NEWSLETTER

NO. 09-31 **MAY 09**

Combat Identification

Tactics, Techniques, and Procedures

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Foreword

This newsletter offers best practices, observations, insights, and lessons (OIL), and tactics, techniques, and procedures (TTP) for leveraging combat identification (CID) initiatives to prevent fratricide. It serves as an open forum for discusssion and differing points of view from subject matter experts within the CID area. While these views are not necessarily representative of higher headquarters, it is important that forums such as this exist to generate discussion and provide for open debate on ways to improve CID and prevent fratricide on today's battlefield. This product is a follow-on effort and companion piece to CALL Handbook 08-43, *Fratricide Avoidance*. Mistakes by combat leaders and U.S. troops during military operations can lead to tragic losses from fratricide or friendly fire (both terms are synonymous for purposes of this newsletter). Joint Publication 1-02, *Department of Defense Dictionary of Military Terms,* defines friendly fire as, "a casualty circumstance applicable to persons killed in action or wounded in action mistakenly or accidentally by friendly forces actively engaged with the enemy, who are directing fire at a hostile force or what is thought to be a hostile force."

This newsletter will help familiarize U.S. Army Soldiers and leaders from battalion to brigade combat team level with CID-related systems that help positively identify friendly targets and integrate them into the common operational picture. Units that do not currently have a habitual training relationship with joint close air support and units that possess joint intelligence, surveillance, and reconnaissance capabilities can enhance situational awareness/situational understanding (SA/SU) regarding CID systems by reading and applying the OIL and TTP in this newsletter.

Fratricide will continue to occur in armed conflicts. Improved CID coupled with troop discipline (adherence to the applicable rules of engagement and escalation of force procedures) heightens SA/SU and reduces the frequency of fratricide. Integrating proven CID TTP and OIL from Army and joint exercises, experimentation, and combat operations (Operation Iraqi Freedom and Operation Enduring Freedom) into planning and troop-leading procedures during training and military operations will help save troops' lives.

Colonel Eric L. Nelson, USAF
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Combat Identification Newsletter

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Zeroing in on Fratricide

COL Rick Starkey, Army Capabilities Integration Center

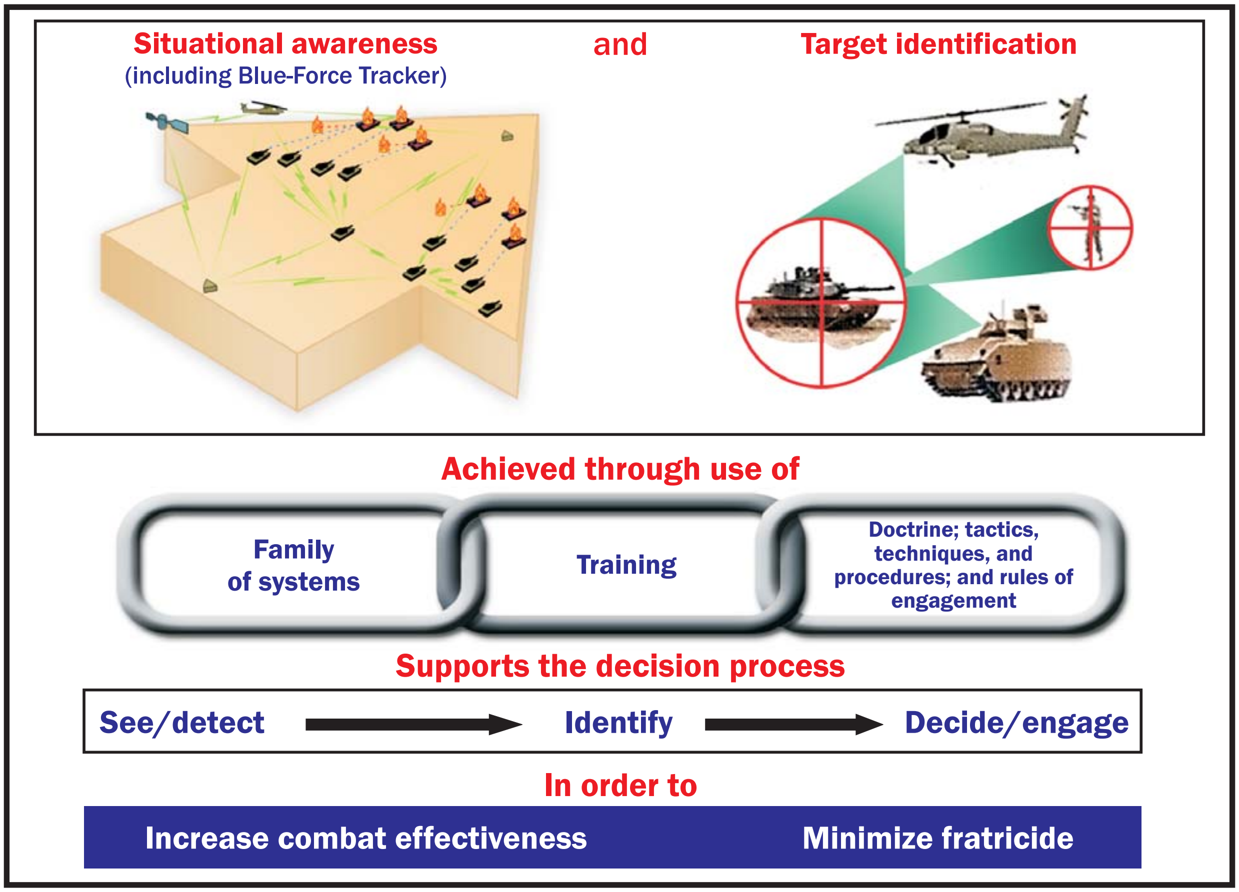

Figure 1-1

Few military leaders understand the numerous improvements made in combat identification (CID) and fratricide mitigation, particularly since Operation Desert Storm. In spite of this, additional improvements are necessary. Despite improvements in situational awareness (SA) and target identification technologies, friend-on-friend engagements still occur. Leaders must collectively address this issue to avoid unnecessary injuries or fatalities caused by fratricide. Whether one commands a corps or a squad, leaders must familiarize themselves with fratricide-mitigation measures and incorporate these measures into individual and collective training prior to deployment to a combat zone.

To close the last tactical mile of the CID and fratricide-avoidance problem or gap, leaders must correctly identify and prioritize the problems and potential solutions. Services and industry continue to focus on material solutions to solve the most pressing gaps; however, there are many reasonable, low-cost solutions in training; doctrine; and improved tactics, techniques, and procedures (TTP). Nevertheless, with some exceptions, schoolhouses, ranges, and unit training do not readily apply these low-cost solutions. Some unit leaders develop unique training to address fratricide-prevention within units, and the U.S. Army is beginning to capture standardized training on ranges and gunnery tables. Yet, lessons learned are not leveraged across the Army, sister services, and coalition partners.

Material solutions can provide additional tools for Soldiers or teams faced with “engage” or “don’t engage” decisions. However, the military needs to shift its resourcing and training paradigm to get at the root of the problem—realistic training that incorporates the many lessons learned in Afghanistan and Iraq and the family of CID solutions already available to the force. Additionally, continued focus on costly, material solutions that do not fix the most critical problems or gaps steal precious resourcing dollars from other, more meaningful solutions and contribute to the failure to reduce the potential for fratricide to even lower levels.

Recent material-solution CID successes focused on improving SA and fielding improved sights and marking systems. These strategies were successful in increasing combat-effectiveness and reducing fratricides over the past several years. The following are examples of successes that resulted in improved U.S. and coalition SA:

- Fielding Force XXI battle command—brigade and below (FBCB2), blue-force tracking (BFT), and the follow-on, joint battle-command platform (JBC-P).

- Fielding improved sights that give forces the ability to detect objects at extended ranges in day or night conditions such as second-generation, forward-looking infrared (2nd GEN FLIR) and the family of thermal sites.

- Standardized marking systems such as those developed as part of the Joint Combat Identification Marking System (JCIMS) contribute to decreasing the potential for fratricide while increasing combat effectiveness. See Figure 1-2.

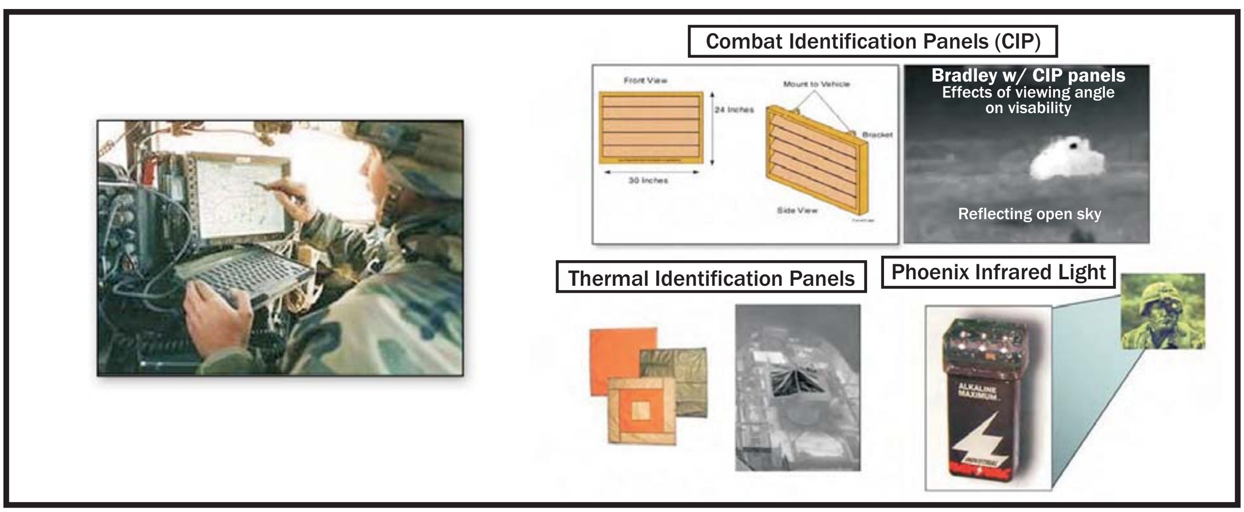

Figure 1-2. On the left is the display provided by FBCB2 including friendly, enemy, and unknown entities on the battlefield. On the right is the JCIMS for Soldiers and platforms.

The Army’s CID strategy to reduce fratricide and increase combat effectiveness was approved by the Army Requirements Oversight Council (AROC) on 3 August 2007. The Vice Chief of Staff of the Army approved the Training and Doctrine Command’s comprehensive plan focused on non-material training fixes and material solutions.[1] The CID initial capabilities document (ICD) was further validated by the Joint Requirements Oversight Council (JROC) in August 2008. The Army also conducted an analysis of fratricide events from Operation Iraqi Freedom

(OIF) and Operation Enduring Freedom (OEF) to assess how CID problems or gaps had changed since Operation Desert Storm. The analysis focused on trends and conditions where most fratricides occur. The information obtained from the analysis coupled with the desire to improve combat effectiveness and reduce fratricide drove the Army's strategy. This analysis is very telling of trends on the battlefield, the impact of fielded solutions and their impact on specific operating environments (OEs), and where the military should prioritize efforts to improve. The analysis and strategy were shared with allies, sister services, U.S. Joint Forces Command (USJFCOM), and combatant commands.

The U.S. Army's assessment, validated by the USJFCOM J85 friendly-fire reporting and investigation process (FFRIP), is that fratricides in the ground-platform, Increment IA OE do not justify significant resourcing. Fratricide trend assessments of OIF and OEF major operations and counterinsurgency (COIN) operations reveal the greatest gaps in fratricide-mitigation capabilities reside within the air-to-ground (AG) OE and environments that have involved fires on dismounted combatants. Taken together, AG and dismounted, friendly-combatant casualties account for 94 percent of the OIF major operation fratricides—those killed or wounded in action. Fratricides in the Increment IA OE account for less than 6 percent during major operations in Iraq and Afghanistan compared with 55 percent during Operation Desert Storm.

The military needs to shift resourcing efforts toward Increment IB, AG (primarily fixed-wing) and dismounted combatant (Increment 2) OEs, where 94 percent of the fratricide casualties occurred during major operations in Iraq, and 100 percent occurred during major operations in Afghanistan. AG incidents accounted for 62 percent of fratricide casualties in major operations in Iraq and 82 percent of fratricide casualties in major operations in Afghanistan. Per incident, OIF and OEF AG friendly-fire incidents are three times more lethal than ground-to-ground (GG) events. Getting SA of friendly, dismounted combatants is the second priority, accounting for 33 percent of the casualties during major operations in Iraq and 18 percent in Afghanistan. Casualties from fires on vehicles in OIF major operations were less than 6 percent. In OIF COIN operations, 37 percent of the casualties were a result of fires on vehicles. The higher percentage can be attributed to reduced air operations, but the percentage is still significantly lower than casualties from AG and dismounted combatant operations. There have been no casualties from fires on vehicles for OEF.[2]

This data goes against the current funding levels put toward ground-platform material solutions such as Battlefield Target Identification Device (BTID), which is a query and response, cooperative, target-identification solution designed to solve the problem encountered by stabilized platforms during Operation Desert Storm. The BTID technology solution also addresses light vehicles, though it does not solve the most pressing problem area in the ground environment—dismounted combatants. The fratricide analyses from OIF/OEF prove the material solutions addressed earlier in FBCB2, 2nd GEN FLIR, and JCIMS have greatly mitigated the risks associated with ground-vehicle fratricides, except where dismounted combatants are involved.

Figure 1-3. Investments and technology should focus on gaining SA of dismounted patrols and developing cooperative target identification solutions for AG and dismounted OEs instead of ground platforms.[3]

The specified capabilities addressed in the Army's ICD and accompanying doctrine, organization, training, materiel, leadership and education, personnel, and facilities (DOTMLPF) change recommendations apply across the four operational Army domains including AG, GG, ground-to-air, and air-to-air. The Army's current budgetary commitment devoted to CID-specific training, doctrine, and range facilities upgrades as compared to its investment in material solutions conveys a lack of emphasis on training and range shortfalls. Only 1.3 percent of the overall CID budget is devoted to CID training and range upgrades.[4] The Army budget devotes $380 million to the BTID solution, and it will require billions more to field BTID to the Army alone. Unfortunately, because of previous agreements and a failure to recognize the shifts in priorities away from ground platforms, the current strategy to procure this solution remains.

While any fratricide event or casualty is serious, addressing the smaller, ground-platform problem prior to addressing the greater AG (fixed-wing) and dismounted combatant problem seems ill-advised. While there are more ground-platform incidents, specifically in the dismounted and light-vehicle OEs, the incidents occurring in the AG environment are far more lethal and require immediate attention. Secondly, improving SA of dismounted combatants requires getting their position-location information into the common operating picture and the Army battle command systems. The Enhanced Position-Location Reporting System and Land Warrior Systems are currently providing this capability. In the future, the Ground Soldier System (GSS) or Ground Soldier Ensemble (GSE) and Rifleman's Radio will provide this linkage using the Joint Tactical Radio System to provide this necessary position-location information to all Soldiers.[5]

Army analysis indicates there are no "silver bullet" solutions that address all service CID gaps. In fact, GEN James Mattis, USJFCOM commander, clearly understands the importance of training relating to the CID issues. At the February 2008 CID Symposium, GEN Mattis stated, "...we won't solve CID with technology alone. Every time a fratricide occurs, there is a human error breakdown. The answer is in cohesive and well-trained units. We need to spend time defining the problem to avoid developing the wrong material solutions."[6] The Army's strategy is fully synchronized with this advice and addresses training; doctrine; training aids, devices, simulators, and simulations; and improved range conditions that support "engage" and "don't engage" decisions as its highest priority.

