Soviet and American Strategy* (New York: St Martin's Press, 1990), p. 160. For a fuller description of nuclear accidents, see J.Oberg, *Uncovering Soviet Disasters: Exploring the Limits of Glasnost* (New York: Random House, 1988), pp. 86, 240–4; G.Yost, *Spy-Tech* (New York: Facts On File, 1985), p. 108; and Bracken, *Command and Control*, pp. 49, 54–5.
93. L.Freedman, *The Evolution of Nuclear Strategy* (New York: St Martin's, 1981), p. 112, 'It takes two to keep a war limited.'
94. Garthoff, *Deterrence and Revolution*, p. 178.
95. Ibid., pp. 178, 185. See also B. Blair, *Strategic Command and Control: Redefining the Nuclear Threat* (Washington DC: Brookings Institution, 1985), p. 7.
96. R.Herres, 'Space-Based Support', *Defense '88* (November-December, 1988), p. 8.
97. V.Stanley and P.Noggle, 'Command and Control Warfare: Seizing the Initiative', *Signal* Vol. 38, No. 8 (April 1984), p. 23.
98. Gottfried and Blair, *Crisis Stability*, p. 85, 'while there would probably be high

confidence that the US is under attack, there would be but low confidence as to the nature of the attack'. Also, from Betts, *Surprise Attack,* p. 231, a single missile could be used to eliminate a national leader; in essence assassination by nuclear decapitation.

99. Bracken, *Command and Control*, pp. 163–5.
100. F.von Ratzel, *Politische Geographie: oder die Geographie der Staten, des Verkehres und des Krieges* (Munich and Berlin: R.Oldenbourg, 1903).
101. Cited in B.Blouet, '*Geostrategic Thought'*, unpublished lectures (August 1994).
102. W.Smith, *The Ideological Origins of Nazi Imperialism* (New York: Oxford University Press, 1986), p. 146.
103. Glassner, *Political Geography*, p. 224.
104. See D.Cole and I.M.Levitt, *Exploring the Secrets of Space; Astronautics for the Layman* (Englewood Cliffs, NJ: Prentice-Hall, 1963).
105. A.Dorpalen, *The World of General Haushofer* (New York: Holt Rhinehart, 1942).
106. Strausz-Hupé, *Geopolitics,* p. vii.
107. Veit, *German People,* p. 246.
108. G.Sabine, *A History of Political Theory,* revised edition ([1937] New York: Henry Holt, 1950), p. 984; and Morgenthau, *Politics Among Nations*, pp. 158–64.
109. Veit, *German People,* p. 666.
110. W.Shirer, *The Rise and Fall of the Third Reich* (New York: Simon & Schuster, 1960), p. 48.
111. Ibid.; see also pages 177–85 in the R.Manheim translation of *Mein Kampf* (Boston, MA: Houghton Mifflin, 1943).
112. Sabine, *Political Theory,* p. 897.

3

Modeling the Astropolitical Environment

It has been suggested that the classical concepts of geopolitics, most of which are outlined in Chapter 2, are remarkably transferable to the *terrain* of outer space. [1] To be sure, the application of space technology is simply the latest in a logical line of techno-innovations in the continuing process of refining and resurrecting geopolitical theory. If indeed the resurrection and rehabilitation of geopolitics is a useful (if not yet altogether laudable) goal, then it requires at a minimum continuing political relevance. In this chapter the essential quality of classical geopolitics is captured, and its reach extended to the realm of outer space, a transition called astropolitics and, where appropriate, *Astropolitik*. If geopolitical theory developed for the Earth and its atmosphere can be transferred to outer space, then, *a fortiori*, the utility and value of its fundamental concepts and holistic design remain relevant, and are suitable for a set of revised or neoclassical geopolitical propositions.

The focus here is primarily on that variant of geopolitics called ‘geostrategy’, or the strategic application of new and emerging technologies within a framework of geographic, topographic, and positional knowledge. Without question, outer space has a distinct and definable geography, and much of the following rests on an exposition of its geographic characteristics. The remaining task, then, is to associate and extend existing geopolitical and geostrategic propositions to the described space model.

MODELING ASTROPOLITICS

Jean Gottman has argued that if the world were as featureless as a billiard ball, without terrain or topography, geopolitics could not have been posited. [2] Probably so, but with the perspective of scale gleaned from an outer space vantage, the Earth’s terrain is relatively smoother than a billiard ball, and topographic features effectively disappear. Only the vast oceans interspersed with their continental juxtapositions remain. With this appreciation of scale, the important astropolitical features of Earth—or for that matter of any celestial body—are chiefly its mass (for determinations of gravitational pull), orbit, and relation to other space phenomena. Astropolitics is in this view the *purest* form of geopolitical analysis, converging entirely on elements of space and scale.

This grandest of all perspectives reestablishes one of the great achievements of the modern geopolitical theorists: the recognition that the study of politics cannot be nationally isolationist in its perspective. The Earth, to them, represented a conceptual unity. Without using systems terminology, they conceived of a single political arena. Each national unit was an integral part of the whole. State actions affected others, and states were in turn affected by the actions and reactions of those others. This holistic approach was a revelation in its day, and pushed the politicogeographic paradigm to lofty new heights.

Rather than reduce the importance of nation-states within the system, however, classical geopolitical theory has tended to amplify the centrality of national or regional rivalries. By manipulating knowledge of geopolitical characteristics, some states could hope to gain an advantage over others. At the very least, states could hope to prevent another from gaining advantages by blocking its efforts at control. The vision of astropolitics presented here reinforces those notions. The logic is so compelling that states wishing to remain sovereign must at a minimum prevent other states from gaining vital control of strategic space locations, pathways, and chokepoints. Before identifying these critical elements of astropolitics, to ensure a common ground for discussion, it seems prudent to describe briefly the physical properties and operating characteristics of outer space.

ORBITS AND ORBITAL MECHANICS

What appears at first a featureless void is in fact a rich vista of gravitational mountains and valleys, oceans and rivers of resources and energy alternately dispersed and concentrated, broadly strewn danger zones of deadly radiation, and precisely placed peculiarities of astrodynamics. [3] Without a full understanding of the motion of bodies in space, in essence a background in the mechanics of orbits, it is difficult to make sense of this panorama.

An orbit is the path of a spacecraft or satellite caught in the grip of gravity. Knowledge of orbits and orbital mechanics is vital for one primary reason—spacecraft in stable orbits expend no fuel. Thus the preferred flight path for all spacecraft (and natural satellites) will be a stable orbit, specifically limited to a precise operational trajectory. With this knowledge we can begin to see space as a demarcated and bounded domain.

The phenomenon that a satellite in orbit expends no fuel or energy is due to the fact that the satellite is constantly falling toward the body it orbits. Consider the arc of a baseball as it is thrown, or better yet the path of a bullet fired from a gun aimed parallel to the Earth's surface (see Figure 3.1). The path of the bullet appears to arc downward toward the Earth until it hits the ground. The faster the bullet goes, the farther it will travel before being pulled to the ground by gravity. In the hypothetical case of a bullet traveling at 17,500 mph (just over 28,500 kph), the bullet would appear to fall toward the Earth at the same rate as the ground curves away, due to the spherical shape of the planet. Technically, the orbiting body is constantly falling (or is being pulled) directly toward the center of the Earth, but it never hits the ground.

An orbit is described first in terms of altitude (above the surface of the orbited body) and eccentricity (or variation in altitude). The highest and lowest points in an orbit are called the apogee and perigee, respectively (see Figure 3.2). Orbits are usually specified as circular, that is to say, of constant altitude with insignificant differentiation of apogee and perigee, or elliptical, of varying altitude and eccentricity. Once these parameters are established the orbit of the spacecraft can be envisioned as part of a flat plane passing through the center of the orbited mass. The time it takes for a spacecraft to complete one

