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The military community and defense contractors have developed an active interest in improving the military's ability to destroy time-sensitive targets (TST) ever since the threat of Scud missile launchers during Operation Desert Storm in 1991. More recently the Yugoslavs demonstrated in Kosovo that adversaries are getting even better at protecting these important and dangerous targets by continually moving them, building vast numbers of decoys and using camouflage and concealment. This will only make the problem more difficult in the future.

However, along with the adversaries improving their techniques to protect these targets, the United States military has developed enormous capabilities in Intelligence, Surveillance, and Reconnaissance (ISR); Command and Control (C2); communication; and computer systems that have improved their ability to destroy these time-sensitive targets. The only major problem that remains is how to integrate all these capabilities into the most efficient time-sensitive target destroying machine. The answer is a time-sensitive targeting cell resident in the Combined Air Operations Center (CAOC) that builds a total picture from all of the ISR assets available, makes rapid decisions based on the information gathered, and assigns the right asset to destroy the fleeting target.

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NAVAL WAR COLLEGE
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Solving the Problem of Time-Sensitive Targeting

By

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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:_____

03 February 2003

Advisor:
Professor David M. Goodrich

Introduction

> *During the 1990s, air operations against adversary mobile force elements (surface-to-air missile defenses, tactical ballistic missile launchers, and fielded forces operating in small units) that employed camouflage, concealment and deception techniques and shoot-and-scoot tactics produced disappointing results.*[1]

The military community and defense contractors have developed an active interest in improving the military's ability to destroy time-sensitive targets (TST) ever since the threat of Scud missile launchers during Operation Desert Storm in 1991. It is an ever lurking problem of significant importance and the focus of every operation and exercise since Operation Desert Storm. There is no evidence to show that its impact will decrease in the future. Defining this dynamic problem and creating a system to solve it has been a major concern of the joint military community and especially the Joint Force Commander (JFC) who is ultimately responsible for the destruction of these elusive threats.

JP 1-02 defines a time-sensitive target as "those targets requiring immediate response because they pose (or soon will pose) a clear and present danger to friendly forces, or are highly lucrative, fleeting targets of opportunity."[2] A few examples of these targets are something inherently mobile like a surface-to-air missile (SAM) system, or they could be something that is stationary but time critical to destroy, like a bridge that an adversary's force is moving towards in order to gain positional advantage. Both have limited windows of vulnerability. The term time-critical target (TCT) has been described in many military documents as a subset of TST. TCT can be defined as "a time sensitive target with an extremely limited window of vulnerability or opportunity, the attack of which is critical to ensure successful completion of the JFC's operations."[3] However, TCT has not been

formally adopted or defined in joint publications, and for the purposes of this paper the two terms will be used interchangeably.

The main point to understand about these terms is that time is the limiting factor and the smaller the window of vulnerability the harder the targets are to destroy. It has been described as "less than 60 minutes gotta be good; 0-30 minutes gotta be lucky and good; less than 10 minutes gotta be crazy,"[4] and the military has expressed interest in decreasing the timetable down to "single digit minutes."[5] This goal is based on the need to kill these targets as quickly as possible because they are so dangerous, militarily important or both. It should also be mentioned that since time is so limited these targets can obviously not be handled under the normal processes of the 72 hour air tasking order (ATO) system[6] and deliberate strike planning.

Recent conflicts like Operation Enduring Freedom (OEF) have shown that these time-critical target sets are becoming increasingly larger and more diverse. They have evolved from Scud missiles in Iraq, to surface-to-air missile systems in Kosovo, to fleeing terrorists in Afghanistan. The solution to the problem could focus on the development of new decision making software; command and control (C2) technology improvements; development of new intelligence, surveillance, and reconnaissance (ISR) platforms; more refined rules of engagement (ROE); or exact organization staffing in the Joint Task Force. All of these are important, and future technology will definitely improve the process, however, this paper is limited to the question of how the Joint Force Air Component Commander (JFACC) can reduce the time of the “TCT kill-chain”[7] of time-sensitive targets at the operational level.