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When prioritizing how to spend limited funds on meaningful solutions, there is no question that training produces the highest payoff. In addressing the material solutions, it is critical, as pointed out by GEN Mattis, to take the time identifying the right problem to fix. With 56 percent of fratricide causalities occurring in the AG domain, 22 percent with dismounted combatants, and less than 5 percent occurring in the GG domain, the answer appears clear. Affordability is important when considering pursuing material solutions. Solutions must also be affordable for coalition partners. Because of budgetary constraints, coalition members have not pursued many of the family of CID solutions available today. The U.S. had to cross-level FBCB2 and BFT devices during OIF/OEF because many coalition partners had yet to begin acquisition programs for this critical SA device.[7]

Adding to the complexity of the CID dilemma is the lack of service, joint, or coalition doctrine. Currently, no joint or coalition doctrine highlights the family of CID solutions or successful and proven TTP to get the joint and coalition forces operating on common ground for fratricide avoidance. There is no “one-stop shopping” document.

Analyzing fratricide data to determine trends becomes challenging when the data has differing levels of detail that is subject to interpretation. This challenging task becomes more difficult knowing there is no reporting or investigating standard for fratricide events. While investigations routinely do not occur for fratricide incidents not involving a casualty, they do occur for all incidents involving casualties. Details and questions asked by the investigating officer vary, so working from a standard set of facts cannot occur. USJFCOM J85 is working through this issue with the ongoing FFRIP.[8] This effort should enable the joint and coalition teams to standardize and sort through the data in a more meaningful way to determine where fratricides predominately occur and to help the Army prioritize efforts to alleviate problem areas.

While there are subtle improvements in how units conduct small-arms and platform ranges and training, leaders need to change the current training paradigm to reflect conditions experienced with friendly, unknown, and hostile targets in Iraq and Afghanistan. Traditionally, most ranges focus on marksmanship, with all targets assumed to be the enemy. Marksmanship training is important, but it should also include the “engage” and “don’t engage” decisions required of pilots, Soldiers, and team chiefs in a combat zone. Further, exposing Soldiers and leaders to the family of CID systems (i.e., JCIMS, digital ranges that incorporate FBCB2/BFT/JBC-P, distributed common ground system—Army, and recognition of combat vehicles [ROCV] training certification as a prerequisite to range performance) will greatly improve decision-making in combat when time to react is limited and stress is high. (See Figure 1-4.) Most fratricides occur because Soldiers violate some portion of the rules of engagement (ROE). Exposing Soldiers to challenging situations that require incorporating ROE-type decisions in training can reduce the potential for future incidents in combat.

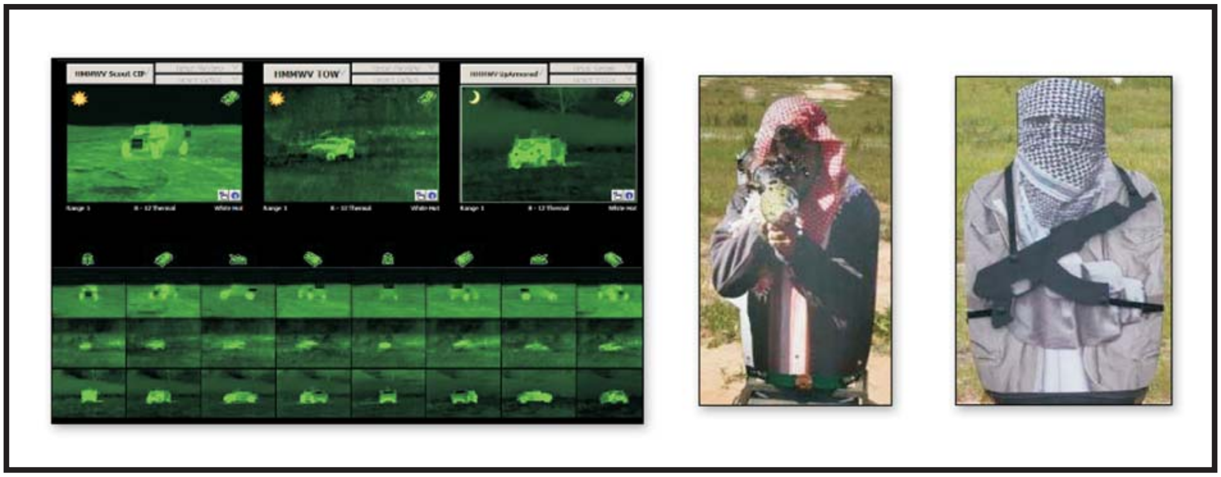

Figure 1-4. The picture to the left shows images provided by ROCV training. The pictures to the right reflect examples of enemy silhouettes to incorporate into range training.

Another potential solution that can aid units in training is identifying a CID master trainer, similar to master gunners in combat formations. The CID master trainer would be a subject matter expert in the area of fratricide mitigation, TTP, and the family of CID solutions. A Department of Defense (DOD) sanctioned, long-distance learning Website would allow them to become certified, maintain proficiency, and retain a current status. By providing these master trainers with an additional skill identifier, these skills will remain with the trainer throughout his career and enhance performance-oriented training in units. By incorporating CID-related training in all crew and individual gunnery, Soldier and unit awareness of the proper use of CID solutions and TTP will improve drastically.

Whichever material solution DOD decides to acquire based on joint-capabilities documentation, the decision must rely on clear and measurable combat effectiveness and fratricide-mitigating metrics that solve the AG and dismounted combatant gaps across the joint and coalition force. Improving SA and improved sights and marking systems alleviated the problems encountered with ground platforms during Operation Desert Storm. As the Army continues to grapple with the CID dilemma across joint and coalition forces, it is clear it has yet to fully exploit the untapped resource of improved doctrine, training, and range upgrades. Clearly, leaders must play an important role in integrating CID training into their formations prior to deploying to OIF/OEF or potential battlefields of the future. The prioritization of doctrine and training coupled with meaningful material solutions that facilitate “engage” and “don’t engage” decisions will result in a far more combat-effective force that focuses its effects and killing power on the desired target—the enemy.

Endnotes

1. The Army CID ICD was AROC approved in August 2007 and JROC approved in August 2008. The document included 27 approaches to addressing CID. Many of these approaches included previously-approved joint and multiservice programs with non-material training solutions rating highest on the list for resourcing.

2. The Army fratricide analysis is the first of its kind and was shared with sister services, USJFCOM, and allies. The USJFCOM J85’s FFRIP effort validated the Army’s trends analysis, though there were subtle disagreements in numbers. This analysis is critical to enable each of the services and coalition partners to gain agreement on how to define each incident and better refine

the analysis to achieve meaningful and prioritized DOTMLPF solutions. The information used for the Army's analysis came from the Central Command database of completed, fratricide investigations and roll-ups of fratricide incidents reported on the database from OIF/OEF. Analysis included reviewing fratricide incidents and events with completed legal investigations involving coalition and U.S. casualties.

3. The photograph on the left portrays a U.S. Army Soldier from the 25th Infantry Division patrolling the streets of Al Asiriyah Village, Iraq. The photograph on the right depicts Soldiers from the Multi-National Division—Baghdad.

4. Budgetary breakdown of material versus non-material training expenditures toward CID is 98.7 percent for material solutions, the majority of which is represented by the BTID material solution. The other 1.3 percent is for training solutions such as range upgrades and ROCV. This information was obtained from Headquarters, Department of the Army G-8.

5. Currently in development, the GSS/GSE Increment 1 will provide the requirement for dismounted-leader battle command and SA. Also, the Rifleman's Radio will provide interoperability with the GSS/GSE. Any solution that adds SA of dismounted combatants is a step in the right direction.

6. An excerpt from a presentation by GEN James Mattis at the Combat Identification Symposium on 27 February 2008 in Virginia Beach, VA. All services, USJFCOM, allies, and key industry members attended.

7. Cross-leveling radios and available CID solutions were common during OIF/OEF when coalition units arrived in theater without CID solutions such as FBCB2, BFT, or JCIMS devices.

8. USJFCOM was tasked by the Joint Requirements Oversight Council Memorandum (JROCM) 076-05, Operation Iraqi Freedom Major Combat Operations Lessons Learned–Fratricide Prevention, 14 April 2005, to implement an independent, non-retribution, joint fratricide process (similar to safety, hazard, and mishap reporting) that provides immediate feedback to operational forces. Additionally, the JROCM tasked USJFCOM to establish a database of combat and training fratricides and analyze contributing causes of OEF and OIF fratricide events. The FFRIP is the process JFCOM J85 is using to solidify and coordinate this process with the services and allies.

Joint Combat Identification Marking System: Mark Friends, Account for Them, Maintain Them, and Train with Them

Michael T. Starr, Combat Identification Liaison Officer,
United States Army Armor Center

The battlefield is a chaotic and dangerous place. Being shot at by someone on your own side only makes matters worse. This is why your vehicle needs combat identification panels (CIPs), thermal identification panels (TIPs), and Phoenix infrared lights.

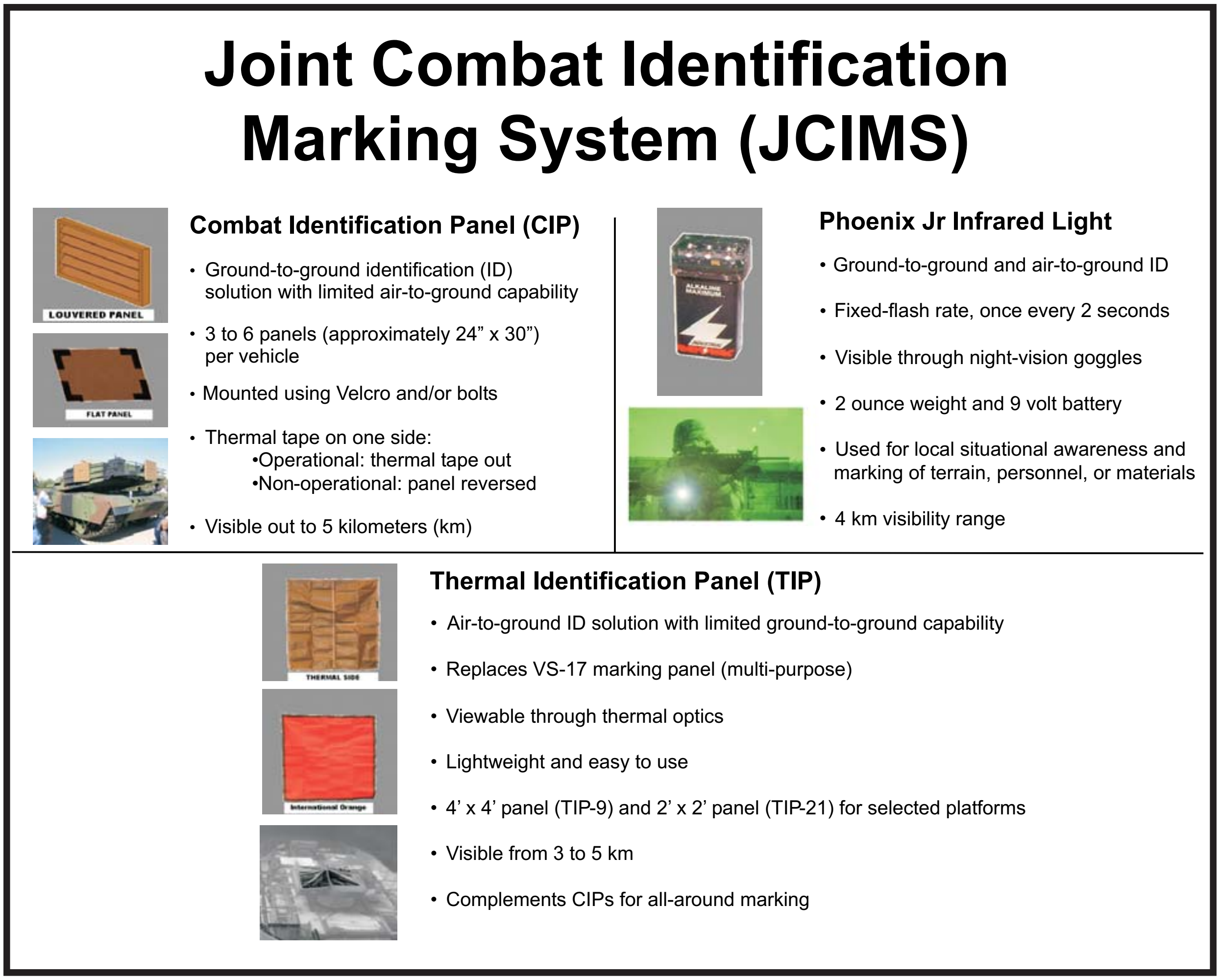

Figure 2-1

On 19 November 2007, the Army G3 officially approved the Joint Combat Identification Marking System (JCIMS) Capability Production Document and established it as the Army's vehicle marking standard. CIP kits are common table of allowance 50-909 items documented in Supply Bulletin 700-20 according to line item number (LIN). The next update of Supply Bulletin 700-20 will publish LINs for CIP kits. CIPs are Class II accountable items that must be included on vehicle hand receipts and retained by units when platforms are returned for reset so they can be reinstalled on replacement platforms.

CIPs have been around for a long time. The rigors of combat combined with extremely high temperatures have resulted in some of the Velcro-mounted panels on the platform to fall off and be lost. To help ensure that CIPs stay on the platform, installation instructions and procedures have been modified. The installation instructions now include adding mounting hardware such as bolts and pop rivets to securely mount the panels to the vehicle chassis.

CIP Technical Bulletin 9-2300-312-13&P (User Guide) includes installation procedures for all CIP kits. A compact disc–read only memory (CD–ROM) detailing installation instructions and listing national stock numbers (NSNs) for all Class IX repair parts is also available. The CD–ROM is especially useful for maintenance technicians to assist requisitioning Class IX repair parts to maintain CIPs. Personnel can request copies of the CD–ROM at the Program Director (PD), Target Identification and Meteorological Sensor (TIMS) Website. All component parts of CIP kits have NSNs and can be requisitioned through the Army maintenance management system. The PD TIMS is the approval authority for requisitioning the entire CIP kit.

Your comments and recommendations will help make this capability better, more useful, and reduce incidents of friendly fire. Please take the JCIMS user survey posted on Army Knowledge Online and the PD TIMS Website <https://peoiews.monmouth.army.mil/TIMS/index.htm>. The survey is short and will help developers focus on critical areas regarding the effectiveness of the JCIMS components and potential tactics, techniques, and procedures in use throughout the current conflict area of operations.

Combat Identification Server: Blue Force Tracker in the Cockpit

Dr. Jason Hinson and Bob Summitt, Joint Fires Integration and Interoperability Team and Dr. Michael Shepko, Center for Naval Analyses

The ability to distinguish and recognize friendly forces continues to be a challenge for tactical forces operating in combat environments, as friendly fire events in Afghanistan and Iraq still occur. Combat planners and system developers continue efforts to develop or modify procedures and technologies to minimize friendly fire incidents. U.S. Joint Forces Command (USJFCOM) is working to help the combatant commands enhance their existing combat identification (CID) capabilities by testing and evaluating emerging CID systems that provide timely solutions to minimize or negate fratricidal events.

