EAGLE ONE

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WEAPONS AND TACTICS INSTRUCTOR COURSE 2-02 LESSONS LEARNED

The intent of the Eagle One Newsletter is to communicate lessons learned from the Weapons and Tactics Instructor course. This newsletter is also published on the MAWTS-1 home page at SIPRNET web site ***http://www.mawts1.usmc.smil.mil***.

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AV-8B FORWARD OPERATING BASE HOT LOAD
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CWO-3 BAILIFF, ORDNANCE DIVISION

During WTI 2-02, the AV-8B and Ordnance Divisions successfully hot loaded ordnance at a Forward Operating Base (FOB) on three separate occasions, both day and night. Per MAWTS-1 request, NAWC China Lake verified that the numerous AV-8B electrical interlocks were sufficient to safely perform reloading procedures with the engine operating, on an aircraft with a fully operational weapon system. Additionally, NAWC China Lake verified the only way to completely isolate the weapon system from electrical power while the engine is operating is to secure the main generator. Upon completion of this study, HQMC authorized MAWTS-1 to use Preload Accessory Suspension Equipment (PASE) to rapid re-arm the AV-8B. The PASE load configuration was an ITER with 3 un-swayed and locked BDU-45's. The ITER and BDU's were strapped to an AERO-74 Cradle. Upon completion of fueling, the aircraft taxied to a designated point in the loading area where aircraft preparation began. Intermediate stations were used since one jet in each section was carrying the Litening II Targeting Pod. Using a SATS loader, both intermediate stations of the AV-8B were loaded simultaneously by two separate loading teams in order to keep the aircraft balanced. CCU-107 CADS were preinstalled in each ITER to mitigate concerns about handling CADS on turning aircraft and to expedite the evolution. Using the intermediate stations served as an advantage for the SATS loader operator. It allowed the operator to work from the side of the aircraft (outboard of the outrigger) vice forward (required if loading inboard stations). Once the aircraft was reloaded, the Ordnance Safety Observer gave the Pilot the signal to secure the generator. Once the generator was secured, the ordnance crew connected the ITER cable (the generator was required to be secured for 15 seconds). Once the generator was turned back on, the Pilot signaled to the crew that the aircraft had successfully re-identified the new load. Expenditure percentage of the hot loads and weapons system re-identification with the generator secured for 15 seconds remains at 100%.

Training the ordnance teams was broken into three phases and was key to overall mission success. The training plan developed by MAWTS-1 allowed the teams to become aware of the numerous hazards related to loading a turning AV-8B, allowed MAWTS-1 to streamline and validate the proposed NAVAIR AV-8B Rapid Rearm Checklist, and prevented any unforeseeable procedural problems with the first time evolution. Phase one was three hours of classroom instruction on procedures and safety (safety/ORM was an all hands effort). Phase two consisted of practice loads on a STATIC AV-8B positioned in the CALA. No CADS were used, procedures were streamlined and all load team movements simulated loading a turning aircraft. Additionally, this gave the ordnance crew a chance to develop their load teams. Phase two continued until all hands were confident. The third phase consisted of the teams performing the evolution in the CALA on a turning AV-8B. Phase three continued until all hands were confident. No CADS were utilized during phase three. The above training plan, coupled with two successful rapid re-armed sections at the FOB allowed the ordnance teams to progress safely into night operations.

Lessons Learned:

1. Initial times for rapid re-arm was 12 minutes per aircraft and were reduced to less than 8 minutes during the first FOB.
2. Optimum turn time is achieved by co-locating the fuel and ordnance loading teams. This allows simultaneous fueling and loading of the section or division.
3. Lighting and signaling plans are needed when moving from day to night operations.
4. Plan for 30 to 45 minutes from recovery to launch per aircraft section.
5. Training cannot be over emphasized.

During WTI 1-03, the MAWTS-1 AV-8B and Ordnance Divisions will continue to hot load in order to validate procedures and implement a NAVAIR checklist based on AV-8B rapid re-arming. MAWTS-1 will continue to explore rapid re-arming procedures and expand to include hot loading of MK 82 HE bombs.

AN/MPQ-64 SENTINEL MOBILE AIR DEFENSE RADAR
MAJ REIMER, C3 DEPARTMENT

Overview: WTI 2-02 introduced the Sentinel Radar into the MACCS integrated air defense system (IADS). The Sentinel radar is a three-dimensional, highly mobile, phased array, system produced by Raytheon. It has built in electronic countermeasures (jam resistance) and has a reduced anti-radiation missile (ARM) vulnerability. The radar is towed behind a HMMWV that carries the required generator making the entire package extremely mobile and completely self-sufficient. Set up time for a crew of two is 15 minutes, teardown 10 minutes. The Sentinel has been selected by the U.S. Army as their next generation tactical air defense sensor. The Army currently has more than 100 Sentinel radars in their inventory.

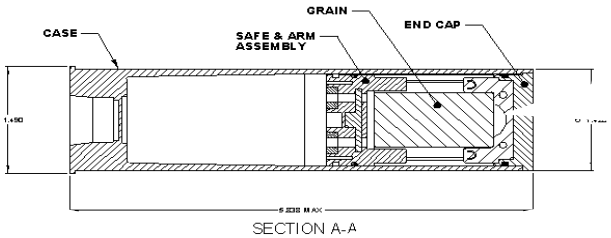
Objectives: MAWTS-1 worked in concert with MACG-38, 3rd LAAD BN as well as Raytheon to conduct an initial evaluation of the Sentinel. Evaluation goals were to develop potential Complementary Low ALT Weapons System (CLAWS) in the areas of slew-to-cue, fratricide warning, target-to-weapons pairing and track correlation. An additional goal was the integration of the Sentinel data into the MACCS recognized air picture (RAP) via the Tactical Air Operations Module (TAOM).

Observations: Sentinel participated in GBAD 1-2, AAW 1-2, OAAW and FINEX 1 evolutions. Conversion of the U.S. Army FDL (FAAD Data Link) messages to match USMC ground based data link (GBDL) message format was accomplished early. Track data information was then broadcast using SINCGARS radios to LAAD teams and LAV/AD vehicles across the battlefield. The sentinel radar offered the Stinger gunners a quality picture not observed with the typical radars associated with LAAD; the Tactical Defense Alert Radar (TDAR) and Continuous Wave Acquisition Radar (CWAR). The Sentinel was able to pick up low flying aircraft up to 45 kilometers away, while keeping the number of false tracks to a minimum. Slew-to-cue with Avenger and LAV/AD was successful with 3D cuing from Sentinel including night operations using the forward looking infrared (FLIR) after cuing from the radar. Integration of the Sentinel data into the RAP resulted in elements of clutter and false tracks. Upon investigation, it was assessed that the update rate of the Sentinel radar was more than the TADIL-B buffer and TAOM software was prepared to receive. Effectively the Sentinel radar would post a track on the first sweep, evaluate it on the second and drop it by the third sweep. While the TAOM would post additional tracks that were not visible on the GBDL link.

