NAVAL WAR COLLEGE
Newport, RI
Department of Joint Military Operations

Self-Synchronization: What is it, how is it created, and is it needed?

BY

Layne M.K. Araki
LCDR USN

A paper submitted to the faculty of the Naval War College in partial satisfaction of the requirements of the Department of Joint Military Operations.

The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College or the Department of the Navy.

Signature: _____

5 February 1999

_____
LTCOL H.M. Davis, USA
JMO Faculty Advisor

REPORT DOCUMENTATION PAGE

1. Report Security Classification: UNCLASSIFIED	
2. Security Classification Authority:	
3. Declassification/Downgrading Schedule:	
4. Distribution/Availability of Report: DISTRIBUTION STATEMENT A: APPROVED FOR PUBLIC RELEASE; DISTRIBUTION IS UNLIMITED.	
5. Name of Performing Organization: JOINT MILITARY OPERATIONS DEPARTMENT	
6. Office Symbol: NWC Code 1C	**7. Address:** NAVAL WAR COLLEGE 686 CUSHING ROAD NEWPORT, RI 02841-1207
8. Title (Include Security Classification): Self-Synchronization: What is it, how is it created, and is it needed? (Unclassified)	
9. Personal Authors: Layne M.K. Araki, LCDR, U.S. Navy	
10. Type of Report: FINAL	**11. Date of Report:** 5 February 1999
12. Page Count: 21	
13. Supplementary Notation: A paper submitted to the Faculty of the NWC in partial satisfaction of the requirements of the JMO Department. The contents of this paper reflect my own personal views and are not necessarily endorsed by the NWC or the Department of the Navy.	
14. Ten key words that relate to your paper: Self-synchronization, Network-Centric Warfare, Pre-planned responses, Crisis Action Planning, Commander's Intent, Rules of Engagement, Unity of Effort, Complexity Theory, Bottom-up organization, Adaptive Learning	

15. Abstract:

In the coming years the decline of nation-states has been predicted and the likelihood of facing enemies without borders will increase dramatically. Technology will shrink the world to a size where anyone with a computer and a modem can retrieve information from the other side of the world through a local phone line. Technology will also tie the world so closely together that national economic boundaries will dissolve and create a global economy. Technology also promises to change the face of warfare. Vice Admiral Cebrowski, in his thought-provoking article on network-centric warfare, introduces a new term to warfare - self-synchronization. Is self-synchronization the answer to mission impossible? To answer this question the term must first be defined. Next a brief glimpse at self-synchronization in other mediums must be examined. Then the steps to create self-synchronization must be delineated. Following that the current military examples of self-synchronization must be presented. It should then be possible to determine if self-synchronization is the solution. If it is the solution every attempt must be made to create this "self-synchronization."

The creation of self-synchronization through unity of effort, commander's intent, rules of engagement, and battlespace knowledge is discussed as a starting point to create self-synchronization. The next steps in achieving self-synchronization are to empower individuals by releasing them from the multitude of requirements currently in place and the expectation and acceptance of the military as an adaptive learning organization.

16. Distribution / Availability of Abstract:	**Unclassified**	**Same As Rpt**	**DTIC Users**
	X		

17. Abstract Security Classification: UNCLASSIFIED	
18. Name of Responsible Individual: CHAIRMAN, JOINT MILITARY OPERATIONS DEPARTMENT	
19. Telephone: 841-6461	**20. Office Symbol:** NWC Code 1C

Abstract of

Self-Synchronization: What is it, how is it created, and is it needed?

In the coming years the decline of nation-states has been predicted and the likelihood of facing enemies without borders will increase dramatically. Technology will shrink the world to a size where anyone with a computer and a modem can retrieve information from the other side of the world through a local phone line. Technology will also tie the world so closely together that national economic boundaries will dissolve and create a global economy. Technology also promises to change the face of warfare. Vice Admiral Cebrowski, in his thought-provoking article on network-centric warfare, introduces a new term to warfare - self-synchronization. Is self-synchronization the answer to mission impossible? To answer this question the term must first be defined. Next a brief glimpse at self-synchronization in other mediums must be examined. Then the steps to create self-synchronization must be delineated. Following that the current military examples of self-synchronization must be presented. It should then be possible to determine if self-synchronization is the solution. If it is the solution every attempt must be made to create this "self-synchronization."