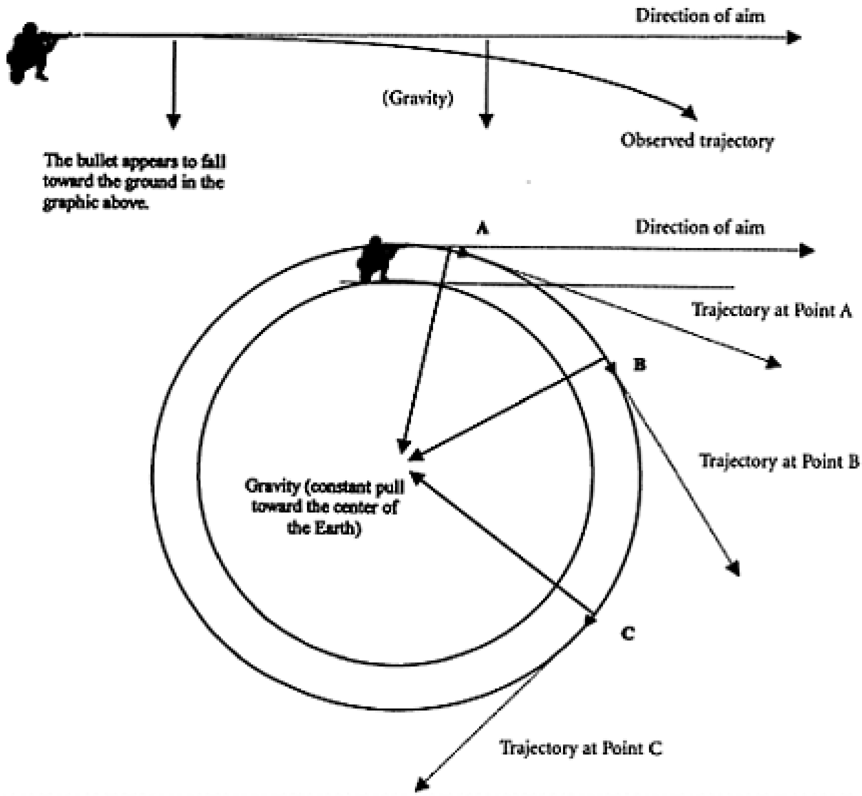

Figure 3.1: Orbital trajectory

orbit is called its period. Additional useful details can be found by determining the satellite's inclination, the angle measured as the difference between the satellite's orbital plane and the orbited body's equatorial plane. The inclination tells us the north and south latitude limits of the orbit. It is also useful to know the orbital plane's position relative to a fixed point on the rotating body of the orbited mass. For the Earth, this point is the vernal equinox. The distance from it to the spacecraft's rising or ascending pass over the equator is called its right ascension. The points where an orbit crosses the Earth's equatorial plane are called nodes. If the orbit crosses the plane going from south to north, the node is the ascending node; from north to south, it is the descending node. The longitude of the nodes helps fix the orbit relative to the surface of the body it is circling.

As a rule, the higher the altitude, the more stable the orbit. This is simply because there is more interference from atmospheric density and gravitational fluctuations the closer one is to the orbited mass. Also, the higher the altitude the *slower* the spacecraft appears to travel relative to the body it orbits (relative orbital speed increases as the spacecraft spirals down the gravity well of the orbited mass). Higher orbits are not necessarily more desirable, however. Orbital differences can also signify a distinction in mission. Lower orbits are advantageous if a close or detailed view of the Earth is required, or a concentrated

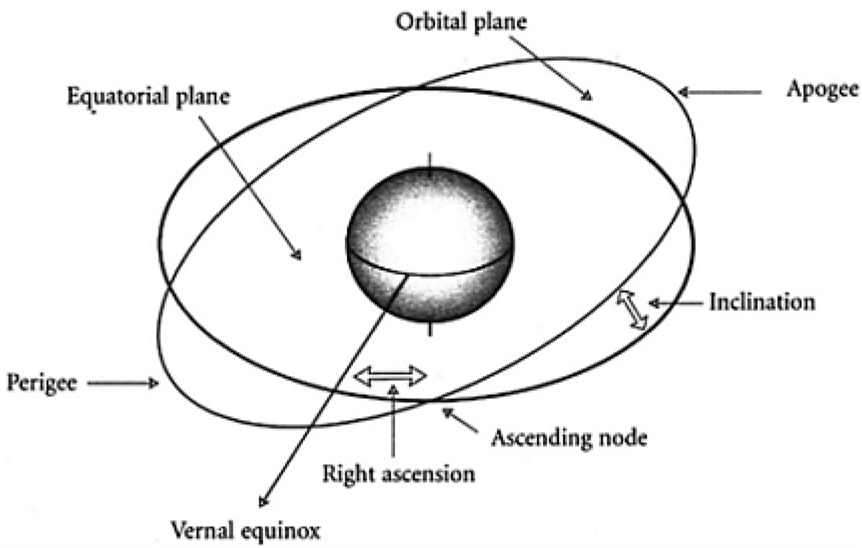

Figure 3.2: Orbital characteristics

low-diffusion communications link is needed. Higher orbits provide a larger field of view, sacrificing detail for comprehension, and offer wider electronic accessibility. Circular or constant altitude orbits are generally used for spacecraft that perform their missions continuously, over the entire course of the orbit, while eccentric orbits usually signify that missions are conducted at critical points in the orbit—usually at perigee or apogee.

Ascension is also differentiated according to mission needs. The most vertical ascension orbit has a 90° inclination, which is perpendicular to the equatorial plane. This orbit is also called a polar orbit, meaning the spacecraft passes over the North and South Pole each complete orbit. The lowest inclination is 0°, which means the orbit is perfectly coincident with the equatorial plane. Inclinations below 90° are called posigrade orbits, meaning that the spacecraft tends to drift eastward on each orbital pass, while inclinations above 90° are retrograde, tending to drift westward. If the spacecraft's inclination is 0°, and its altitude is constant at 36,000 km, the spacecraft will appear fixed relative to a point above the Earth. This is called a geostationary orbit, and is the only orbit that has this fixed-point capacity. This orbit has extraordinary value for terrestrial acquisition of the spacecraft, as a tracking station or satellite dish does not have to move to maintain contact with the satellite. It is today undoubtedly the most commercially lucrative of the terrestrial orbits.

Orbits that are impacted by forces other than the constant gravitational mass of the orbited body have fluctuations in their natural movement. The orbit of an Earth satellite is never perfectly circular due to these fluctuations, which are called perturbations. The lower the altitude of a spacecraft, the more significant the friction caused by an encroaching atmosphere. As already mentioned, the effects of atmospheric drag are significantly reduced as periods (altitudes) increase. The effect is critical to space operations as satellites in a circular orbit with a period of less than 93 minutes require large amounts of fuel to make orbital corrections necessary to maintain spacing, distance, and velocity. Satellites in circular orbits with a period greater than 101 minutes are essentially unaffected by the atmosphere, and require relatively few attitude adjustments, as a consequence saving fuel and extending the useful life of the satellite. Orbits below about 160 km altitude (or an orbital period of 87.5 minutes) are theoretically possible, but not practically achievable due to accumulating atmospheric drag.

Perturbations also come from the bulge at the Earth's equator caused by the centrifugal force of its over 1,000 mph rotation, which causes the Earth's gravitational pull to be inconsistent. The Earth is actually flattened slightly at the poles and distended at the equator, a phenomenon that also creates small deviations in the flight path of a ballistic missile (one of the functions of geodetic satellites is to accurately measure the ever-changing oblation of the Earth—called spherical modeling—to increase the accuracy of intercontinental ballistic missiles [ICBMs]). Other perturbations, increasingly significant as one moves away from the Earth, are the gravitational fields of the sun, moon, and other celestial bodies, and the effects of solar radiation including solar flares, and the impacts of meteors and debris that strike the satellite at hyper-velocity. Thus, no orbit is perfect and all spacecraft must have some fuel to occasionally make corrections. The useful life of a spacecraft is, for the most part, a function of its fuel capacity and orbital stability.

Given these parameters, currently useful terrestrial orbits can be clustered into four generally recognized categories based on altitude and mission utility (see Figure 3.3). The first encompasses *low-altitude orbits,* between 150 to 800 km above the surface of the Earth. These are particularly useful for Earth reconnaissance (military observation to include photographic, imaging, and radar satellites, and resource management satellites that can take a variety of multi-spectral images) and manned flight missions. These altitudes allow for 14 to 16 complete orbits per day. Manned flights generally have low inclinations to maximize spacecraft to control center contact, while reconnaissance flights generally have high inclinations to maximize coverage of the Earth's surface. Polar low-Earth orbits with a slightly retrograde inclination can be made to orbit in such a way that they are constantly above a sunlit Earth. This is extremely important for imaging satellites, and is all the more useful because the satellite can be made to stay above early morning or early evening regions. This creates long shadows helpful in identifying and determining the height of objects seen from directly above. Low-altitude orbits have the added advantage that satellites can be placed into them with cheaper and less sophisticated two-stage rockets. Orbits with a period in excess of 225 minutes (above 800 km) require at least a third-stage boost to achieve final orbit.