Simply stated, the destruction of time-sensitive targets is a problem of time, space, and force. There are many capabilities and technologies that already exist to help with the

solution. The shortcomings we have experienced in the past, and how the military can solve this problem today should center around the idea that the "problem is 20% technical and 80% procedural."[8] The tools required to solve this problem are already in the military's inventory, but how they are all tied together functionally and procedurally is where the solution exists. The thesis of this paper is that the problem of destroying time-sensitive target lies in the relationships of time, space and force, and that establishing a Time-Sensitive Targeting Cell at the Combined Air Operations Center (CAOC) could shrink these issues to a manageable size. The cell enables the centralized control of all available ISR assets to find the target, reduces the decision making process, and allows the quick assignment of the best strike asset to destroy the target.

The Vision

The problem of TSTs has received high level attention, being addressed by the Joint Chiefs of Staff in Joint Vision 2020, which states, "precision engagement success depends on in-depth analysis to identify and locate critical nodes and targets. The pivotal characteristic of precision engagement is the linking of sensors, delivery systems and effects."[9] All the subordinate services have in turn defined the idea further. The Air Force states in Air Force Vision 2020, "We'll provide the ability to find, fix, assess, track, target and engage anything of military significance anywhere. We'll transition from the ability to do that in hours to the ability to do it in minutes."[10] While the Navy says in Navy Vision 2020, "Shortening our decision timelines by improving and connecting sensor, information and targeting systems, including focusing on real-time location of an adversary’s mobile targets."[11] It is evident from these long range mission statements that the problem of dynamic targeting of time-

sensitive targeting is not going away and that it has become a major concern of the joint military world.

The Problem of Time, Space, and Force and the Joint Targeting Cycle

Why is time-critical targeting so difficult? The operational art ideas of time, space, and force frame the problem. It can be compared to trying to find a needle (sometimes a moving needle) in a haystack in a limited amount of time with assets or forces that are probably already tasked for other purposes.

A large part of the problem has to do with executing our Joint Targeting Cycle against a TST before it moves or is no longer a legitimate target. Time, space, and force and their relationships to each other are embedded in this predicament. There is limited time to get forces across the area (space) and destroy the target. As stated earlier, these targets could be TSTs because they are mobile, or they could be TSTs because they are important pop-up targets that must be targeted quickly like destroying a bridge to stop unforeseen troop advancement. This idea of beating the adversary to the punch can be explained by the premise of operating inside your enemy's decision timeline (i.e., OODA loop). Col. John R. Boyd defined the Observation-Orientation-Decision-Action (OODA) Loop as the four steps in a commander's decision making process: observe the enemy, orient own troops about enemy weaknesses, decide on best course of action, and initiate action by own forces.

The adversary's OODA loop may only be a mobile SAM operator realizing his location has been discovered and deciding to move or conceal himself, while the destruction of that target after being discovered involves the whole Joint Targeting Cycle. The individual steps of the Joint Targeting Cycle are:

(1) Commander's Objectives, Guidance, and Intent
(2) Target Development, Validation, Nomination, and Prioritization

(3) Capabilities Analysis
(4) Commander's Decision and Force Assignment
(5) Mission Planning and Execution
(6) Combat Assessment[12]

It has been further noted in joint doctrine that "although the successful attack of TSTs requires the targeting process to be significantly compressed, the individual steps still must be executed."[13]

With good preplanning and intelligence preparation of the battlefield (IPB), the TST process can be compressed to detect, locate, identify, decide, strike, assess (sometimes referred to as find, fix, track, target, engage, assess or F2T2EA or TCT kill chain).[14] This process is still cumbersome because it requires that multiple decisions be made at various levels and locations, and rapid coordination achieved between sensors and shooters for destruction of the target. Modern technology, with the advent of improved ISR capabilities, precision munitions, communications, and automated systems has made the solution to this problem more feasible, but it has still not been completely solved. The problem is further compounded because the goal is no longer hours, or tens of minutes but "single digit minutes". [15]

Two other things that must also be mentioned about this dynamic problem, and can not be overstressed when looking for solutions, are the ideas of risk and asset management that are inherent in time-sensitive targeting. Anytime a process, like time-sensitive targeting, is rushed there will always be a certain level of risk, and depending on the political situation, especially with today's media reach, the results could be catastrophic. Even when it is not truly a time-sensitive target, the military has made high visibility mistakes, like the bombing of the Chinese Embassy in Operation Allied Force (OAF).