The creation of self-synchronization through unity of effort, commander's intent, rules of engagement, and battlespace knowledge is discussed as a starting point to create self-synchronization. The next steps in achieving self-synchronization are to empower individuals by releasing them from the multitude of requirements currently in place and the expectation and acceptance of the military as an adaptive learning organization.

Self-Synchronization: What is it, how is it created, and is it needed?

A worldwide terrorist organization hás taken over a United States Embassy in a third world country. Two hundred Americans are taken hostage, including the Secretary of State and the Ambassador. A CNN news team with a satellite feed direct to CNN just happened to be in the compound. The leader of the terrorist organization, who is not with his followers in the embassy, has released a videotape to CNN stating that one hostage an hour will be killed and the body will be thrown outside the embassy gates. He has made no demands. It appears he just wants to teach the United States a lesson. The local terrorist commander in the embassy makes it clear to the hostages and the CNN camera crew that he and all his 300 heavily armed compatriots expect to die. The third world country has a very small militia and a corrupt police force. The government has stated that a hostage rescue by their personnel is impossible. The intelligence community had no indications that this takeover was imminent or even probable. The closest American military force is an Amphibious Readiness Group (ARG) with their full Marine Corps complement. The National Command Authority (NCA) has ordered the Commander in Chief (CINC) to utilize the ARG and any other available forces to conduct a hostage rescue as soon as possible with minimum casualties.

The current crisis action planning timeline would probably include the following chain of events:

1. Event occurs and is reported to the NCA and Chairman of the Joint Chiefs of Staff (CJCS)
2. CINC provides a Commander's Estimate of the Situation and a recommended course of action (COA)

3. NCA selects the COA and CJCS issues an alert or warning order
4. Operational Order delineating COA promulgated
5. Operation executed[1]

Every hour means another American body with a hole through the skull. How fast can the ARG Commander get the information needed to conduct this operation? During this planning process how many body bags are going to be filled? In this scenario speed saves lives, every American life is valuable and any American casualty is abhorrent. The desired solution is to complete the mission before any American lives are lost. Has the NCA just asked for mission impossible? In today's military perhaps this is mission impossible, but in the military of the future when dominant battlespace knowledge[2] is a way of life perhaps this scenario has a solution.

In the coming years the decline of nation-states has been predicted and the likelihood of facing enemies without borders will increase dramatically. Technology will shrink the world to a size where anyone with a computer and a modem can retrieve information from the other side of the world through a local phone line. Technology will also tie the world so closely together that national economic boundaries will dissolve and create a global economy. Technology also promises to change the face of warfare. Vice Admiral Cebrowski, in his thought-provoking article on network-centric warfare, introduces a new term to warfare - self-synchronization.[3] Is self-synchronization the answer to mission impossible? To answer this question the term must first be defined. Next a brief glimpse at self-synchronization in other mediums must be examined. Then the steps to create self-synchronization must be delineated. Following that the current

military examples of self-synchronization must be presented. It should then be possible to determine if self-synchronization is the solution.

What is Self-Synchronization?

VADM Cebrowski defines self-synchronization as follows:

> *Self-synchronization is the ability of a well-informed force to organize and synchronize warfare activities from the bottom up. The organizing principles are unity of effort, clearly articulated commander's intent, and carefully crafted rules of engagement. Self-synchronization is enabled by a high level of [knowledge of] one's own forces, enemy forces, and all appropriate elements of the operating environment. It overcomes the loss of combat power inherent in top-down command directed synchronization characteristics of more conventional doctrine and converts combat from a step function to a high-speed continuum.*[4]

