Realities of Space Age

& the Realities of Carl von Clausewitz's Theories of "Fog and Friction"

<< story

<< about the author

By Rodger S. Pitt
MAJ, Military Intelligence
Army Space Operations Officer
National Reconnaissance Office

MAJ Rodger Pitt is an FA40 (Space Operations) officer serving in the National Reconnaissance Operations Center as the National Reconnaissance Office's enterprise interface with external agencies (Service Components, Combatant Commands, the Intelligence Community and the Joint Staff) for compartmented programs. His previous tour was at the Naval Post Graduate School where he completed two Masters of Science Degrees: Space Systems Operations and Physics. His thesis research topic was "Mitigating Plasma-Induced Communication Signal Attenuation for Hypersonic Reentry Vehicles." He is en route to the 1st Infantry Division, Fort Riley, Kan., to stand up their Space Support Element.

The advent of Space force enhancement[1] capabilities, as applied directly to improving the effectiveness of forces across the full spectrum of operations by providing worldwide operational assistance to combat elements,[2] potentially reduces the effects of Carl von Clausewitz's famous "fog and friction" of war. The Space assets utilized in Space force enhancement can be critical combat multipliers by providing combatant commanders with real time information that greatly enhances situational awareness and decision-making. But a cautionary note accompanies these technological advances. Satellite technologies provide a commander with a wealth of data, which, if not properly synthesized, have the potential to overwhelm. Thus, modern "fog and friction" can be caused by having to decipher too much information, just as it arises when leaders possess too little data to make measured decisions.

Carl von Clausewitz (1780-1831) described the essence of war in his famous work, "On War":

> "Everything in war is very simple, but the simplest thing is difficult. The difficulties accumulate and end by producing a kind of friction that is inconceivable unless one has experienced war . . . Fog can prevent the enemy from being seen in time, a gun from firing when it should, a report from reaching the commanding officer."[3]

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Friction is the force that makes the apparently easy task so difficult to complete.[4] According to Alan Byerchen, a student of both Clausewitz and nonlinear dynamics, "friction" can be defined by the information theory that states that the more possibilities a system embodies the more information it contains. Constraints on those possibilities are needed to extract signals from "noise." One aspect of the fog of war concerns how the overload of information, the "noise," produces uncertainty as to the actual state of affairs.[5]

There have been many theorists over the years who have analyzed Clausewitz's theories on friction; some speculated that as the technology revolution came to fruition the friction of war would diminish. It is generally believed that the onset of the digital age, and the additional information available to commanders, would greatly reduce the fog and friction of war to virtually nothing. Technological advancements, however, have only improved the access to data and increased the amount of data collected. Technological advancements have not been able to automatically synthesize the collected data into useful intelligible knowledge that aids in a leader's decision.

In 1996, Barry Watts, former Director of both the Office of the Secretary of Defense Program Analysis and Evaluation and the Northrop Grumman Analysis Center, wrote that general friction has been a continuing feature of war since Napoleon, which consistently and strongly confirmed general friction's persistence. Thomas Keeney, former professor of military strategy at the National War College and current Acting Director of the Strategic Studies Program at the Merrill Center for Strategic Studies within John Hopkins University, "observed that friction's persistence is the one Clausewitzian concept that most military officers, especially those from combat arms, instinctively embrace."[6] These authors may not have considered the massive benefit that Space systems can provide to the warfighter and how they might affect the fog and friction of war.

According to the Army's Space Support to Army Operations Field Manual (FM 3-14), "Space is the newest of the warfighting media, alongside air, land, and sea."[7] Prior to DESERT STORM, Space systems were designed, built, launched, and operated for the primary purpose of supporting the communication, information and intelligence needs required by national agencies in direct support of the National Strategic Objectives. In August of 1991, the Air Force Magazine quoted the Assistant Secretary of the Air Force, Martin C. Faga as saying "DESERT STORM was the first large scale opportunity for our forces in the field to understand that Space systems are vital to their success."[8] Moreover, the Army's Space Brigade Operations Field Manual recounts both the first comprehensive use of Space systems and the most recent success in war by stating that:

> "Operation Desert Storm is generally accepted as the first Space war—the first conflict in history to make comprehensive use of Space system support. Military, civil and commercial Space systems significantly aided the coalition's air, ground and naval forces by providing communications, navigation timing, and intelligence, surveillance, and reconnaissance. In Operation Iraqi Freedom, joint and Army dependence on Space capabilities exceeded that of Operation Desert Storm by an order of magnitude. Space capabilities have contributed to many recent successes in combat and military operations other than war. The greatest successes have come through their application on global and theater levels when synchronized with the principles of unity of command and objective."[9]

As a result of this success, the Army has dedicated, trained Space operations officers who are permanently assigned to the Space Support Element at every Division in the Army. These Space operations officers integrate Space force enhancement and Space control[10] operations by working closely with the entire battle staff to ensure Space support is optimized for all six warfighting functions.[11] In order to better understand how Space systems affect Clausewitzian "fog and friction," one must first grasp Space-based capabilities.

- Global Position System (GPS)
  - GPS Constellation Status (accuracy predictions).
  - Space-based navigation signals for precision-guided munitions.
  - GPS and Satellite Communications are both used to track supply movements from embarkation at continental United States facilities through points of debarkation to the Soldiers intended to use the supplies.
- Space-based Remote Sensing
  - Space-based imagery are provided to enhance analysis of optimum staging areas and lines of communication.
  - Hyperspectral (such as Hyperion) and multispectral (such as LANDSAT) imagery for intelligence, terrain analysis and targeting analysis.
- Satellite Communications (SATCOM)
  - Access to dedicated, secure SATCOM on the Defense Satellite Communications System and the MILSTAR (a.k.a. Military Strategic and Tactical Relay) constellation for long-haul communications that are critical to command and control.
  - Alternate communications through other Space systems such as Iridium, International Maritime Satellite, and International Telecommunications Satellite Organization.
- Space-based Intelligence, Surveillance and Reconnaissance (Space assets that find and identify targets)
- Space control (in-theater negation and surveillance)
- Satellite reconnaissance advanced notice products
- Space-based Blue Force Tracking
- Theater Missile Warning (TMW)
- Space environmental status
- Space assets that provide global weather situational awareness
- Protect friendly Space assets and capabilities

The warfighter can communicate, navigate, target, find, and fix the enemy using a variety of different communication, Global Position System (GPS), and Intelligence, Surveillance and Reconnaissance satellites, respectively. Other satellites can provide data that help anticipate weather and protect friendly forces. The military also endeavors to control Space so adversaries cannot overcome the United States' asymmetrical advantages in Space.[12]

Space-enabled capabilities are sophisticated combat multipliers that are used to help warfighters shape the following operations: shaping the operational environment; prompt response; mobilizing the Army; forcible entry operations; and sustained land dominance. The following Space force enhancement capabilities[13] "are vital to overall military mission accomplishment, provide the advantages needed for success in all joint operations, and support the principles of war."[14] These Space-enabled capabilities provide the warfighter with a greatly increased situational awareness within the battlespace and make that knowledge available in near real time. Furthermore, the Army's FM 3-14 states:

> "The Army of today leverages Space capabilities to accomplish a wide variety of missions. Space-based and Space-enabled communications; position, velocity and timing; environmental monitoring; intelligence, surveillance and reconnaissance (ISR); and missile warning support are robust capabilities that continue to be necessities for success on the battlefield. Robust Space capabilities are a prerequisite for the Army of the future. They enhance information superiority and situational awareness, aiding high-tempo, noncontiguous, simultaneous distributed operations."[15]

Even though Space professionals provide tremendous leverage to warfighting capabilities by utilizing and exploiting these Space-enabled capabilities, caution must be taken as these capabilities make an exponential amount of additional information available to all levels of operations. The astronomical amount of information, provided by Space-based and Space-enabled assets, is vastly challenging to synthesize into useful intelligible knowledge that will aid in a leader's decision making. Joint Intelligence doctrine states that:

> "Intelligence is not an exact science; there will always be some uncertainty in the minds of intelligence analysts as they assess the adversary, and the commander and staff as they plan and execute operations. Likewise, intelligence, as synthesis of quantitative analysis and qualitative judgment, is rarely unequivocal and is therefore subject to competing interpretation."[16]

However, the required information must be available at the right time and in the right format for leaders to understand. Therefore, this vast amount of information must be filtered, processed, analyzed and produced into timely, actionable intelligence so that leaders can take full advantage of it. Until this plethora of information can be truly synthesized, Clausewitz's fog and friction will simply move from a lack of information to a lack of synthesized information. In other words, data from the battlefield is available, but full knowledge of the battlefield is not yet realized by the commander or it is deciphered too late.