Results: During April the Commanding Officer of MAWTS-1 briefed the results of this evaluation to the MACG OAG ESC. The brief addressed Sentinel's potential for tactical applicability especially regarding LAAD and CLAWS. Three dimensional aspect and mobility were outlined as significant enhancements to current systems. Results of the MACG OAG recommendations will be published via separate correspondence.

SM-875 AX/ALE SIMULATOR FLARE
MAJ DOBSON, EA-6B DIVISION, ADT&E DEPARTMENT

During WTI 2-02, MAWTS-1 conducted an informal evaluation of the SM-875AX/ALE training flare. The SM-875AX/ALE Flare Simulator, shown below, is an improvement to the SM-875A/ALE. The improvement reconfigured the original design to enhance visible output. MAWTS-1 instructors in the FA-18 and AV-8B divisions evaluated 42 of these devices to see if they enhanced the pilots' ability to detect them visually as compared to the existing SM-875s. The SM-875AX/ALE will be procured for attrition replacement of the current SM-875A/ALE simulator flares.



SM-875/A SIMULATOR FLARE (ENHANCED)

FA-18

The FA-18 sortie evaluated the flares from perch BFM start parameters. Most of the starts had the attacking aircraft 40 deg off the defender's tail, both aircraft in a left or right hand turn, and within 1.5 nm of one another. The offensive aircraft would obtain a radar lock, then select AIM-9 confirming good tone and seeker head acquisition. After this confirmation, the offensive aircraft would call for flares and observe and listen for feedback. The Results were the same, the new false produces a better visual signature and correct IRCCM tones from the AIM-9, which enhances . No problems were noted in the loading or expending of the SM-875AX.

AV-8B

The AV-8B evaluated the flares on the lead aircraft with the dash two aircraft noting visual presentation as well as LITENING II pod sensor presentation. The lead AV-8B had 21 SM-875AX flares as well as SM-875A flares. The dash two aircraft captured the flare dispensing both electro-optically and with Infrared camera. The digitized video has been forwarded to PMA-272J with a copy of this report.

CONCLUSION

The test flares were a significant improvement over the SM-875A in both the visual arena as well as the 3-5 micron range. These improved training rounds would be a significant improvement to the effectiveness of training due to their improved decoy ability, their improved visual signature, and their compatibility with current systems. Recommend accelerating the replacement of the SM-875A with SM-875AX.

UH-1N BRITE STAR
MAJ WISE, UH-1N DIVISION, ASD DEPARTMENT

During WTI 2-02, the MAWTS-1 hosted Naval Rotary Wing Aircraft Test Squadron, HMX-1 OT and FLIR Systems Inc. in order to finish LASER designation trials on the new UH-1N Navigational Thermal Imaging System-LASER Designator (NTIS-LD). Named BRITE Star, the sensor is an upgrade to the current AN/AAQ-22C (Star SAFIRE) system. The BRITE Star upgrade looks similar in appearance but contains an upgraded payload, to include: 1) LASER Designator, compatible with all current PRFs and future PIM codes; 2) Black and white CCD TV, with matched fields of view to the FLIR; and 3) Eye-safe LASER Rangefinder. An improved detector element, coupled with a 4-Axis stabilized turret, increases the FLIR identification ranges over the Star SAFIRE by about 80-100%.

During the UH-1 specific flight phase, the UH-1N-equpped BRITE Star flew 6 sorties. The first BRITE Star engagement included a successful 3800m AH-1W Hellfire shot, with the BRITE Star designating at a range of 2800m. The second successful designation engagement on the same day was at 4835m for a 4500m Hellfire shot. Both missiles shacked their intended targets.

BRITE Star was also employed during the UH-1N FAC(A) Day to gather FW data points. The BRITE Star designated targets, utilizing TV, in R2507N for a section of AV-8Bs dropping LGTRs. Designation ranges were between 7500m and 8700m, with the AV-8B picking up the spot just inside of the IP at ranges around 3-4nm. The AV-8s dropped one LGTR successfully which landed 80ft from its intended target. The final BRITE Star engagement was in the Iris wash area. BRITE Star was employed on the east side of the wash, identifying targets in the Punch Bowl target area at just under 9km. The UH-1N FAC(A) used the BRITE Star to designate for F/A-18Cs, F/A-18Ds and A-10s dropping LGTRs, GBUs and Mk-76s. The LASER spot tracker-equipped aircraft all picked up the spot and dropped effectively on their targets

The BRITE Star’s ability to identify and designate targets at greater ranges will increase the survivability of the UH-1N and its aircrew and significantly add to the Huey’s effectiveness and lethality. The NTIS-LD BRITE Star can be mounted on the UH-1N and be forward fit to the UH-1Y. This will allow designation for any current and future PGM in production.

CAS IN THE URBAN ENVIRONMENT

MAJOR DAVID BUSSEL, RW OAS SPECIALIST, ADT&E DEPARTMENT
MAJOR RICH JORDAN, UH–1N DIVISION, ASD DEPARTMENT
MAJOR MARK PALMER, FA–18 DIVISION, TACAIR DEPARTMENT

GENERAL

During WTI 2-02, FA-18s, AV-8Bs, AH-1Ws and UH-1Ns performed CAS under terminal control within 300 (RW) and 1000 (FW) meters of a manned observation post under both day and night conditions. Based on the experiences gained from these sorties, several techniques unique to the urban environment are presented for consideration.

Generally, the tactics, techniques and procedures utilized validated those taught in the Urban CAS class during the academics phase. There were a few highlights that brought to light how we might better employ RW and FW aircraft in an urban environment.

RW LESSONS LEARNED

Specifically, during night operations, targets were marked using IR pointers. The ability to overlay an aircraft mounted IR mark over the FACs IR mark greatly increased first round effects on the desired target. Without the aid of IR pointers, confirming target identification became very difficult. In addition, we found that target confirmation, overall, was more difficult during day operations. However, tracers from organic infantry weapons worked well for day operations.

Although not employed during WTI 2-02, based on conclusions from the Urban CAS Assessment, TOW and Hellfire missiles are the preferred weapons in an urban environment due to accuracy and minimized fratricide and collateral damage. However, rockets, 20mm and crew served weapons proved to be a lethal option to utilize as well, if employed correctly. We found that great success was achieved when employing rockets and fixed forward 20mm from AH-1Ws utilizing diving fire profiles from an overhead orbit. However, when utilizing this technique over an urban environment, one must assume a permissive threat (1st generation IR SAM / RPG / small arms / unguided AAA). Specifically, 3000' diving profiles with dive angles ranging from 10 – 30^{0} were utilized. These profiles originated from a 2 – 3 radius kilometer overhead to provide sufficient tracking time with pull offs at 1000'. All overhead work was done by aircraft with operational aircraft survivability equipment, specifically, the ALQ–144 and ALE–39. This technique provided for both successful FAC acquisition and accurate delivery while minimizing overall exposure events. In addition, it was found that dedicated door gun attacks by UH-1Ns were very effective when the ingress was executed at +/- 20–40 degrees off the Forward Line of Troops, allowing the gunners to accurately employ the weapon parallel to the FLOT. In addition, making pulls toward friendly lines further enhanced success. This allowed the target to be engaged for a longer period of time. We also found that if the threat permits, pulling off the target with a lower AOB turn allows the gunner to continue to engage the target without reaching the lower depression limits.