In particular, CID has always been a significant challenge whenever friendly and opposing forces close for combat and is especially problematic for joint close air support (JCAS) aircrews when supporting ground forces. Currently, fighter aircrews rely on joint terminal attack controllers' (JTACs) and joint fires observers' (JFOs) observations and voice reports (e.g., 9-lines) of the intended target and nearby friendly forces. JTACs or JFOs reporting from "eyes on the ground" are invaluable. These reports identify friendly units/personnel locations in relation to the target under attack. JCAS aircrews must receive and understand all of this critical information before releasing ordnance on the requested target; however, what if there are friendly forces closer to the target that the JTAC or JFO cannot see? This is exactly the type of situation where recent technological advancements may enhance friendly force situational awareness (SA). The CID server offers one such technological solution to provide friendly force information to a variety of U.S. and coalition link-enabled aircraft.

The CID server provides a net-centric CID capability that can interoperate between cooperative target identification (CTI) systems, friendly force tracking and SA systems, and data link-equipped close air support (CAS) aircraft. During a mission, the server gathers Blue Force Tracker (BFT) data from a variety of CTI systems:

- Radio-based combat identification (RBCI)
- Battlefield Target Identification Device (BTID)
- BTID Transponder Airborne Platform Surveillance System (BTAPSS)
- Force XXI battle command—brigade and below (FBCB2)
- Radio-based SA (RBSA)

Fighter aircraft query the CID server to determine friendly force proximity to a potential target. The fighter indicates the target using a J-series target sort message (J12.6) that marks the fighter's sensor point of interest (SPI). The CID server then interrogates any available ground sensor networks and polls its BFT database to collect the timeliest position of each friendly vehicle. Using data link land track messages (J3.5s), the server reports back friendly positions within a 1- or 2-kilometer radius of the SPI, depending on the request type. To avoid saturating the aircraft display, the server sends a maximum of five messages per query, reporting the positions closest to the SPI. If there are no BFTs within the 1- or 2-kilometer radius, the CID server reports a series of "unknown" J3.5 track updates, each followed by a drop track message, which produces a short-duration flashing track symbol on the aircraft display centered at the J12.6 SPI. Given the potential of this system, U.S. and allied forces have expressed a desire to see a demonstration of its CID enhancement capabilities in an operational environment.

USJFCOM J85, the Coalition Combat Identification (CCID) Advanced Concept Technology Demonstration (ACTD) office, is responsible for identifying and providing joint fires and CID solutions to U.S. and allied acquisition decision makers to support joint and coalition operations. Combatant commands identify operational gaps and issues. The services and allied partners, incorporating candidate resolution solutions (procedural or technical) in an evaluation environment, review these gaps and issues. These environments take form as coordinated live events to demonstrate and assess candidate solutions using a structured data collection and analysis methodology to evaluate and report findings, conclusions, and recommendations. This information provides U.S. and allied decision makers with objective data on systems or capabilities to resolve operational deficiencies.

USJFCOM J85 initially investigated the CID server as part of its 2007 CCID ACTD event called Bold Quest. Most recently, the CCID ACTD extended efforts to include Bold Quest Plus (BQ+), assessing the CID server as a CID enhancement capability. During BQ+, J85 requested the Joint Fires Integration and Interoperability Team (JFIIT) be the lead agency for the CID server technology assessment. Specifically, JFIIT would evaluate the server's capability to provide friendly force SA via Link 16 and situation awareness data link (SADL) to aircrews conducting JCAS.

From 19 through 23 July 2008, JFIIT analysts assessed CID server performance during live-fly operations on Eglin Air Force Base (AFB) ranges. Specific operating areas included Santa Rosa Island (SRI) and the B-70 range complex. The combination of heavily wooded pine forest on the B-70 range and the open, sandy areas on SRI provided the participants with varying environmental challenges. Figure 3-1 depicts the geographical area and applicable ranges and airspaces used during the BQ+ CID server assessment.

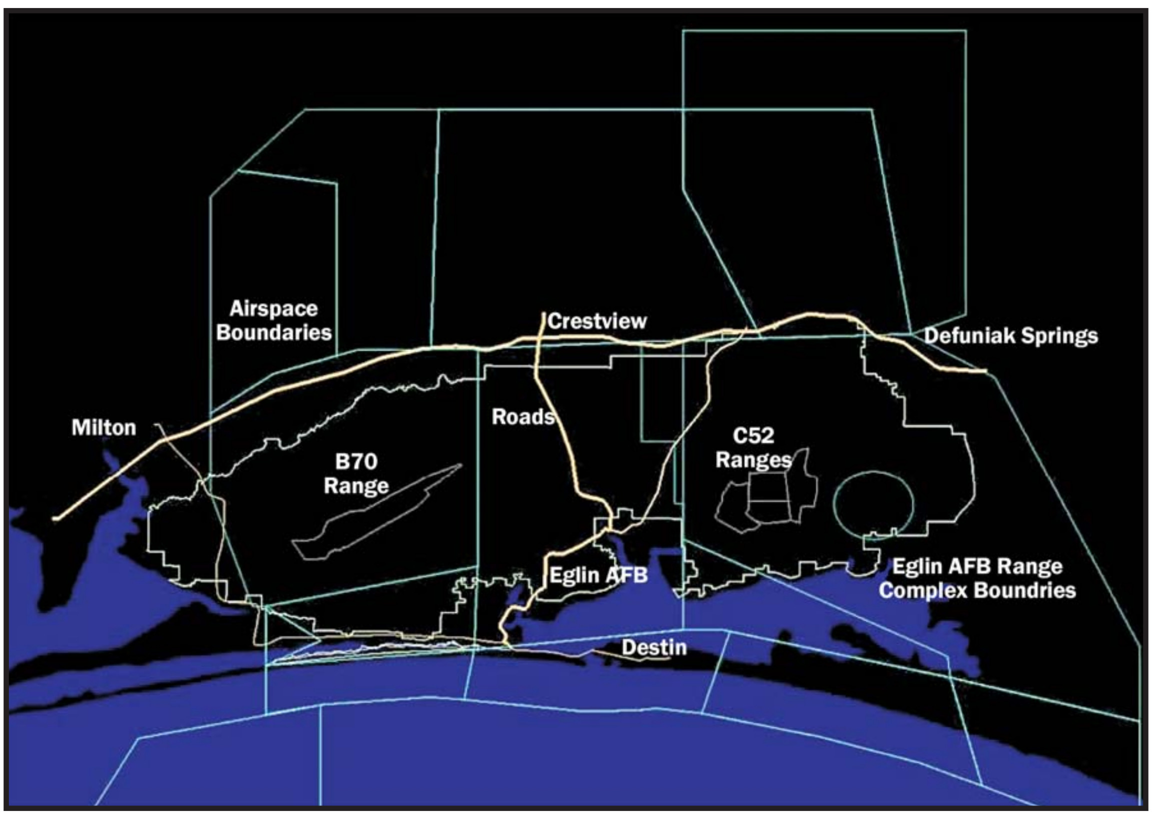

Figure 3-1. BQ+ area and ranges

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Canadian Forces G-Wagons comprised the bulk of the friendly and hostile vehicle force. Each vehicle, instrumented with a scaled-down version of Advanced Range Data System (ARDS) pods, provided analysts with time-space-position information (TSPI) known as "ground truth." Canadian forces planned and orchestrated daily vehicle movements during the vulnerability windows to, in part, support the CID server assessment.

Instrumented aircraft flown during the assessment included F-15E, F-16CM, F/A-18E, CF-18, and A-10C performing CAS operations. The aircraft were equipped with Link 16 or the SADL, and each was capable of querying the CID server and receiving responses via the data link. The aircraft operated in Eglin airspaces to conduct CAS on the Eglin SRI and B-70 ranges. All aircrews participating in the BQ+ CID server assessment were fully qualified military operators, most with high levels of test and evaluation experience.

Figure 3-2 illustrates a combined operational and system view involving the CID server during BQ+.

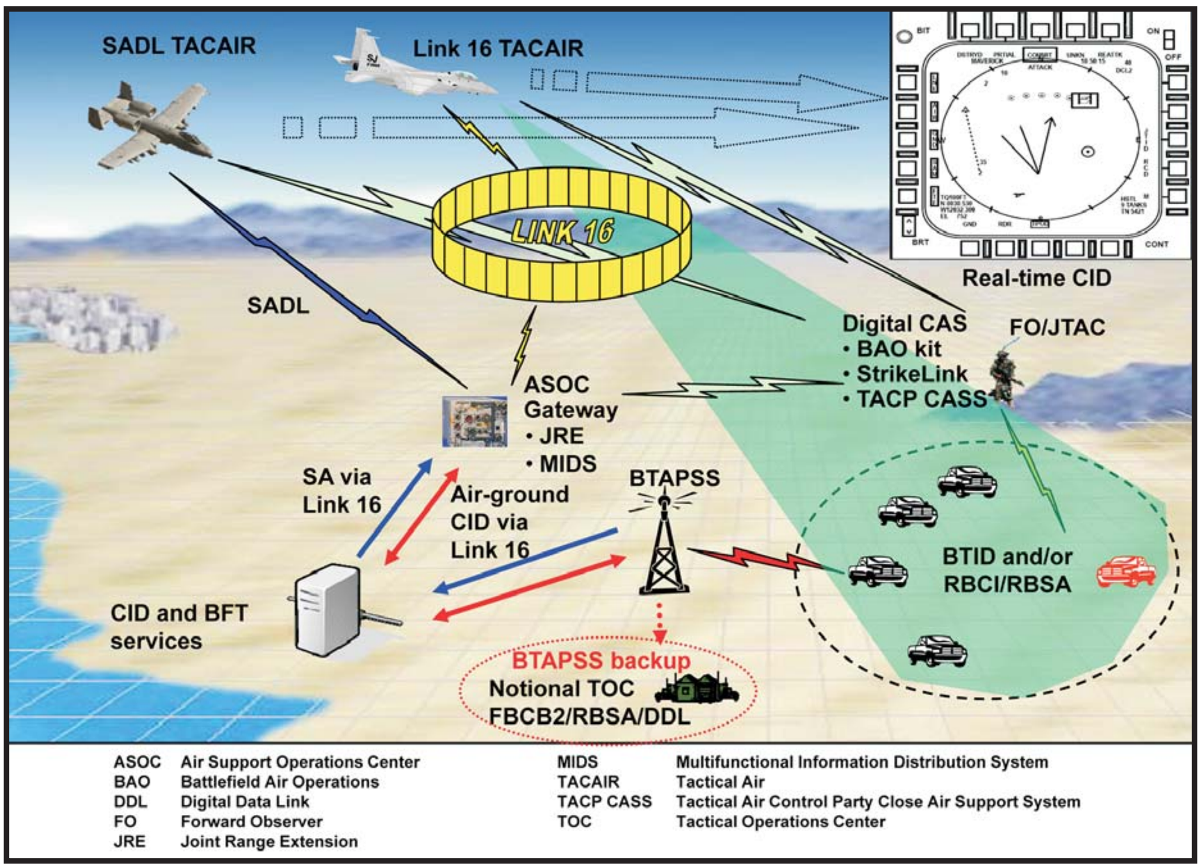


Figure 3-2. BQ+ operational and system view

JFIIT assessed the ability of the CID server to receive tactical queries from fighter aircraft via J12.6 data link messages and to determine the locations of up to five closest friendly units within a 1-kilometer radius of the J12.6 SPI.[1] The assessment was limited to the server's ability to perform properly using available BFT data.[2] The accuracy of the BFT data had no bearing on the CID server performance metrics. Figure 3-3 provides a general overview of the information exchange between the CID server and participating fighter aircraft.

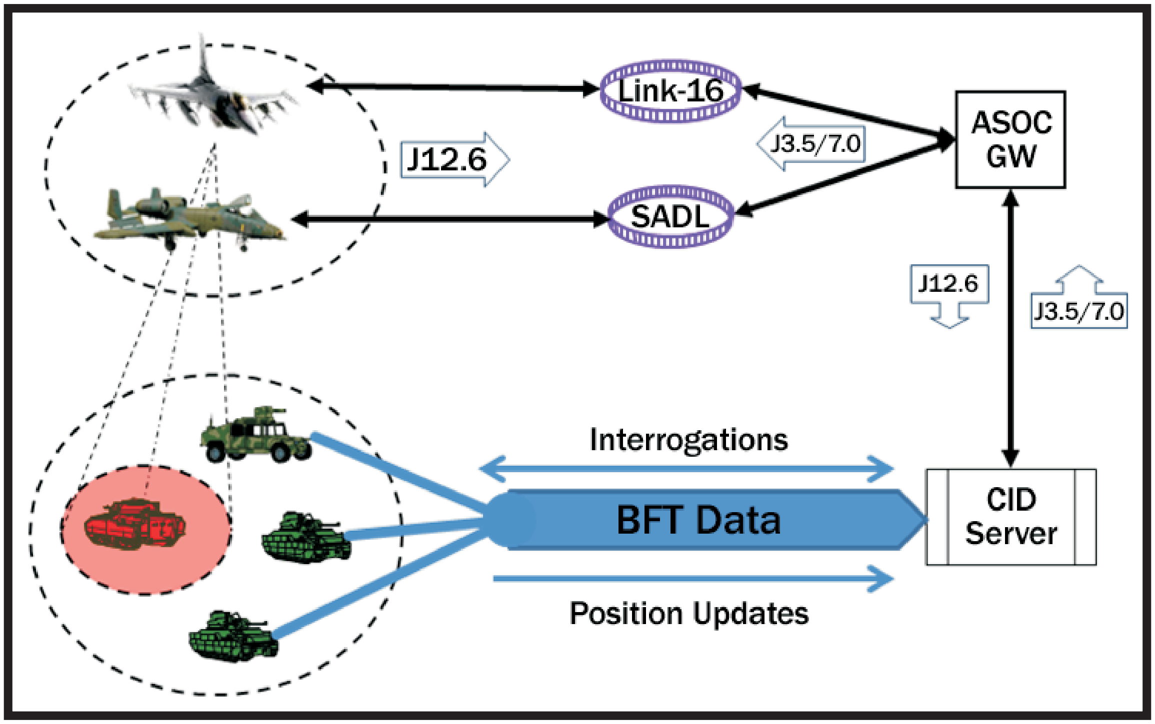


Figure 3-3. Information exchange between CID server and aircraft

Fighters generated J12.6 messages for multiple purposes (e.g., locking up a wingman for SA), but only a small subset were intended to generate a CID server query. Participating BQ+ fighter aircrews generated 41,366 J12.6 messages during the evaluation period. Of that number, the CID server successfully ignored 41,006 messages that did not warrant a server response to report a friendly location. Figure 3-4 depicts a snapshot of a near real time Link 16 display showing A-10 position (via J2.0) and the pairing line of the fighter to its intended target (J12.6).[3] It also shows instrumented ground entities representing truth locations for friendly and hostile forces.

