The Concept of Space Combat

Whereas those who have the capability to control the air, control the land and sea beneath it, so in the future it is likely that those who have the capability to control space will likewise control the earth's surface.

—Gen Thomas D. White
Chief of Staff, USAF, 1957

Imagine a different set of events leading to the 1991 Gulf War. First, imagine that Saddam Hussein was able to procure a reliable source of space-derived data.[1] Or that his contract with Brazil's National Institute for Space Research (INPE) for a military reconnaissance satellite had been successful.[2] Or, barring that, he might have contracted with France's Matra Defence Space for the development and launch of a military reconnaissance version of their *satellite pour l'observation de la terre (SPOT).*[3] Such capabilities would have allowed Saddam to monitor the deployment and beddown of all coalition forces. He could have targeted ports and airfields as forces arrived in-theater. He could have attacked Patriot batteries before they were operational. Even if he did not attack during the buildup, he would have never missed the "left hook," which was key to the coalition strategy.

Along with the acquisition of ballistic missile technology and the development of nuclear and chemical weapons, imagine he had more aggressively pursued development of his indigenous space launch capability to launch militarily significant satellites.[4] A space launch capability provides the foundation for conducting physical attacks on many military satellites, either through direct ascent or co-orbital antisatellites (ASAT). A preemptive space denial campaign could have negated US and allied capability to maintain their knowledge of the theater.[5]

With a space launch capability, Iraq could have had space-based weapons which could attack Persian Gulf neighbors or any member of the coalition, including the United States. Any simple reentry vehicle could have had profound psychological effects on the US

population, as buzz bombs and V-2s did on the population of London in World War II. The US has never been attacked from the air and, certainly, never from space. Fortress America could have been vulnerable. At this writing, Iraq is rebuilding its ballistic missile research program at new laboratories and rebuilt research and development centers.[6]

Finally, imagine that the invasion of Kuwait didn't stop at the Saudi Arabian border but pushed further south to Riyadh and beyond. Mobile Scuds could have been deployed south and used against airfields and ports, in effect strategically cutting off Saudi Arabia from the rest of the world. Without the "land carrier" of the Saudi Arabian peninsula, the strategic buildup of air and ground forces could not have occurred. In spite of the availability of aircraft carriers off the Saudi Arabian peninsula and air bases in Egypt and Turkey, and even intercontinental bombers based in the US, an air campaign would have been next to impossible to execute. Some other form of combat power "in the theater" would have been useful—perhaps precision-guided munitions based in space.

Any combination of these three scenarios would have, at least, reduced US strategic options and increased casualties. Any of these scenarios by itself would have significantly altered the outcome of the confrontation. Today, the US has little or no way to deny space to its opponents. It has no active means of protecting its space order of battle.[7] If forces are not deployed in an area of interest, a capability to strike from space might provide some strategic and tactical regional options.[8]

Definition and Relevance

Space combat can provide those options. Space combat employs space in the execution of missions. Space combat forces would provide commanders additional tools and methods for engaging an enemy.

The missions of space denial, space strike, and space protection comprise space combat.[9] Space combat is the hostile application of destructive or disruptive force into, through, within, or from space. This definition includes actions taken against space systems that are

not in space.[10] Space denial is the hostile application of destructive or disruptive force against enemy space systems to deny the enemy's use of the space medium.[11] Space strike is the hostile application of destructive or disruptive force from space against natural-body-based (earth, moon, and asteroid) targets.[12] Space protection is the active, defensive application of destructive or disruptive force to defend friendly space systems.[13] This essay examines the importance and usefulness of space combat and proposes a preliminary theory of space combat. It asserts that a theory of space combat is required to understand and effectively employ US space capabilities against existing and future space threats resulting from the proliferation of spacefaring technologies.