FW LESSONS LEARNED

The overwhelming majority of the misses from the CAS aircraft during WTI 2-02 were long or short, not lateral. This will dictate the utilization of final attack cones that are generally parallel to the forward line of troops. Additionally, expect a small final attack cone (10 degrees) or even a single heading.

The FAC had a greater chance of obtaining a visual on fixed wing aircraft and giving a clearance when CAS aircraft used low to medium altitude attacks. The effects of rockets and guns were more accurate at decreased slant ranges and lower altitudes. Low altitude, low angle attacks helped with target acquisition. We recommend the use of low altitude releases in order to provide a better chance of the FAC acquiring the aircraft and obtaining better effects on target.

In addition, we found that a single rocket or short burst of the gun (under one second) increased the chances of hitting the target while minimizing the effects of short or long misses. For the FA-18, with high rate of fire selected, a one second burst should result in less than 100 rounds and a half second burst with less than 50 rounds. The chances of impacts missing short or long increased as the burst length or number of rockets increased.

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Accurate fires within an urban environment are critical due to the potential proximity of enemy and friendly forces. The utilization of an IR pointer for marking and confirmation, diving fire from an orbit, and carefully constructed run-in geometry relative to friendly positions, proved successful for RW aircraft. In addition, the use of small final attack cones, low altitude releases, and single rocket / short gun burst proved successful for FW aircraft.

As with any mission, the situation will drive tactics, but the above considerations should help improve our lethality in the urban CAS environment.

STATIC HOT TBFDS
CAPT ABRAMS, CH-53 DIVISION, ASD DEPARTMENT

During Operation Anaconda in Afghanistan, the 13th MEU (SOC) executed static-hot refueling with a CH-53E configured with the Tactical Bulk Fuel Delivery System (TBFDS). This was the first time, either in training or real-world operations, that static-hot refueling of rotory wing aircraft was executed at a FARP utilizing the CH-53E with TBFDS. Shortly thereafter, during WTI 2-02 while executing Assault Support Tactics (AST) III, AH-1W and UH-1N helicopters utilized static-hot refueling points off of a CH-53E configured with TBFDS. The ability to "train the way we fight" is critical to our success, although static-hot refueling operations during training has some limitations.

The execution of Static-hot refueling, defined as an aircraft landing at a single point conducting all FARP operations to include: de-arming, refueling, ordnance uploading and arming with the receiving helicopter's rotor head engaged provides a measure of safety and efficiency in the austere environment, especially the severe brown-out conditions that exist in Afghanistan. NAVAIR 00-80T-109 currently states the "minimum safe distance of 300ft" is required for either dearming or arming procedures and refueling operations. The distance requirement stated in paragraph 18.12.4.2.5 is easily achieved utilizing truck refuel and aviation ground support equipment. However, maintaining 300ft separation while maintaining required fuel pressure to the receiving aircraft is unachievable with the CH-53E TBFDS. The minimum safe distance stated takes into consideration a large range of ordnance as well as a wide range of potential hazard class of munitions (K factor). Rather than use the generality of the 300ft minimum distance requirement, the exact distances of specific ordnance was computed utilizing quantity distance tables found in NAVSEA OP 5 Vol. 1 Ammunition and Explosives Ashore, as well as quantity distance formulas for the exact hazard class of munitions. During AST III evolution, skid ordnance included 2.75" inert rockets, 20mm TP ammunition, .50 cal and 7.62. This particular ordnance load requires a 75 ft minimum distance between fuel and aircraft while conducting arming and de-arming procedures, which is easily achieved by the CH-53E TBFDS configuration allowing aircraft to land directly to the fueling point, de-arm, refuel, re-arm and depart. Hot tube loading was not accomplished on this evolution, although it could have been conducted with the 2.75" inert rockets based on the exact minimum safe distance computed. Computing the exact safe distances for the ordnance loads utilized during this evolution, allowed us to conduct this operation during training and better prepare those involved for real-world mission profiles.

Issues to consider:

1. The approach path of the aircraft flying to the site must not over fly the CH-53.
2. The landing points must be clearly marked for day or night landings.
3. Landing direction of points 1 and 2 must take into consideration normal procedures for de-arming and arming with forward firing ordnance.
4. Fuel hoses and nozzles must be removed from the landing environment prior to aircraft approaches and departures.
5. With only two points available, detailed planning is required if more aircraft require fuel during a mission. Utilizing lager points may be necessary to allow aircraft to hold on deck when required.
6. With Robertson tanks installed in the cabin of a CH-53E, little room is available for ordnance, ordnance personnel and zone security personnel. To support multiple sorties to an objective area from a TBFDS site, additional aircraft may be required to carry ordnance and Marines.
7. Operational commanders must weigh the risk of utilizing distances other than those specified in NAVSEA OP 5 Vol. 1 when conducting contingency operations.

Conducting a static hot TBFDS operation is safely executable during training and is a reality in combat operations as evidenced in OEF, Operation Anaconda.

LARGE AREA TRACKING RANGE (LATR) AND NEW COOPERATIVE TRACKING SYSTEM (NCTS)

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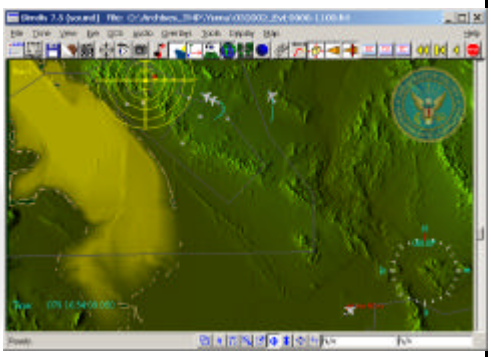
CAPT BAGGETT, UH-1N DIVISION, ASD DEPARTMENT
CAPT NOTHELFER, EA-6B DIVISION, TACAIR DEPARTMENT

The MAWTS-1 AV-8B, EA-6B, and UH-1N Divisions employed the Large Area Tracking Range (LATR) and New Cooperative Tracking System (NCTS) during WTI 2-02 to assess their utility as training aids.

LATR is an unclassified, GPS-based aircraft tracking system that has the potential to offer many of the training enhancing characteristics of TACTS. NCTS is the software that enables the recording of data (via a desktop computer linked to an antenna) transmitted by aircraft instrumentation pods. The systems may be employed in any airspace as long as the ground station can maintain line of sight digital communication with one of the mission pods. Additionally, since one LATR pod can relay data from others to the ground station, low altitude coverage may be significantly improved when compared to TACTS, as long as a "high bird" maintains connectivity with the ground station. LATR systems can be configured for carriage in external pods identical to TACTS pods or as packages for carriage in the cabins of assault helicopters, cargo aircraft, and surface vehicles.