Simply put self-synchronization is doing the right thing at the right time for the right reason without having to be told by someone higher in the chain of command. Some of the advantages of self-synchronization are speed of command, speed in exploiting opportunities, adaptability, and reduced planning. In today's information age this is enabled by the creation of battlefield vision and empowered leadership. The goal is to have the right action taken so quickly the opponent is always in the observation phase, never gets oriented, and thus can never make a decision and can never act (observe, orient, decide, act or OODA loop).[5] The enemy is literally left without an ability to react, much less take the initiative. The key is getting and staying inside the opponent's OODA loop. Self-synchronization of one's forces should lead to paralysis of the enemy. The enemy is never granted the assessment phase which is inherent in a top-down command structure. Self-synchronization requires empowered leadership on the battlefield and will result in changes from the bottom up.

The disadvantages are lethal decisions are made by more junior personnel. Once this self-synchronized combat power is unleashed it may run its course before it can be stopped. Combat becomes more like turning on a light then slowly bringing a pot of water to a boil. It seems inherent that as the size of the operation increases self-synchronization becomes more difficult. Special Operations Forces appear much easier to self-synchronize than an Army Corps. It is precisely this mentality which justifies the existence of the operational staff. A large number of forces with different capabilities and missions must somehow be organized and directed. How could the individual parts of the whole act in such a way that their actions are synchronized without outside intervention? To answer this question a brief sojourn to the world of fireflies and geese must be taken.

Fireflies, Geese, and Modern Warfare

> *Imagine a tree thirty-five to forty feet high..., apparently with a firefly on every leaf and all the fireflies flashing in perfect unison at the rate of about three times in two seconds, the tree being in complete darkness between flashes.... Imagine a tenth of a mile of river front with an unbroken line of [mangrove] trees with fireflies on every leaf flashing in synchronism, the insects on the trees at the ends of the line acting in perfect unison with those between. Then, if one's imagination is sufficiently vivid, he may form some conception of this amazing spectacle.*[6]

This description of the amazing ability of fireflies to mutually synchronize was written in 1935. If one breaks down the biological observation it appears each firefly is able to synchronize with all the other fireflies without an exterior command and control system, i.e. each firefly is able to self-synchronize. Those who study non-linear dynamics, which this paper will not delve into, have observed this mutual synchronization in other natural systems. Several other examples include the pacemaker

cells of the heart, the insulin-secreting cells of the pancreas, crickets that chirp in unison, and even groups of women whose menstrual periods become mutually synchronized.[7] These examples are not given to further confuse the self-synchronization issue but to validate that the phenomenon is possible in nature. If it is possible in nature it may be possible in warfare.

If one accepts the possibility of self-synchronization it still leaves the problem of individuality. What if one platoon or one ship or one rifleman is out of synch? This is where we turn to geese. Geese and other animals that travel in flocks or herds have been studied for years to determine better ways to manage traffic. It has been observed that when geese are migrating that if one bird swerves off course then neighboring birds will attempt to follow. It seems that this one bird could lead the entire group off course or at the very least cause mass confusion, but this does not occur. Instead the neighboring birds go off-course less than the initial bird did and the error of the errant goose diffuses across the formation until the error vanishes and the flock continues heading in the original direction.[8] Nature can also be self-correcting in a self-synchronized evolution like migration. Those who fear self-synchronization will be able to be disrupted by the single rogue should take some solace that geese still reach their destinations despite some errant geese.

The naysayers will immediately say the natural examples of self-synchronization occur between like entities, i.e. fireflies, crickets, women, and are unique tasks, i.e. flashing, chirping, menstruating. They will then say, "show us how you synchronize a cricket with a firefly or cells of the pancreas with cells of the heart or different tasks like crickets flashing or fireflies chirping. Because in the joint arena or even in our own ship,

battalion, or air wing the differences of personnel and equipment are enormous and every day the tasks are different. This whole idea of natural self-synchronization only applies to like entities and as an operational planner dealing with a variety of forces it does not help." The response to this naysayer is that elements of self-synchronization already exist in the military and are already being incorporated in training exercises.