The fog and friction shift between lack of information to lack of synthesized information may change as the military and intelligence communities move further and further into the digital age with technological sophistication that stretches "the battlefield into multidimensional battlespace, which includes the land, sea, air, outer Space and the electron."[17] The later term denotes that the form of war is becoming information-oriented. Timothy Thomas, a Department of the Army civilian

at the Foreign Military Studies Office at Fort Leavenworth, Kan., analyzed an article published in the China Military Science journal in 2002 where Major General Dai Qingmins, head of the 4th Department of the General Staff, compares China's integrated network-electronic warfare[18] concept with the U.S. network-centric warfare[19] concept. Both of these "concepts evade the fog and friction of war, assuming perfect information and ignoring those problems at their own peril."[20]

Timothy Thomas posits that "nowhere does Dai entertain fog and friction in the information age; he presents his argument as if there were no such problems . . . The struggle for information superiority is vital since it is a precondition for seizing sea, air and Space superiority."[21] This oversight, or intentional omittance, of the fog and friction of war in the information sphere (electron) by two major military powers seems to make an argument that these key aspects underlying Clausewitzian's theories will no longer be valid if perfect information[22] can be achieved. But therein lies the problem, the military does not operate on information in perfect form, nor is it currently able to synthesize information in such a way that instantaneously provides the commander with complete knowledge of all enemy actions on the battlefield that could possibly effect a commander's decision.

As technology and processes continue to advance, it is worth remembering the quote from David Keithly and Stephen Ferris in their article, "Auftragstaktik, or Directive Control, in Joint and Combined Operations."

> "A GRAVE CONTEMPORARY MISTAKE IS TO REGARD TECHNOLOGICAL ADVANCES IN COMMUNICATIONS AS A MEANS FINALLY TO OVERCOME THE FOG AND FRICTION OF WAR. TECHNOLOGICAL SOPHISTICATION SHOULD NOT DETER US FROM ENDEAVORING TO IDENTIFY LESSONS FROM THE PAST AND, ACCORDINGLY, TO LEARN FROM THE SUCCESSES AS WELL AS THE FAILURES OF EARLIER WARRIORS . . . ONE CONTEMPORARY OBSERVER HAS BEEN PROMPTED TO SUGGEST THAT WHATEVER THE ADVANCES IN RADIOS, COMPUTERS, SATELLITES, AND SOPHISTICATED ELECTRONIC COMMUNICATIONS SYSTEMS, WAR'S FOG WILL REMAIN AS RESISTANT TO TECHNOLOGICAL FIXES AS THE COMMON COLD HAS TO THE MARCH OF MODERN MEDICINE. THIS NOTION ACCENTUATES THE NEED TO CONSIDER ENDURING FUNDAMENTALS."[23]

Barry Watts has discussed that the implications of "friction" on future war will undoubtedly involve human foibles, inaccessible information and nonlinear dynamics. The greater the stress, he argues, the more data will be ignored; "noise" will be mistaken for information, and information misconstrued. No matter how much technological advancement constrain general friction in some areas it will simply balloon in others.[24] Space force enhancement capabilities have enabled access to a wealth of information to now be available to commanders, but have not addressed the ability to synthesize this wealth of information. Therefore, due to current technological infeasibility to make "decisively intelligible synthesized knowledge" out of a "wealth of information" and the fact that it is virtually impossible to obtain perfectly synthesized information the Clausewitzian theories on the fog and friction of war continues to be relevant.

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—Endnotes—

1 Space Force Enhancement – Combat support operations to improve the effectiveness of military forces as well as support other intelligence, civil, and commercial users. The Space force enhancement mission area includes: intelligence, surveillance, and reconnaissance; integrated tactical warning and attack assessment; command, control, and communications; position, velocity, time and navigation; and environmental monitoring. (Joint Publication (JP) 3-14, Joint Doctrine for Space Operations, 9 August 2002)

2 FM 3-14 (Space Support to Army Operations) Headquarters, Department of the Army, May 2005, 2-1.

3 Carl von Clausewitz, On War, ed. and trans. Michael Howard and Peter Paret (Princeton: Princeton University Press, 1976), 119-120.