The AV-8B and EA-6B Divisions utilized the LATR system during their Electronic Warfare in support of Close Air Support (EWCAS) mission in the R2507 complex. The EWCAS sortie provides AV-8B prospective Weapons and Tactics Instructors (PWTIs) their first opportunity to deliver live ordnance during the WTI course, while demonstrating the tactical utility of the EWCAS techniques employed by EA-6Bs against RF surface-to-air missile threats. Connectivity with the LATR ground station, located over 45 miles away at MCAS Yuma, was maintained by the participating EA-6B a crucial link during AV-8B low-altitude attacks. This relay capability facilitated accurate mission reconstruction during the debrief. EA-6B and AV-8B PWTIs were able to draw out the benefits of on-axis EA-6B alignment with fixed-wing strikers conducting CAS in a high surface-to-air threat environment. The two most important drawbacks to the use of LATR this class concerned connectivity issues for the debrief. First, the NCTS was not integrated with the SAM threat simulator used in the sortie, so it was unable to graphically demonstrate SAM shots taken at aircraft. The ability to re-create SAM engagements (3-dimensionally) during CAS attacks would have been very powerful. Another limitation of the system is the inability to replay communications. Second, the ability to record voice communications, a significant component of the debriefing process, was limited.

UH-1N aircraft carried LATR pods during Defensive Maneuvers training versus F-5s from VMFT-401. Sorties were conducted in the Moving Sands area of R2301W, with single UH-1Ns operating at 100 feet above ground level (AGL) against single F-5s operating no lower than 500 feet AGL. It was expected that the F-5 mounted pods would relay data from the UH-1Ns to the NCTS ground station, set up 20 miles away at MCAS Yuma, with an antenna height of approximately 25 feet. Data from the engagements was reviewed at the end of the day in several formats with the assistance of a system operator. A "zoomable," three-dimensional replay of the line numbers from an offset perspective allowed pilots to observe UH-1N reactions to bandit maneuvers pre-merge, in the merge, and post-merge. This has significant potential as a debriefing tool. The three-dimensional viewpoint could be adjusted to any point in space, to include the perspective from inside the cockpit. A two-dimensional "god's eye" overhead view also showed utility for monitoring general mission progress. Of note, a LATR package was operated on a vehicle collocated with a ground-based emitter, demonstrating the ability to track a surface vehicle. A significant deficiency noted during the UH-1N/F-5 evolutions was the current inability of NCTS to record aircraft pitch, roll, and yaw data, resulting in degraded three-dimensional reconstructions of engagements. Efforts are underway to upgrade NCTS software to capture this data, or to create a desktop computer based version of the original, more capable LATR tracking software. The other deficiency noted was that the F-5 fuselage occasionally masked the pod antenna during maneuvering,

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interrupting data transmission (during which time the display would show predicted movement based on data received prior to the interruption). These gaps could have been eliminated if additional aircraft had been airborne to relay the data.

Overall, the system performed well. LATR and NCTS showed particular potential for enhancing fixed wing training in areas where TACTS coverage does not exist, to include civilian airspace and urban centers, and might be utilized by units deployed aboard ship or where TACTS ranges are unavailable. The ability to conduct three-dimensional replays of helicopter versus fixed-wing engagements could also enhance training. The system's greatest potential, perhaps, is as a real-time mission monitoring system and debriefing tool for large exercises involving multiple types of airborne and surface participants.

KRILL LAMP ELECTRONIC LIGHTSTICK IN SUPPORT OF MARINE AIR TRAFFIC CONTROL MOBILE TEAM (MMT) QUALITATIVE ASSESSMENT
GYSGT FRAZIER, MMT DIVISION, C3 DEPARTMENT

The following is an unclassified executive summary of observations of the Krill Lamp Electronic Lightstick ISO MATC MMT qualitative assessment conducted by MAWTS-1 during WTI 2-02. The final results of this demonstration will be released in an unclassified format. To obtain a copy of the final report, please refer to the contact information at the end of the article.

During WTI 2-02, Marine Air Traffic Control Mobile Team (MMT) incorporated and conducted a Qualitative Assessment of the Krill Lamp Electronic Lightstick in support of Tactical Landing Zones, Helicopter Landing Zones, and Forward Arming and Refueling Points. The Krill Lamp is a battery operated suitable substitute for the Cyalume Chemlights. The Krill Lamp operates on two "AA" batteries. It has the capability to withstand the rigors of the operational environment. The Krill Lamp is manufactured by the Kriana Corporation and comes in many different colors and an Infrared version. The Lamps are built in both a 360 degree and 180 degree directional versions. The Lamp has the ability to be turned on and off allowing the operator to remain more tactical and extending battery life cycle. The Original Krill Lamp and the Extreme Krill Lamp, which is a brighter version of the original, were tested during WTI 2-02. The testing of the Krill Lamp was conducted in two stages; NITE lab testing for overall battery life and luminance, and operational testing with personnel and

aircraft. The average life cycle for a Krill Lamp operating on two "AA" batteries is 70 hours which is 4 ½ times longer than the Cyalume life cycle. Initial results also concluded that the intensity of the Krill Lamp was not as bright as the Cyalume Chemlight upon initial activation, but the Krill Lamp was capable of holding a steady level for a longer period of time. Results of these tests are contained in the Qualitative Assessment conducted by MAWTS-1 and will be published in June.

Operationally the Krill Lamp is a good tool for marking personnel and equipment within a landing zone and could be used for aircraft landing point markings in a sustained operation. The Cyalume Chemlight would still be the choice for marking aircraft landing points in a rapid response short duration operation. Pilots who utilized the Krill Lamp within the cockpit noted the utility of the device was excellent and suited them better than the Cyalume Chemlight due to its capability to turn it on and off and its extended life. The aircrew did note that they would like to test the 180 degree directional version of the Krill Lamp vice the 360 degree version.

Additional testing of the Krill Lamp will occur during WTI 1-03. The initial results support the assumption of a total cost savings by using the Krill Lamp vice Cyalume Chemlights. All results of testing will be published in the Qualitative Assessment conducted by MAWTS-1. This report will be available in June 2002 on the MAWTS-1 webpage. At the following address: http://www.mawts1.usmc.mil

USMC TTPS FOR NIGHT AND ALL WEATHER CAS
MAJ MCPHILLIPS, AV-8B DIVISION, ADT&E DEPARTMENT

During WTI 2-02, MAWTS-1 GFACs controlled CAS attacks using the USMC CAS TTPs for JDAM. (MAWTS ONE 041530Z JAN 02 INTERIM USMC TTPS FOR JDAM). Attacks were conducted to validate these TTPs when dropping unguided ordinance on GPS resolved coordinates. Ordnance expended consisted of inert and live GP bombs up to 1000 pounds and one GBU-12. Attacks took place day and night using AV8B and FA-18 GPS equipped aircraft on targets that ranged from 1000 to 4950 meters from friendly positions. The aircraft used the GPS coupled automatic delivery mode from 6000-16000' AGL. Target locations were derived primarily by the ACASS system, with an integrated MK-7 laser range finder. In other cases target location was derived by locating the FACs position with GPS , measuring range to target with a MULE, and azimuth with a compass. This bearing and range would then be converted on the GPS to produce a target location.