Elements of Self-Synchronization

For many years synchronized responses have been a part of the Naval Nuclear Power Program. Given particular indications or trends a predetermined response by individual watchstanders should be accomplished without order. The responses are called immediate actions which are codified in operating manuals. As the size of the unit is increased to that of a ship the Captain has Battle Orders in which are written emergency responses. If an unidentified air contact is detected an announcement by the Tactical Action Officer sets in motion predetermined actions throughout the entire ship. On an even larger scale a battle group commander will promulgate pre-planned responses for his entire battle group to certain detectable events such as a submarine contact that set into motion predetermined actions to be taken by all the ships and air assets in the battle group. These are not examples of self-synchronization in network-centric warfare but are a familiar starting point for understanding. All three involve a detectable event by someone low in the chain of command. All three involve actions being taken by these people without a new order (standing orders are in place in all three cases) being given. Thus, in these examples there is a bottom-up sequence of events which occurs at a high speed. However, this is not self-synchronization. All of the responses were promulgated

from the top down. Naval Reactors (NAVSEA 08) approves the nuclear propulsion plant manuals, the Commanding Officer of the ship approves his own battle orders, and the Battle Group Commander approves his own pre-planned responses.

These examples of synchronization are reactive instead of proactive. The people who respond to the stimulus, whether it is a propulsion plant casualty, or an unidentified air or subsurface contact are all motivated by a preservation mentality – put the reactor plant in a safe condition, destroy, neutralize, or identify the air or subsurface threat. The responses are all instigated by events outside the immediate sphere of control of the people taking action. The number of scenarios for which preplanned responses are generated is determined by predicting the most likely failures or threats one is likely to encounter or by scientifically determining which events could lead to catastrophic failure without prompt action. As time goes on and new scenarios unfold the preplanned responses continue to grow in number. The situations a Commanding Officer of a ship at sea has to worry about has increased through the years. One of the first concerns was running aground and/or being boarded by a hostile enemy, then as time progressed guns and cannon complicated the problem, as did submarines, as did air power, and now information warfare. At each stage of change new responses are generated and while some threats become less likely the threats are almost always additive, very rarely are threats taken off the list. The lists of preplanned responses just gets longer and longer. The brains of those who are supposed to take the synchronized actions just get fuller and fuller. As the world becomes more complex the number of possible events a military force could encounter increases dramatically. It is simply not possible to plan for and to train for every possible event a soldier, sailor, airman, or marine could encounter. It

seems impossible to train and equip for predictable events on the tactical level much less prepare for the unpredictable ones.

The increased complexity of warfare as more dimensions were added and units became larger was dealt with by the creation of the staff concept. The staff at the operational level could take a new and complex problem and determine the possible courses of action for both own and enemy forces and choose the course of action with the highest probability of defeating any enemy course of action. This plan could then be properly sequenced, synchronized, and promulgated to incorporate all the elements of the force in the way which best reflected the existing doctrine, the principles of war, and the fundamentals of operational art. The problem is that this step added to process takes time. What if, as in the initial hostage rescue scenario, there is no time? A combination of the pre-planned synchronized responses from the lower level coupled with the overarching and all encompassing view of the staff, where hopefully everything is fused together, is needed to resolve this dilemma. The answer is self-synchronization.

Step One in Creating Self-Synchronization

How can a self-synchronized response occur to a new and complex situation? As VADM Cebrowski states, self-synchronization has four main elements: unity of effort, commander's intent, rules of engagement, and a high level of knowledge of own and enemy capabilities and the operating environment. To achieve the unity of effort required the goal, purpose, or mission must be known by everyone and everyone must direct their efforts toward achieving it. Immediately when a problem is encountered it must be articulated to everyone who is going to be or might be a part of the solution.

Parallel processing vice sequential processing of information must be the goal. The geese must all know the destination to create a self-correcting system. This knowledge of the problem immediately starts all levels of the force working on their part of the solution. There can not be a bottom-up solution if the bottom is not aware of the problem. Then to truly achieve unity of effort a mechanism must exist to feed information, courses of action, and action being taken up and down the chain of command.