The problem of limited assets or forces in theater has been an issue in the past and will continue to be one in the future. With military downsizing and many assets over-tasked, the daily ATO will normally utilize all available assets in theater, leaving no extra assets standing by to prosecute time-sensitive targets. Assets usually being used to engage TSTs are probably diverted from a pre-planned mission that was scheduled on the ATO and that further slows down and complicates the problem. The decision to divert these assets is even harder because ATO missions have a higher probability for success due to the fact that there was enough time to do the appropriate amount of planning to make them successful.

The option of setting aside assets specifically for TST via the ATO has been discussed, but as stated before, there are no excess assets, and the possibility of an asset not being used at all because a TST never emerges may be something that is not acceptable. "To be effective, joint targeting must identify the best weapon for the intended target with appropriate timing to meet the objectives established by the JFC."[16]

TST in the Past

A big concern of the military during Operation Desert Storm was the threat of Scud missiles. The main reason for this was due to its range and damage it could inflict when employed. The Scud missile systems were constantly being moved around at night, which only complicated the targeting problem.[17] The military had no chance at the successful prosecution of Scuds pre or post launch, partially because it did not possess the ISR and C2 capabilities required to support the effort. "In the gulf war, we never did get the Scuds. We would still have difficulty getting them, but we'd be a lot better at it with the resources we have today."[18]

Desert Storm was also the first time the Joint Air Operations Center (JAOC), headed by the JFACC, was employed at one single location to control the air operations of the war.[19] The JAOC was based on models from the past that had been used in Vietnam and previous conflicts. The JAOC successfully provided centralized control, however, it did receive criticism in other areas. "The criticism of the JAOC centered around its "functional rigidity" -its inability to respond immediately to tactical threats or targets of opportunity such as the Iraqi Scud missiles."[20]

Operation Allied Force used many of the lessons learned from Desert Storm to help solve the TST problem. The primary TST during OAF was SAM systems, especially mobile systems like the SA-6, because they were so deadly to allied air assets. During the 78 days of air operations, Kosovo SAM operators fired 700 radar guided SA-3 and SA-6 missiles, and it was assessed that NATO forces damaged or destroyed 40 % of the SAM systems.[21] The Yugoslavs also showed that adversaries are getting better at protecting these important and dangerous targets by continually moving the SAM systems, only operating SAM radars when airplanes where nearby, building vast numbers of decoys and using camouflage and concealment. This will only make the problem more difficult in the future.

Even with these obstacles, the military did destroy many of the time-sensitive targets in OAF. Capabilities were greatly improved in this arena because of the use of the JSTARS[22] airplane and the advent of unmanned airborne vehicles, which combined with improved data links allowed decision makers in the Air Operations Center to receive real-time video from the battlefield. The air operations center also established an ad hoc Flex Targeting Cell (FTC), a planning group assigned to coordinate the destruction of TSTs, which helped focus the effort on TSTs.[23] " During Operation Allied Force (in 1999), it

would take several hours from finding the target to striking it. Our best successes there were in the 40- to 50- minute window."[24] The FTC never completely solved the problem of destroying TSTs due to shortcomings in the integration of the ISR and strike capabilities that were available at the time.

After OAF, the issue of TST was an ever evolving problem in the patrolling of Iraq's No-Fly Zone. The flyers patrolling the air space were often called upon to destroy mobile SAM systems, usually unsuccessfully, due to the same old issues of not getting all the available information from ISR sources.

> The bulky munitions glide silently for a direct hit on a Global Positioning System coordinate chosen by the carrier battle group's intelligence team and approved by Joint Task Force Southwest Asia. The Hornet pilots have done their job well and U.S. high-technology weapons performed flawlessly. The next morning, however, the battle group's intelligence staff briefed the SAM battery as fully operational. In the time it took to pick and validate the target and get munitions on top, the SAM battery had moved and the Joint Standoff Weapons exploded harmlessly over an empty stretch of sand. National technical means had confirmed the departure of the target hours before the aircraft left the carrier, but slow, stove-piped intelligence processes prevented rapid retargeting before the weapons were launched.[25]

Operation Enduring Freedom, in 2001, was almost exclusively a time-sensitive targeting operation. "About 80% of Navy strikes were against time-critical targets. Planned raids were largely limited to the first few days of combat operations."[26] The targets for most of the operations were terrorists and Taliban troops. The increased numbers of UAVs, and friendly troops on the ground directing airpower to targets drastically improved successes in Enduring Freedom. The fact that the skies of Afghanistan were a low threat environment, due to lack of air defenses, also reduced the risk for the air assets used to destroy TSTs.