M*edium-altitude orbits* range from 800 km to 35,000 km in altitude, and allow for 2 to 14 orbits per day. These are generally circular or low eccentricity orbits that support linked satellite networks like the recently deployed—and now possibly defunct—Iridium system from Motorola. Currently, navigational satellites such as the US GPS (Global Positioning Satellite, see Figure 3.4), that fix terrestrial positions through the triangulation of at least three satellites in view, dominate this orbit,though increasingly

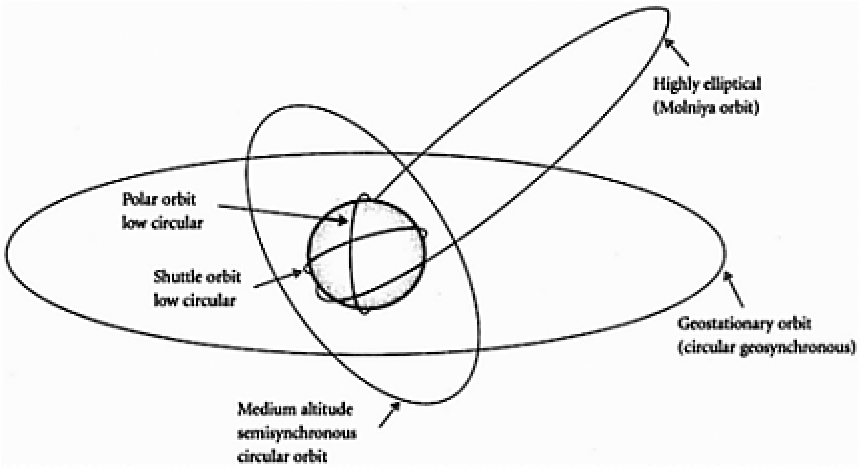

Figure 3.3: Terrestrial orbits

high-speed global telecommunications networks are envisioned in operation here.

H*igh-altitude orbits,* at least 35,000 km, provide maximum continuous coverage of the Earth with a minimum of satellites in orbit. Satellites at high-altitude orbit the Earth no more than once per day. When the orbital period is identical to one full rotation of the Earth, a *geosynchronous* orbit is achieved. Again, a geosynchronous orbit with a 0° inclination (placed directly above the equator) appears fixed in the sky from any point on Earth. This is called a *geostationary* orbit. Just three satellites at geostationary orbit, carefully placed equidistant from each other, can view the entire planet up to approximately 70° north or south latitude (see Figure 3.5, a satellite at geostationary orbit has a field of view of 28 percent of the Earth’s surface). Since the satellites don’t appear to move, fixed antennae can easily and continuously access them. Global communications and weather satellites are typically placed in this orbit.

For those latitudes above 70°, the advantage of long dwell time over target provided by a geostationary orbit is absent. This is simply because the limb or horizon of the Earth is not functionally visible. The angle of direct view is too oblique. One technique to overcome this deficiency is to use the fourth orbital category, the *highly elliptical orbit.* This orbit is described as highly eccentric with a perigee as low as 250 km and an apogee of up to 700,000 km. In theory, the Earth’s gravitational pull extends about 900,000 km (one 166th of the distance between the Earth and Sun, about twice the distance between the Earth and Moon). Beyond this distance Earth orbits are not possible, as a spacecraft will eventually be drawn to another gravitational field.

Placed in a highly inclined orbit with apogee at 36,000–40,000 km, the satellite appears to dwell over the upper latitudes for several hours, making this a particularly useful orbit for communications satellites servicing Arctic and Antarctic regions. This apparent pause occurs because the speed of the spacecraft at apogee is only about 3,000 mph,while the speed at perigee is over 20,000 mph. At the great distance of apogee,the

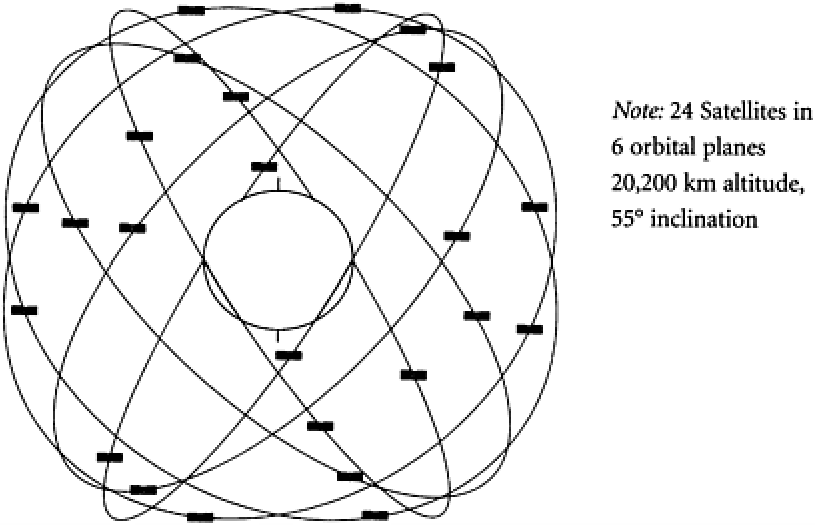

Figure 3.4: Linked network (NAVSTAR/GPS)

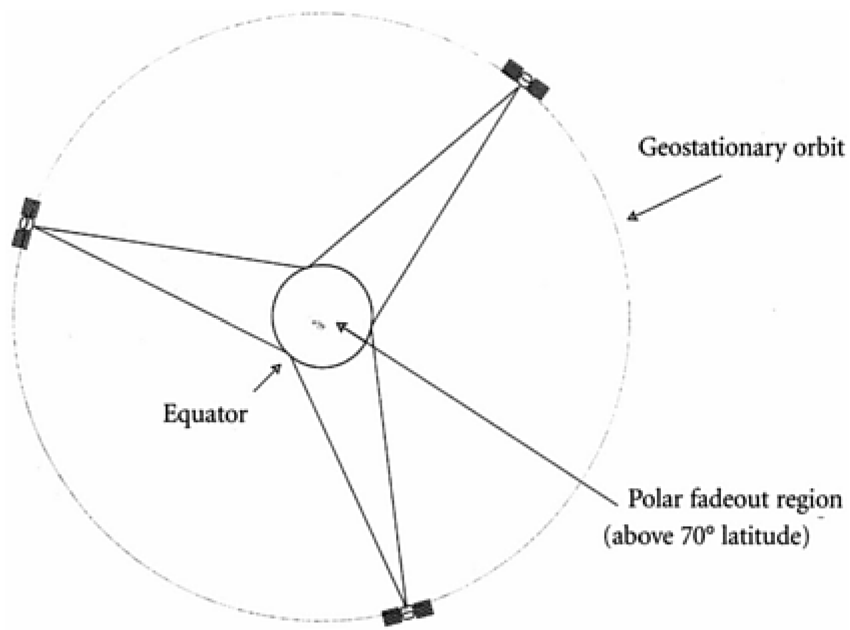

Figure 3.5: Geostationary fields of view

satellite appears to be barely moving relative to the surface of the Earth. When networked in the same orbit, one behind the other with equally spaced right ascensions, a minimum of three satellites can continuously access a single high latitude ground station. The Russians have made the greatest use of this semi-synchronous 12-hour orbit, and it is now routinely referred to as a *Molniya*-type orbit, after the Molniya series communications and weather spacecraft that use it (see Figure 3.6). A highly elliptical orbit with apogee at over 700,000 km can have a period of more than a month, and is especially useful for scientific missions that study comets, asteroids, solar and cosmic radiation, and other space phenomena.

With this essential exposition of orbital definitions and mechanics out of the way, an analysis of the terrain of outer space and the interaction of classical geopolitical theories can begin.

Figure 3.6: Molniya satellite and orbit

THE FOUR REGIONS OF SPACE

Halford Mackinder keyed his classic 1919 study of world power to the identification of distinct regions whose interactions defined the course of global history. History, he believed, could be understood as an alternating struggle between sea and land power. He projected that the nineteenth-century naval dominance of Britain would soon give way to a continental land-based power with the practical dominance of the new railroad technologies—unless, of course, the British actively prevented that dominance through balancing and other *Realpolitik*-style diplomatic techniques.

The key dynamic was the coming change in transportation technology, and with the inevitable rise of space transportation/exploration, a comparable division of the known environment into politicogeographic regions seems supported. So, following Mackinder's lead, astropolitics begins with a demarcation of the geopolitical regions of outer space (see Figure 3.7).

An assumption of this analysis is that the resource potential of space, like Mackinder's heartland, is so vast that, should any one state gain effective control of it, that state could dictate the political, military, and economic fates of all terrestrial governments. The Moon, for example, is rich in aluminum, titanium, iron, calcium, and silicon. Iron is in virtually pure form, and could be used immediately. Titanium and aluminum are 'found in ores not commonly refined on Earth, [and would require] new methods of extraction'. [4] Silicon is necessary for the construction of photovoltaic solar cells, an impressive and needed source of cheap energy. Abundant oxygen for colonies and fuel can be extracted from the lunar soil simply by heating it. Water from impacting comets is presumed to have collected in the permanently shadowed edges of craters. This near-Earth resource can already be exploited given current technology. The potential of the asteroids, planets and their moons, comets and meteors, and the sun can only be imagined. Access to these resources is possible only through the intervening regions between them and the Earth. The four distinct astropolitical regions of space are described here on the basis of physical properties.