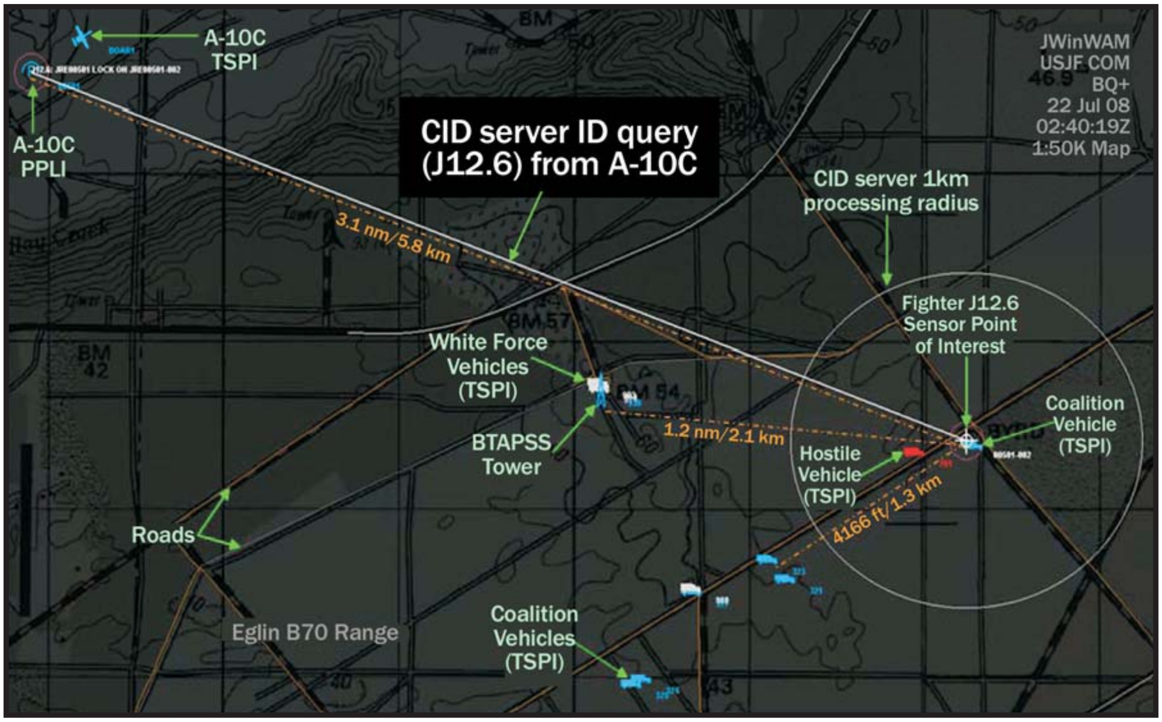


Figure 3-4. Link 16 display

Throughout BQ+ assessment periods, 1,005 vehicle tracks resident in the CID server fell within a 1-kilometer radius and met the closest five "friendlies" reporting criteria. The server properly reported on 998 of those vehicles; however, it erroneously reported 11 additional tracks (1 percent of the 1,009 total track reports). All erroneous reports emanated from a known, correctable bias introduced by the CID server when it derived the J12.6 SPI location. Relative to the CID servers biased SPI; all 1,009 reported tracks were proper responses. Additionally, the server properly reported 36 "unknown" J3.5 land tracks indicating the absence of friendly forces within 1 kilometer of the corresponding fighter query.

Another measure used to address the adequacy of responses to J12.6 queries was the time required to make the response. JFIIT calculated the average response time from when the CID server received a query to dissemination for Link 16 reporting. The total delay for all periods averaged less than 9 seconds. To put this metric in perspective, whenever CAS aircraft sent a J12.6 message on an intended target looking for nearby friendly information, the aircrew received a response within 9 seconds from initiating the request. Six to seven seconds of this delay is due to a manual process required to transfer information across classified and unclassified domains. Efforts to automate information exchange will reduce delays in the future.

Because of the BQ+ technical demonstration, JFIIT analysts concluded that the CID server successfully demonstrated the ability to perform the following:

- Receive tactical queries from all variants of participating fighters through Link 16/SADL.
- Process aircrew queries and retrieve friendly information from the server's database.
- Promptly report the information back to the aircrew through the Link 16 interface.

While the JFIIT assessment provided insight into the CID server's capabilities, the scope and limitations of BQ+ did not provide an opportunity to address its operational effectiveness. The value of the CID server's JCAS support capability rests in the following key questions:

- How will the CID server function in a challenging environment, combining multiple CTI feeds from significant numbers of BFT-equipped vehicles?
- Are contemporary BFT systems capable of providing the timely information needed to support JCAS operations?

Answering these questions will require further assessment of the CID server with a realistic BFT load in an operational environment.

The USJFCOM J85 CCID ACTD staff and allied staffs are in the process of determining the next CID technologies for evaluation during Bold Quest 09. The assessment of the CID server to fulfill an operational gap to provide shooters with timely and accurate CID information before the trigger pull is just one example of USJFCOM's efforts to improve joint fires operations.

Endnotes

1. During BQ+, the CID server request employed only the 1-kilometer radius.

2. Because of the design and scope of BQ+, BTAPSS/BTID systems were the only live sources of BFT data available to populate the CID server. The data, augmented with an emulated BFT system, reported time-delayed, instrumented truth locations as a surrogate source of friendly force reporting separate from BTID.

3. JFIIT uses the Joint Windows Warfare Assessment Model to visualize data feeds from tactical data sources in near real time. Distributed interactive simulation converts tactical data sources (e.g., Link 16) merging with other converted data sources (e.g., instrumented truth) to provide tactical reporting overlaid with truth data to support near real time mission monitoring, analysis, and debriefing activities.

Sensor Point of Interest—Joint Close Air Support: Preventing Fratricide

Clip Clippinger, Joint Fires Integration and Interoperability Team

A terminal attack controller used aircraft to destroy a vehicle used by insurgents to launch mortars. The vehicle was in close proximity to a building that was on fire from previous attacks. The controller gave the F-16 pilot a "9-line" mission brief and described the target as "just 20 meters north of the smoking building." Cleared inbound, the pilot proceeded at low altitude toward the target area. The pilot pulled up into a pop-up maneuver and acquired smoke coming from a rectangular pattern on the ground. He radioed he could see the smoke. The controller could see the aircraft pointed in the direction of the target. The controller radioed, "Cleared hot," to the pilot, who pressed his attack.

There were actually two smoke sources in the area, one friendly and the other, the target. The pilot acquired the friendly smoke source and attacked it, including personnel, vehicles, and a smoldering stack of supplies recently hit by an incoming mortar.[1]

Figure 4-1

Obviously, there were assumptions and mistakes that led to this "friendly fire incident." However, had the terminal attack controller been able to graphically display the aircraft weapon solution (pilot's aim point), he could have seen there was a targeting error and could have averted the resulting incident by aborting the weapons delivery.

Joint close air support (JCAS) is the most time sensitive and critical air-to-ground mission U.S. aviation services perform. The failure of an aircraft to hit a correct target or to delay hitting a target may result in ground force casualties or unachieved objectives. JCAS, like other forms of fire support, must perform in night and adverse weather conditions and from standoff positions, further complicating a mission that is difficult enough to execute in ideal conditions.

Regardless of environmental conditions or the weapons delivery tactic used, the joint terminal attack controller (JTAC) is, by doctrine, expected to be able to determine that the pilot is attacking the correct target before allowing the mission to continue. The evolution of digital technology can simplify this target confirmation process. The common term for the digital exchange of this target aim point is the sensor point of interest (SPI) or designated ground target. Problems arise because JTACs are not well equipped to make correct aircraft aim point determinations even in the most ideal close air support (CAS) environment of unobstructed visibility.

Current technology allowing for an SPI "data exchange" between a JTAC and aircrew greatly increases the probability of correct target acquisition and thereby reduces the likelihood of friendly fire incidents. If the JTAC had been able to correctly assess where aviation-delivered ordnance was going to impact—for example, via SPI—before verbally clearing an attack to proceed, the majority of JCAS friendly-fire combat incidents in the past few years could have been avoided.

To illustration this situation, consider the following: An F/A-18 pilot designates a target after receiving a 9-line from a JTAC. He now has a "diamond" centered on the desired target in the heads up display. The aircraft weapon system knows where the target is, but while in the dive run, the pilot— with just seconds to make a decision—"slews the diamond" to another object that better fits the verbal description given to him by the JTAC. The pilot's "slew" and the corresponding flight path adjustment are imperceptible to the JTAC, and he radios "cleared-hot" to the pilot. Because of this misinterpretation, the pilot drops ordnance on a friendly position. In this case, SPI could have overcome the error and aborted the drop if the controller knew the programmed weapon system's hit location.[2]

To illustrate this situation, consider the following: During a training mission at night, a fighter drops a bomb on an infrared (IR) spot that he thinks is the target but is actually an IR spillover onto trees 1,000 meters long of the target. In this case, the pilot mistakes the IR spot in the trees for the target marked by the forward area controller (FAC). His ordnance lands within feet of a platoon bivouacked for the night. To avert this incident, the controller must have been able to receive and display the aircraft SPI and overlaid it on a location other than the target.[2]

Various factors determine the type of control a JTAC will use to conduct a JCAS mission. Using Type 1 control,[3] JTACs are expected to use visual and verbal cues to acquire a target and the supporting aircraft visually and to analyze the attacking aircraft's attack geometry to determine if the delivered weapon ordnance will impact where desired. This "clearance of fires" decision requires information from a variety of sources that are not usually collocated in one radio or system. Often times, JTACs may have three to five handsets at the ready to coordinate and orchestrate a JCAS mission. In an All Service Combat Identification Evaluation Team (ASCIET) force-on-force evaluation,[4] ASCIET analysts concluded that in many instances the "controllers are unable to determine aircraft aim points" by observing the supporting aircraft. The JCAS joint test and evaluation (JT&E) included a mini-test[5] to assess and quantify the JTACs' capabilities to comply with Type 1 control procedures under ideal weather and lighting conditions by predicting which targets to hit. The JTACs were able to make a correct prediction 45 percent of the time.

SPI can be shared using communications technology currently available for data exchange between JTACs and JCAS, as well as FAC airborne (A) aircraft. The design of current and future aircraft puts ordnance on a target by accepting target location data and computing a weapon release point compensating for wind; ballistics; guidance package performance characteristics; and aircraft altitude, vector, and acceleration. Normally, when a pilot enters target coordinates, accepts target location information, puts a sensor cursor on the target, or designates the target manually, the aircraft systems compute an exact impact point and associated weapons release point. Test results confirm that what the system is set up to hit blows up 99 percent of the time.[6] When a pilot configures the cockpit for a weapon release, the SPI is resident in the aircraft targeting system and appears on applicable cockpit displays. This information can then be extracted, messaged, and sent. The following figure depicts a JTAC display of SPI using Falcon View software with a 1:50,000-map underlay. The arched symbol (lower right) is the aircraft. The end of the dark line running northwest is the aircraft SPI. The symbol under the end of the SPI line is the target in close proximity to friendly forces.

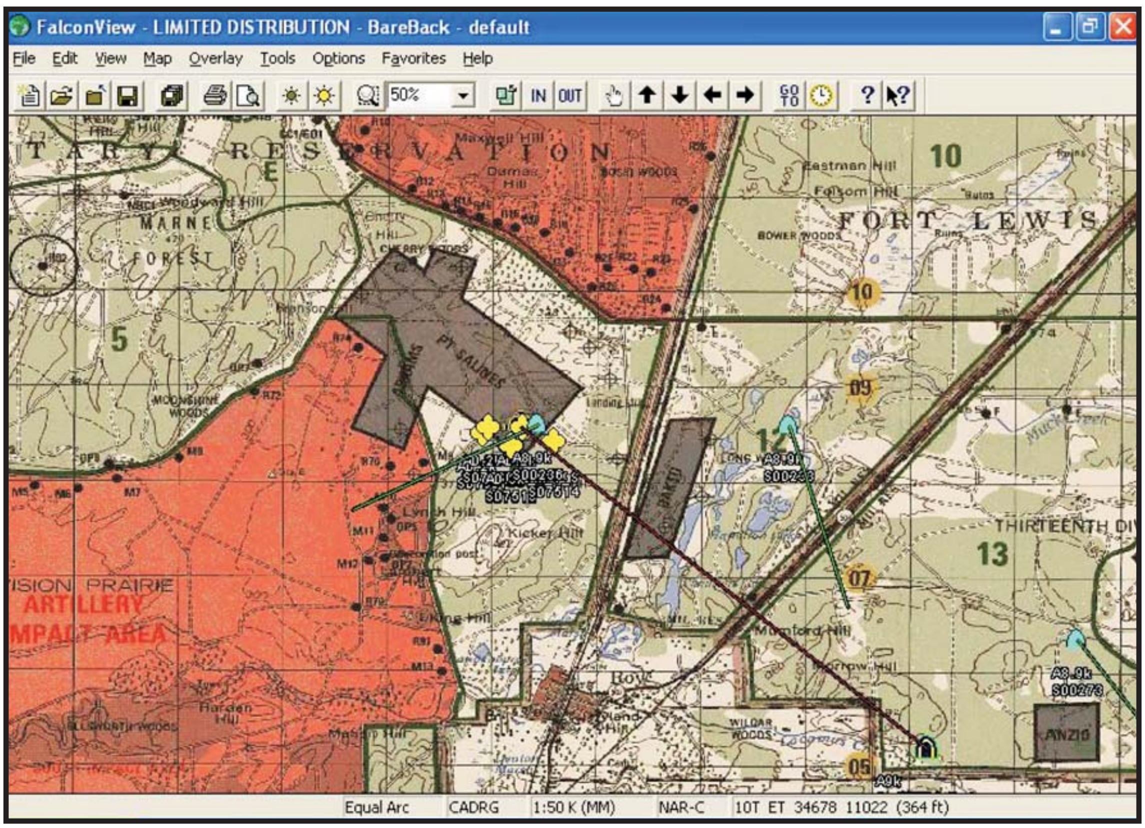


Figure 4-2

Live testing has shown that when a JTAC receives an aircraft computed weapon solution as SPI overlaid on a map or imagery of the target area, the controller can quickly and accurately determine if the proper target is being attacked thus allowing him to issue a "cleared hot" with full confidence. In another JCAS JT&E Mini-Test,[7] situation awareness data link-equipped F-16C+ aircraft communicated SPI to the terminal attack controller via data link. A laptop displayed SPI with a 1:50,000-map underlay. In this test, correct JTAC weapon impact assessments jumped from 67 percent using only visual cues of aircraft location and vector to a remarkable 97 percent when SPI was available. Although the tests were conducted in a clear air environment, this method of confirming target selection, unlike the visual method, would not have been affected by atmospheric conditions or standoff ranges.

Another useful demonstrated SPI method in combat uses targeting pod video displayed on the Remotely Operated Video Enhanced Receiver (ROVER) system. Using this system, JTACs are able to see what the pilots see including the targeting pod SPI. In the photo below, the crosshairs clearly show the aim point of the targeting pod's laser designator to the JTAC enabling confirmation or correction. The JTAC is consequently able to adjust the aircrew's crosshair placement as needed to refine a desired aim point. This video-sharing capability was successfully demonstrated in urban combat areas where ambiguity and the effects of differing viewing angles by controller and aircrew have made the traditional talk-on cumbersome, lengthy, and often unsuccessful. In the Secretary of the Air Force AIM Points, January 2007, the Air Force Chief of Staff said, "The ROVER technology provides a phenomenal asymmetric advantage in prosecuting the Global War on Terror. It saves lives by quickly directing close air support when American and allied troops are under fire. By allowing the forward controller to see what the pilot sees, it enables greater precision in targeting, especially important in positions close to friendly forces."