Space Combat Employment

Why is space combat useful? What operational utility does it bring to military operations? Space denial makes the high ground of space unavailable to an adversary. The most important current space missions are the force multipliers: surveillance and reconnaissance, warning, navigation, environmental monitoring (weather), and communications. The significance of these missions was not lost on the military forces of the world during Desert Storm.[14] If an adversary possessed or had access to force multiplying space systems, friendly operations could be put at risk. Friendly forces could be under constant observation. Sensors of all varieties based in space could track force deployment and supply movement. This information could be decisive in an information dominance sense. Space denial allows friendly forces to operate without being observed.

Other force enhancing space systems can benefit our adversaries. Enemy munitions could be precisely guided by Global Positioning System (GPS)-like signals. Satellite communications enhance theater operations when a communication infrastructure does not exist. Weather information from environmental monitoring satellites supports campaign planning and execution. A space denial capability removes the benefits such force enhancement systems provide.

Space denial also prevents the passage of enemy military platforms through space. Intercontinental ballistic missiles (ICBM) and submarine launched ballistic missiles (SLBM) are current candidates. These vehicles usually have an exoatmospheric phase where they are vulnerable to space denial weapons which could be ground- or space-based. Expendable space launch vehicles (SLV) are another type of platform to be denied. Closing space lines of communication prevents the deployment of new space platforms and the reconstitution of existing space systems. Reusable, recoverable space vehicles which take off vertically, like the space shuttle or the experimental single-stage-to-orbit Delta Clipper, or horizontally, like a US National Aerospace Plane or German Sanger, might also be likely targets if they are carrying force enhancing satellites or weapons deliverable from the vehicle.

Space strike brings a new set of war-fighting tools to terrestrial fights. Just as space-deployed systems provide space combat support capabilities to a surface fight, they can also provide offensive firepower. Space strike systems can provide an increased capability for prompt, intense, lethal or nonlethal, parallel attack against terrestrial (land, sea, and air) targets with minimum risk to allied personnel and minimum collateral damage. Lowell Wood of Lawrence Livermore National Laboratory clearly sees a requirement for the future USAF to block large-scale attacks by large quantities of compact, ultra-precision munitions launched in inconvenient locations with only hours notice.[15] One can postulate that future force postures will continue to move away from large, fixed overseas bases and the accompanying logistics support. Future US forces will be more expeditionary and will have to respond upon short notice. A premium will be placed on early show of force in an attempt to diffuse crises.[16] Space strike forces could do that.

These capabilities could be applied at the strategic, operational, and tactical levels of war as well as across the spectrum of conflict. They could be used to deter, defend, and defeat. Space strike could be applied singularly as a show of force or independent flexible deterrent option, or integrated into joint, coalition, or combined operations.

Space protection provides security to space systems beyond traditional passive defense mechanisms. Space systems based either in space or on the ground could be defended by space systems in space or on the ground. Space protection systems (counter-ASAT) could defeat antisatellites engaging our satellite or launch systems. Such systems are the P-51 escort fighters of the future, providing defensive firepower for our space force multipliers and space strike systems (the B-17s of the past).

The Significance of Space Combat

Why is the subject of space combat important? First, residual military space capabilities exist in the former Soviet Union (FSU). These capabilities could again threaten the US and allies or proliferate to other nations. The US may need to counter these capabilities.

Second, space technologies are proliferating and third world countries are developing military space capabilities (combat and combat support). These countries could threaten the US and, again, the US may need counters.

Third, space combat concepts have existed since the time of sputnik and are part of US military doctrine and thought. But these ideas have not gone much past the conceptual and, in some cases, the experimental stage. Finally, in spite of past US attempts to acquire elements of space combat, like antisatellites and space-based ICBM interceptors, no US operational space combat capability exists today.

The Emerging Space Threat

Many nations learned a great deal from the Gulf War. They noted not only the significance of precision-guided munitions, but also the importance of space-based force enhancement. Access to space systems may make the difference between victory and defeat in future wars.

These nations are attempting to acquire space-derived data through their own military systems or through international commercial systems. In addition to learning the importance of access to

space-derived data, they learned the importance of denying enemies access to space-derived data. Space combat support systems have become high-value targets.