The aircrew must confirm the target location sent by the FAC. In doing so, we discovered that the F/A-18 may round the fifth digit in the Northing and Easting components of the 10-digit grid. This caused some concern because coordinates being read back were not exactly what the FAC sent and the effect of the rounding may add a small component of TLE. Both factors are considered insignificant. The FACs that used the digital system to derive and send target location noted that workload was low to moderate, and consistency of targeting was good. If target location was being derived using a compass and MULE, workload was high because multiple verifications of target location were required. Generally, this was the least accurate and most time-consuming method employed.

These procedures proved effective and reliable using unguided munitions, day or night, and in non-visual situations. The major issue with this type of CAS is the accuracy of the target coordinates. While the aircraft are very accurate using GPS as a targeting solution, the GFAC equipment currently available is incapable of providing an accurate location at longer ranges. The target location error (TLE) induced by the FAC's target locating equipment or method could be large, and ranged from 50 feet with the ACASS, to 150 meters using the MULE and compass technique described above. In both cases, as range increased so did the error. Due to this error, it is recommended that multiple weapons per target are employed and careful attention is given to the attack's geometry and friendly locations. Although TLE exists in the digital systems, their use is recommended during this type of CAS because of the consistency, accuracy, and speed with which a target can be located and attacked. The procedures used are listed below.

TYPE II CAS PROCEDURES

1. Confirm Type II in effect at check in.
   FAC " Razor 51 this 2W7 standby for your 9-line Type II in effect"
   Aircrew "Razor 51 Type II in effect MK-83"
2. Receive 9-Line Briefing.
3. FAC requests your read back of line 4 and 6
   "Razor confirms Line 4-450, Line 6-1234567890"
   FAC responds "Read back correct"
4. FAC sends Remarks and TOT.
5. Confirm TOT.
6. Validate target location as correct.
   Examples: a) Plot TGT Loc. On 1:50:000
   b) Assess UTMB/UTMR data
   c) Assess Friendly HUD symbology
   d) Assess Offset and friendly symbology and Digital Map
   e) TPod/IR marker "Request my mark your correction"
7. Transmit System check to FAC
   "2W7, Razor 51 system check Line 4-450 Line 6-PT 1234567890"
   <u>Ensure that the data being transmitted is the target location as displayed on the DATA sub-level page.</u>
8. Report "Pushing"
9. FAC sends "Cleared Hot"
   May receive "Cleared Hot" after system check.
   The aircrew <u>may not</u> slew a GPS systems designation off the FAC transmitted location.

(Continued from page 9)

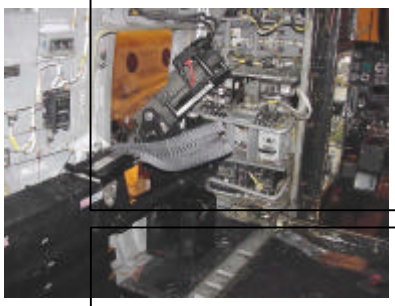
10. Aircrew transmit "IN" when maneuvering for weapons solution .
    For medium alt level=1nm prior to release
    For dive deliveries just prior to RIP
11. Report weapons released.
    "Razor 51 off south 6 away"

Note: AV8s may send and receive all data digitally.

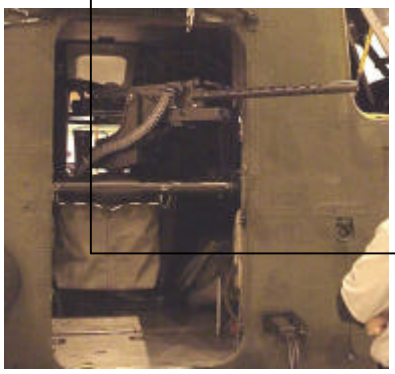
M3M .50 CALIBER CREW SERVED MACHINE GUN QUALITATIVE ASSESSMENT
CAPT BAGGETT, UH-1N DIVISION, ADT&E DEPARTMENT
GYSGT HAMMER, CH-53 CREWCHIEF DIVISION, ASD DEPARTMENT

The following is an unclassified executive summary of observations from the M3M .50 caliber crew served machine gun qualitative assessment conducted by MAWTS-1 during WTI 2-02. The final results of this demonstration will be released in an unclassified format. To obtain a copy of the final report, please refer to the contact information at the end of the article.

Mission Needs Statement (MNS) AAS 34.2 identified the need for an assault support helicopter defensive armament system capable of countering current and predicted threats. The Marine Corps Assault Support (AS) Operational Advisory Group (OAG) has repeatedly identified the need for a replacement for the current helicopter .50 caliber crew-served weapons, the XM-218 and GAU-16, consistently listing this requirement as a top five priority for the community. Fabrique Nationale Herstal (FNH) has developed a high rate of fire, single barrel .50 caliber machine gun that appears to offer several improvements over similar currently fielded weapons, and is a potential replacement for the XM-218 and GAU-16. The system is designated the M3M-MK2, and consists of three major elements: the weapon (M3M), the Medium Pintle Head (MPH) shock absorbing cradle, and the Medium Window Pintle Connection (MWPC) or Medium External Pintle Connection (MEPC) that attaches the system to the airframe. A Qualitative Assessment (QA) conducted during WTI 1-02 indicated that the M3M system provided effective suppressive and destructive fires when employed aboard the UH-1N.



The WTI 2-02 QA examined M3M system effectiveness and suitability when employment aboard the CH-46E and CH-53E, as well as the effectiveness of an increased capacity ammunition supply system aboard the UH-1N. A total of 35,000 rounds were fired through eighteen M3M systems by WTI students and MAWTS-1 instructors. Performance was assessed primarily through qualitative comparison to currently fielded .50 caliber crew-served weapon systems. M3M characteristics were also assessed in comparison to constraints set forth in the MNS for the common assault support defensive armament system.



CH-46E assessment systems were configured for employment from the port side weapon station and included a 600 round ammunition canister that mounted to the floorboards to the left of the window and provided ammunition to the weapon via a flexible feed chute. Questionnaire responses indicated that the M3M system was more stable than the current XM-218 system, and transmitted significantly less recoil force to the operator and airframe, further increasing gunner accuracy. The major deficiency noted was the size and weight of the MPH, MWPC, and ammunition canister (approximately 200 pounds more than the XM-218 and associated hardware). Aircrew found the M3M system awkward to install and difficult to traverse at airspeeds over 90 knots due to aerodynamic forces on the weapon and MPH. Overall, operator responses indicated that the M3M, with minor modifications, could be employed on the CH-46E with greater effectiveness than the XM-218.

(Continued from page 10)

CH-53E assessment systems were configured for employment from the starboard side weapon station and utilized the 100 round ammunition canister system that is integral to the MPH. Initial sorties indicated that the weapon could not be effectively employed at airspeeds above 40 knots due to aerodynamic forces on the system. Airflow also pulled rounds from the ammunition canister, leading to malfunctions and potential hazards to operators and the aircraft. Operators indicated that, in addition to the weapon sitting too far into the wind stream, the mount itself was excessively large, negatively impacting aircrew performance of lookout responsibilities and obstructing emergency egress.