Figure 4-3. Down-linked targeting pod video

While ROVER is unquestionably a very powerful and promising technology, it does have limitations, most notably, the need for unobstructed line of sight from the targeting pod to the target. Because of the size and weight of this receiver and antenna, the ability of the controller to set up the receiver and display the equipment is limited. Tactical situations often make equipment setup risky or impossible. Additionally, aircraft weapons delivery using modes not integrated with the targeting pod that is providing the video to the JTAC can result in weapons release on the wrong target unless the JTAC is aware of the disparity.

So, where is the joint community in fielding SPI? Most CAS platforms are still developing the software updates to extract the computed weapon aim point so the SPI can send via data link or digital modem. The Marine Corps Strike Link can receive and display SPI when controlling Strike Link modem-equipped F/A-18s. The Air Force Special Operations Command battlefield air operations kit can display SPI over its network. The Air Force Tactical Air Control Party Close Air Support System does not currently display SPI. ROVER III, fed by the Marine Corps/Navy/Air National Guard Lightning Advanced targeting pod and the latest versions of the Air Force Sniper targeting pod, is currently in use in theater.

JTACs must ensure they communicate the requirement for this capability throughout JTAC chains of command to influence service program offices and service representatives on the JCAS Executive Steering Committee.[8]

In order to optimize this essential, across-the-board SPI capability, the military should implement some key enablers. First, to gain interoperability among all JCAS platforms, the military should establish a common digital message standard and enforce it. Because the new Joint Strike Fighter will hit the ramp with Variable Message Format D in 2011, this aircraft configuration should define the standard for developing systems and upgrades to fielded systems, including both CAS and FAC (A) aircraft and JTAC equipment suites. An aircraft programmable translator radio component should extract and process SPI for transmission rather than hitching this important capability to the lengthy and expensive aircraft Operational Flight Program update processes and schedules. Second, the military should analyze and publish doctrine and tactics, techniques, and procedures to support the evolution of SPI from all JCAS platforms to all JTACs. This analysis will allow a completely new concept of JCAS control. Relieved of the task of observing the aircraft during weapons delivery (i.e., evaluating "nose position"), the controller could, with digital technology, actually perform Type I control. In fact, he could even confirm some level of collateral damage prevention, something that is critical in the current fight. Type 1, 2, and 3 controls would blend in terms of execution procedures, and the types of control would only refer to specific coordination requirements. Finally, training for all JCAS players should include hands-on digital data exchanges in realistic and challenging settings to provide both proficiency and confidence in what SPI offers.

SPI will provide JTACs the rapid capability to prosecute targets with a commensurately high confidence that the intended target will be hit. If the joint fire support community's goal is to save friendly lives and kill the enemy in JCAS operations, the fielding of an SPI capability is decidedly one of the fastest, most cost-effective and surefire ways to do so.

Endnotes

1. This account is fictional but contains key elements of actual incidents symptomatic of an important JCAS control shortfall.

2. These accounts are fictional but contain key elements of actual incidents symptomatic of an important JCAS control shortfall.

3. Type 1 definition from Joint Publication 3-09.3, *Joint Tactics, Techniques, and Procedures for Close Air Support (CAS)*, 3 September 2003, Incorporating Change 1, 2 September 2005: "JTACs use Type 1 control when the risk assessment requires them to visually acquire the attacking aircraft and the target under attack."

4. Section 3, paragraph 3.1.3.3 of the *ASCIET 96 Evaluation Report,* May 1997, "Forward air controllers (FACs) had difficulty verifying that CAS aircraft were attacking the right target." Because of parallax problems, limited line of sight, and lack of any aids for situational awareness, the FAC could not tell which target CAS aircraft were attacking before weapons impact. The FAC had considerable difficulty judging medium altitude and non-wings-level deliveries, and night deliveries with "blacked-out" CAS aircraft were impossible. This situation resulted in two blue-on-white engagements and numerous abort calls by the FAC.

5. JCAS Day CAS Mini-Test Results (DCMT), February 1999, "The services provided operationally deployable test subjects for DCMT 1. The four test subjects from each Service were grouped into two teams, resulting in two forward observer, enlisted terminal attack controller, and FAC teams, for six teams. The six teams responded to the 111 validated CAS aircraft runs, resulting in 666 responses for analysis. They were able to make a correct visual determination of target attacked on 45 percent of the 666 observations." The JCAS JT&E DCMT 1 took place at the National Training Center (NTC) Fort Irwin, CA, from 9 to 13 November 1998.

6. Office of the Secretary of Defense JCAS JT&E, Joint Close Air Support Interim Report, 2002.

7. JCAS JT&E Mini-Test 2 Plan and Report*,* June 2002. "The JCAS JT&E Mini-Test 2 took place at NTC, Fort Irwin, CA, from 4 to 15 February 2002. Test elements consisted of static target groups spread over approximately 50 square kilometers; air-to-ground data link equipped A-10 and F-16 aircraft; and four TAC manned OPs [operations]. Terminal attack controllers (TACs) used visual means (visual acquisition and analysis of aircraft nose position and geometry), data link information, or a combination of the two when determining which target set was under attack."

8. Department of Defense gave U.S. Joint Forces Command (USJFCOM) the responsibility of overseeing the JCAS Executive Steering Committee in October 2002 to resolve inter-service issues and standardize the services' training and procedures. USJFCOM's Joint Capability Development Directorate (J8) works to ensure the services combine their capabilities into a single successful effort and chairs the committee.

Digital Close Air Support (CAS) or Digitally-Aided CAS Improves Combat Effectiveness

Tim Finn, Joint Fires Integration and Interoperability Team

Improvements in digital capabilities and tactics, techniques, and procedures (TTP) may finally overcome obstacles associated with digitally-aided CAS.

Steel 50, a joint fires observer (JFO) supporting 2nd Platoon, Bravo Company, thought quickly about what the tactical air control party (TACP) had said before departing, "Maintain your communications; as long as you can communicate, we can make it happen." "It," in this case, was Type 2 terminal attack control of CAS. Steel 50 quickly reviewed the communications plan and radio settings, and he was pleased all appeared in order. The CAS rehearsals with the TACP explaining digitally-aided CAS gave him a shot of confidence the unit had a workable plan of action to integrate air support. As the second M-1114 vehicle of Steel 50's patrol approached the intersection, an improvised explosive device detonated, and insurgent gunfire erupted from the west side of the road. Having seen this before, Steel did not wait for direction and immediately went to work notifying higher headquarters of troops in contact (TIC).

As soon as Magnum, the battalion TACP, received notification of the TIC, it began checking the maneuver graphics. Magnum was in luck—the insurgent ambush corresponded to a planned digital target reference point (DTRP) or electronic mark. After double-checking its information and conferring with the fires and effects coordination cell, the TACP received the go-ahead from the battalion S3 to publish the DTRP to the "link" as a land track. Pushing the DTRP to the link would allow any Link 16 or situation awareness data link (SADL)-capable aircraft to quickly orient itself onto a specific location; in this case, the TIC. The TACP also received approval from the S3 to push a land track to the link to identify Steel 50's position.

Steel's and Magnum's planning and rehearsals were about to pay off. Snake 30, a flight of two F/A-18s, had their sensors trained on the enemy's track before checking in with the battalion TACP and confirmed the friendly track shortly thereafter. The communications drills practiced repeatedly by Steel and Magnum paid dividends and allowed Snake flight to rapidly locate friendly and insurgent positions and expend ordnance in a timely manner. The insurgents broke contact, but Snake flight kept its "eyes" trained on "leakers." Steel thought to himself, maybe this digitally-aided CAS stuff has some "play" and made a mental note to discuss it with the TACP at mission completion.

The preceding vignette, although fictional, highlights how newly fielded digital aids and familiarity between JFOs and TACPs can expedite CAS. The services, however, have not widely embraced digital CAS. Some question the wisdom of such an investment. This article addresses that question and makes a case for digitally-aided CAS to improve combat effectiveness and reduce the potential of fratricide and collateral damage.

First, put aside a recurring misperception: Digital CAS execution (i.e., digital information exchanges in the absence of voice communications) does not yet exist. Messages supporting digital CAS operations are, for the most part, templates of Joint Publication 3-09.3, *Joint Tactics, Techniques, and Procedures for Close Air Support (CAS*)-directed communications exchanges but do not cover every possible eventuality.[1] CAS is and will remain for the near future a voice communications-intensive operation. Therefore, digital capabilities and systems augment information exchanges that occur between CAS mission participants. If that is accepted, then digital CAS is really digitally-aided CAS. So what does digitally-aided CAS bring to the warfighter?

Digital capabilities bring accuracy, automation, and speed to CAS participants' communications processes. Because of their accuracy and speed, computers and their associated software applications revolutionized information development and sharing. Similarly, aircraft systems, managed through Operational Flight Programs and joint terminal attack controller (JTAC) suites using various software applications, compile and transfer CAS messages resulting in increased accuracy and speed of communications processes. This increased accuracy provides greater capability to build and track situational awareness (SA) displays that include hostile and friendly positions, as well as aids in reducing the potential for fratricide. Digital messaging also provides standardization and, in some instances, can replace verbal information exchanges. For example, the variable message format departing initial point (DPIP) message supplants the need for a voice call of DPIP. Similarly, the same message protocol can provide aircraft position, thus replacing the "in with direction" radio call. Another benefit of digital communications is the avoidance of the transmit-pause-then-transmit-again cycle that longer information exchanges require. Modem-based radio communications often occur in fractions of a second and do not require breaking up transmissions to avoid overly long transmit times.

When contemplating the pluses of digitally-aided CAS, the trump card especially from a fratricide reduction and targeting efficiency perspective surely must be the JTAC's receipt of the aircraft's predicted impact point for weapons employed. When properly implemented, the aircraft position and target designation, sensor point of interest, or designated ground target message appears on the JTAC's situation display as aircraft targeting symbols overlaid on the controller's display of the intended ground target. This single capability closes the loop for controller SA and essentially culminates in "yes" answers to the critical questions JTACs address during CAS control:

- Did the JTAC pass the coordinates that correspond with the hostile icon on the JTAC's SA display?
- Did the aircraft target the provided coordinates?
- Did the CAS aircrew read back the target coordinates?

This single message provides more all-weather targeting confidence than any other single communications exchange between CAS platforms and JTACs. Carrying this construct one step further, it is probable that increases in targeting efficiency would be realized because of fewer incorrect targeting attempts. For example, controllers could abort a misdirected aircraft attack run long before any visual cues become apparent to a JTAC.

So, why are JCAS mission area participants not embracing digital capabilities? There are a number of reasons ranging from its difficulty-to-use and the unwieldy JTAC suites to the aircrews' lack of familiarity with aircraft digital CAS menus. However, improvements to existing systems and soon-to-be-fielded new capabilities could tip the scale in favor of digitally-aided CAS employment. The Target Location, Designation, and Hand-off System or Strike Link is currently being fielded to U.S. Marine Corps forward air controllers and TACPs in large numbers. In addition, the U.S. Air Force (USAF) TACP Close Air Support System (CASS) is undergoing a major improvement. Both systems will allow controllers to refine target coordinates, which may potentially improve targeting effectiveness.

Additionally, USAF air support operation centers (ASOCs) will be equipped with a data link-capable gateway that will allow them and TACPs to transmit ground points of interest to Link 16 and SADL-capable aircraft. Both Strike Link and TACP CASS provide line-of-sight 9-line CAS briefings to select airborne platforms (i.e., AV-8B, F-16, F/A-18, and, soon, A-10Cs). The battlefield air operations (BAO) kit (the USAF Special Operations Command-developed suite used by some combat controllers) coupled to a micro-light SADL radio is also capable of passing line-of-sight targeting information to SADL-equipped platforms. The BAO kit can also forward actionable targeting information beyond line of sight for injection into Link 16 networks.

What is missing from the digitally-aided CAS picture? Some answers to that question are in a JCAS Joint Mission Thread assessment report,[2] which is available on the Joint Fires Integration and Interoperability Team (JFIIT) Website (<https://jfiit.eglin.af.mil/public/JFIITReports.php>). Several observations and recommendations in the report link the use of digitally-aided CAS to the operators' familiarity with their systems and call for detailed system checklists both in the air and on the ground.

Another area that is missing is TTP for digitally-aided CAS, although the USAF has taken an initial step in this area. This step came during the 2008 Weapons and Tactics Conference, where CAS mission area participants and subject matter experts, led by a U.S. Central Command Air Forces action officer, drafted baseline TTP that leverage the capabilities resident with the ASOC Gateway and TACP CASS 1.4.1. The TTP focuses on using existing data link architectures to shorten the CAS engagement process. Once approved for release, the TTP will be posted on the 561st Joint Tactics Squadron Website. Following on the heels of that effort will be a U.S. Joint Forces Command/JFIIT-hosted working group to address digitally-aided CAS TTP. Their focus will be on digital line-of-sight communications between CAS participants. After the initial shakedown of data link and line-of-sight digitally-aided CAS TTP, future working groups may merge the best of both approaches.

Upon returning to the combat outpost, Steel 50 looked up his TACP counterpart and commented on Snake flight's good work. "Yes," Magnum remarked, "digitally-aided CAS is probably here to stay, and in the future, I'll be able to see the aircraft's actual sensor point of interest on my JTAC kit display."

Endnotes

1. Joint Publication 3-09.3, *Joint Tactics, Techniques, and Procedures for Close Air Support,* 3 September 2003.

2. Technical Review 07-06, *Coalition Combat Identification Advanced Concept Technology Demonstration Bold Quest Close Air Support Assessment Report,* October 2007.

Global Area Reference System—Digitizing the Operational Environment to Reduce Fratricide

LT Brian "FOD" Bansemer, Joint Fires Integration and Interoperability Team, U.S. Navy

> **"GARS [Global Area Reference System] provide a single source solution to facilitate faster and more accurate coordination, synchronization, and deconfliction of military forces that will ultimately increase our combat effectiveness and reduce the potential of fratricide and collateral damage."**
>
> **—COL L. Ross Roberts, U.S. Marine Corps**

Area reference systems are finding their way into the tactical arena. While more commonly used at the operational level and above, these systems can help aviators and maneuver forces determine where kill-box interdiction (KI) and close air support (CAS) operations are occurring and allow for better coordination with ground troops. This improved method to synchronize and coordinate fires will improve combat effectiveness while reducing the potential of fratricide on an ever-changing and asymmetric battlefield.

The Common Grid Reference System (CGRS) was very effective at defining KI/CAS areas in both Operation Iraqi Freedom and Operation Enduring Freedom (OIF/OEF). KI/CAS plots were generated at the Air and Space Operations Center (AOC) to show where missions were taking place, as well as the location of the forward line of own troops and fire support coordination line.

Although very effective, CGRS did have its problems, one of which was the use of multiple CGRSs within the same region. For example, in the U.S. Central Command's (CENTCOM) theater of operation, there was a CGRS for OIF and one for OEF. Both used the same labeling convention (but different origins), causing confusion in the AOC (i.e., a given area was referenced but not identified as belonging to the Iraqi or Afghanistan theater). The problem was eventually resolved by creating a single CGRS for the entire theater that is still in use today. The CENTCOM example led to the realization that if a conflict broke out over two combatant commanders' boundaries, they could be faced with a similar problem.