(1) *Terra* or *Earth,* including the atmosphere stretching from the surface to just below the lowest altitude capable of supporting unpowered orbit. This is also known as the Karmann primary jurisdiction line, named after Theodore Von Karmann, the mathematician who first suggested its use. The inclusion of a terrestrial region is a critical concept for my model, and is a proper setting for space activities. Here the Earth and its atmosphere are the conceptual equivalents of a coastal area for outer space. [5] All objects entering from Earth into orbit and reentering from space must pass through it. It is on the surface of the Earth *(Terra)* that all current space launches, command and control, tracking, data downlink, research and development, production, anti-satellite activities, and most servicing, repair, and storage operations are performed. Terra is the only region or model that is concerned with traditional topography (continental forms, oceans, etc., see terrestrial basing below, p. 79) in the classic geopolitical sense, and is the transition region between geopolitics and astropolitics.

(2) *Terran* or *Earth space,* from the lowest viable orbit to just beyond geostationary altitude (about 36,000 km). Earth space is the operating medium for the military's most advanced reconnaissance and navigation satellites, and all current and planned space-based weaponry. [6] At its lower limit, Earth space is the region of post-thrust medium and long-range ballistic missile flight, also called low-Earth orbit. At its opposite end, Earth space includes the tremendously valuable geostationary belt, populated mostly by communications and weather satellites.

(3) *Lunar* or *Moon Space* is the region just beyond geostationary orbit to just beyond lunar orbit. The Earth's moon is the only *visible* physical feature evident in the region, but it is only one of several strategic positions located there. Earth and lunar space encompass the four types of orbits described above, with the exception of the highly elliptical orbit with apogees beyond the orbit of the moon, currently used exclusively for scientific missions.

(4) *Solar space* consists of everything in the solar system (that is, within the gravity well of the Sun) beyond the orbit of the Moon. The exploitation of solar space will be treated quite briefly, as expansion into this region using current technologies will be quite limited. Nonetheless, the exploration of solar space is the next major goal for manned missions and eventual permanent human colonization. The near planets (Mars

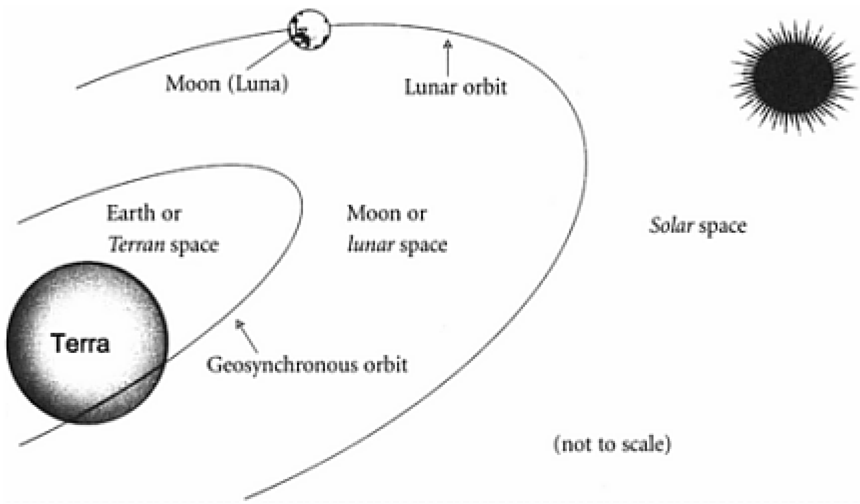

Figure 3.7: Four regions of space

and Venus), the Jovian and Saturnian moons, and the many large asteroids in the asteroid belt undoubtedly contain the raw materials necessary to ignite a neo-industrial age. From an antiquated *Geopolitik* point of view, it also contains the *Lebensraum* for a burgeoning population on Earth. [7]

The vast resources of solar space represent the heartland equivalent of the astropolitical model. Earth space, like eastern Europe in Mackinder's design, is the most critical arena for astropolitics. Control of Earth space not only guarantees long-term control of the outer reaches of space, it provides a nearterm advantage on the terrestrial battlefield. From early warning and detection of missile and force movements to target planning and battle damage assessment, space-based intelligence gathering assets have already proven themselves legitimate combat force multipliers. The most surprising and enduring contributions evident in the expanded military role of outer space technology, however, may have come from the previously under-appreciated value of navigation, communications, and weather-prediction satellites. [8] With its performance in the Persian Gulf, space warfare has emerged from its embryonic stage and is now fully in its infancy. All the industrially advanced states now recognize military space power as the apex of national security, and have tossed aside long-standing objections to military space programs as they eagerly pursue their own space infrastructures. [9] In future wars involving at least one *major* military power, space support will be the decisive factor as nations rely ever more heavily on the force multiplying effect of 'the new high ground'. [10]

With the growing importance of space technology on the modern battle-field, control of space becomes increasingly vital. The geo-/astropolitical mandates of space operations are now discussed in greater detail, beginning with Earth and lunar space associations and ending with terrestrial basing requirements.

ASTROPOLITICAL CONSIDERATIONS FOR EARTH AND LUNAR SPACE

After the demarcation of space into astropolitically bounded regions, we turn to the ‘wide commons’ of Alfred Thayer Mahan, ‘over which men may pass in all directions, but on which some well-worn paths [emerge for] controlling reasons’, the aforementioned lanes of commerce and critical chokepoints of the open oceans. [11] Outer space, too, appears at first as a wide common over which spacecraft may pass in any direction, and to an extent this is so, but efficient travel in space requires adherence to specific and economically attractive lanes of movement, specific routes that are easy to project.

In the Age of Sail, wind and current—their appearance, prevalence, or lack thereof—were the determining factors in transoceanic travel. In rail travel, gradient is the determining limitation in transcontinental planning. In space, gravity is the most important factor in both understanding and traversing the topography of space. It dictates prudent travel and strategic asset placement. The unseen undulations of outer space terrain, the hills and valleys of space, are more properly referred to as *gravity wells*. Depiction of this terrain is difficult, but a two-dimensional portrayal is that of a weight sinking into a taughtly stretched sheet of rubber (see Figure 3.8). The more massive the body, the deeper the well. Travel or practical distance in space is less a function of linear distance than of effort or work expended to get from point A to point B. Traveling 35,000 km from the surface of the Earth, for example, requires 22 times as much effort as traveling a similar distance from the surface of the Moon, as the Earth’s gravity well is 22 times deeper. [12]

In spacefaring terms, the important measure of work is the propulsive effort required to change a velocity vector, or the total velocity required to get from point A to point B. The total velocity effort (also called Δv or Delta V) is the key to understanding the reality of space travel and the efficient movement of goods. In another example of effective distance in space versus linear distance, it is much cheaper in terms of Δv to propel a spacecraft from the Moon to Mars (56 million km at the closest orbital point) than to propel the same spacecraft from the Earth to the Moon (just 385,000 km). [13]

> Thus the Δv to go from low Earth orbit (an orbit just above the atmosphere) to lunar orbit is 4100 m/s, which is only 300 m/s more than to go to geosynchronous [orbit, indeed] most of the effort of space travel near the Earth is spent in getting 100 km or so off the Earth, that is, into low Earth orbit. [More revealing,] to go from low Earth orbit to lunar orbit takes about 5 days, but requires less than half the effort needed to go from the Earth’s surface to low orbit. [Thus,] certain points that are far apart in distance (and time) are quite close together in terms of the propulsive effort required to move from one to the other. [14]

The previous discussion of orbital mechanics has shown that a spacecraft in stable orbit expends no fuel, and is therefore in the most advantageous Δv configuration. The most efficient travel in space can then be envisioned as a transfer from one stable orbit to

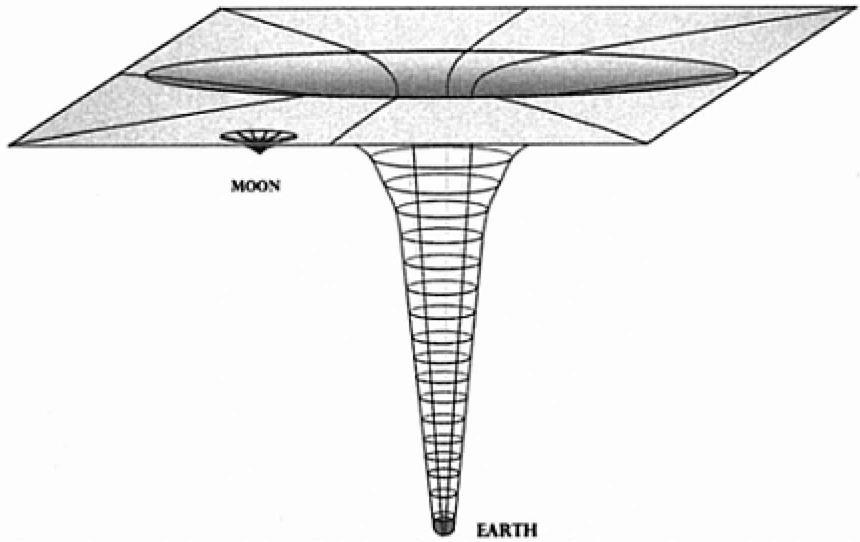

Figure 3.8: Earth-Moon gravity well comparison

another with the least expenditure of Δv. Using this logic, in space we can find specific orbits and transit routes that because of their advantages in fuel efficiency create natural corridors of movement and commerce. Space, like the sea, potentially can be traversed in any direction, but because of gravity wells and the forbidding cost of getting fuel to orbit, over time spacefaring nations will develop specific pathways of heaviest traffic.