New technology made the fight against TSTs more effective, but it also made the battlefield more accessible to higher echelon commanders. This enabled the commanders to

intrude on tactical level decisions which slowed the process, frustrated many aviators, and many opportunities to prosecute TSTs were lost.[27]

Analysis of the Facts

"The time-critical targeting problem is the most difficult and often most important part of combat operations."[28] Developing good procedures and systems to prosecute time-sensitive targets in the future is not going to be easy. However, we have had many experiences in recent history that have given us glimpses into possible solutions to this dynamic problem.

The one thing that these recent operations have proven is that solving the problem of destroying time-sensitive targets requires a joint effort. No one service owns all the assets required to solve the problem associated with time, space, and force. "Time critical targeting that evolved during Allied Force drew on the resources of satellites, reconnaissance aircraft, UAVs, forward air controllers, airborne battle managers, and intelligence specialists processing data and tracking targets at the CAOC and other locations. Finding and killing a target is a team game."[29]

The solution to time-sensitive targeting has often been centered on air power, but quite often target discovery or destruction can be done by non-air assets. The value of non-air assets can not be overemphasized. Thinking out of the "box" and using all assets, especially non-air assets, that are available in theater to find and destroy TSTs will greatly increase the probability of destruction of these dynamic target sets. This will require coordination between JFACC, Joint Force Land Component Commander (JFLCC), and the Joint Force Maritime Component Commander (JFMCC). This coordination should be discussed and agreed upon before the hostilities begin to insure proper procedures, staffing,

training, and planning are established. Examples of these non-air assets will be cited in the recommendations.

Technological improvements in intelligence, surveillance, reconnaissance; command and control; and advanced precision ordnance have greatly simplified the problem. The addition of the Predator and Global Hawk UAVs and the communication/data links that tie them and the other assets in theater together have allowed us to reduce time and "virtually shrink" the space (size of the battlefield). "Now we have varieties of ways to put eyeballs on or unmanned sensors on target and stare at (the targets) -- gather information about trends and habits (and) pick the time and place of our choosing to attack in ways we never had before."[30]

Other developments like the Flex Targeting Cell in OAF should not be forgotten. The cell worked to build a completely integrated intelligence picture from all available ISR assets and improve command and control which decreased the time to destroy target to hours and sometimes minutes. "Quite simply, what we're trying to do is get that horizontal integration of our shooters, our intelligence, our reconnaissance, and our surveillance assets to decrease the timeline from target discovery to target destruction."[31]

OEF's success in destruction of TSTs needs to be closely scrutinized because of the unique situation surrounding the conflict. Quite often air assets were orbiting overhead the area awaiting TSTs because there were no pre-planned targets, and it was the only way to destroy quickly fleeting terrorist targets. Not to mention that during OEF there were no traditional air defense system to suppress, C2 infrastructure to destroy, or many, if any, actual known target locations. This, combined with the fact that there were highly trained friendly ground troops finding targets and calling in orbiting air assets to destroy them, greatly

simplified the problem.[32] This process of destroying TSTs, used during OEF, may not be possible in future conflicts against more formidable adversaries who pose a higher threat level to air assets and possess many pre-planned targets that will need to be destroyed.

The military is continuing to dissect this problem, and the lessons learned about destroying TSTs, to improve the process for the next conflict and the continuing War on Terrorism. Defense contractors are devoting a considerable amount of effort to developing new decision making tools, new ISR platforms, and C2 improvements, in order to reduce the affects of time, space, and force so the military can effectively destroy these difficult targets.

Some of the big efforts between the military and defense development industry are the Joint Force Experiments and Millennium Challenge that have been conducted recently. All of these events were joint exercises that tested present, as well as future warfighting capabilities, with a definite focus on the time-sensitive targeting problem. Various time critical targeting cells and new technologies were tested to destroy mobile targets in "single digit minutes".[33]

From results seen in these exercises, the Navy and Air Force are currently turning one of their Concept of Operations (CONOPS) from Millennium Challenge 2002 into Time-Sensitive Targeting Tactical CONOPS.[34] It is a detailed plan for a TST cell, which includes such specifics as staffing requirements and the daily schedule of the cell at the CAOC. It is more focused at the tactical than the operational level, but could become a good starting point for the TST cell idea once it is accepted at the operational level. More specifics of this Time-Sensitive Cell model will be discussed in the recommendations.