The National Geospatial-Intelligence Agency developed GARS at the direction of the Secretary of Defense and from a request from the Joint Chiefs of Staff. The goal was to create a global grid to meet combatant commander and service (including U.S. Coast Guard) requirements. The grid is an evolution of CGRS with one major exception—it has one common grid origin (the South Pole) and is labeled to cover the entire world (see Figure 6-1).

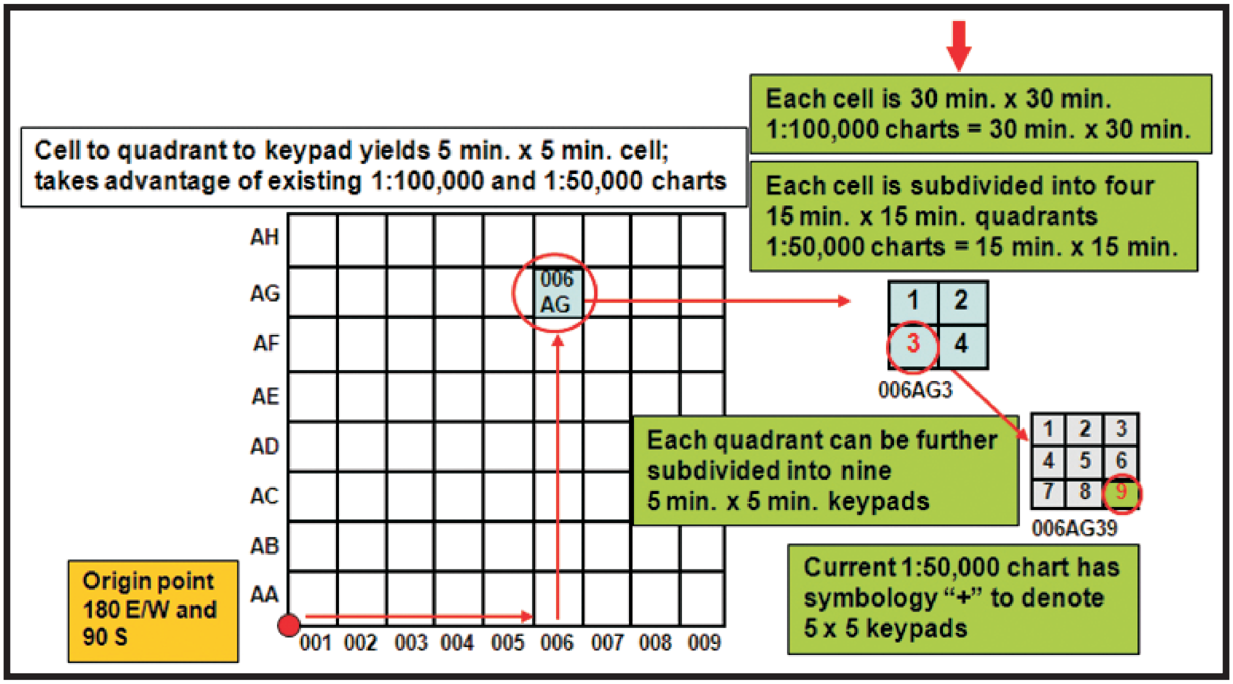


Figure 6-1. GARS labeling

Implementing a standardized global grid will ensure the military does not repeat the OIF/OEF CGRS mistake and will provide system engineers the ability to place this single, global grid into various command and control (C2) systems with confidence; it will not change in the foreseeable future. When units change theaters because of a humanitarian relief effort, training event, or conflict, the system's grid will not require updates or changes. Whether units are training in the U.S. or fighting in Iraq, the grid's labeling convention and origin will be the same.

Currently, efforts are underway to provide the warfighter with a near real time snapshot of a GARS-defined operational environment by digitizing and disseminating information on GARS cells, quadrants, and keypads via a GARS Link 16 message J16.2. Instead of aviators coming on station with old information acquired during mission planning, they will have the current operational environment snapshot that can include kill-box status, altitude, and other potential restrictions. This information enhances their abilities to assist ground troops and reduces the possibilities of fratricide. With the Link 16 capability of the air defense and airspace management (ADAM)/brigade aviation element (BAE) cells, ground commands have better situational awareness (SA), and ADAM/BAE cells can potentially use this capability as a gateway to relay GARS information for their areas of responsibility.

The J16.2 message will provide units the capability to share a three- or four- (with time) dimensional operational environment depiction based on the two-dimensional (2-D) area reference system using a tactical data link. This message will allow for up to four vertical layers of information about every keypad in the region. For CAS missions, the message will show who controls the keypad, how to contact them, airspace altitudes, and what aircraft is working the mission. Other features include a free-text message portion for additional information, as well as the ability to share Unmanned Aircraft Systems and tanking locations and airspace coordinating measures (ACMs).

On the envisioned, future digital battlefield, C2 nodes and command posts could define GARS area (cell, quadrant, and keypad) ownership and operational status as needed. This information would instantly and automatically disseminate to system displays of all battle management; intelligence, surveillance, and reconnaissance platforms; strike aircraft; command centers; and maneuver forces. Air and ground commanders could use this information to plan missions and quickly react to changes in the operational environment.

GARS is a reference system, not a fire support coordination measure (FSCM) or ACM. Units build control and coordination measures from these 2-D structures. Such control measures may include FSCMs, ACMs, and no-fly areas. Units may use the area reference system for a variety of purposes, to include aiding National Guard units operating with other government organizations such as the Federal Emergency Management Agency. GARS is not a precise location provider resembling latitude and longitude or the Military Grid Reference System; the key word is "area." The system does not describe exact geographic locations, nor does it replace the use of operational graphics for maneuver forces. It also does not express precise positions for guided weapon employment or pinpoint navigation.

GARS is designed to rapidly coordinate areas to facilitate deconfliction and synchronization. With military operations conducted in a complex, interconnected, and increasingly global operational environment encompassing air, land, and maritime domains, the ability to deconflict and synchronize efforts is imperative. GARS provides a common language between services and components regardless of whether the task is training or real-world operations.

The possibilities are great, but the possibilities start with service and combatant commander implementation. While challenges exist, such as swapping systems mid-conflict (already successfully executed once as indicated by the CGRS example) or convincing foreign governments who currently use locally defined reference systems to switch to a global standard (e.g., South Korea), units must overcome these hurdles. Effectively digitizing the operational environment by integrating GARS into digital C2, fire support systems, and tactical data links today—and the Global Information Grid tomorrow—could significantly improve operational environment SA and warfighter effectiveness, enhance joint interdependence in air and ground operations, and reduce the likelihood of fratricide and collateral damage.

Sound Off: Why Not Recognition of Combat Vehicles?

Mark Rasins, Joint Fires Integration and Interoperability Team

While there are much needed efforts to equip live-fire ranges with friendly target sets, unit leadership must ensure the crews being trained are not seeing these target sets for the first time on a live-fire range or, worse, an operational situation. For example, where does a Soldier first see the effects of the Joint Combat Identification Marking System (JCIMS)? That marking system can save lives and increase friendly force combat effectiveness; however, when and how does a Soldier learn to look in the correct places for a thermal panel? How does a forward observer, an Unmanned Aircraft System operator, or even a fixed-winged weapon system operator know what a thermal panel looks like through his sights?

There are currently only two answers to those questions: (1) The unit should stage a training situation or exercise, which can be both costly and time consuming. (2) The unit can train at home station with the most current version of Recognition of Combat Vehicles (ROCV) while waiting to participate in a live training event. So what exactly is ROCV?

ROCV is a Microsoft Windows-based combat identification (CID) thermal sight-training program with an interactive curriculum. It teaches the unique patterns, shapes, and thermal signatures of more than 200 U.S. and foreign platforms. The program is customizable, provides standardized tests, and records the learner’s progress. ROCV can also be adapted to support institutional, unit, and individual training. Most importantly, ROCV uses U.S. Training and Doctrine Command-validated training and testing methodology.

Version 9.4, released in February 2007, is distributed in three compact disc sets or is available for download. In addition to the vehicle identification trainer, the library has examples of two-dimensional generation forward-looking infrared (FLIR) improvements, tutorials of JCIMS, explanations to maximize FLIR imagery with brightness and contrast controls, examples of atmospheric and battlefield effects, and FLIR imagery of personnel.

While ROCV is a robust ground-to-ground trainer, the recent addition of simulated three-dimensional vehicle models enhances its air-to-ground capabilities. A complete air-to-ground trainer (with real imagery) and a user upload feature are scheduled for release in April 2009. Other modules within the Recognition of Combatant-Suites (ROC-Suites) include ROC-Improvised Explosive Device (ROC-IED) and ROC-Suicide Bomber (ROC-SB). Additionally, all imagery and training software is entirely government-owned and available to the services. Plans include collecting coalition platforms, and a signed agreement is already in place with the United Kingdom.

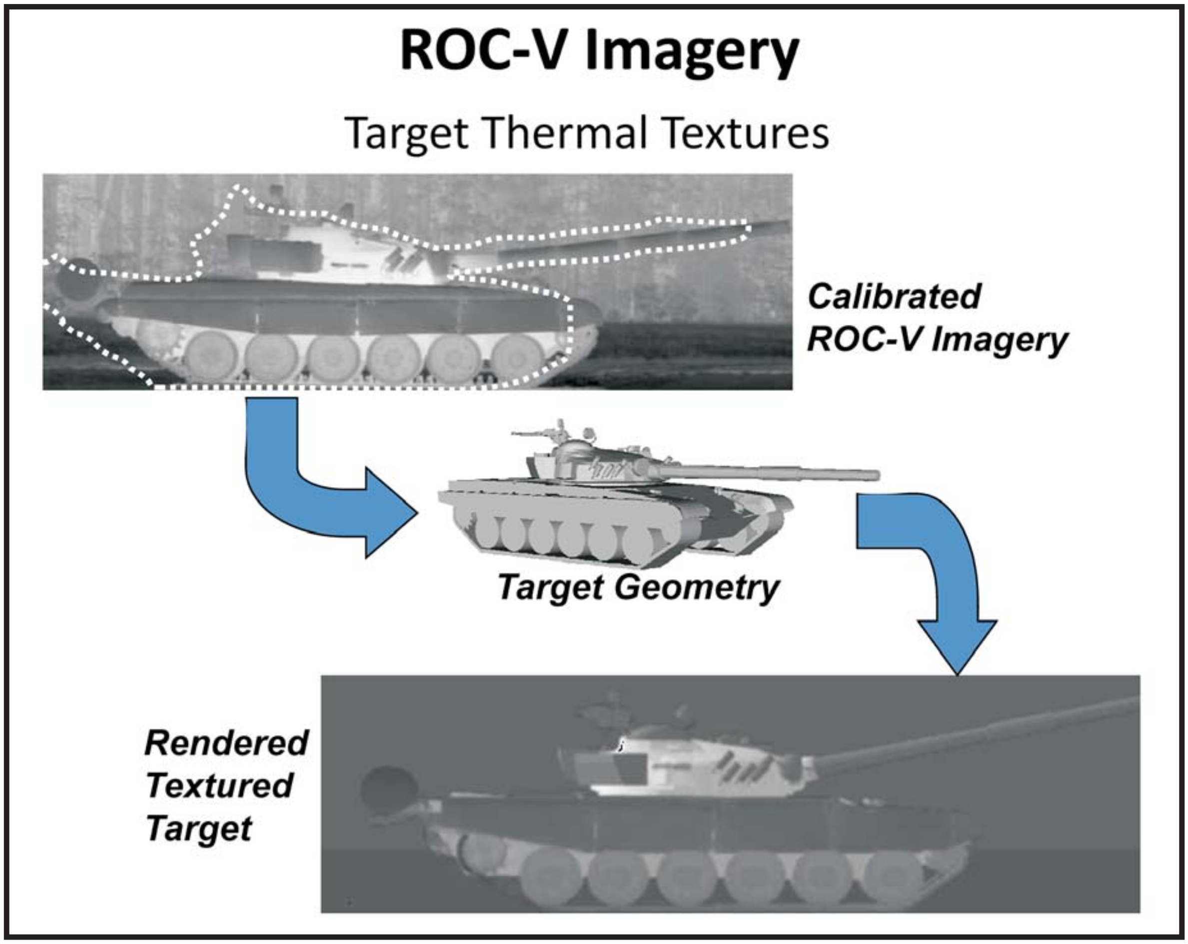


Figure 7-1. ROCV imagery

Conclusion

The logic behind investing money in simulators was the long-term savings they could generate. For every dollar invested, units saved X-number of tank rounds and X-number of tank miles that the unit can then divert to training crews for war. In addition to the saving, simulations helped reduce the inherent risks involved with training crews for high-intensity conflicts and full-spectrum operations.

The training and resource investment up front was well worth the long-term benefits. Ensuring base-level competency before rolling out of the motor pool is a very efficient way of training. In the CID training arena, units will also see benefits such as risk mitigation and increases in combat effectiveness in the air-to-ground arena.

In the current environment, both operationally and economically, efficiency must be the rule going forward. After years of fighting in far-off lands, U.S. forces want to spend as much time as possible at home station during their limited dwell time. ROCV is perfect for home-station training and the financially constricted environment of the future.

Do You See What I See? Digital Message Exchange Closes Gaps—Reduces Fratricide

Perry Davis, Joint Fires Integration and Interoperability Team

Sharing digital coordinates and aircraft aim points significantly improves combat effectiveness and reduces collateral damage and fratricide.

Current threats and precision-guided munitions (PGM) technology have dramatically altered joint close air support (JCAS). Extended launch ranges, higher altitudes, and all-weather/day-night employment push command and control (C2) decisions and airborne target acquisition well beyond the visual arena. These changes make the already challenging Type 1 terminal attack control process more difficult.

The commonly held perception that aircrews can positively identify friend from foe before weapons release has been proven false in Joint Fires Integration and Interoperability Team (JFIIT) assessments, as has the ability of even the best trained joint terminal attack controller (JTAC) to accurately predict a weapon's impact point in medium-altitude and standoff conditions. Failure to correct these critical deficiencies in visually-based terminal attack control equates to treating the symptoms while failing to cure the disease.

Typically, target coordinates provide the initial cue for the aircrew to begin target acquisition. A talk-on process describing target area geographical features and target orientation/layout follows to help the aircrew during the search. This talk-on process can be time-consuming and is prone to errors because of differences in perspective. For example, an aircrew may find a likely looking hot spot appearing near the target coordinates from the airborne perspective, which is beyond the ground controller's field of view or knowledge. Additionally, commonly found geographical features, such as multiple T-intersections, can cause aircrew and controllers to believe they are referring to the same target when, in fact, they are not. Terminology frequently contributes to this confusion. When an aircrew reports it has acquired or identified the target, it typically is indicating it has simply acquired a "blob" whose recognizable attributes and position generally match the description provided by the controller. The JTAC then makes a "cleared hot" call, believing the pilot has accurately identified the intended target. With clearance, the pilot releases ordnance on this "blob," confident the controller has confirmed he is engaging the desired target. This scenario results in a high potential for ineffective missions, undesirable collateral damage, or fratricide.