Orbital maneuvers can be performed at any point, but in order to conserve fuel, there are certain points at which thrust ought to be applied. The most efficient way to get from orbit A to orbit B (the proper language of space travel) is the *Hohmann transfer* (see Figure 3.9). This maneuver is a two-step change in Δv. Engines are first fired to accelerate the spacecraft into a higher elliptical orbit (or decelerate into a lower one). When the target orbit is intersected, the engines fire again to circularize and stabilize the final orbit. A Hohmann transfer orbit is depicted from the Earth to geosynchronous orbit, but the same logic is used in all transfers including low-Earth orbit to geostationary, planetary movement, even interception of comets from Earth launch facilities. So-called 'fast transfers', in which the rules of orbital mechanics are ignored and a spacecraft simply expends fuel throughout its flight path, are of course possible, but require such an expenditure of Δv they will only be done only if fuel is abundant/functionally without cost, or if time is critical. This is the outer-space equivalent of sailing the long way round, however, and can make business unprofitable and military losses unacceptable. Given the vital necessity to conserve fuel and increase the productive lives of spacecraft, *the future lanes of commerce and military lines of communications in space will be the Hohmann transfer orbits between stable spaceports*.

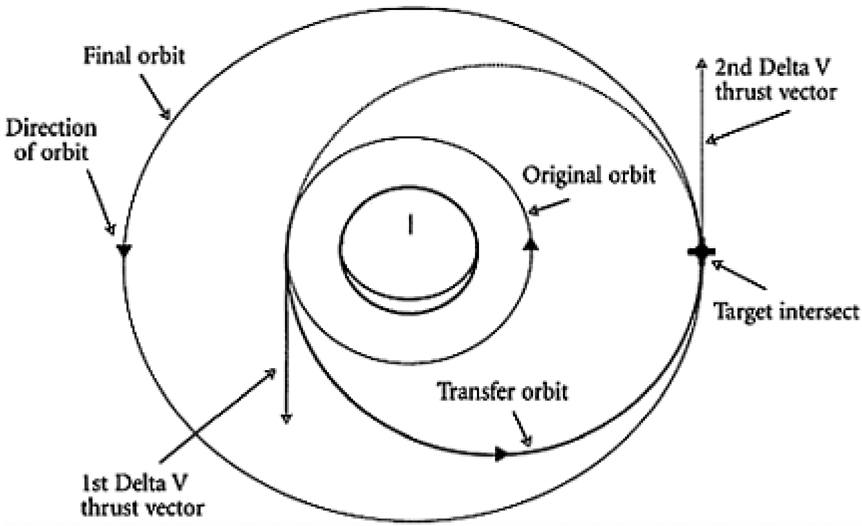

Figure 3.9: Hohmann transfer orbit

Britain's rise to power came, Mahan believed, because it had exploited its location across the sea routes of Europe. A modern astrostrategist can and should make similar arguments. Mahan correctly observed that a prudent state not only could avoid garrisoning all the seas to dominate them, it would not even have to garrison the whole of the commerce lanes. Only the critical point locations along these lanes need be controlled. A small but highly trained and equipped force carefully deployed to control the bottlenecks or chokepoints of the major sea lanes would suffice. Control of these few geographically determined locations would guarantee dominance over military movement and world trade to the overseeing state.

The Hohmann transfer establishes the equivalent of the lane of commerce for space. Domination of space will come through efficient control of specific outer space strategic narrows or chokepoints along these lanes. The primary and first readily identifiable strategic narrow is low-Earth orbit itself. This tight band of operational space contains the bulk of mankind's satellites, a majority of which are military platforms or have military utility. This is also the realm of current anti-satellite (ASAT) weapons technology and operations, including the US F-15 launched satellite interceptor and the massive Russian proximity blast co-orbital ASAT. Within this narrow belt are the current and projected permanently manned space stations, and all space shuttle operations. Moreover, all the incomprehensible vastness of the universe can be accessed only by traveling through it.

At the edge of Earth space, beyond low-Earth orbit, lies the most obvious and discussed strategic narrow—the geostationary belt. This band about the equatorial waist of the Earth is the only natural orbit that allows for a stable position relative to a given point on the Earth. The geostationary belt has severe constraints on the number of satellites that can operate within it, however, due to the possibility of broadcast interference from adjacent platforms. This has caused it to be considered a scarce and precious *international* natural resource by *most* members of the international community. Nonetheless, in 1977, nine equatorial states asserted in the Bogota Declaration that national sovereignty extended upward, *ad just coloeum,* to geostationary altitude. The action is not dissimilar to the attempts of numerous coastal states to extend the limit of their internationally recognized territorial waters. In other words, the geostationary belt is considered the sovereign territory of those states directly beneath it, transforming an area routinely referred to as ‘the common heritage of mankind’ into a geopolitical conflict zone (see Chapter 4 for a complete discussion).

Mahan additionally advocated the establishment of naval bases at strategic point locations, including Hawaii, the Philippines, and several Caribbean islands, to act as fueling and resupply stations for the seafaring state’s navy. The range of ships and natural interests of the state geographically determined their spacing. Without these bases, US war and trade ships would ‘be like land birds, unable to fly far from their own shores’. [15] The notion is not fresh, and such staged basing is historically common, but its tendrils reach to outer space. Giulio Douhet’s advocacy of a basing procedure predicated on new technology complements the Mahanian vision when transferred to space. Douhet wrote extensively of the coming revolution in modern warfare due to the fact that aircraft were essentially unimpeded by the Earth’s surface features (a critical change in the evolution toward astropolitics with the gradually decreasing importance of topography). Air power was limited in its operations, however, by critical *air operations routes,* which required precisely located takeoff and landing fields and effective maintenance and repair facilities at major centers. Such bases should be considered critical for space control, and planets, moons, asteroids, and other heavenly bodies are obvious locations for ‘way stations’ or ‘stepping stones’ for space operations. But these may not be the most favorable point locations from a strategic perception. Another consideration based on Δv advantages must be taken into account.

The gravity well concept discussed above has important implications for military combat operations other than space transportation/logistics and way station location. In 1981, G.H.Stine wrote of the *energy* and *maneuver* advantages of high ground positions in outer space. [16] The first, energy advantage, is a firepower benefit because weapons placed higher in the gravity well gain the downward momentum—velocity in the power equation, velocity times mass—while kinetic energy weapons firing up the gravity well lose momentum, thus power. The maneuver advantage comes because spacecraft higher up in the gravity well have more time to observe and react to attacks than those at lower positions. Stine argued that true tactical and operational advantage in space would go to those who could dominate the top of the gravity wells, and the best positions were those that because of counterbalancing gravitational forces had no down well pull in any direction.