The next element of self-synchronization is the commander's intent. The commander's intent should be memorable, should state the purpose of the mission, should include a vision of the battlefield, and must include the end state.[9] If all else fails and the promulgated plan is falling apart the individual warfighter should be able to fall back on the commander's intent and work to achieve it. At the same time, the commander's intent must be flexible enough to take advantage of unforeseen opportunities and to adjust if the end state is reached without having met all the tactical objectives. The battlefield paralysis caused by high speed warfare may cause the enemy to surrender sooner.

The rules of engagement must also be clearly specified. The warfighter must know the limits beyond which he must not go. The rules must not be looked upon as limiting and final. Instead the rules of engagement must be looked upon as focusing and flexible. It will involve a mindset change in some instances on both those who establish and approve the rules and by those who must follow them. The capability to engage targets at greater and greater depths in the battlefield with higher precision and lethality than ever before will require limitations in a self-synchronizing battlefield. Just because the ability exists to destroy something does not imply that one should destroy it even if it

is an enemy asset. This should prevent the progression to a force annihilation mentality - the ephemeral decisive victory.

The technologically enabling element is knowledge of the battlefield. In the future the common operating picture will allow all levels of the chain of command to see the force dispositions. The commander in the field will not have to rely on periodic voice reports to determine how far his own forces have advanced or where the enemy targets are located. If a soldier can see that a target is already being engaged by another element of his own forces he can move on to the next target automatically. Recently in Fleet Battle Experiment Delta the following example of self-synchronization took place:

> *By relying on the network for precise information about the approach of enemy troops, the pilots and aircrews engaged the simulated invading forces en masse - and at the farthest possible range....Best of all, the planners said, the system was "self-synchronizing." The headquarters staff didn't set the launch times for each airfield's helos. Instead, individual aircrews did by checking the network and calculating their own time-to-target....By pushing such decisions to the lowest possible level, the system frees the command staffs to concentrate on strategic considerations while enabling sailors and airmen to act on knowledge about their own equipment.*[10]

Unity of effort, commander's intent, and rules of engagement are nothing new. The vision of the battlefield has consistently increased as technologically advanced. So why is self-synchronization still not a reality? Some would argue the missing link is the battlefield vision. However, even if the desired vision is achieved two hurdles must still be overcome to achieve self-synchronization. The first is the creation of empowered leadership and the second is the transformation to an adaptive learning organization.

The Next Step toward Self-Synchronization

Frequently the phrase, "it is easier to beg for forgiveness, then ask for permission" is used when something needs to be done right now. The implication is that a requirement, written or unwritten, must be ignored to accomplish the task. But afterward, as long as no one gets hurt and the job gets completed, the brief "you should not have done that reprimand" is fairly painless. However, the decision still must be made to ignore the requirement. In some cases, the person performing the task may not know the requirements. But he knows when he asks permission to perform the task, more often than not, a requirement which will increase the time to get the job done will be added. So, the question is not asked. This mentality, which does exist in some parts of the military, must be purged. It can either be eliminated by ironclad discipline, which takes away the easy forgiveness at the cost of a loss of creativity and innovation, or by the simplification of the requirements to a set which will allow creativity and innovation. The latter is the path to self-synchronization.

Currently during a Navy ship's interdeployment training cycle (IDTC) there are well over a hundred inspections, certifications, or assist visits which must be completed to verify a ship is prepared to go on a six month deployment. Recently the IDTC was reviewed and 20 inspections, certifications, and assist visits were eliminated, 72 were consolidated and 27 previously mandated were made optional.[11] The decrease in the IDTC requirements is primarily a response to a need to improve sailor quality of life. The large number of inspections, assist visits, and certifications all started with good intentions, which could be described as a preventive pre-planned response. But as was discussed earlier, the requirements eventually become so overwhelming instead of

serving the original purpose, which varies with requirement, it only serves to foster "solution will be provided" or "there has to be a checklist" attitudes. This decrease in requirements must also be used as an opportunity to put the responsibility, accountability, and in essence the power back down where it belongs. The individual sailor must be empowered to be a self-correcting part of the organization. Fewer people are going to come aboard and point out and fix the problems, instead those who should be fixing the problems in the first place will be empowered to do so. This empowerment of the individuals in the organization is a necessary step in achieving self-synchronization. Turning to religion there is probably a good reason why God only gave Moses Ten Commandments in Exodus[12] and why Jesus only gave his disciples two great commandments in the New Testament.[13]