Recommendations

When making recommendations to solve any problem in the military, including the TST problem, it is recognized technological improvements will always help solve the problem, but the emphasis here is more on procedural improvements. The solutions must be able to reduce the problem of time, space, and force to a manageable size in order to successfully destroy TSTs inside the adversary's OODA loop.

The procedural solution is a time-sensitive targeting cell that resides at the CAOC, made up of a cross section of intelligence officers and operators from the various capabilities (platforms) in theater that would be used in the TST process. These operators must include both ISR and strike specialists, as well as ground, maritime, and special operations forces' (SOF) specialists that are experts in what their specialty can bring to the fight in the area of destruction of TSTs. Some of these staffing issues are discussed in the Time-Sensitive Targeting Tactical CONOPS draft,[35] but it has some noticeable shortcomings.

The draft is only a combined effort of the Air Force and Navy, so it does not take into account the capabilities of all the services. There is little representation from non-air assets that will be required to increase the probability of successful engagement of these dynamic targets. The only non-air assets really discussed were SEALS and other SOF operators. It does not take into account the many other assets the ground forces have available to prosecute targets like the US Army Tactical Missile System (ATACMS) and conventional artillery.[36]

Another shortcoming is that the described cell is not necessarily located in one single room with all the operators working in concert, face-to-face. The idea of a virtual room is addressed, because improvements in computer systems and communications would not

require everyone to work in the same space or even building. However, OEF has shown that even with today's technological improvements in communications and data links, there is no substitute for talking to someone face to face in the same room to allow for accurate transmission of information in the shortest time possible.[37] The TST cell room should function almost "like an airplane cockpit."[38] The weapon system and ordnance of this "airplane" are all the sensors in theater tied together with all the assets capable of destroying the TSTs.

Another key element for the TST cell to function effectively is that it must be empowered with the proper guidance and authority to help it solve the dynamic problem of TST. This guidance should include very specific orders on what actual time-sensitive targets are in the operating area, so effort is not wasted chasing every needle in the haystack. Obviously these targets are extremely dynamic, and the definition of what is a TST and what is not a TST will change over time. This requires the TST target set to be constantly updated so the TST cell can stay focused. The bottom line is that a TST is "whatever the JFC says it is!"[39] and the cell must know this.

A rule set established by the JFACC which gives the cell guidance and augments the standing ROE could further streamline the decision making process. Specific examples of possible rule sets are given in the draft CONOPS.[40] The rule set provides a structured checklist that the cell can quickly complete to decide if the decision to destroy the TST can be made within the cell or if it requires higher authority. If the target meets the criteria established in the rules set it can be destroyed, and if it does not it is either no longer a valid TST, requires more ISR to decide, or requires approval from a higher authority. This process could be even further streamlined if the JFACC or another higher authority that the JFACC

designates is “virtually connected” to the cell (i.e., via intercom or computer) on the few occasions that would require his decision. This could allow the higher authority to authorize the destruction of the TST by not stopping the cell from issuing the order to destroy the target or more simply stated, "Silence is consent." This “virtual connection” would remove the problem of hunting down the JFACC, explaining the situation, and waiting for him to make the decision, which would waste valuable time.

The TST cell must also have authority over ISR capabilities to not only get information but also to task ISR assets if this is required. This authority should be established, by the JFACC, in standard operating procedures (SOP) with specific tasking guidance based on importance of target, time limitations, etc. "Using ISR sensors in this manner "attacks many sacred cows" because commanders want dedicated control of those assets."[41] The idea of fusing all ISR within the TST cell embraces the idea of network centric warfare and truly optimizes their capabilities.[42] In many situations this will allow the cell to virtually shrink the battlefield (space) by combining all available ISR assets, including national assets, as well as reduce time by being able to task them at their level without having to get approval from higher echelons.