Perhaps the most intriguing point locations useful for strategic or commercial bases in Earth-Moon space are the gravitational anomalies known as Lagrange Libration Points, named for the eighteenth-century French mathematician who first postulated their existence. [17] Lagrange calculated that there were five specific points in space where the gravitational effects of the Earth and Moon would cancel each other out (see Figure 3.10). An object fixed at one of these points (or more accurately stated, in tight orbit around one of these points) would remain permanently stable, with no expenditure of fuel. The enticing property of libration points is that they maintain a fixed relation with respect to the Earth and Moon. In practice, owing to perturbations in the space environment including solar flares, orbital drift and wobble, and micrometeorites, only two of the Lagrange points are effectively stable—L4 and L5. The potential military and commercial value of a point in space that is virtually stable is highly speculative, but imaginatively immense. The occupation and control of these points is of such vital importance that an advocacy group called the L-5 Society was formed to influence national policymakers. [18]

One last phenomenon of the region that requires mapping and understanding is the location and impact of the Van Allen radiation belts, 'two donut-shaped regions circling the Earth inside the magnetosphere [that] trap charged particles and hold them. Spacecraft passing through the Van Allen belts are subject to damage. Astronauts passing through these areas risk [mortal injury]. Fortunately, they are well mapped and can be avoided.' [19] The inner belt first appears at about 400 to 1,200 km, dependent on latitude (see Figure 3.11). It extends outward to about 10,000 km with the deadliest concentration at 3,500 km. Anomalies in the belts put the lowest altitude at upper latitudes of the Southern Hemisphere, a particularly troublesome area for polar-orbiting satellites but easily avoidable by most manned flights.

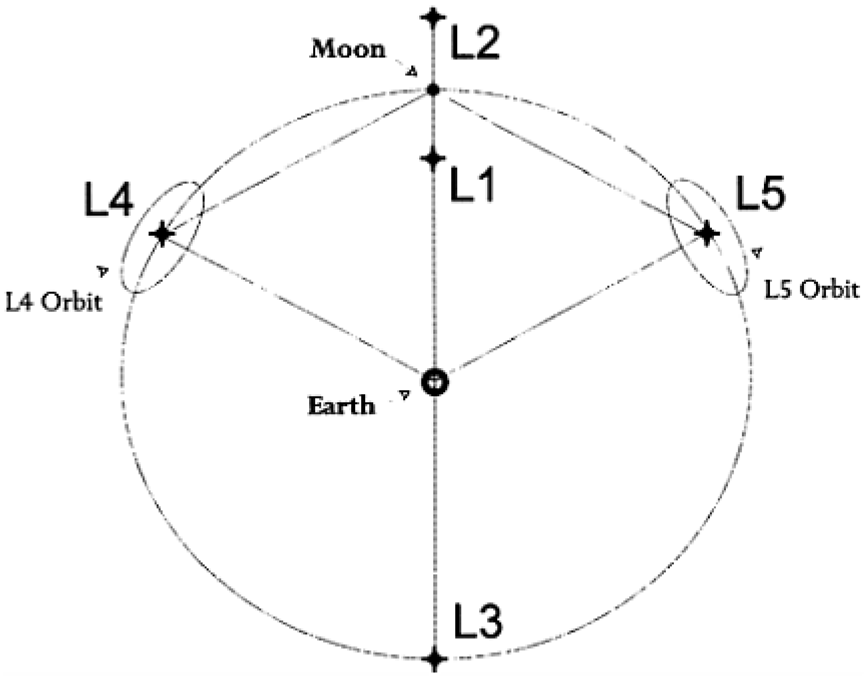

Figure 3.10: Lagrange libration points

The second ring begins near 10,000 km and extends up to 84,000 km, with deadliest concentrations at 16,000 km. The edges of the belts are relatively benign, thus a safe operating channel is evident between the two belts from about 9,000 to 11,000 km altitude. Of note, the outer belt is flattened to about 59,500 km in sunshine, extending to its maximum altitude in the Earth's shadow.

These few examples are just some of the many astro/topographical features of the currently exploited space terrain. Astropolitical analysis describes critical chokepoints in space as those stable areas including the planets, moons, libration points, and asteroids where future military and commercial enterprises will congregate. These are the coming ports of space, co-located with the valuable energy and mineral resources estimated to be there, or Mahan's, Douhet's, and Mitchell's way stations on the various Hohmann transfer routes to these resources.

ASTROPOLITICAL CONSIDERATIONS FOR *TERRA*

Earth is the current point of origin for all spacecraft and space-support operations. Ultimately, efficiency and economy will dictate that all essential

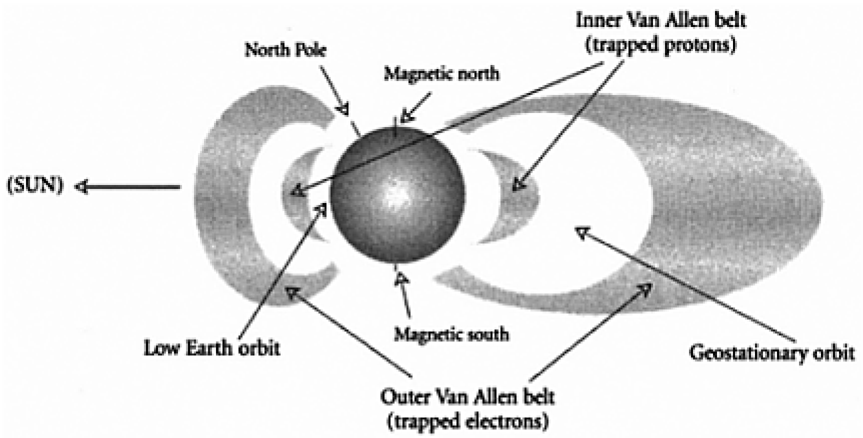

Figure 3.11: Van Allen radiation belts

space operations, including construction and launch, tracking and control, and various forms of space commerce will take place in space. For now, however, all of these functions are Earth-bound. When the day comes that these functions are performed off world, the vast population that feeds off the bounty of outer space will still remain, as will the governments that control space operations. The importance of *Terra* will not diminish, in the near term at least, nor will the necessity of political control. The astropolitical question, given the current realities, is simply where on Earth are the vital centers most efficiently placed?

We begin with launch center location in part because of its intrinsic relationship with orbital efficiency. The originating launch site of a spacecraft has a significant impact on its orbit. The equator, for example, has particular value as a launch site location, especially into geostationary orbit. This is because the spin of the Earth can be used to assist in the attainment of orbital velocity, and the relative velocity of the Earth's motion decreases from 1,670 kph at the equator to no relative motion at the poles. Since the minimum velocity necessary to climb out of the Earth's gravity well is just over 28,000 kph (mach 25), a launch vehicle heading due east along the equator would have to achieve a speed of just 26,400 kph relative to its launch point to achieve orbit. Conversely, a satellite launched due west along the equator would have to *add* 1,670 kph, and thus would need to achieve a velocity of almost 29,700 kph relative to its start point to place a satellite into orbit—a 3,300 kph difference. The fuel/Δv impact is plainly significant. In a real world example, a European Ariane rocket launched due east from the French Space Center at Kourou, French Guiane, just 5° north of the equator, receives a 17 percent fuel efficiency advantage over a US rocket launched due east from Cape Canaveral, about 28.5° north of the equator. In perhaps a more powerful example, a Space Shuttle launched due east from Cape Canaveral has a cargo capacity of 13,600 kg. A Space Shuttle launched due west from roughly the same latitude (from the US Western Space Range at Vandenberg Air Force Base), can barely achieve orbit with its cargo bay empty.

Another factor of terrestrial launch basing is that the latitude of launch affects the inclination of the orbited spacecraft. Launches due east (90°) of Cape Canaveral will enter into low-Earth orbit at an inclination of 28.3°. Indeed, launches due east from any site on the Earth will have an inclination exactly the same as the launch latitude, given a two-stage direct insertion launch. Spacecraft do move from their original orbit, of course, and in the process change their inclinations (this is how the Shuttle places payloads into geostationary orbit, releasing them with an attached upper stage or bus). But the transfer costs additional fuel, fuel that had to be placed on the launching rocket, ultimately limiting payload weight or spacecraft lifespan. Launches on *any other azimuth* will place a satellite into orbit at *greater* inclination than the latitude of the site. Thus the launch site determines the *minimum* inclination (with a launch due east). A launch due west allows for the *maximum* inclination (in the case of the Cape, 151.7°, or 180° minus 28.3°). Launching due north or south will result in a polar orbit, that is, an orbit with an inclination of 90° relative to the equator.

The polar, sun-synchronized orbit is in fact one of the most important for military reconnaissance and weather imaging. A spacecraft placed into polar orbit passes over both the North and South Poles. If placed in a slightly retro-grade motion (greater than 90° inclination), this configuration allows satellites to eventually fly over every point on the Earth, and to *remain in the sunlight at all times*—extremely important for satellite cameras that takes images in the visible light spectrum and for satellites that require continuous solar access for power. To place a satellite into a polar orbit, the most efficient launch azimuth is due north or due south.

Thus a space launch center that can send rockets both due east and either due north or south has distinct orbital efficiency advantages. Because rockets eject lower stages, and occasionally destruct in flight, it is further necessary that the launch sites have considerable downrange areas of open ocean or unpopulated landmass (at least 1,000 km). The optimum astropolitical launch points under these criteria are the northern coast of Brazil, the east coast of Kenya, and any of several Pacific islands east of New Guinea (see Figure 3.12). These locations are all sovereign national territory with astropolitical international importance.