4 Ibid. 119-121.

5 Alan Beyerchen, "Clausewitz, Nonlinearity, and the Unpredictability of War", International Security, Vol. 17, No. 3 (Winter, 1992-1993), 76-77.

6 Barry D. Watts, "Clausewitzian Friction and Future War", Institute for National Strategic Studies, National Defense University, McNair Paper 52 (October 1996), 37.

7 FM 3-14 (Space Support to Army Operations) Headquarters, Department of the Army, May 2005, 1-1.

8 JP 3-14 (Joint Doctrine for Space Operations), Chairman of the Joint Chiefs of Staff, 9 August 2002, II-4.

9 FM 3-14.10 (Space Brigade Operations) Headquarters, Department of the Army, October 2007, 1-1.

10 Space Control – Combat, combat support, and combat service support operations to ensure freedom of action in Space for the United States and its allies and, when directed, deny an adversary freedom of action in Space, The Space control mission area includes; protection of US and friendly Space systems; prevention of an adversary's ability to use Space systems and services for purposes hostile to US national security interests; negation of Space systems and services used for purposes hostile to US national security interests; and directly supporting battle management, command, control, communications, and intelligence. (Joint Publication (JP) 3-14, Joint Doctrine for Space Operations, 9 August 2002)

11 Warfighting Functions are: 1) movement and maneuver; 2) intelligence; 3) fires; 4) sustainment; 5) command and control; and 6) protection. These six warfighting functions are multiplied by leadership and complemented by information to make up the eight elements of combat power. (FM 3-0, Army Field Manual for Operations, February 2008, 4-1) This sentence is paraphrased from FM 3-14 (Space Support to Army Operations) Headquarters, Department of the Army, May 2005, D-1 & D-2.

12 Ibid. Foreward.

13 Ibid. 1-11 thru 1-14.

14 JP 3-14 (Joint Doctrine for Space Operations), Chairman of the Joint Chiefs of Staff, 9 August 2002, ix.

15 FM 3-14 (Space Support to Army Operations) Headquarters, Department of the Army, May 2005, 1-1 & 1-2.

16 JP 2-0 (Joint Intelligence), Chairman of the Joint Chiefs of Staff, 22 June 2007, I-3.

17 China's National Defense in 2002, white paper (Beijing: Information Office of the State Council of the People's Republic of China, December 2002), available at <http://www.aseansec.org/ARF/ARF-DWP/China-2002.doc>.

18 INEW – A series of combat operations that use the integration of electronic warfare and computer network warfare measures to disrupt the normal operation of enemy battlefield information systems while protecting one's own, with the objective of seizing information superiority—similar to the U.S. definition of IO [Information Operations]. (Timothy L. Thomas, "Chinese and American Network Warfare, National Defense University, 16 March 2008, 77, available at <http://www.ndu.edu/inss/press/jfq_pages/1538.pdf>)

19 Network-centric warfare (NCW) – An information superiority-enabled concept of operations that generates increased combat power by networking sensors, decision-makers, and shooters to achieve shared awareness, increased speed of command, higher tempo of operations, greater lethality, increased survivability, and a degree of self-synchronization. In essence, NCW translates information superiority into combat power by effectively linking knowledgeable entities in the battlespace. (David S. Alberts, John Garstka, et al., Network Centric Warfare: Developing and Leverage Information Superiority (Washington, D.C.: National Defense University Press, 1999), 2.)

20 Timothy L. Thomas, "Chinese and American Network Warfare, National Defense University, 16 March 2008, 77 available at <http://www.ndu.edu/inss/press/jfq_pages/1538.pdf>.

21 Ibid. 78.

22 Perfect Information – A term used in economics and game theory to describe a state of complete knowledge about the actions of other players that is instantaneously updated as new information arises. (Wikipedia, available at <http://en.wikipedia.org/wiki/Perfect_information>)

23 Keithly, David M. and Ferris, Stephen P., "Auftragstaktik, or Directive Control, in Joint and Combined Operations" Parameters Autumn (1999): 118-133.

24 Barry D. Watts, "Clausewitzian Friction and Future War", Institute for National Strategic Studies, National Defense University, McNair Paper 52 (October 1996), 126.