The other end of the sensor to shooter relationship must also be addressed in the TST cell. The cell will have the authority to task strike assets to destroy the target. The decisions will be based on prioritizing the relative importance of time-critical target versus what pre-assigned assets are doing. This should not be limited to air assets. As stated before, the cell will have representation from ground units and SOF which might be the right tool for the job. Who the cell can employ to destroy the target, and how they can be used needs to be pre-coordinated so time is not wasted during the actual “TCT kill chain".[43] The problem of what

assets are available could be solved by a real-time electronic template, to be manipulated by the cell. This electronic template's capabilities could be advanced further in the future to become the ATO of the future with the proper integration of computer systems and technologies.

"Doctrine for air warfare all hangs on the tenet of centralized control and decentralized execution,"[44] and the TST cell follows these tenets. This cell model pools the ISR capabilities, which are the limiting factor, insuring all the intelligence is combined to optimize the information gathered by all the ISR assets. Time critical targeting "requires the C2ISR assets to work together as an integrated system" and the cell model does this.[45] It also addresses the problem of redundant targeting because the TST cell is resident at the CAOC and has access to what is being targeted, by who, and when.

Decentralized execution allows tactical operators to optimize their capabilities and effectively destroy the time-sensitive target. Who knows better how to optimize their equipment than the person who trains and operates it everyday? Decentralized execution also reduces the workload of the TST cell, because once an asset is assigned to destroy the target the cell is no longer involved in the process.

The last point to be addressed about the TST cell model, but possibly the most important, is that it must be established in joint doctrine. Doctrine needs to be established to allow for proper staffing, training, and standardizing. The same model should be used by all Combatant Commanders to allow for proper development of tactics, training and procedures.

It must also be permanent part of the CAOC, instead of an ad hoc organization established once a conflict starts. The cell can not be established as a campaign kicks off and be expected to work effectively.

When conflicts are not occurring in the area, the TST cell could spend time studying the local "hot spots" and giving recommendations to the JFC as to possible TSTs if a conflict occurred. This initial intelligence preparation of the battlefield, focused specifically on mobile and TST threats, would help eliminate ramp up time that was required to destroy these targets in past conflicts. It may also reduce some of these threats by having a plan and the ability to destroy them before they become time critical.

The draft in work by USN and USAF called Time-Sensitive Targeting Tactical CONOPS is a good start in the right direction for specifics on a TST cell at the tactical-operational level, but doctrine must be written for the establishment of the cell and to define why it is the solution to this dynamic problem.

Simply stated, the TST cell helps reduce the problems of time, space, force and their relationships by adhering to the time tested ideas of centralized command and decentralized execution. It harnesses all the technological advances in ISR capabilities and command and control into a single focused effort that can effectively and efficiently destroy time-sensitive targets.

NOTES

[1] Myron Hura and others, Enhancing Dynamic Command and Control of Air Operations Against Time Critical Targets (Santa Monica, CA: RAND, 2002), ix.

[2] U.S. Joint Chiefs of Staff, DoD Dictionary of Military and Associated Terms, Joint Pub 1-02 (Washington, DC: 12 April 2001), 435.

[3] Combat Air Forces and COMSECONDFLT, USN-USAF Time-Sensitive Targeting Tactical CONOPS (Draft), 01 August 2001, 15.

[4] Captain Bob Huddleston, USN, "USN-USAF Time Critical Targeting/ Time Critical Strike Road Ahead," 12 October 2000, <http://www.dsc.osd.mil/dasd/TCT/019_Huddleston.ppt> [18 January 2003].

[5] General John P. Jumper, USAF, quoted in Frank Wolfe, "Air Force Hopes to Reduce Time Critical Targeting to Minutes," Defense Daily, September 8, 2000, Online: Proquest Direct, <http://www.umi.com/pqdauto>.

[6] The ATO process is performed at the Air Operations Center under the guidance of the Joint Force Air Component Commander (JFACC). It is the overall scheduling of the air operations. The specifics of the plan (i.e. time, target, ordnance, air asset, etc.) for each day are started 72 hours in advance.

[7] Combat Air Forces, Concept of Operations for Time Critical Targeting (Draft), 01 February 2001, 13.

[8] Huddleston.

[9] U.S. Joint Chiefs of Staff, Joint Vision 2020, (Washington, DC: 2000), 22.

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[11] Deputy Chief of Naval Operations (Plans, Policy and Operations), Naval Vision 2020: The Future…From the Sea, <http://www.hq.navy.mil/n3n5/NV2020.htm> [12 January 2003].