There is at least one other critical feature of space launch centers that is based in astropolitical theory. Orbital perturbations degrade the stability of

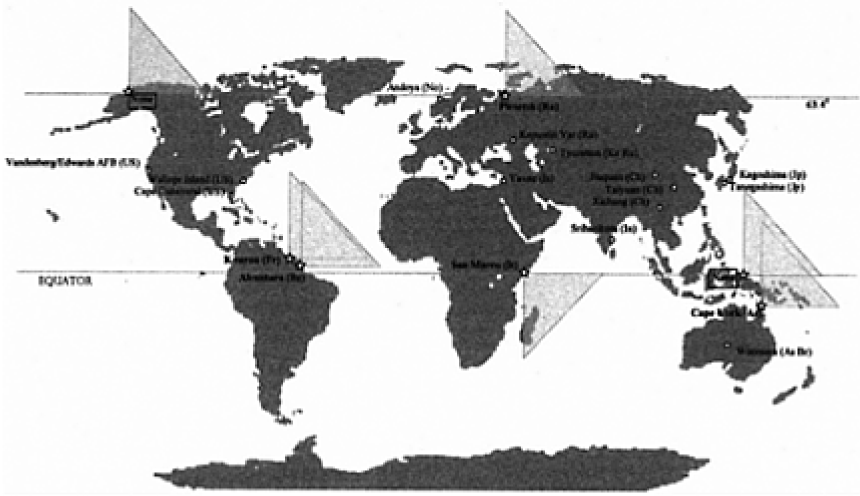

Figure 3.12: World space centers and Earth optimal launch points

all but two Earth orbits, requiring regular expenditures of Δv to restabilize them. The highly stable orbits are inclined at 63.4° and 116.6° relative to the equatorial plane. This means a satellite in orbit at either of these inclinations will remain stable with minimal expenditures of fuel, greatly increasing their useful lifetimes. More importantly, satellites operating in networks will maintain their proper spacing without continual orbital corrections. Satellites launched due east (maximizing the earth's rotational effects) from a space center at 63.4° north or south latitude will efficiently enter a 63.4° inclined orbit with a minimum expenditure of on-board fuel. Geolocations at 63° north with sufficient downrange capacity include northern Siberia, the east coast of Greenland, far north Canada, and most of Alaska (see Figure 3.12). The 63° south latitude intersects the Antarctic landmass, a cost-inefficient terrestrial location for a major spaceport. The most accessible of these areas are Alaska and northwest Siberia. Indeed, Russia's northern spaceport is efficiently located northeast of Moscow at Plesetsk, exactly 63.4° north latitude.

Finally, for the purposes of this book, a brief discussion of satellite *fields of view* completes the terrestrial survey but does not exhaust the astropolitical ramifications of Earth-centered placement. The important point here is that in order to control satellites in space, or to control the Earth from space, a global network of terrestrial contact points *or* a global network of interlinked satellites, respectively, is required. For several reasons, a state may wish to eschew the latter option. Satellite-linked networks are more vulnerable to Command, Control, Communications, and Intelligence (C^3I) interference than non-linked networks, and are especially worrisome for espionage satellites. Burst transmission and/or directed beam transmission from satellite to ground control is far more secure. Satellite-to-satellite C^3I linking is timelier, however.

Regardless of the control requirements of the satellite and/or network, space dictates the number of satellites needed for effective coverage. Physical limitations of orbital mechanics dictate that the only position in space that allows a satellite to maintain a constant position relative to the surface of the Earth is the geostationary belt. In order to optimize Earth access from geostationary position, a network of at least three satellites is necessary to view any point on the Earth between 70° north and south latitude (see Figure 3.5). Overlapping satellite fields of view are necessary to account for highly oblique lines of sight from the limb of the Earth, hence two satellites cannot effectively cover the globe. Even with three satellites, however, much of the Earth's territory cannot be reliably accessed. Terrestrial areas above 70° latitude routinely have transmission difficulties from satellites in geostationary orbit, especially in bad weather and during periods of heavy solar activity. These areas include much of Scandinavia, Russia, and Canada. They require an alternate or auxiliary network of three to six Molniya-type orbiting satellites for continuous communication.

In order to provide truly global coverage of the Earth from space, including the polar regions, in theory a minimum of just four satellites is required. Placed in precise 63.4° inclined supersynchronous (greater than 24-hour) orbits, one satellite can be in view from any point on the Earth at any time. Because these satellites are not fixed relative to the Earth's surface, terrestrial users would need the ability to track and acquire satellites as they move in and out of view, an expensive and time-consuming practice. Their use entails even more practical encumbrances. Satellites at super-synchronous altitude require large, heavy, high output transmitters to communicate with terrestrial users (due to physical distance). They are further unsuitable for some missions, such as high-resolution Earth imaging (again due to distance). For these applications, some satellites must maintain orbits closer to the surface of the Earth.

Conversely, in order to guarantee *continuous* communications with any *one* satellite from the Earth, at least three control stations spaced evenly around the Earth along the orbital plane are necessary for high Earth orbit and above altitude satellites (at inclinations of 63.4° or less, four or more for higher inclinations), and a minimum of 16 control stations for low-Earth orbit ones. This is why the United States maintains deep space-tracking stations in Australia and Spain (among other states), and Russia has kept a fleet of space-tracking and control ships deployed in international waters. Terrestrial control and data receive bases become less important as satellite networks become more common, however. Satellite-to-satellite electromagnetic linkage means that formerly dispersed functions can be conducted from virtually any site worldwide. That situation does increase vulnerability, however, by extending the command and control link and increasing the number of critical operations nodes.

As satellite orbits decrease in altitude, and increase in practical value, more satellites are required to maintain continuous global coverage. The Global Positioning Satellite (GPS) navigation system, which has an operational requirement for four satellites to be in view of any one point on the Earth at any given time (for accurate geolocation), requires 21 satellites to be precisely spaced in inclined semi-synchronous (12-hour) orbits at 24,000 km altitude. The Iridium commercial mobile communications network initially deployed a network of 66 satellites at 725 km altitude to ensure that at least one satellite is always in view. [20] The system offered state of the art global positioning and communications; the venture ultimately failed due not to technical problems, but to marketing failures.

The closer to the Earth, the more satellites are needed to provide continuous coverage. It is quite reasonable, however, to accept non-continuous or spot coverage of high-interest areas on a recurring basis. This is the function of intelligence-quality imaging satellites. These spacecraft can take higher detail pictures the closer they are to the target, a simple function of imaging resolution. The more detailed the picture, however, the less coverage of area (see Figure 3.13). Let us say, for example, that a camera can take a picture from 90 miles (145 km) altitude that would be so detailed as to distinguish facial features. The field of view would only be a few meters at best. The greater the detail, the less the field of view (think in terms of a variable zoom telephoto lens), and the more images needed to cover a large area. The more images there are, the more analysis is required.

Computer processing of raw data can speed the process, but it still requires a human analyst to interpret the images and make sense of the mass of incoming data. Hundreds of pictures can be generated in an hour from one imaging satellite, but it takes a human analyst several minutes (at least) to scan each image for useful or irregular information, even after the image has been machine processed and flagged for the same material. Once an image is identified as significant, it may take an analyst several hours to completely scan and correlate the information with other sources and to verify the intelligence accuracy on the image. For each imaging platform in orbit, hundreds of human analysts are necessary to fully exploit its capabilities.

This brings up a response to an interesting criticism of the intelligence community. With all its huge resources, why can’t it find a specific individual (such as a dictator or an international terrorist) for targeting? If a license plate can be read from space (arguable, but an accepted assumption in order to respond to the question), why can’t we find a particular person at a particular time with an imaging satellite (presumably so we could then launch a cruise missile at or dispatch an assassin to that location)?

The answer is relatively straightforward. The wider the field of view of the camera, the less detail in the image. The greatest detail, of course, comes from air-based platforms, to include aircraft and remotely piloted drones (they come physically closest to the target). These are also the most susceptible to enemy action, and the most obvious to the target. It is difficult to hide from a satellite that cannot be seen, much less shoot it down. In order to get an image resolution high enough to identify individuals and read license plates, the field of view can only be about 100 meters square (10 by 10 meters) or less. In order to point a camera so precisely, one has to know exactly for what one is looking.