Once the creativity and innovation of our sailors are unleashed it must be properly channeled by the evolution from a trained organization to an adaptive learning organization. The United States Navy is unquestionably one of the finest trained organizations in the world. To operate a naval nuclear propulsion plant every individual, both officer and enlisted, goes through an intense six month classroom phase of training to learn the book-knowledge required to understand nuclear power. The classroom phase is followed by six months of continuously supervised hands-on training at an operating nuclear power plant. Then when he reaches his ship or submarine he spends another two to six months qualifying to operate that particular ship's or submarine's propulsion plant. Almost every other specialty in the Navy and the other services has a similar training pipeline.

The training approach is ideal for technologies where change is slow and the fundamentals are well known like nuclear power. The problem arises when technology changes faster than the training provided by the in place organizations responsible for the training changes. A prime example is in the area of information technology. According to Moore's law computer processing capability doubles every eighteen months.[14] This processing capability increase has enabled technology to grow and change at a similar rate and has driven the incorporation of commercial off the shelf technology. A structured training organization can not keep pace. Three responses can be made, one is to wait till the technology is established and stabilized and then incorporate the new "fundamentals" into the training cycle. The second is to throw out the old and teach the new as soon as it is introduced. The third is to retain the applicable portions of the old and constantly update the system with new information. The first response will lead to obsolescence in this age of rapid change. The second might be characterized as careless - "throwing out the baby with the bath water." The third response is the response of an adaptive learning organization.

The concept of an adaptive learning organization stems from complexity theory, which like non-linear dynamics, this paper will not dig too deeply. An adaptive learning organization is the result of reaching the conclusion that simple cause and effect relationships cannot be determined with any reliability. An important mindset change is the rejection of an organization as a machine. "The key to a machine is that each part has a known, predictable behavior in the system, and that the interconnection of the parts results in the results for which the system is designed."[15] For years the military has attempted to force this model on a human organization and has been relatively successful.

Despite this success, to take the next step toward self-synchronization the military must shift from the military as a machine to the military as a predatory animal. As John F. Schmitt says:

> *In a complex, open environment, command and control is fundamentally a process of continuous adaptation. The simple command and control model, the Observation-Orientation-Decision-Action cycle (or OODA loop), essentially describes a process of continuous adaptation to a changing situation.... We might better liken the military organization to a predatory animal—seeking information, learning and adapting in its desire for continued survival—than to some "lean, green machine." Most military actions do not proceed with clockwork mechanics—as "operations"—but instead as "evolutions" along the "edge of chaos."*[16]

How does one change this instilled mindset of the military as a machine? The search for the best answer must be replaced by the search for an answer that works. The command and control structure must evolve from omnipotent direction from above to influence from above with sufficient latitude given to subordinates. The commonly used example is the difference between a chess player and a soccer coach.[17] The chess player has omniscient knowledge of both his own and his opponent's force dispositions and has omnipotent control of each individual piece. The soccer coach on the other hand can choose the players he puts on the field and can choose the training that occurs before the game. But once the game starts the players not the coach must synchronize the actions on the field. The military must continue to develop the specialized skills necessary for the soldier, sailor, airmen, and marine to operate his technologically advanced equipment but also create an environment where adaptation is expected and accepted. The Navy is taking strides toward this with the Fleet Battle Experiments and the Army with their Force XXI.

Conclusion

Few would argue they want empowered people working for them who are constantly learning and thus adding to the knowledge base of the force, but the military is in a dangerous business. The military is tasked to fight and win the nation's wars. Inevitably, given the tools of destruction on ships, aircraft, tanks, and on the individual soldiers death and destruction will result. In a business environment if an individual makes a poor decision money, not lives, are usually the cost. It is because of the stakes involved that the top-down command structure must be in place. The decisions that matter involving life and death must be made by those who are the most experienced. If this animal of "self-synchronization" is released unnecessary death and destruction will occur. This assertion is true but only if the problem is not bounded, guided, and influenced by those with the experience. The advantages of self-synchronization are worth this risk.