[12] U.S. Joint Chiefs of Staff, Joint Doctrine for Targeting, Joint Pub 3-60 (Washington DC: 17 January 2002), vi.

[13] Ibid, B-2.

[14] Combat Air Forces, 13.

[15] General John P. Jumper, USAF, quoted in Frank Wolfe, "Air Force Hopes to Reduce Time Critical Targeting to Minutes."

[16] U.S. Joint Forces Command, Commander's Handbook for Joint Time-Sensitive Targeting (Joint Warfighting Center, Suffolk, Virginia: 22 March 2002), I-3.

[17] James W. Canaan, "With James G. Roche," Aerospace America (February 2002): 13.

[18] Ibid.

[19] Lieutenant Colonel Terrie M. Gent, USAF, "The Role of Judge Advocates in a Joint Air Operations Center," Airpower Journal, 13, no. 1 (Spring 1999): 47.

[20] Ibid, 47-48.

[21] General John P. Jumper, USAF, "Statement," U.S. Congress, House, Committee on Armed Services, Hearings before the Subcommittee on Military Readiness, 106th Cong, 26 October 1999, 4.

[22] The Joint Surveillance Target Attack Radar System (Joint STARS) is a long range, air-to-ground surveillance system designed to locate, classify, and track ground targets in all weather conditions. While flying in friendly airspace, the Joint Army-Air Force program can look deep behind enemy lines to detect and track ground movement both in forward and rear areas. It has a range of more than 150 miles.

[23] General John P. Jumper, USAF, "Statement," 5.

[24] Captain Amie Brockway, USAF, "New Programs Speed Information to Warfighter," Air Combat Command News Service, September 16, 2002, <http://www2.acc.af.mil/accnews/sep02/02350.html> [12 January 2003].

[25] Lieutenant Commander Dan Shanower, USN, "Naval Intelligence Must Focus on Time-Critical Targeting," U.S. Naval Institute Proceedings (October 2000): 102.

[26] Robert Wall, "War Expansion May Require New Operational Techniques," Aviation Week & Space Technology, 156, no. 17 (April 29, 2002): 58.

[27] Rebecca Grant, "An Air War Like No Other," Air Force Magazine, 85, no. 11 (November 2002): 34.

[28] Shanower, 102.

[29] Rebecca Grant, "Altitude," Air Force Magazine, 84, no. 10 (October 2001): 57.

[30] John A. Tirpak, "War and Transformation," Air Force Magazine, 85, no. 7 (July 2002): 76.

[31] General John P. Jumper, USAF, quoted in William B. Scott, "Experimental Center Nails Time-Critical Targets," Aviation Week & Space Technology, 153, no. 14 (October 2, 2000): 70.

[32] Wall, 55.

[33] General John P. Jumper, USAF, quoted in Frank Wolfe, "Air Force Hopes to Reduce Time Critical Targeting to Minutes."

[34] Combat Air Forces and COMSECONDFLT.

[35] Ibid, 69-76.

[36] U.S. Joint Forces Command, Appendix D.

[37] Based on personal experiences while working on a Carrier Air Wing staff, trying to coordinate ATO changes and recommendations to the CAOC from CVN 74. The coordination always took multiple phone calls and/or emails to insure that the CAOC understood what we wanted them to change, and this exchange could take hours depending on the issue and the schedule of the person at the CAOC.

[38] Scott, 71.

[39] William B. Huntington, "Collection Management and Time-Critical Targeting," 12 October 00, <http://www.dsc.osd.mil/dasd/TCT/018_Huntington.ppt> [18 January 2003].

[40] Combat Air Forces and COMSECONDFLT, 50-52.

[41] Scott, 71.

[42] Vice Admiral Arthur K. Cebrowski, USN, and John J. Garstka, "Network Centric Warfare its Origin and Future," U.S. Naval Institutes Proceedings (January 1998): 28-35.

[43] Combat Air Forces, Concept of Operations for Time Critical Targeting (Draft), 13.

[44] Rebecca Grant, "The War Nobody Expected," Air Force Magazine, 85, no. 4 (April 2002): 38.

[45] David Nichols, "Air Force Official Urges Decentralized Time Critical Targeting, More Integrated Training," C4I News, October 19, 2000, Online: Proquest Direct, <http://www.umi.com/pqdauto>.

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