Rotary Wing Operations in a CBRN Environment

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The number of nations capable of developing and possessing WMD is steadily increasing and the potential for their use can range from blackmail or acts of terrorism to conflict or war.

Joint Pub 3-11, Joint Doctrine for Nuclear, Biological, and Chemical (NBC) Defense

The Marine Corps does not like to say no...that applies to the conduct of combat operations in a chemical, biological, radiological and nuclear (CBRN) environment. Due to the now wide-spread proliferation of chemical, biological, radiological and nuclear weapons, waging war in a CBRN environment is an ever present possibility for the United States.[1] The depth, breadth, and pace of modern battles will require the speed and flexibility of Marine Corps rotary wing aircraft to support combat operations. However, current Marine aviation squadrons are not prepared to operate in a CBRN environment due to a lack of pilot and aircrew training. Moreover, conducting sustained operations in such an environment would pose an even greater challenge. In fact, decontamination of the aircraft at the conclusion of combat operations poses an insurmountable challenge for such operations. While the Marine Corps advertises the capability of conducting aviation operations in a CBRN environment, its capability is very limited and sustainable only at a very high cost.

CAPABILITY

Limited Training

According to the *Training and Readiness Manual* (T&R Manual), which directs and governs all aircrew training,

[1] *MCWP 3-37 MAGTF Nuclear, Biological, and Chemical Defense Operations* identifies a number of countries that either have or are working to develop weapons of mass destruction (WMD). Appendix 1 contains the complete table.

training flights for a CBRN environment are defined as a core plus skill, one that is a “high risk, low probability of execution, and/or are theater specific.”[2] These training flights are a “nice to have,” but are not required for individual flight leadership progression nor for a squadron to accomplish its current mission. Moreover, in today’s operating environment of increased deployment cycles, squadrons have less time to train and fewer assets to train with when not deployed. Therefore, squadrons focus their training efforts on those T&R codes and skills that will be in greatest demand during current combat operations. Conducting flight operations in a CBRN environment is not deemed an imminent threat in the current fight. For these reasons, CBRN training flights are completed to minimum standards and in an incomplete manner in fleet squadrons.[3] The bottom line is pilots and aircrew do not receive the adequate training required to operate in a CBRN environment.

One might argue squadrons can simply accelerate CBRN training when faced with the threat of combat operations in a CBRN environment. However, CBRN threats are not announced and little-to-no prior notice translates into little-to-no time for ad hoc training. A squadron may be able to conduct limited

[2] Department of the Navy, *MCO P3500.14J Aviation Training and Readiness (T&R) Program Manual*, 2005, 2-4.

[3] When CBRN training is conducted, typically only the mask is used to train with and not the complete set of protective garments, usually due to flight equipment limitations. Night flights with the mask and night vision devices (NVDs) are rarely, if ever, completed due to the high risk associated with that training flight.

training once or twice prior to deployment. However, like many other skill sets involved in aviation, conducting training just once or twice before being called upon to perform those skills in real world missions presents an operational risk management (ORM) hazard. In contrast, attack helicopter pilots fly several close air support (CAS) and simulated close air support (SIMCAS) missions in training before doing so in combat. Similarly, assault support pilots conduct hundreds of practice landings in training before doing so in combat, and so on. The answer is to incorporate CBRN training on a regular basis in squadron training plans rather than react to the first attack or threat thereof. However, this becomes a circular argument because squadron time and assets are limited between deployments for this type of training. Therefore, commanding officers focus their limited resources on those skill sets currently in greatest demand.

Limited Employment

Immediate divert and immediate on-call sorties are the most responsive means for ground units to request air support. However, immediate divert flights redirected from another assigned flight into a CBRN environment are not an option because the pilots and aircrew would not be wearing the required protective equipment, nor would they be able to don such equipment in flight. Immediate on-call missions would be possible to launch only if the pilots and aircrew were already wearing the protective gear. If they were not, a substantial amount of time would be required to prepare an entire flight crew with this equipment, reducing their ability to respond immediately.