The creation of self-synchronization is a desired characteristic of today's military. It needs to be shaped by unity of effort, specifically by making all hands aware of the mission immediately. It needs to be created through the Commander's Intent that must include a desired vision that is constantly reevaluated in battle. It must also be also be focused by flexible Rules of Engagement to minimize undesirable consequences with the clear knowledge that there may be some unintended consequences. It must be enabled by the battlefield vision promised by technological advances so that as bottom-up actions are taken they do not become redundant. On top of these four principles must be added the lifting of the requirement thumb which prevents individuals at all levels of the military organization from being empowered. Underlying the other five steps toward self-

synchronization must be the expectation and acceptance of the transformation of the military from a machine to an adaptive learning organization.

> Returning to the initial hostage rescue situation a military organization which is self-synchronous will be able to marshal all resources such that without order the following events will occur:
>
> - The hostage problem will immediately be disseminated via the command and control net to all forces who may be able to assist in the hostage rescue. This states the unifying problem for all levels of the chain of command to focus and unify their efforts.
>
> - The commander will be designated and he will promulgate his intent. The vision for the operation will be divulged which will include the freeing of the hostages with minimal loss of life.
>
> - The Rules of Engagement will be issued making all terrorist personnel in the compound hostile and delineating the acceptable level of destruction.
>
> - The intelligence community will link all resources and obtain a list of hostages with pictures and possible locations. They will link with the contractor who designed the embassy to obtain blueprints. They will determine hostage armament and any weaknesses. They will send all of this information electronically to the ARG Command ship which will electronically disseminate the information to the forces. All available sensors will be allocated to the operation and this picture will be provided to the ARG. The battlefield picture will be clear in everyone's mind.
>
> - Without order the helicopter crews will conduct preflights as they prepare to transport the Marines to the Embassy compound.
>
> - Without order the Marines will arm themselves and divide the compound into sectors of responsibility.
>
> - The Marines will be able to conduct the final brief in the air and will be inserted and free the hostages with minimum loss of life.

The above solution is obviously a gross oversimplification of a difficult mission but it is a goal for the military to strive to achieve. Self-synchronization can save time and should be developed for this and other time-sensitive missions so that lives can be saved. The solution is not one that can occur overnight, it cannot be created self-synchronously. In

fact, it will take years to change the cultural mindset required to lift the requirement thumb and to create an adaptive learning organization but it is worth the effort.