The threat of observation can be most disarming for commanders, especially if their strategy is maneuver-oriented. An Air Force Space Command National Security Industries Association study stated that imaging systems have direct military utility in:

- Technology verification of an enemy's capabilities;
- Analysis of terrain features for combat planning;
- Surveillance of forces and their movements;
- Targeting of hostile forces; and
- Assessment of battle damage.[17]

Commanders can take some actions to minimize observations, but it will be impossible to totally avoid detection. Multiple sources of space data exist. Data can come from military, civil, or commercial satellites owned by the using country or owned by another country. Some nations have "intelligence-sharing agreements" or commercial arrangements with spacefaring nations. Other aspiring nations are pursuing indigenous capabilities.[18]

Space launch by itself is not a threat per se, but it is required for an indigenous space combat capability. A space launch capability enables the other space combat and force enhancement missions. Space launch technologies also enable ballistic missile development. Third tier states attempting to procure ballistic missile or space launch capabilities are Libya, Indonesia, Iran, Iraq, Pakistan, Taiwan, South Africa, and South Korea.[19]

A space launch capability is an incremental step toward a counterspace capability. If an enemy can launch a satellite, it can certainly launch an elementary antisatellite. A simple ASAT would consist of a nuclear weapon on top of a ballistic missile. A more sophisticated one could employ a conventional or kinetic kill warhead which requires more accurate tracking, targeting, and guidance.

The only country, other than the US and FSU, to start the development of an ASAT capability was China, which conducted a

co-orbital ASAT program up to the early 1980s. Except for Russia, no other country is openly pursuing a space strike or space protection capability. But with the proliferation of advanced space technologies, other countries may soon have this capability.

Current US Military Thought about Space Combat

Current space combat thought is important to future resource allocation and to research and development decisions. Also, it will influence the employment of space weapons.

Current US military thought is found both in official doctrine and in professional journals and other military writings. Official US military doctrine is beginning to address the integration of space operations into joint operations. Doctrine tends to focus on force enhancement and space support, though space combat missions are beginning to get more attention. Professional journals and other military writings have the same force enhancement slant, but more articles about space combat are beginning to appear.

Surface Service Thoughts on Space Combat

The three surface services (Navy, Marines, and Army) generally see military space operations in a force enhancement function. The US Navy is primarily interested in exploiting space for its force multiplier and information domination capabilities.[20] However, the Navy has acknowledged the importance of space control as a contributor to battlespace dominance.[21] Like the Navy, Marine Corps space thought is focused on the force-multiplying effects of space systems.[22] The US Army credits the exploitation of space-based capabilities (along with other technological advances) with increasing "the lethality, range, accuracy and reliability of our weapons systems."[23] Brig Gen Robert Stewart, the Army's first astronaut, captured the Army's view on space: "The Army's role will be what it's always been: to assure proper support to the combat soldier. He is the element to project force on the battlefield, and everybody else in the Army exists to help him."[24] The Army sees the day when it will

man "ground-based ASAT firing batteries" in support of USCINCSPACE.[25] In spite of its work in strategic defense, the Army plans to exploit space in support of ground forces.

US Air Force Thoughts on Space Combat

In his article, "The Uniqueness of Space Doctrine," Lt Col Charles Friedenstein said the 1979 version of Air Force Manual (AFM) 1-1 "cracked the door on our use of force in space by stating that it should 'enhance deterrence by developing the capability to deny or nullify hostile acts in or through aerospace.'"[26] This type of space operation was called space defense. In 1982, AFM 1-6, *Aerospace Doctrine: Military Space Doctrine*, became the first separate space doctrine. It officially acknowledged for the first time there were some "potential warfighting missions."[27] Space strike and space denial are clear missions. Both AFM 1-1 and variations of AFM 1-6 have evolved the space missions.[28] The latest draft of Air Force Doctrine Directive (AFDD) 4, *Air Force Operational Doctrine: Space Operations*, appears to be a small doctrinal step forward. Though AFDD 4 seems to focus on enhancement capabilities and information dominance (e.g., information warfare, information combat, and integrated reconnaissance, surveillance, and target acquisition), it does introduce the concepts of integrated application of firepower (including the possibility of space strike), space-based BMD, and integrated air and space control.[29]