Preplanned scheduled sorties are the most efficient use of aviation assets in any type of support mission, because they give the aviators that are flying the mission the ability to conduct detailed flight planning to provide the best support to ground units. Aviators could plan a detailed timeline that would include the additional pre-flight preparation time required for CBRN operations to meet a scheduled take off, overhead, and land time. However, preplanned scheduled sorties are not consistent with or responsive to unscheduled emergency situations that may arise such as troops in contact (TIC) or a casualty evacuation (CASEVAC).

Preplanned on-call missions offer a greater possibility of being used for emergency situations. The additional time requirements for aircrew preparation would be factored into the planning considerations to maintain the required alert status. Without a hard scheduled launch and land time, the flight crew could respond to situations when they develop. The drawback would be a reduced amount of time each flight crew could remain on alert. A CBRN capable flight crew may only be able to cover a standby window of four to six hours due to human limitations associated with wearing the additional protective equipment. A flight crew dressed without the protective gear could remain on standby for up to twelve hours. The amount of time a CBRN capable crew could stay on an alert status would be based on ORM and risk mitigation issues as determined by the appropriate level commander. The potential then exists that flight operations in a CBRN environment could require two to three times as many pilots and aircrew to cover an on-call alert window as would be required in a non-CBRN threat environment. Indeed, the CH-46E Naval Aviation Technical Information Publication (NATIP) states "Throughout contaminated operations, aircrew workload will drastically increase and time on station will decrease. To maintain a continuous presence on the battlefield, units will have to plan for crew replacement more frequently than for "clean" operations."[4] Therefore, the trade off is time and assets versus capability. In this case "assets" refers to the number of pilots and aircrew a squadron can provide for this mission. Simply stated, the capability to operate in a CBRN environment comes at a high cost of resources.

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[4] Department of the Navy, *NTRP 3-22.4-CH-46E Naval Aviation Technical Information Product (NATIP)*, 2005 (Washington D.C.), 4-26 – 4-27.

SUSTAINABILITY

Flight crew preparation

In 2003 on the USS Boxer, LHD 4, Marine Medium Helicopter Squadron 165 (HMM-165) conducted tests and training with the aviator's variant of CBRN protective equipment. During one part of that training, the full protective ensemble was donned by an aviator to demonstrate the process. According to Major T.J. Oneto and Captain M.A. Crivello who documented the event, two well-trained aviation life support systems (ALSS) technicians took a minimum of 30 minutes to outfit one crewmember with the protective ensemble and flight gear.[5] Such tests and training had not been conducted previously in that squadron. With time and practice, the proficiency of the ALSS technicians and crewmember donning the gear might reduce preparation time to 15 to 20 minutes per crewmember. In a best-case scenario, an additional 60 to 90 minutes would be required to prepare eight flight crew members with the protective suits and flight gear in order to launch two aircraft. Additional time and personnel would also be required to remove the gear at the end of a flight because all of those aircrew would have to be treated as contaminated. There are no procedures for MOPP (mission oriented protective posture) gear exchange of the aviator's

[5] Major Todd J. Oneto and Captain Michael A. Crivello, "Aviation Operations in an NBC Environment," *Marine Corps Gazette*, March 2005, 36-39.

protective garments so each crew member would have to undergo a complete detailed troop decontamination at the end of each flight.

Human Limitations

Another obstacle to operating in a CBRN environment is the human limitation of flying with the protective equipment. Of the testing completed by HMM-165, the following was noted by Major Oneto and Captain Crivello:

> Test subjects donned the M-40 gas mask and Saratoga suit with a full complement of flight gear including body armor. They then walked from the ready room, up one level to the flight deck (climbing one ladder well), and climbed into the cockpit where they ran through the prestart checklist. After approximately 30 minutes, they admitted to feeling fatigued to the point that they would have been combat ineffective. Hindsight showed that few (if any) flight operations were conducted in less than a 30-minute window. This evaluation was conducted midday while aboard the USS Boxer with temperatures in the mid-80-degree(Fahrenheit) range. Temperatures in the Iraqi theater, which during the summer months averaged over 100 degrees (typically in the 120-degree range), would undoubtedly increase the onset of these stressors. Also, the aircrews used for this evaluation were experienced aviators. One could guess that less experienced aircrew might succumb to these factors more rapidly.[6]