JFIIT's efforts to leverage data links' potential to improve JCAS focused on providing two integrated capabilities:

- Passing the digital target location to the attacking aircraft's weapons system
- Displaying the aircraft's aim point to the JTAC

These enhancements will dramatically improve the combat effectiveness of air-delivered fires and, simultaneously, minimize the potential for fratricide and undesirable collateral damage.

JCAS Type 1 Terminal Attack Control Capability Gaps

While medium-altitude and standoff tactics help aircrews cope with today's threat, they aggravate the challenges in target acquisition and terminal attack control. JFIIT historical data confirms the impact of these visual limitations. During both All Services Combat Identification Evaluation Team 2000 and Joint Combat Identification Evaluation Team (JCIET) 2002, aircrews were able to positively identify the target in less than 1 percent of attempts to employ ordnance.

Likewise, under ideal conditions, terminal controllers were able to visually determine the medium altitude weapons aim points in only 45 percent of the close air support (CAS) attacks in the JCAS Joint Test and Evaluation (JT&E) Mini-Test 1 (February 1999) and in 67 percent of CAS attacks in the Mini-Test 2 (June 2002). These two capability gaps not only jeopardize the effective application of CAS but also contribute to lengthy delays in delivering the necessary air power. To frame JFIIT observations in the proper context, personnel first must understand the root cause of visually-based terminal control deficiencies.

Gap 1: Aircrews cannot reliably identify the intended ground target

On the modern battlefield, an A-10 Thunderbolt 30-mm high-angle strafe attack probably provides the best opportunity for a fixed-wing attack pilot to visually identify a tactical target. The aircraft has a typical roll-in and engagement decision range occurring at approximately 9,600 feet. To put this in the perspective of what the pilot sees at this range, a T-72 tank appears smaller than the word “TRUST” viewed on a quarter held at arm’s length. At best, this target may be recognizable as a vehicle and possibly armored, but the characteristics that determine friend from foe cannot be reliably distinguished visually, even at this short tactical range. At a 6,000-foot firing range, the T-72 is barely wider than the two milliradian-aiming index of the A-10 sight (2.56 mils).

Standoff weapon deliveries produce similar identification problems, even with the aid of aircraft sensors. A typical weapon’s release slant range for a medium-altitude PGM attack is 26,000 feet. Using an onboard targeting pod with 20-power magnification, a T-72 on a cockpit display would be approximately the size of George Washington’s head, using the same arm’s-length quarter comparison. Although this equates to a larger apparent target size, the gains in magnification are offset by a loss in detail because of the display’s resolution and environmental factors of the increased range.

Gap 2: The JTAC cannot reliably determine the weapon impact point

Increased release ranges also create a problem with visual acuity for the JTAC. At medium altitude employment ranges, JTACs’ visual acuity is insufficient to accurately assess an aircraft’s altitude, dive angle, airspeed, attack azimuth, anticipated release point, and the weapon’s ballistic profile in order to accurately predict an impact point. While it may be possible for a controller to predict the impact point for a short range 30-mm strafe attack, this task is impossible for a Maverick missile launched from a 3.5 to 6 nautical mile (nm) slant range or Global Positioning System-guided munitions dropped from a bomber flying 20,000 feet above the target. Assessing a “dot in the sky” dropping a “nonballistic” PGM with a flight path that is, to the JTAC, unpredictable—even in perfect meteorological conditions—forces the JTAC into an untenable “best guess” situation.

The Near-Term Solution—Tactical Data Links

Digitally sharing continuously updated targeting information via fielded tactical data links (TDLs) can mitigate the problems inherent in visually-based terminal attack control. During certain JFIIT assessments, participants are encouraged to explore the practical application of TDLs in a robust data link architecture. Although data links support a broad range of C2 messages, two specific TDL capabilities can leverage existing technology to overcome the two fundamental Type 1 terminal attack control gaps.

TDL Priority 1: Transmit target location (coordinates/elevation) directly to the aircraft's avionics and displays

An accurate target location integrated with the aircraft avionics is an aircrew's most useful cue to initiate its search for the target. While not directly addressing the deficiencies associated with visual terminal control, this data link significantly reduces cockpit workload and minimizes the multitude of potential format and data entry errors associated with the manual coordinate processing. In properly configured aircraft, the accurate target coordinates provide the aircrew a digital target mark in the form of a cross-hair position on a weapons video screen and designation cue in the heads-up display.

TDL Priority 2: Digitally share the attack aircraft's current sensor or weapons system aim point with the JTAC and C2 systems

While a data link dramatically improves the speed and certainty of communicating a target location, this capability alone does not ensure an aircrew can acquire and designate the correct target. A complementing and critical data link to close the loop is referred to as sensor point of interest (SPI). SPI is a generic term describing the ability to share the attack aircraft's current sensor or weapons system aim point with the JTAC via a data link. In a stand-off weapons delivery, receipt of the SPI allows the JTAC to determine the aircrew's intended aim point and confidently declare "cleared hot" or "abort," as necessary.

TDL Use in JCAS Live Experiments

The TDL capability was successfully employed during JCIET 2002. In this experiment, a Marine Corps air officer had a TDL laptop terminal, Joint Surveillance and Target Attack Radar System (JSTARS) workstation, Unmanned Aircraft System (UAS) video feed, and appropriate radio frequency communications. In coordination with friendly maneuver units, the air officer used JSTARS and UAS cues to detect possible enemy locations. With an SPI-capable UAS, he identified an enemy tank (a T-72, in this case), extracted rough coordinates, and digitally transmitted a "9-line" brief to a TDL-equipped aircraft. The pilot cued his sensor to the steer point automatically generated from the data linked coordinates, refined his sensors to a suspected target hot spot, and made an "SPI on" radio call. The air officer then confirmed that the SPI location received via data link from the fighter and the UAS were on the same target. After a final check of the UAS video to confirm the target as a hostile T-72, the air officer made the "cleared hot" call with high confidence, knowing that the hot spot seen by the aircrew was, indeed, the intended target. The aircrew's post-mission comment, "This is too easy," highlights the dramatic improvement in speed and accuracy these two TDL capabilities bring to the JCAS terminal attack control process.

Other tactics, techniques, and procedures quickly evolved as participants experimented with data links. An air officer performed a talk-on, steering the aircraft's SPI location: "Viper 51, you're looking too far south; bump your sensor 300 meters north up the dirt road…that's good, right there." This transmission was followed shortly by, "Viper 51, contact." A JTAC also used the UAS SPI as a digital mark on a moving vehicle. Because target coordinates were rapidly changing, he directed the attack aircrew to "hook" (capture) the UAS SPI in lieu of giving target coordinates. The aircrews easily used the UAS SPI as a pointer to acquire the moving target.

In another development, attack flight leads and wingmen employed SPI to rapidly sort and coordinate multiple aim-points to maximize their weapons effects on the first pass. In a separate evaluation (JCAS JT&E Mini-Test 2), terminal controllers using stable SPI accurately confirmed aircraft aim points in 97 percent of all attacks without visually observing the attacking aircraft or target.

Defining Priorities

As number and type of TDL applications for JCAS increase, aircraft and systems program managers struggle to reconcile priorities based on differing perspectives and legacy systems without the benefit of clearly defined joint TDL implementation standards. To leverage current and emerging TDL capabilities, implementation efforts must focus first on fielding an interoperable capability to digitally share target location and SPI between all JCAS terminal controllers and attack aircraft. In the near-term, existing gateways and translator forwarders can bridge interoperability shortfalls to attain these two essential capabilities. By establishing joint standards prioritizing implementation of these achievable capabilities, the services can realize immediate gains in supporting the maneuver force commander.

The underlying JCAS goal has always been to put the right weapon on the right target at the right time to achieve the desired effects for the ground commander. Aggressive joint development, acquisition, and implementation of these crucial TDL priorities will provide the tools to improve joint terminal attack control while offering a near-term capability to both significantly increase combat effectiveness and reduce the potential for fratricide.

Joint Readiness Training Center Improves Force Protection Training

Casey Bain, Joint Fires Integration and Interoperability Team

While monitoring the security of a U.S. forward operating base (FOB), base defense operations center (BDOC) personnel observed an unknown civilian pickup truck that suddenly stopped just outside the FOB's perimeter and started lobbing mortars inside the FOB.

The BDOC crew alertly sounded an acoustic alarm notifying all FOB personnel to take cover. At the same time, the BDOC crew forwarded information about the attack to the brigade tactical operations center, which deployed its quick reaction force and eliminated the threat without any friendly casualties.

This event did not take place in Iraq or Afghanistan; it is part of the training conducted at the Joint Readiness Training Center (JRTC) at Fort Polk, LA. Focused on improving the force protection capabilities of military units preparing to deploy into combat, the JRTC conducts the training with assistance from the U.S. Army's Counter-Rocket, Artillery, and Mortar (C-RAM) Program Office, Huntsville, AL, and the U.S. Joint Forces Command's Joint Fires Integration and Interoperability Team (JFIIT).

"The C-RAM initiative at JRTC has made significant strides in improving the force protection training for Army brigade combat teams [BCTs] as they prepare for eventual deployments to Iraq and Afghanistan," U.S. Navy LCDR Chris Olson, C-RAM project lead at JFIIT, said. "The great training that JRTC and the C-RAM Program Office provide here will continue to lay the foundation for success. This training provides the maneuver commander with another tool to defeat the perimeter threat that we see today in theater."

The Integrated Base Defense System of Systems (IBDSoS), part of the C-RAM program's enhanced force protection capability, integrates multiple systems and sensors to improve situational awareness and provide an audible warning of a potential attack on an FOB.

"IBDSoS provides the FOB commander with an integrated set of capabilities that are designed to protect against and defeat perimeter threats," Mitch Rosiere, senior IBDSoS trainer at the JRTC, said. "IBDSoS is an integral part of C-RAM and provides the ground commander with additional capabilities to help defeat the insurgent threat and prevent loss of life."

The JFIIT, in support of the C-RAM Program Office, is working to improve the integration of IBDSoS into existing joint fires and joint intelligence, surveillance, and reconnaissance (JISR) capabilities to increase force protection at U.S. and coalition FOBs.

"Fully incorporating all the joint assets into IBDSoS training also means improving the ability to provide early warning to personnel located on the FOBs and give forces time to take appropriate actions and defeat this type of irregular warfare threat," LCDR Olson said. "Eventually, we will digitally integrate IBDSoS and C-RAM system information with joint fires and command and control systems. That will greatly improve shared situational awareness among coalition forces and make it easier to defeat FOB threats."

Army SGT Kijan Edwards, BDOC noncommissioned officer in charge from the 3rd BCT, 82nd Airborne Division, Fort Bragg, NC, said, "The IBDSoS training that we've received here has been outstanding. Our ability to immediately get eyes on a potential threat allows us to provide immediate early warning of a potential attack to personnel on the FOB, and that helps us save lives.

“Our ability to integrate joint assets with our own fires capabilities cuts down on the time to gain a positive identification on a threat and that helps us to respond quickly and appropriately,” Edwards said. “IBDSoS provides us with a mission-essential capability that will give our unit an unprecedented level of force protection once we deploy in theater.”

The C-RAM Program Office has been providing IBDSoS support at the JRTC since September 2005. With assistance from the JFIIT, the C-RAM Program Office plans on using current IBDSoS capabilities to enhance joint fires and JISR integration to fully maximize base defense training at the JRTC and other combat training centers.

“IBDSoS training is another opportunity for BCTs to receive realistic and rigorous training that prepares them for their next mission,” Rosiere said. “The goal of IBDSoS training here [at the JRTC] is to provide units with the exact tools and capabilities that they will have once deployed. When maneuver commanders know they can reach out and fully leverage this system, it will increase their force protection and help them save lives. The more units can learn about this system before coming here to train, the better they will be able to leverage its capabilities once deployed in combat.”

Exercise Focuses on Improving Combat Identification for U.S. and Coalition Maneuver Forces

Casey Bain, Joint Fires Integration and Interoperability Team

While providing humanitarian assistance to a war-torn village, a coalition team receives heavy sniper fire from a nearby building where friendly forces were patrolling earlier. Concerned about returning fire in a populated area, the coalition team contacts the U.S. Air Force (USAF) joint terminal attack controller (JTAC) to request close air support.

The JTAC locates the threat and passes the location information to a USAF F-16 overhead. The F-16 pilot receives the threat information, initiates a friendly force location request from a combat identification (CID) server on the ground, confirms no friendly forces are in the targeted area, and neutralizes the threat.

This demonstration of coalition combat identification (CCID) technologies occurred during Bold Quest Plus (BQ+), a two-week advanced concept technology demonstration (ACTD) held in July 2008 at Eglin Air Force Base (AFB), FL. The ACTD focused on improving air-to-ground CID capabilities for Army brigade combat teams, other maneuver forces, and coalition forces by showcasing innovative CCID technologies.

Sponsored by U.S. Joint Forces Command (USJFCOM), BQ+ used work conducted during the Bold Quest exercise at Nellis AFB, NV, and the National Training Center at Fort Irwin, CA, in September 2007.

According to John Miller, USJFCOM's operational manager for BQ+, "The purpose of this demonstration is to help provide warfighters with CID technologies that will maximize their combat effectiveness on today's asymmetric battlefield. We're trying to give our coalition team the tools that will allow them to sort through the dust and fog of war to be faster and more accurate in a gunfight."

USJFCOM's Joint Fires Integration and Interoperability Team (JFIIT) and the 46th Test Wing helped host BQ+. The demonstration focused on testing systems and refining tactics, techniques, and procedures through a variety of air-to-ground CID technologies designed to improve U.S. and coalition capabilities and combat effectiveness.

"The CID server is a perfect example of how we could potentially improve our CID capabilities and combat effectiveness for our coalition team," Bob Summitt, senior analyst, JFIIT, said. "The CID server provides the pilot with an on-demand request capability for friendly force location information. The pilot can initiate a request for friendly location information from the CID server located on the ground and receive real-time situational awareness data in the cockpit where he can quickly verify friendly locations in the area of interest to enable a more efficient response to the ground commander's request for close air support."

More than 600 personnel participated in BQ+, including military units from the United States, Canada, and the United Kingdom.

"The USJFCOM Bold Quest Plus and Eglin Air Force Base team assembled here to conduct this exercise has provided an ideal opportunity for our U.S. and coalition partners to continue their assessment of advanced CID technologies," Jim MacDonald, test engineer, 46th Test Squadron, said. "These technologies could significantly improve our ability to identify friendly objects on the battlefield and help enable quicker shoot–don't shoot decisions that are critical in today's warfight."

Miller added, "We're focused on the tools required by aircrew and ground controllers who coordinate the attack or drop bombs on targets. Ensuring that these technologies are built coalition interoperable will enable them to do that more quickly and effectively … and will, ultimately, result in saving lives."

Solving the Combat Identification Conundrum: The Way Ahead

Gordon White, Joint Fires Integration and Interoperability Team

The quest for fratricide prevention technological solutions continues—and the doctrine, tactics, techniques, and procedures (TTP) and training must evolve with them.

Fratricide is a painful reality with serious consequences for unit morale and cohesion, Soldier retention, and recruiting. Even so, progress in combat identification (CID) has been slow and uneven. It took a long time for the warfighting community to accept that it has a problem and then to accept that a holistic approach to solutions is required. Fortunately, concerted efforts have raised awareness to the necessary level, and the warfighting community is moving forward. For the past 15 years, the Joint Fires Integration and Interoperability Team (JFIIT) and its predecessors have been dedicated to finding ways to reduce friendly fire and improve CID as an inherent part of the joint fires process.