UH-1N assessment systems were configured for employment from the port side of the aircraft utilizing the MEPC in place of the standard Defensive Armament Subsystem (DAS), and included a 600 round ammunition canister that was mounted to the aft wall of the cabin, providing ammunition to the weapon via a flexible feed chute. Because the WTI 1-02 QA thoroughly examined the characteristics of the M3M and MPH, primary focus of this QA with respect to the UH-1N was the effectiveness of the 600 round canister. Operators indicated that the large magazine provided ample ammunition supply and eliminated previously identified deficiencies of the 100 round canister system integral to the MPH. The major deficiencies noted were overall system weight and the excessive amount of feed chute required to carry ammunition from the canister to the weapon throughout its entire range of traverse, which inhibited operator movement when the chute was not extended to full length.

The following major conclusions and recommendations were reached:

1. The M3M can be effectively employed aboard the CH-46E and UH-1N under tactical conditions to provide suppressive and destructive fires.
2. The M3M can not be effectively employed in the current configuration aboard the CH-53E under tactical conditions due to excessive aerodynamic loads on the system at standard operational airspeeds.
3. Significant deficiencies identified by all communities were primarily related to mount design and included excessive size, weight, and aerodynamic loads.
4. The M3M satisfies the majority of constraints set forth in the MNS for a common assault support defensive armament system. The system could be modified to meet several constraints that it currently does not satisfy. Some constraints may be unattainable with the M3M, specifically the requirement for a selectable rate of fire and the option to operate crew-served or fixed-forward, or in a turreted configuration.
5. The suitability of the M3M must be examined in a more comprehensive manner to determine whether the system can be maintained and logistically supported in the current USMC maintenance concept. The increased complexity of the M3M system in comparison to current weapons may present significant challenges to assault support aircrew, maintainers, and the established supply system.

MAWTS-1 will to continue working with the Marine Corps Warfighting Laboratory, Naval Air Systems Command, and FNH to assess the M3M during WTI 1-03. Current plans are to assess the M3M on the starboard side of the CH-46E and on the UH-1N utilizing a mount that is compatible with the Improved DAS. Further assessment of the M3M on the CH-53E is dependent upon significant redesign of the mounts for that aircraft. It is expected that in fiscal year 2003, PMA-242 will assume program management responsibilities for acquisition of a common assault support defensive armament system.

LANDING ZONE CLEAR BY FIRE CONSIDERATIONS FOR ESCORT HELICOPTERS

MAJ WATKINS, AH-1W DIVISION, ASD DEPARTMENT
MAJ HACKETT, AH-1W DIVISION, ASD DEPARTMENT

Since the end of the Vietnam War, the use of escort helicopters to clear a landing zone (LZ) by fire has become something of a lost art. There are many reasons for this, but probably the foremost reason is that allocations of training ordnance do not support the use of rockets, 20mm, and crew served weapons ammunition for this purpose. Most likely, the ordnance allocated to squadrons each year for training is used for higher priority training objectives such as offensive air support missions and pilot/aircrew proficiency. As a result, training to clear LZs by fire has been largely overlooked by escort aircrews. However, *Clear the LZ by Fire* is still one of the six missions of escort helicopters and in light of recent events in Afghanistan, it is a mission that needs to be trained for. During WTI 2-02, AH-1W and UH-1N students had the opportunity to conduct live clear by fire missions during the Assault Support Tactics (AST) and final exercise (FINEX) phases of the class. Many key learning points were brought out during the planning and execution of these missions. What follows is a summary of the key considerations for clearing an LZ by fire based on the lessons learned from WTI 2-02.

First and foremost, escort aircrews must understand what is trying to be accomplished when clearing by fire. All escorts are prepared to engage known targets in the LZ and neutralize these targets with onboard weapon systems or supporting arms. The primary purpose of clear by fire is to ensure that *likely and suspected* threats in the LZ have been neutralized prior to the assault aircraft landing. The primary types of threats to be neutralized as a result of a clear by fire mission are such targets as crew-served weapons, ambush sites, enemy personnel in concealed positions, and enemy observers/observation posts. In short, we want to ensure that no enemy position in or near the LZ can interfere with either the assault helicopters inbound to the LZ or the Marines once they are on the deck. Clearing the LZ by fire does not guarantee that all targets will be neutralized, but it greatly increases the chances that all hidden targets will be neutralized. If timed properly (ideally 2-5min prior to the first assault wave touching down in the LZ), the shock and psychological effect on enemy personnel in or near the LZ may be enough to prevent their interference with the insert.

As with any other escort or OAS mission, clear by fire operations should be planned in detail to the maximum extent possible given the constraints of time and manpower. The planning effort must always begin in the objective area. The HUC, EFL, and AFL must conduct the process of LZ selection together. Too often LZ selection is left solely to the AFL and HUC. The EFL can bring escort, fire support, and force protection considerations out that might otherwise be overlooked. While LZs ultimately must be selected on the basis of their ability to support the GCE scheme of maneuver, thought must be given to the vulnerability and supportability of that LZ for pre-, post-, and landing fires. EFLs can use IPB techniques to highlight potential threat locations and courses of actions once the LZs have been selected. Focus should be given not only to the LZ itself, but also to any areas from which the enemy might directly affect that LZ. An example might be surrounding high ground that could provide potential RPG and mortar positions or a base of fire. Consideration might be given to sanitizing tree lines, and any natural depressions that might conceal an enemy force. Once the threat axes have been identified, the EFL can focus on how best to address those areas, be it through visual observation, sensor sweep, clear by fire, or a combination of methods. If clear by fire is an option, the EFL must analyze his asset and ordnance availability relative to the perceived threat, then develop a plan to methodically and expeditiously clear that LZ.

Second, it must be realized that the use of escorts to clear the LZ by fire should only be done when there is not another capable supporting arms asset available to do the job. Artillery, mortars, naval gunfire, and fixed wing fires can all be used very effectively to clear the LZ by fire. The amount of ordnance carried by escort helicopters is limited. Escort helicopters must have enough ordnance onboard to neutralize not only the threats in and around the LZ, but also to protect the Marines and assault helicopters once on the deck. As a result, the escort flight leader must take the available ordnance from all supporting arms into consideration when deciding whether or not to clear the LZ by fire.