As noted in the article, the testing was done with the Saratoga suit, not the aviator's protective equipment which, by design, is more breathable and cooler to operate in. However, even the aviator's protective equipment would add stressors such as increased heat, dehydration, and fatigue. These factors

[6] Major Oneto and Captain Crivello, 36-39.

decrease the amount of time a flight crew can operate. Continued combat operations in OIF and OEF have proven that few flight missions have been completed in 30 minutes or less. The planning consideration becomes one of determining acceptable risk. The longer a crew must operate in this condition, the greater the risk of losing an entire aircraft and the personnel on board in an aviation mishap due to pilot error. This risk assessment must be applied to an enduring squadron mission over days or weeks. If the acute fatigue experienced during a single flight does not cause an accident during the first or second launch of this type of mission, a very high risk exists that cumulative fatigue will in subsequent flights.

One might argue that the longer flight crews in a squadron operate in these conditions, the more proficient they will become. This reasoning may be true in terms of adapting the skills required to execute these missions, but it is not the case when dealing with the onset of cumulative fatigue. One possible solution is to change the rules regarding crew rest for aviators involved in these operations. Instead of working a maximum 12- or 14-hour crew day with eight hours of crew rest, a commanding officer could shorten the maximum allowable workday and increase the required time for crew rest before and after CBRN flights. The downside becomes availability: fewer flight crews would be available to task during a given 24-hour period, thereby limiting a squadron’s ability to conduct flight operations.

Aircraft Maintenance

In normal day-to-day operations, aircraft require approximately eight to twelve man-hours of maintenance for every one hour of flight. Many of the skills required to fix various aircraft components require fine motor skills that are difficult to accomplish in MOPP gear. Even in areas with a moderate climate, working in MOPP gear adds heat, frustration, and fatigue to any task. For simple tasks, such as conducting visual inspections or servicing aircraft with fluids, the time requirements might not increase by a significant amount. However, when major aircraft components such as engines, transmissions, or rotor heads need to be replaced, the ability to perform these tasks may be prohibitive to the point of being impossible in MOPP gear. Working in protective gear will assuredly increase the maintenance-time-to-flight-hour ratio and have the overall effect of significantly reducing the total number of helicopter sorties available to support ground forces.

Aircraft Decontamination

Any type of chemical, biological, radiological or nuclear contamination will be spread to, in, and around a helicopter as dust or dirt would be spread. A helicopter may fly through an airborne cloud of contamination or land in a contaminated zone where the rotor wash would effectively spread the contamination throughout the aircraft. Anyone who has seen a helicopter fly around dusty or sandy zones, such as in OIF, has seen that dust and sand will accumulate everywhere in and on that aircraft. Anywhere this dust and dirt can be found, contamination will also be present.

Marine Corps Warfighting Publication 3-37 and the CH-46E NATIP each define three levels of decontamination: "spot" or "immediate decon," "hasty" or "operational decon," and "deliberate" or "thorough decon." The stated purpose of spot decontamination is to "limit the spread of contamination on personnel and remov[e] contamination from selected areas of the aircraft." The purpose of hasty decontamination is to "remove gross contamination from personnel and aircraft...in order to maintain sustained helicopter operations."[7] Neither of the above procedures rid the aircraft entirely of contamination; therefore, maintenance Marines and aircrew alike would still have to wear MOPP gear while working around these aircraft. On the occasions when major aircraft parts need to be replaced before the aircraft can fly again, the aircraft would need to go through a "deliberate decontamination." The goal of this procedure would be to allow maintenance personnel the ability to

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[7] Department of the Navy, *NTRP 3-22.4-CH-46E Naval Aviation Technical Information Product (NATIP)*, 2005 (Washington, D.C.: GPO, 2005), 4-24 – 4-26.

fix the aircraft unhampered by the restrictions of working in MOPP gear.