The Case against Space Combat

In spite of the argument for space combat power, the US is not falling all over itself to develop it. Several arguments against space combat exist. The first is the physical challenge of getting into space. The current fleet of SLVs and the space launch infrastructure are not designed to be tactically responsive.[30] The existence of the Russian spacelift capability is proof that responsive launch is achievable. The Russian system may be more expensive (which is debatable) and not as technologically sophisticated as the US system, but it is militarily responsive.

Second is the cost of spacelift. Individual space launches range in cost from tens of millions to hundreds of millions of dollars. The cost of launch may be the single greatest drag on the development and employment of space combat systems. In spite of this cost, some rudimentary space combat systems could be and have been developed; for example, the air-launched miniature homing vehicle antisatellite. The approach and cost of space launch are recognized problems that multiple recent studies have addressed.[31] An associated challenge is that of maneuvering in orbit. Orbit changes can use up large amounts of fuel (which is either not replaceable or replaceable only at great cost). New propulsion technologies may be required for maneuverability. Inexpensive and responsive lift and on-orbit propulsion are required to employ space combat power. This approach assumes they will be available in the foreseeable future.

The third challenge is the cost of space combat systems. The cost of development and test of space combat systems can be substantial, but perhaps the highest recurring cost is the cost of spacelift or launch. Thirty-three billion dollars were spent on the Strategic Defense Initiative (SDI), and not a single operational system was produced.[32]

Fourth, political resistance in Congress stifles the development of space combat systems. Congress has been concerned about the possible violation of the 1972 Antiballistic Missile (ABM) Treaty. The ABM Treaty prohibits the basing of ABM weapons or detection devices in space. President Ronald Reagan, when he announced SDI, took a "broad interpretation [of the Treaty that] would have permitted virtually unlimited testing and development of spacebased ABM systems or components, provided they employed so-called 'exotic' technologies (other than missiles or radars)."[33] President George Bush continued support for the broad interpretation in his SDI budget request, which would have funded both an allowable fixed ground-based ABM system and a space-based system using Brilliant Pebble interceptors.[34] The Clinton administration has turned around the 10-year-old decision and has embraced the traditional or narrow interpretation of the treaty, which "prohibits the development, testing

and deployment of sea-based, air-based, space-based and mobile land-based ABM systems."[35]

A fifth challenge to space combat is technical viability. Many respected scientists and engineers doubt that space combat systems can be developed. After 10 years, the SDI did not produce the global protective umbrella originally promised by President Reagan.

One final argument against space combat is that the employment of space combat weapons violates the self-imposed space sanctuary policy established by President Dwight Eisenhower. President Eisenhower wanted to preserve space for peaceful purposes. To establish the principle of freedom of space, to protect US satellites from interference, and to avoid an arms race in space, the US pursued the goals of protecting the right to collect data from space, which was particularly important during the early days of the cold war. This policy was at odds with the desire to develop space combat capabilities. When space combat threats developed, such as the Soviet fractional orbital bombardment system and the co-orbital ASAT, we did not respond with countermeasures or systems in kind. But the US deployment of ICBMs, experiments with ASATs since the 1960s, and the SDI program, all hint that the US has abandoned sanctuary doctrine.

Both the US and the FSU pursued space combat power during the cold war. The US abandoned its capabilities, but the FSU is still thought to have some residual capabilities. Evidence indicates that other nations may be pursuing at least the basic technology needed to conduct space combat. The US disarmed itself for political reasons and the political debate about space combat continues. The US military needs to debate and explore the significance of space combat even if the political debate is not encouraging.