(Continued from page 12)

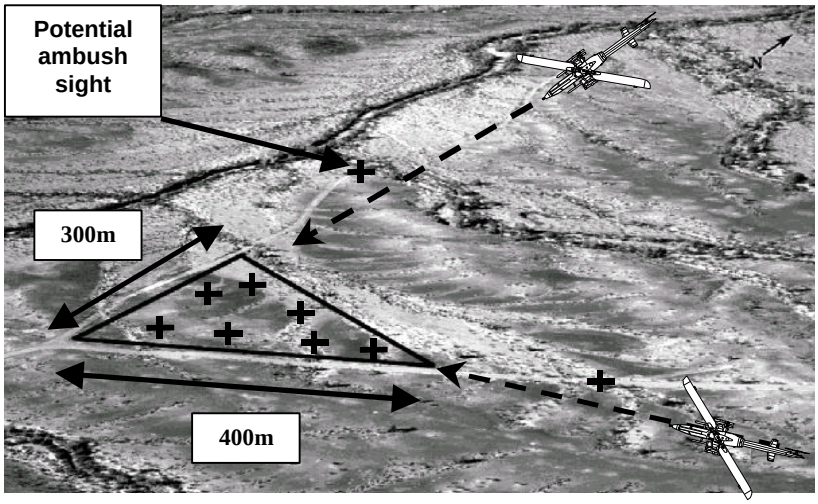
Third, the EFL must make the proper weapons-to-target match when planning to clear the LZ by fire. Not only must the EFL consider the effect on the enemy, but he must also consider the effects of expended ordnance on the friendly forces once in the LZ. As a result, dud-producing ordnance (ICM, cluster munitions, etc.) must not be used. Also, ordnance that is likely to create subsequent fires (WP/RP) should be avoided in order to prevent interference with the assault flight on short final to the zone (especially during NVG conditions). Considering the threats we are attempting to target when clearing the LZ by fire, and considering the effects on friendlies, the best choice for escort helicopter delivered ordnance is a combination of high-explosive (HE) rockets, flechette rockets, 20mm, and crew served weapons. When used together, these types of ordnance are complementary and very effective against the types of targets we are concerned with. When planning for fixed wing delivered ordnance, HE bombs or rockets, and Napalm (if available) should be employed. Likewise, artillery, mortar, and naval gunfire should employ HE rounds.

Consideration must not only be given to the types of ordnance selected, but how best to employ combinations of those munitions to achieve the maximum effect. An effective technique used during the Vietnam War was to have fixed-wing aircraft drop HE bombs on the LZ to shock and disorient the enemy. Napalm was then dropped to neutralize those personnel. These "shake and bake" missions are prime examples of the use of combinations of fixed-wing ordnance to clear an LZ by fire. Similar tactics were found to be effective during Operation Enduring Freedom in Afghanistan. HE bombs dropped on or near enemy positions caused severe effects on those personnel forcing them from their concealed positions. A second pass using HE rockets or flechette was then used to neutralize the exposed enemy personnel.

Next, the EFL must plan for the delivery of fires to provide adequate coverage of the LZ and likely enemy positions near the LZ. The key here is to methodically place ordnance to cover the likely and suspected enemy positions rather than randomly throw ordnance into the center of the LZ. A good technique for pre-planned missions is to develop aim points based on a map/LZ photo study. By taking into consideration the lethal fragmentation pattern of the ordnance to be delivered, the size of the LZ, and suspected or likely enemy positions, pre-planned aim points will ensure adequate coverage. If time allows, aim points can be loaded into the mission data loader in the aircraft for even greater accuracy. However, many escort missions are hasty in nature, i.e., there is not time to develop pre-planned aim points. In such a case, it will be important for the EFL to determine aim points based on the initial sensor sweep of the LZ. Once aim points have been determined, the EFL will then divide up the LZ into sectors and provide an attack brief to his flight. The EFL should pass an attack pattern and primary aim points and/or sectors to each wingman to concentrate their fires on to ensure adequate coverage.

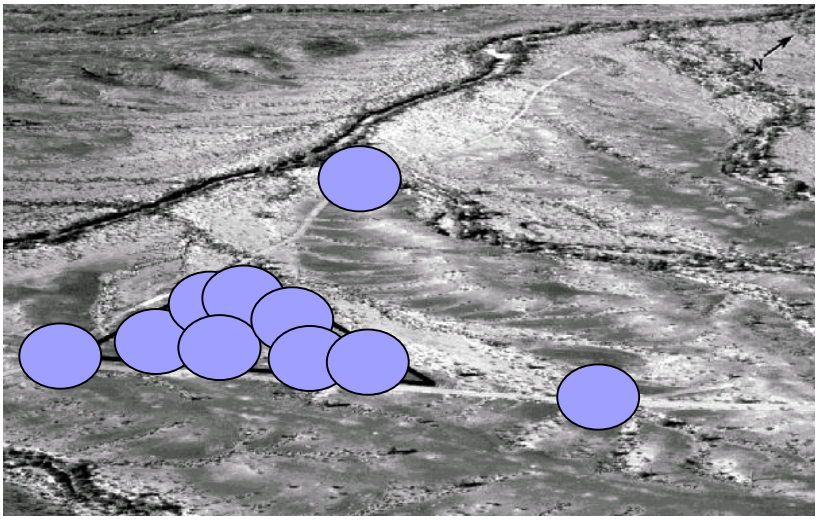
Whether the clear by fire mission is pre-planned or immediate, the EFL will need to ensure that the attack pattern chosen for the delivery of ordnance provides the greatest chance for adequate coverage. The long axis of the LZ should coincide with at least one of the escort helicopter's attack heading when delivering ordnance. The attack profile should include at least a short pop to a shallow dive to increase the accuracy of the ordnance delivery for rockets. The attack patterns should be set up to complete the clear by fire in no more than two passes on the LZ and the ordnance delivery should be complete no later than two minutes prior to the assault aircraft touching down in the LZ. Two minutes should ensure that all fragments have settled prior to the insert and should ensure that the effects of the fires are still fresh on any potential threats while the insert is taking place. It is vital that the EFL know the location of all friendlies in or near the LZ (i.e. R & S assets) prior to delivering ordnance and that escort fires are properly denconflicted. If at all possible, R & S/STA teams should be informed of the plan to clear the LZ by fire. The following pictures illustrate an example of the optimum coverage of escort ordnance to clear an LZ by fire:

(Continued from page 13)



Attack

+ Aim Point



Relative coverage of 2.75" Flechette Rocket

Note from the above pictures that this represents only one type of ordnance: flechette rockets. Ideally, a combination of flechette rockets, HE rockets, 20mm, and crew-served weapons would be used to maximize the effects of all fires. It is imperative that any clear by fire mission is properly coordinated with all key players (HUC, AFL, AMC, FSC, and R &S). Clear by fire missions can be written into unit SOP to reduce the amount of coordination that needs to take place. However, be cautious that clearing the LZ by fire does not become the sole focus of the EFL. There are plenty of situations where there is not the time to clear by fire or the threat does not require such actions. In short, do it if the tactical situation calls for it and don't forget your primary mission of protecting the assault support package.

(Continued from page 14)

To sum up, here are the key points to consider when planning to clear the LZ by fire:

1. Target known, suspected, and likely threat positions.
2. Use another fire support asset if available and capable.
3. Ensure there is adequate ordnance to complete the clear by fire and provide protection to the assault helicopters as well as the Marines on the deck.
4. Select aim points based on the size of the LZ, likely and suspected threat locations, and ordnance effects.
5. Attack patterns should conform to normal delivery profiles and should be set up to ensure the long axis of the LZ coincides with at least one escort helicopter attack axis.
6. Strive to have the clear by fire mission complete within two passes on the LZ and no later than 2 minutes prior to the assault package landing in the LZ.
7. Clearing the LZ by fire does not guarantee that all targets will be neutralized, but it greatly increases the chances that concealed enemy positions will be unable to influence the insert and actions of the Marines on the deck.