Here is the problem. Saddam Hussein, for example, could be anywhere in Baghdad. At less than 6-inch resolution, not quite enough to identify someone through facial characteristics, it would be necessary to take over 16,000 pictures (with a field of view of 10m squared) to blanket the city. By the time analysts have had a chance to scan the pictures, even after machine processing, Hussein would be long gone. Essentially, one has to know where an individual *will be* in order to direct a space-based intelligence asset

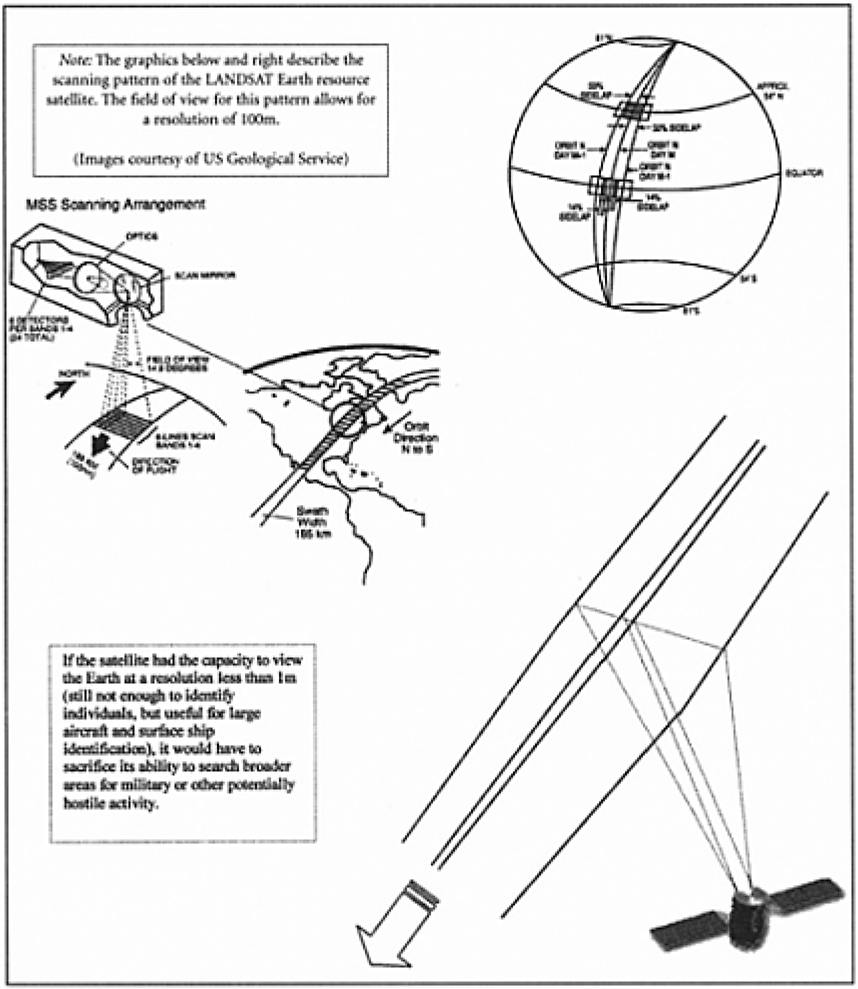

Figure 3.13: Satellite fields of view

to look at that point at that precise moment. In other words, one needs intelligence to do intelligence. Electronic Intelligence (ELINT) collection satellites could possibly pinpoint a location, through an intercepted telephone conversation, say, and relay it to imaging satellite controllers in time to get a useful photograph, but that eventuality is based on luck. A reliable human agent (HUMINT) familiar with the dictator's schedule would provide much more time for satellite guidance and targeting preparation. High-tech imaging assets, then, are currently much better suited to real time identification of large equipment (airplanes, tanks, ships, industries, and infrastructure) and military units through broad area scans than individual persons. This is especially applicable to the traditional war scenarios against an enemy using modern equipment and tactics. Against guerrilla armies and non-traditional foes, which would be difficult to identify in wide-angle broad search techniques from space, and presuming communications for these groups does not enter into the electromagnetic spectrum, low-tech HUMINT may still be the most cost-effective instrument—if for nothing else than to key high-tech assets where and when to look.

This brief description has outlined only a few of the more salient astropolitical concepts. It is not an exhaustive list. The purpose is to combine sophisticated astronomical concepts with political theory in a manner that is heuristic. As space technology progresses, many of the above assertions will become dubious or even moot. New hypotheses will surface that have not yet been considered. However, the astropolitical dictum that control of certain terrestrial and outer-space locations will provide a distinct advantage in efficiency and will lead the controller to a dominant position in commercial and military power seems assured.

None of this analysis may matter if the ongoing moribund efforts to conquer space continue at their current lackluster pace. The likelihood of a golden age of space exploration seems remote given the current conditions. The following chapters veer away from the astropolitical model to describe the conditions and circumstances prompting the Cold War inspired entry of mankind into space. This compilation from the historical and legal record is used as the foundation of an argument to reinvigorate humanity's entry into outer space with a reintroduction of the motivator that began it all, national rivalry and self-interested competition. This time, however, the competition needs to be on an economic playing field, and not a nuclear war battlefield. If done properly, the tenets of *Astropolitik* can be invoked fruitfully.

NOTES

1. This chapter is adapted from my article, 'Geopolitics in the Space Age', *Journal of Strategic Studies*, Vol. 22 (Fall) 1999, pp. 83–106. Also included as a chapter in Colin Gray and Geoffrey Sloan (eds), *Geopolitics: Geography and Strategy* (London: Frank Cass, 1999), pp. 83–106.
2. J.Gottman, *Centre and Periphery* (Beverly Hills, CA: Sage, 1980), p. 1.
3. I am indebted to the many professionals at the Air Force Training Command's Joint Space Intelligence Operations Course (JSIOC) in Colorado Springs, who instructed me in orbital mechanics from 1986–90 when I took, and then had the opportunity to lecture in, their outstanding program.
4. T.Damon, *Introduction to Space: The Science of Spaceflight* (Malabar, FL: Orbit, 1989), pp. 180–2.
5. B.Smernoff, 'A Bold, Two-Track Strategy for Space', in U.Ra'anan and R.Pfaltzgraf (eds), *International Security Dimensions of Space* (Medfors, MA: Archon, 1984), pp. 17–31.
6. P.Stares, *Space and National Security* (Washington, DC: Brookings Institute, 1987), pp. 13–18. Stares presents a superior chronology of the process of space militarization in *The Militarization of Space: US Policy, 1954–1984* (Ithaca, NY: Cornell University Press, 1985).

7. For a more thorough exposition, see H.Herwig, '*Geopolitik:* Haushofer, Hitler, and Lebensraum', in Gray and Sloan (eds), *Geopolitics,* pp. 218–41.
8. Especially the case for Global Positioning Satellites, or Navstar/GPS. See M.Ripp, 'How Navstar Became Indispensable', *Air Force Magazine,* November (1993), pp. 46–9.
9. A.McLean, and F.Lovie, *Europe's Final Frontier: The Search for Security Through Space* (Commack, NY: Nova Science Publishers, 1997).
10. See T.Karras, *The New High Ground: Strategies and Weapons of Space Age Wars* (New York: Simon and Schuster, 1983).
11. A.Mahan, *The Influence of Seapower Upon History 1660–1783* (Boston, MA: Little Brown, 1890), p. 25.
12. M.Vaucher, 'Geographic Parameters for Military Doctrine in Space and the Defense of the Space-Based Enterprise', in Ra'anan and Pfaltzgraf (eds), *International Security,* p. 35. Vaucher's descriptive comes very close to the type of astropolitical analysis I am attempting here, and his work deserves extraordinary praise.
13. A.Wilson (ed.), *Interavia Spaceflight Directory* (Geneva: Interavia SA, 1989), p. 600. Formerly *Jane's Spaceflight Directory.*
14. NASA Web Site, 'Two Kinds of Separation in Space: Metric Distance vs Total Velocity Change (Δv)', *Space Settlements: A Design Study* (http://www-sci.nas.nasa.gov/Services/Education/SpaceSettlement/75SummerStudy/TableofConte
15. Mahan, *Seapower, 1660–1783* (1890), p. 83.
16. G.H.Stine, *Confrontation in Space* (Englewood Cliffs, NJ: Prentice-Hall, 1981), pp. 58–9.
17. See D.Beason, 'What Are these Lagrange Points Anyway?', in J.Pournelle (ed.), *Cities in Space: The Endless Frontier,* Vol III (NewYork: Ace, 1991), pp. 58–65.
18. The L-5 Society has since been absorbed into the National Space Society, where many of its former members are now primary officers.
19. Damon, *Spaceflight,* p. 40.
20. The Iridium constellation originally was to have 77 satellites, and was named after the 77th element on the Periodic Table. When the constellation was scaled back to 66 satellites at a slightly higher altitude, a name change to Dysprosium (Periodic Table element number 66) was not made, for aesthetic reasons.