Fratricide has been a fact of conflict documented throughout history, and there is ample evidence to substantiate that recent conflicts are no exception. The Department of Defense and the services maintain databases to track fratricide events because they have such profound costs for the people and units involved. Tragic events serve to increase awareness and sometimes provide the catalyst for action. Because of the associated cost, the services are currently debating where to spend their limited resources. The Army has also conducted a current gap analysis using recent data from the conclusion of major combat operations in Iraq and is placing greater emphasis on solving the air-to-ground mission area. The Army's statistics suggest a realignment of priorities, which is causing concern from many affiliated with the desire to move forward.

The services have plenty of data that substantiates that the highest occurrences of fratricide are still in the ground-to-ground and air-to-ground domains, and they continue to witness occurrences, even post conflict, with lightly armored or dismounted personnel. The ability to conduct effective and accurate CID becomes even more challenging in the current irregular warfare environment, where insurgents blend in with noncombatants and even use them as shields.

Searching for Solutions

Figure 11-1 depicts the evolution of non-cooperative and cooperative CID solutions. To achieve the desired result of reducing potential fratricides, a holistic approach must combine a family of systems (FoS) with training, doctrine, and TTP. While it has been painful to see practical solutions cut for lack of funds, the warfighting community must continually strive to find alternatives and solutions from available technologies. The low-cost combat identification panels (CIPs) and thermal identification panels (TIPs) solutions are going a long way to supplement the identification process, but they are not the final fix, nor are they an effective air-to-ground solution. Several tests conducted by JFIIT and the U.S. Marine Corps have proven CIPs and TIPs are ineffective for the air-to-ground domain.

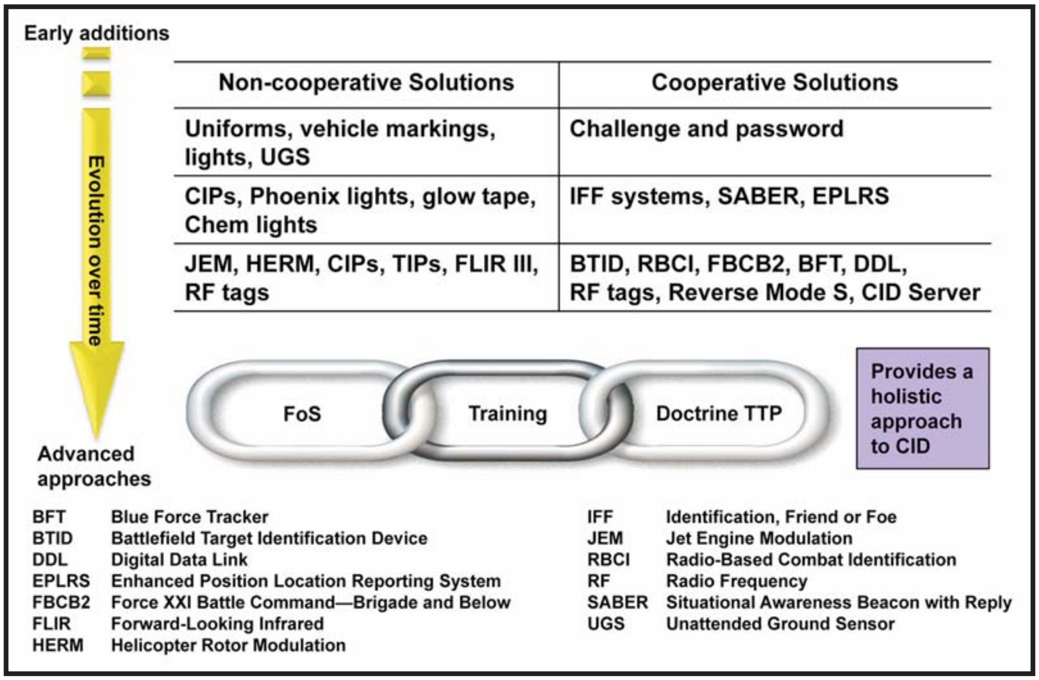


Figure 11-1. Evolution of CID solutions

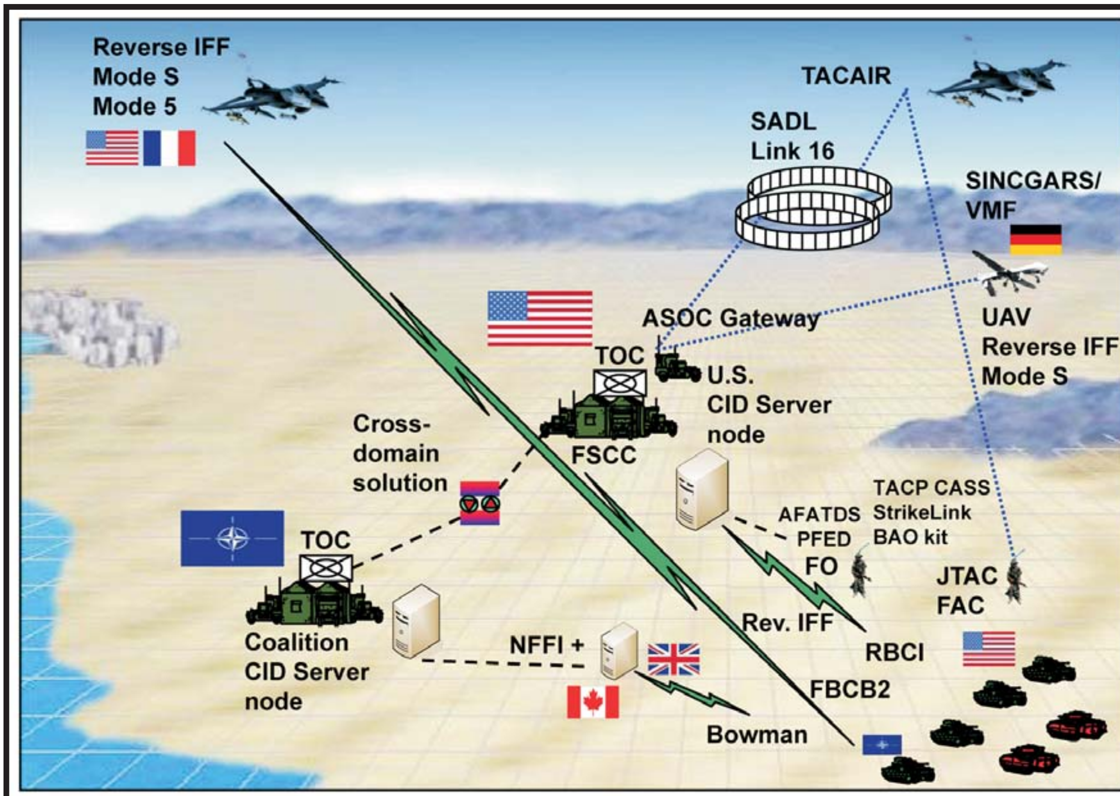
In September 2005, the culminating event for the Advanced Concept Technology Demonstration (ACTD), Exercise Urgent Quest, took place to demonstrate technologies developed to reduce fratricide while enhancing fires. This event was the most ambitious undertaken to date by the U.S. Joint Forces Command acting in concert with the North Atlantic Treaty Organization; Allied Command Transformation; and coalition partners Australia, Canada, Denmark, France, Germany, Italy, Sweden, and the United Kingdom (U.K.). This extraordinary gathering of U.S. and coalition forces examined existing and new and developing CID technologies.

The U.K. hosted Urgent Quest at the Salisbury Plains Training Area near Stonehenge and the city of Salisbury. Army and Marine Corps participants used several CID systems, the principal being the cooperative, millimeter-wave radar, friend identification system known as Battlefield Target Identification Device (BTID). A secondary objective during this exercise was a demonstration of the situational awareness and data sharing capability of BTID's digital data link features. JFIIT led the military utility assessment of these technologies and assessed BTID for its contribution to mission effectiveness, coalition interoperability, friend identification, and engagement decision time. Vendors provided three BTID versions mounted on French, Italian, Swedish, U.K., and U.S. vehicles. Urgent Quest was a tremendous success; the event produced a multitude of CID data and generated a host of findings and potential solutions for the CID conundrum, including radio-based combat identification (RBCI), Joint Combat Identification Marking System, and BTID.

The success of Urgent Quest generated momentum, which resulted in additional resources and an extension to the program that led to Bold Quest in 2007. Bold Quest in 2007 looked at Synthetic Aperture Radar Automatic Target Recognition and Laser Target Imaging Program. The follow-on ACTD event Bold Quest Plus in 2008 assessed the CID server. Bold Quest 2009, currently scheduled for October 2009, will formally assess air-to-ground applications for BTID, RBCI, and the CID server. RBCI coupled with the CID server (or CID services) may hold the most promise as low-cost solutions. The greatest challenge for this approach is the interoperability of sharing information between U.S. and coalition forces. For more details, see Chapter 3 for a related article on the CID server.

During Bold Quest 2009, JFIIT will also be reviewing and possibly collecting data for a French technology that has gained momentum. Referred to as Reverse Mode S or Reverse identification, friend or foe (IFF), it expands the accepted technology of ground-to-air and air-to-air encrypted radar friend interrogation IFF to the air-to-ground mission area. The airborne platform uses its IFF (Mode S in Europe and Mode 5 in the U.S.) capability to interrogate an area on the ground and to view responses by any friends in that area. IFF equipment is widely fielded on fixed-wing, rotary-wing, and Unmanned Aircraft System platforms. This approach also minimizes engineering modification to air platforms and, therefore, saves money. The cost of this technological solution is dependent upon the requirement for transponders on ground vehicles. Additional modeling and experimentation must take place to determine how widely to field such ground transponders and how they would tie in or cooperate with the U.S. military's proposed system of systems. Conceptually, responses to interrogation could also be fed into the CID server and distributed through command and control systems (such as Force XXI battle command—brigade and below) to provide an alternative ground-to-ground target identification functionality similar to BTID; however, Reverse Mode S would likely be a significantly lower cost technological solution.

Figure 11-2 depicts a conceptual CID architecture for how these technologies might work together in a ground-to-ground and air-to-ground environment. It does not depict all the existing nodes of interoperability—simply how these technologies might interface to provide a practical solution.



AFATDS	Advanced Field Artillery Tactical Data System	**FO**	Forward Observer
ASOC	Air Support Operations Center	**FSCC**	Fire Support Coordination Center
BAO	Battlefield Air Operations	**JTAC**	Joint Terminal Attack Controller
FAC	Forward Air Controller	**NFFI**	NATO Friendly Force Information
SINCGARS	Single Channel Ground-to-Air Radio System	**UAV**	Unmanned Aerial Vehicle
VMF	Variable Message Format	**PFED**	Pocket-sized Forward Entry Device

Figure 11-2. Conceptual CID architecture

Not Just Technology

All three links as depicted in Figure 11-1 must be strong—the warfighting community must go beyond the FoS and also review doctrine, TTP, and training. The recent Center for Army Lessons Learned Handbook 08-43, *Fratricide Avoidance*, is a great resource for leaders and should be integrated into unit training. Only after reviewing FoS, doctrine, TTP, and training, as well as integrating new elements of these CID factors, can the warfighting community declare it has applied a holistic approach to solve this CID conundrum.

Because the U.S. will fight future conflicts alongside its allies, coalition partners will wait for the U.S. to define a strategy or way ahead before they spend additional scarce resources. One thing is certain—the U.S. cannot solve or mitigate friendly fire without an unwavering commitment to solve it. Maximizing the interoperability of CID systems into future combat systems and developing the appropriate doctrine, TTP, and training is progress in the right direction.

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CALL produces the following publications on a variety of subjects:

- **Combat Training Center Bulletins, Newsletters, and Trends**
- **Special Editions**
- ***News From the Front***
- **Training Techniques**
- **Handbooks**
- **Initial Impressions Reports**

You may request these publications by using the "Request for Information or a CALL Product" link on the CALL home page.

COMBINED ARMS CENTER (CAC)
Additional Publications and Resources

The CAC home page address is:

<http://www.leavenworth.army.mil>

Battle Command Knowledge System (BCKS)

BCKS supports the online generation, application, management, and exploitation of Army knowledge to foster collaboration among Soldiers and units in order to share expertise and experience, facilitate leader development and intuitive decision making, and support the development of organizations and teams. Find BCKS at <http://usacac.army.mil/CAC/bcks/index.asp>.

Center for Army Leadership (CAL)

CAL plans and programs leadership instruction, doctrine, and research. CAL integrates and synchronizes the Professional Military Education Systems and Civilian Education System. Find CAL products at <http://usacac.army.mil/CAC/CAL/index.asp>.

Combat Studies Institute (CSI)

CSI is a military history "think tank" that produces timely and relevant military history and contemporary operational history. Find CSI products at <http://usacac.army.mil/CAC/csi/RandP/CSIpubs.asp>.

Combined Arms Center-Training: The Road to Deployment

This site provides brigade combat teams, divisions, and support brigades the latest road to deployment information. This site also includes U.S. Forces Command's latest training guidance and most current Battle Command Training Program Counterinsurgency Seminars. Find The Road to Deployment at <http://rtd.leavenworth.army.smil.mil>.

Combined Arms Doctrine Directorate (CADD)

CADD develops, writes, and updates Army doctrine at the corps and division level. Find the doctrinal publications at either the Army Publishing Directorate (APD) <http://www.usapa.army.mil> or the Reimer Digital Library <http://www.adtdl.army.mil>.

Foreign Military Studies Office (FMSO)

FMSO is a research and analysis center on Fort Leavenworth under the TRADOC G-2. FMSO manages and conducts analytical programs focused on emerging and asymmetric threats, regional military and security developments, and other issues that define evolving operational environments around the world. Find FMSO products at <http://fmso.leavenworth.army.mil/recent.htm> or <http://fmso.leavenworth.army.mil/products.htm>.

Military Review (MR)

MR is a refereed journal that provides a forum for original thought and debate on the art and science of land warfare and other issues of current interest to the U.S. Army and the Department of Defense. Find MR at <http://usacac.leavenworth.army.mil/CAC/milreview>.

TRADOC Intelligence Support Activity (TRISA)

TRISA is a field agency of the TRADOC G2 and a tenant organization on Fort Leavenworth. TRISA is responsible for the development of intelligence products to support the policy-making, training, combat development, models, and simulations arenas. Find TRISA Threats at <https://dcsint-threats.leavenworth.army.mil/default.aspx>
(requires AKO password and ID).

United States Army Information Operations Proponent (USAIOP)

USAIOP is responsible for developing and documenting all IO requirements for doctrine, organization, training, materiel, leadership and education, personnel, and facilities; managing the eight personnel lifecycles for officers in the IO functional area; and coordinating and teaching the qualification course for information operations officers. Find USAIOP at <http://usacac.army.mil/CAC/usaiop.asp>.

U.S. Army and Marine Corps Counterinsurgency (COIN) Center

The U.S. Army and Marine Corps COIN Center acts as an advocate and integrator for COIN programs throughout the combined, joint, and interagency arena. Find the U.S. Army/U.S. Marine Corps COIN Center at: <http://usacac.army.mil/cac2/coin/index.asp>.

Support CAC in the exchange of information by telling us about your successes so they may be shared and become Army successes.

Center for Army Lessons Learned

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US Army Combined Arms Center

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