End Notes

[1] Joint Pub 5-0 Doctrine for Planning Joint Operations, April 13, 1995, III-11.
[2] David Alberts, "The Future of Command and Control with DBK," Dominant Battlespace Knowledge, October 1995, http://www.ndu.edu/inss/books/dbk/dbkch05.html (25 January 1999).
[3] Vice Admiral Arthur K. Cebrowski and John J. Garstka, "Network-Centric Warfare: Its Origins and Future," US Naval Institute Proceedings, 124 No. 1, January 1998, 28-35.
[4] Ibid, 35.
[5] Steven M. Rinaldi, "Complexity Theory and Airpower: A New Paradigm for Airpower in the 21st Century," Complexity, Global Politics, and National Security, November 1996, http://www.ndu.edu/inss/books/complexity/ch10b.html, (1 February 1999).
[6] H.M. Smith, "Synchronous flashing of fireflies," Science, 82, 1935, 151.
[7] Renato E. Mirrolo and Steven H. Strogatz, "Synchronization of Pulse-Coupled Biological Oscillators," SIAM Journal of Applied Mathematics, Vol. 50 No. 6, December 1990, p. 1645 provides these examples with the individual examples footnoted.
[8] Adam Rogers, "Going With the Flow: Can watching birds flock help humans beat morning gridlock?," Newsweek, October 19, 1998, 65.
[9] Lieutenant Colonel Walter N. Anderson, "Commander's Intent – Theory and Practice," Armor, May-June 1998, 46-52.
[10] Peniston, Bradley, "Navy continues innovations for 1999", Navy Times, January 18, 1999, 26.
[11] JO2 Sean A. Hughes, "Sailors Happy to Spend more Time at Home", Pacific Fleet News and Information, 27 October 1998, http://www.cpf.navy.mil/pages/cpfnews/9810idtc.htm, Also JO1 Chris Alves, "CNO Highlights Further Reductions in IDTC at testimony before Senate Armed Services Committee," CNO News, 5 January 1999, http://www.chinfo.navy.mil/navpali..ags/johnson_j/cno-news/cno0105.txt, (31 January 1999).
[12] Exodus 20:1-17.
[13] Matthew 22:37-40.
[14] Intel Corporation, "What is Moore's Law," Processor Hall of Fame, 1999, http://www.intel.com/intel/museum/25anniv/hof/moore.htm, (1 February 1999) .
[15] Robert R. Maxfield, "Complexity and Organization Management," Complexity, Global Politics, and National Security, November 1996, http://www.ndu.edu/inss/books/complexity/ch08.html, (25 January 1999).
[16] John F. Schmitt, "Command and (Out of) Control: The Military Implications of Complexity Theory," Complexity, Global Politics, and National Security, November 1996, http://www.ndu.edu/inss/books/complexity/ch09.html, (25 January 1999).
[17] Ibid.

Bibliography

Alberts, David, "The Future of Command and Control with DBK," Dominant Battlespace Knowledge, October 1995, http://www.ndu.edu/inss/books/dbk/dbkch05.html (25 January 1999).

Alves, JO1 Chris, "CNO Highlights Further Reductions in IDTC at testimony before Senate Armed Services Committee," CNO News, http://www.chinfo.navy.mil/navpali..ags/johnson_j/cno-news/cno0105.txt, (31 January 1999).

Anderson, Lieutenant Colonel Walter N., "Commander's Intent – Theory and Practice," Armor, May-June 1998, 46-52.

Cebrowski, Vice Admiral Arthur K. and John J. Garstka, "Network-Centric Warfare: Its Origins and Future," US Naval Institute Proceedings, 124, no. 1, January 1998, 28-35.

Hughes, JO2 Sean A., "Sailors Happy to Spend more Time at Home", Pacific Fleet News and Information, http://www.cpf.navy.mil/pages/cpfnews/9810idtc.htm.

Intel Corporation, "What is Moore's Law," Processor Hall of Fame, 1999, http://www.intel.com intel/museum/25anniv/hof/moore.htm, (1 February 1999).

Joint Pub 5-0 Doctrine for Planning Joint Operations, April 13, 1995.

Maxfield, Robert R., "Complexity and Organization Management," Complexity, Global Politics, and National Security, November 1996, http://www.ndu.edu/inss/books/complexity/ch08.html, (25 January 1999).

Mirrolo, Renato E. and Steven H. Strogatz, "Synchronization of Pulse-Coupled Biological Oscillators," SIAM Journal of Applied Mathematics, Vol. 50 No. 6, December 1990, 1645-1662.

Peniston, Bradley. "Navy continues innovations for 1999", Navy Times, January 18, 1999, 26.

Rinaldi, Steven M., "Complexity Theory and Airpower: A New Paradigm for Airpower in the 21st Century," Complexity, Global Politics, and National Security, November 1996, http://www.ndu.edu/inss/books/complexity/ch10b.html, (1 February 1999).

Rogers, Adam, "Going With the Flow: Can watching birds flock help humans beat morning gridlock?," Newsweek, October 19, 1998, 65.

Schmitt, John F., "Command and (Out of) Control: The Military Implications of Complexity Theory," Complexity, Global Politics, and National Security, November 1996, http://www.ndu.edu/inss/books/complexity/ch09.html, (25 January 1999).

Smith, H.M., "Synchronous flashing of fireflies," Science, 82, 1935, 151.