Notes

1. This is a concern voiced after the war by the then commander of Air Force Space Command, Lt Gen Thomas S. Moorman. He also argued "for an ASAT system to assure that just as US forces achieved control of the air and the battlefield, we can control space as well." Lt Gen Thomas S. Moorman, Jr., "Space: A New Strategic Frontier," *Airpower Journal* 6, no.1 (Spring 1992): 14–23.

2. Thomas G. Mahnken, "Why Third World Space Systems Matter," *Orbis,* Fall 1991, 569–70.

3. France developed a satellite called Helios for joint use by France, Spain, and Belgium.

4. In December of 1989, Iraq launched a vehicle for the announced purpose of launching satellites. Mahnken, 567.

5. This is an inference based on the importance observers are putting on space. One source said about the Gulf War, "military experts are generally agreed that satellites helped to win the political battle, sustained command and control, shortened the war and saved lives. [Space's] highly effective, economic and flexible capabilities will be needed even more in the increasingly volatile world of the future." If space capabilities were, and will be, so useful, then denying the use of space would increase an adversary's uncertainty on the ground. Sir Peter Anson, BT, and Dennis Cummings, "The First Space War: The Contribution of Satellites to the Gulf War," *RUSI Journal*, Winter 1991, 53.

6. Iraq rebuilt its Saad research and development center near Mosul and built a new laboratory, Ibn al-Haytham, near Baghdad. Also, the Saudis intercepted a shipment of ammonium perchlorate, the oxidizer of choice for solid rocket boosters, from China. It was bound for Iraq via Lebanon. Thomas Sancton, "No Longer Fenced In," *Time*, 23 May 1994, 37–38.

7. With the exception of a few on-orbit spares and a few extra satellites in storage on the ground, which might take months to launch, the US has no means to reconstitute our space order of battle if it came under attack. For an outstanding discussion of this strategic problem, see Maj Jeffrey L. Caton, *Rapid Space Force Reconstitution: Mandate for United States Security*, Research Report no. AU-ARI-94-4 (Maxwell Air Force Base, Ala.: Air University Press, December 1994).

8. For another scenario-based argument for space combat capability, see Lt Col Michael E. Baum, "Defiling the Altar: The Weaponization of Space," *Airpower Journal* 8, no.1 (Spring 1994): 52–62. The term *space combat* is not used in Colonel Baum's article.

9. These are nonstandard terms. Hopefully, the author's terms are more complete.

10. This is the author's definition and is a composite of official and unofficial definitions for the medium of space. It is surprising, but there is no official definition of combat in Joint Pub 1-02. There are multiple definitions using the word combat without defining it. Army Regulation 310-25 does not include the definition of combat. *The USAF Dictionary* and the *Dictionary of Weapons and Military Terms* contain definitions of combat. Col T. N. Dupuy's book has a very comprehensive definition of military combat. Appendix A has all of these definitions. Joint Pub 1-02, *Department of Defense Dictionary of Military and Associated Terms*,

23 March 1984; AR 310-25, *Dictionary of United States Army Terms*, 15 October 1983; Woodford A. Heflin, ed., *The United States Air Force Dictionary* (Maxwell AFB, Ala.: Air University Press, 1956); John Quick, *Dictionary of Weapons and Military Terms* (New York: McGraw-Hill Book Co., 1973); and Col T. N. Dupuy, *Understanding War: History and Theory of Combat* (New York: Paragon House Publishers, 1987).

11. Space denial is an expanded form of offensive counterspace. Defensive counterspace includes both passive and active defensive operations or designs.

12. Space strike is an expanded form of force application, which includes attacks on other heavenly bodies besides the earth.

13. This definition excludes the active countermeasure of maneuver, but includes the use of electronic warfare to defend space systems.

14. Mary C. FitzGerald, *The Impact of the Military-Technical Revolution on Russian Military Affairs*, vol. 2 (Washington, D.C.: Hudson Institute, August 1993), 19.

15. Lowell Wood, "The US Air Force in 2020," SPACECAST 2020 lecture, Air War College, Maxwell Air Force Base, Ala., 27 October 1993, 8.