At the end of a deployment, squadron personnel perform a detailed wash down of every aircraft that would be similar to a deliberate decontamination. This process takes close to a hundred man-hours to complete per aircraft. Even during this detailed cleansing process without MOPP gear, it is practically impossible to reach every crack and hollow that could retain contamination. Performing this level of cleaning in MOPP gear would be stressful and fatiguing and would significantly slow the process. The decontamination effort would also be complicated by the difficulties of detection. Radiological detection would not be affected since no radioactive components that could be confused for foreign contamination exists in any of the rotary wing aircraft in the current inventory. Chemical detection would be hindered because the detection mechanisms currently used give false positive results from petroleum-based products. Finally, no direct means of detecting biological contamination currently exists. The end result is one would never be certain that an aircraft is free from chemical or biological contamination. Yet commanders would have to weigh directing their Marines to fix or operate an aircraft at the risk of death from biological or chemical contamination. More likely, the aircraft would be stricken from the inventory, thereby adding to the cost of operating in a CBRN environment.

CONCLUSION

The threat of chemical, biological, radiological and nuclear weapons exists in regions in which the Marine Corps may find itself in the future. Wherever the Marine Corps and its ground combat units operate, a need for helicopter (and tilt-rotor support) will exist to deal with such threats. However, operating in CBRN protective gear makes such flights more fatiguing, stressful, and difficult than normal flight operations. These flights and their duration will be severely restricted by the capabilities of the aircrews flying them. Moreover, the ability to maintain the aircraft will limit how long Marine squadrons can sustain these operations. Most importantly and most limiting to Marine aviation operations in a CBRN environment will be the inability to decontaminate those aircraft dedicated to this mission. Flying in these conditions is not impossible, but it will come at the high price of time and limited Marine Corps resources.

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BIBLIOGRAPHY

Department of the Navy. *MCO P3500.14J Aviation Training and Readiness (T&R) Program Manual,* 2005. Washington D.C.: GPO, 2005.

Department of the Navy. *NTRP 3-22.4-CH-46E Naval Aviation Technical Information Product (NATIP),* 2005. Washington D.C.: GPO, 2005.

Department of the Navy. *MCWP 3-37 MAGTF Nuclear, Biological, and Chemical Defense Operations,* 1998. Washington D.C.: GPO, 1998.

Department of the Army. *MCWP 3-37.3 NBC Decontamination,* 2000. Washington D.C.: GPO, 2000.

Joint Staff. *Joint Pub 3-11 Joint Doctrine for Nuclear, Biological, and Chemical (NBC) Defense,* 1995. Washington D.C.: GPO, 1995.

Oneto, Major Todd J., and Captain Michael A Crivello. "Aviation Operations in an NBC Environment." *Marine Corps Gazette*, March 2005.

Sadlier, Captain D.F. "NBC Decontamination." *EWS Contemporary Issue Paper.* 2003.

Appendix 1

Marine Corps Intelligence Activity (MCIA) publication 1586-001-97, *Marine Corps Midrange Threat Estimate-1997-2007: Finding Order in Chaos (U),* identifies countries (listed in table 1-1) that have or can field a WMD program. Despite treaties that ban NBC weapons, many of these countries have researched the use of one or a combination of these weapons as a WMD.

Afghanistan	Indonesia	Philippines
Algeria	Iran	Russia
Angola	Iraq	Rwanda
Bangladesh	Israel	Somalia
Bosnia	North Korea	Sudan
Burundi	Liberia	Syria
China	Libya	Taiwan
Cuba	Mozamique	Turkey
Ethiopia	Niger	Vietnam
Haiti	Nigeria	Yugoslavia
India	Peru	Zaire

Table 1-1: Countries of Concern to the Marine Corps[8]

[8]Department of the Navy, *MCWP 3-37 MAGTF Nuclear, Biological and Chemical Defense Operations*, 1998 (Washington, D.C.: GPO, 1998), 1-1 – 1-2.