IMPLEMENTATION OF TAWS 2.4/NOWS 6.2/AREPS 2.1
CAPT BOHANNON, AGS DIVISION, WX DEPARTMENT

WTI 2-02 saw the implementation of the latest upgrade build in TAWS 2.4, (Target Acquisition Weather Software), NOWS 6.2, (Night Vision Goggles Weather Software), and AREPS 2.1 (Atmospheric Refractive Electromagnetic Prediction Software). The primary purpose of the TAWS 2.4 software is to provide a performance prediction of the maximum effective range of aircraft weapon sensors in a given environment. NOWS 6.2 software is closely related to TAWS 2.4 in that it provides a range capability of night vision devices against various targets in a given environment. NOWS 6.2 software also provides range capabilities of enemy night vision devices. AREPS 2.1 provides a capability that gives the warfighter information as to how both friendly and threat platforms would perform in a given environment. The meteorological environment is a major consideration in how effectively we can employ the sensors of our weapons systems. The requirement to effectively integrate this ware into the WTI tactical scenario was paramount in that it provided personnel with a unique capability in receiving a performance prediction of weapon sensors.

WTI 2-02 Employment

The above-mentioned software was effectively integrated into both the planning and execution phase of WTI 2-02. The primary goal was to provide the aviation community with the best performance prediction ranges for the assets employed against various targets. Overall, the software provided excellent to satisfactory range predictions. Weather was not a factor during the course since flying conditions were excellent 99.0 percent of the time. The software was integrated into the tactical scenario during the WTI 2-02 in a variety of scenarios. Real time performance predictions were provided, however some deficiencies were noted.

1. TAWS 2.4 had trouble with FLIR systems in the narrow field of view.
2. NOWS 6.2 on several occasions provided unrealistic distance for ANVIS 9.
3. APRES 2.1 preformed well with no deficiencies.

WTI 2-02 Data Points

A number of data points were collected during WTI 2-02. Some of the specifics include:

1. TAWS 2.4 should be used as a planning tool only. Aviators should not expect exact detection ranges when the programs consider 50 percent detection only.
2. TAWS 2.4 provided unrealistic FLIR detection ranges for the F-18 FLIR, AV8B FLIR, and NTS FLIR in the narrow field of view. Until the software in corrected and upgraded, it is suggested that the narrow field of view not be used.

(Continued from page 15)

3. TAWS 2.4 presented a problem with the system default when using FA-18 LTDR. When using mode 1 to compute the receiver range, the final product yielded the incorrect designator range that in turn provided the incorrect output range required. It is a default parameter error since 4.1 miles is considered each time. This problem was also noted in the 2.3 build.
4. NOWS 6.2 consistently provided greater view ranges for the ANVIS 9 in comparison to the PVS-5A NVG system.
5. AREPS 2.1 provided realistic atmospheric views as to the state of the atmosphere.
6. METOC personnel identified the need for two additional sensors for the TAWS program. TAWS 2.4 does not support sensor systems for the ATARS or the UH-1N Brightstar FLIR systems. These sensors will be included into the next build for the TAWS program. Both sensors are to be used during WTI 1-03.
7. MAWTS-1 personnel have contacted NRL (Naval Research Lab) and other agencies connected with the development of the above mentioned software, and will continue to work with agencies to ensure requested sensors are added into the software database.

METOC LEAD

Expanded employment of the TAWS 2.4, NOWS 6.2, and AREPS 2.1 is anticipated for WTI 1-03. All inquiries, recommendations, and suggestions can be directed to:

-Captain D. L. Bohannon AGS Weather Officer (X2534)

MAWTS-1 SUBJECT MATTER EXPERTS
DSN (269-XXXX) COM (928) 269-XXXX

SUBJECT	P.O.C.	EXT
RF SAMS:	Capt Suggs	2643
IR SAMS:	Capt Platz	3469
AAA Threat:	Maj Abrams	2968
F/W Threat:	Maj Antonio	2024
R/W Threat:	Maj Watkins	2967
Surface to Surface:	Capt Zuber	3359
UAV Threat:	Capt Zuber	3359
Threat IR AAMs:	Maj Wadsworth	3668
Threat RF AAMs:	Maj Pappas	2930
TOW:	Maj McKay	3361
Hellfire:	Maj Watkins	2967
HARM:	Maj Antonio	2024
JDAM/JSOW:	Maj Rowell	2276
Maverick:	Capt Huber	2752
LGBs:	Maj Palmer	2261
Cluster Munitions:	Maj Rowell	2276
Conventional Ord:	Capt Huber	2752
Reactive Wpns:	Capt Huber	2752
Fuzes:	Maj Huff	5302
AIM-9:	Maj Wadsworth	3668
	Maj Hackett	3591
AIM-7:	Maj Boyles	6025
AIM-120:	Maj Palmer	2261
M61A1/2:	Maj Reed	5303
Rockets:	Maj Hudson	3591
APG-65/73:	Maj Wadsworth	3668
Weaponeering:	Capt Huber	2752
	Maj Hudson	3591
FLIR/LDT:	Maj Wadsworth	3668
Litening II:	Maj Woodard	2752
ALE-39:	Maj Abrams	2968
	Maj McPhillips	2498
ALE-47:	Maj Pappas	2930
	Maj Harp	2684
ALR-67:	Maj McPhillips	2498
ALQ-157:	Capt Platz	3469
ALQ-164:	Maj McPhillips	2498
APR-39:	Maj Harp	2684
APR-44:	Maj Harp	2684
RSEAD:	Capt Nothelfer	2952
Self Escort Tactics:	Maj Palmer	2261
TACP:	Maj Palmer	2261
TAC(A):	Maj Palmer	2261
NVDs:	LCDR Blow	3652
Urban CAS:	Maj Bussel	3681
TRAP:	Maj Glasgow	2133
ROE:	Capt Doty	3679
NEO:	Capt Gillard	2199
RWC2/ASC(A):	Maj Baggett	2132
TBFDS:	SSgt Wright	3363

INSTRUCTOR STANDARDIZATION

DIVISION	P.O.C.	EXT
NSI:		
AH-1:	Maj Watkins	2967
UH-1:	Maj Baggett	2132
CH-53:	Maj Abrams	2968
CH-46:	Capt Gillard	2199
AV-8B:	Maj Mcphillips	2498
FA-18:	Maj Pappas	2008
KC-130:	Maj Patrick	3547
EA-6B:	Maj Bew	3573
ACTI/DMI/DACTI/DEFTACI:		
AH-1:	Capt Barranco	3361
UH-1:	Capt Rampey	2132
CH-53:	Capt Bridgewater	2133
CH-46:	Capt White	3469
AV-8B:	Maj Woodard	2252
FA-18:	Maj Huff	5302
KC-130:	Maj Peck	3547
EA-6B:	Maj Bew	3573
LATI:		
AV-8B:	Capt Huber	2752
FA-18:	Maj Wadsworth	3668
KC-130:	Maj Peck	3547
FAC(A)I:		
AH-1:	Maj Moore	3361
UH-1:	Maj Darby	2132
FA-18:	Maj Palmer	2261

EAGLE ONE

COMMANDING OFFICER
MAWTS1
PO BOX 99200
YUMA AZ 85369 9200

MAWTS-1