16. Deputy for Development Planning, Space and Missile Systems Center, "An Evolving Focus for Military Missions in Space, 1995–2020," vol. 1, Executive Summary, 50–51.

17. Rich Poturalski et al., *Space Combat Panel Final Report: An Advocacy Plan for Future Space Combat Capabilities*, National Security Industrial Association (NSIA) Space Study 1992 (Colorado Springs, Colo.: NSIA, February 1993), 15.

18. Mahnken, 565–66.

19. Ibid., 564, 573.

20. The Navy's vision white paper, . . . *From the Sea*, states that "our surveillance efforts will continue to emphasize exploitation of space and electronic warfare systems to provide commanders with immediate information, while denying and/or managing the data available to our enemies." The paper focuses on information collection, but is silent on communications and environmental monitoring applications in spite of the fact the Navy depends on space for these functions. Department of the Navy, . . . *From the Sea: Preparing the Naval Service for the 21st Century* (Washington, D.C.: Government Printing Office, 1992), 8.

21. The white paper makes a quick reference to using "space-based assets to achieve dominance in space" as a part of battle space dominance, but does not elaborate on how this is to be achieved. . . . *From the Sea*, 9.

22. The US Marine Corps basic doctrinal manual, FMFM 1, *Warfighting*, 6 March 1989, is silent on space operations. The section on combined arms could be interpreted to include operations in space. A second manual, FMFM 1-2, *The Role of the Marine Corps in the National Defense*, does refer to space operations, but in support of combat operations. It lists space forces as one component of US military

posture for national defense. The focus of these forces is force enhancement. The section on projection forces is silent on space combat options. FMFM 1-2, *The Role of the Marine Corps in the National Defense*, 21 June 1991, 2-3 and 2-7.

23. FM 100-5, *Operations*, 14 June 1993, 2-3.

24. Quoted in "Space Primer," *Soldier*, April 1987, 8.

25. Heike Hasenauer, "Army Takes the Lead in ASAT," *Soldier*, August 1989, 13–20.

26. Quoted in Lt Col Charles D. Friedstein, "The Uniqueness of Space Doctrine," *Air University Review* 37, no. 1 (November–December 1985): 15.

27. AFM 1-6, *Aerospace Doctrine: Military Space Doctrine*, 15 October 1982, 8.

28. First, no space role is suggested or discussed under force application. Spacelift is listed as force enhancement in an attempt to closer associate it with airlift. Launching satellites doesn't seem to be in the same category as providing communication and navigation support. AFM 1-1, *Basic Aerospace Doctrine of the United States Air Force*, vol. 1, March 1992, 6–7.

29. Air Force Doctrine Directive (AFDD) 4, *Air Force Operational Doctrine: Space Operations* (draft), November 1993, 7, 11, 14, 19, 27–28.

30. Caton.

31. In spite of all these studies, only incremental improvements in responsiveness, cost reductions, and increased throw weight have been identified. Real improvements may require revolutionary approaches. See Lt Col John R. London III, *LEO on the Cheap: Methods for Achieving Drastic Reductions in Space Launch Costs*, (Maxwell AFB, Ala.: Air University Press, June 1993).

32. An argument can be made that SDI was a technologically driven program, not an operationally driven one. Lots of good ideas and science came out of it, but no systems.

33. Dunbar Lockwood, "Administration Backs 'Narrow' Interpretation of ABM Treaty," *Arms Control Today*, September 1993, 22.

34. Pat Towell, "Nunn Assails Bush's Request for Space-Based Weapons," *Congressional Quarterly*, 11 April 1992, 962. See also Pat Towell, "Bush Carries on Fight for SDI, but Space Weapons in Doubt," *Congressional Quarterly*, 6 July 1991, 1836–44.

35. Elizabeth A. Palmer, "Clinton Hews to Narrow View on ABM Treaty," *Congressional Quarterly*, 17 July 1993, 1894.