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**Expeditionary Fire Support System**

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## Expeditionary Fire Support System

Since the early 1970's, mortars have not complemented the Marine Corps Artillery Table of Equipment (TE). Expeditionary Fire Support System (EFSS) program will acquisition a mortar into service within the Marine Artillery community. This is not a new concept, but one that the Marine Artillery units will revisit. Thirty years ago 107mm Mortar, "Whiskey" Battery's supported Marine infantrymen in the close fight. In Fiscal Year 2006, Marine artillerymen will assume their positions behind a mortar to provide close fire support to Marine Expeditionary Units (MEU) in the Ship to Objective Maneuver (STOM) mission. Marine Artillery must be prepared to support all units with fire support in a non-linear battlefield. EFSS will support the ever changing battlefield and be the flexible fire support system that remains in the fight.

Former Commandant of the Marine Corps, General James L. Jones, stated, "In the past 10 years or so, we have decreased our fire support systems too far. We got rid of a lot of our artillery weapons in the name of efficiency, in the name of mobility… We have atrophied our Marine ground fires inventory to a dangerous point. We're out- gunned and out-ranged by just

about everyone. So I am fixing the artillery- bringing robustness back to the Marine Artillery."[1]

Marine Corps Combat Development Command (MCCDC) refined and validated the Mission Need Statement (MNS) for EFSS, by defining the requirements through the Capabilities Development Document (CDD). Marine Corps Systems Command (MCSC) identified candidate solutions for EFSS and ultimately selected a material solution. Those candidate solutions ranged from 155mm-105mm howitzers, 150mm rockets, 120mm mortars, and extended range 81mm mortars. Recognizing factors such as lethality, accuracy, movement method, ammunition procurement, and life cycle cost, MCSC had to select a solution based on the Key Performance Parameters(KPP's) defined in the CDD, or requirements document. It is important to note that the KPP's in the requirements document are non-negotiable and must be met. Those KPP's defined by the requirement document are as follows:

1. Vertical Transportability, internal to the CH-53E Super Stallion Helicopter and V22 Osprey Tilt Rotor Aircraft.[1]
2. Threshold range of 7,000 meters, and an objective range of 14,000 meters.[2]
3. A threshold Probable Error of Range and Deflection of

[1] General James L. Jones, Commandant of the Marine Corps "*Fixing the Marine Artillery*", Field Artillery, September-October 2000
[1] MCCDC, "*Capability Development Document for the Expeditionary Fire Support System",* 02 November 2004, 10.
[2] MCCDC,10.

0.6% of Range, and an objective Probable Error of Range 0.3% of range, and Probable Error of Deflection of 0.1% of range.[3]

MCSC selected the 120RT, 120mm Rifled Towed Mortar. This system will most successfully fill the immediate needs of the Marine Corps fire support in a STOM environment.

Mortars typically belong to infantry units. This Mortar will be fielded to the Marine artillery community in support of a need from the Marine infantry community. Although this sparks controversy from time to time, this Mortar requires a dedicated unit due to its size and logistical support that artillery units can fill.

The Marine infantry units saw a need for a more capable, expeditionary indirect fire system; one that could be moved by helicopter for a deep land locked battle field; additionally, the need for a system that could fit in a V22 Osprey and will fill a future fighting capability such as STOM. This became more evident with Marine Corps operations in Afghanistan. One of the first comments to the Marine Corps Warfighting Laboratory from then Major General James N. Mattis about the deployment to Camp Rhino, Afghanistan was that he needed organic fire support. The major issue of his helicopter-borne Marines was they could not

[3] MCCDC,10.

take their heavy 155mm Howitzers with them to Camp Rhino and they had to rely on their light mortars.[1]

For the last decade, Marine artillery units have existed with an extremely heavy 155mm towed howitzer system. During two major conflicts, Desert Shield/Desert Storm and Operation Iraqi Freedom, this system served the Marines well in an environment unrestricted with port of entries and numerous air bases. The M198, 155mm Howitzer was an adequate source of fire support where terrain and weather facilitated its limited capabilities. While it's overall weight is 16,000 pounds, it was worth its weight in gold to the infantrymen needing fire support. Artillerymen owe a great debt of gratitude to the aviators for establishing a safe area for artillerymen to employ this system without the threat of an air attack in the open desert. The M198 capabilities were, and still are, less then those of our enemy forces in both of the above stated conflicts, specifically with respect to range.

Marine artillery will transform during the next decade with three new systems being fielded during fiscal years 2005 and 2006, the Lightweight 155 XM777, High Mobility Artillery Rocket Launch System (HIMARS), and EFSS. These systems will change the

[1] Otto Kreisher, "*Traditions and Transformations,*" Navy League of the United States, November 2002.

way Marine artillery deploy, operate as batteries, battalions, and regiments.

EFSS will be fielded in two distinctive phases. First phase, the Initial Operational Capability (IOC), is scheduled for fiscal year 2006. This will be a small number of systems fielded to MEU's to provide an internally transportable vertical lift capability that currently does not exist. Approximate number of systems fielded will be six during this phase. It is important to note that a complete system is a weapon (120mm mortar), prime mover (vehicle to tow the mortar), an ammunition prime mover (vehicle), and a trailer for extra ammunition. Full Operational Capability (FOC) is scheduled for fiscal year 2008. This will encompass any changes or modifications to the IOC systems, or could be a completely new system based off the requirements defined.

The threshold requirements defined for IOC were based off of three Key Performance Parameters (KPP's) of transportability, range, and accuracy. Transportability, as it relates to the V22 Osprey, was a difficult requirement to meet. The V22 Osprey cabin space is 60 inches wide, 60 inches high, and 200 inches long. A mortar and vehicle had to fit in that space. The threshold range is 7,000 meters. Most candidate solutions made that range with no problem. Probable error in range, and deflection was also met by most candidate solutions. The

consistent problem with all of the candidate solutions was the size and weight to fit a complete system within the cargo box internal to the V22 Osprey. The objective requirements defined will be ranges of up to 14,000 meters, better accuracy and still fit the V22 Internal cargo box. Full Operational Capability (FOC) will more than likely address these objective capabilities, based off of the IOC system.

During selection of EFSS, many systems for consideration were examined. Howitzers that were considered were the 105mm, and 155mm. All new 105mm Howitzers and older 105mm Howitzer that were considered could not fit the V22 internal Cargo box.

Lethality analysis was completed by the Office of Naval Research (ONR) at Naval Weapon Station Center Dahlgren Division (NWSCDD). It was found that the 105mm artillery round was one of the least effective projectile with respect to lethality. The 155mm Howitzer or the Lightweight XM777 was pitched as a candidate solution; however, it would have to be externally moved with the V22 osprey. This was not a viable solution due to its external lift requirements. To maximize the V22 Osprey capabilities, with respect to range and speed, it must be completely buttoned up and full tilt rotor. External loads greatly reduce speed and range of the aircraft, therefore, compromising the STOM mission.

Mortars were examined, specifically the 81mm and 120mm systems. The 81mm mortar, extended range system, looked to be a viable solution, however, accuracy is a problem with a fin stabilized projectile with the ranges that are trying to be achieved with EFSS. Another note of friction with the 81mm extended range system is who would be the fielding unit, artillery or infantry? Mortars have proven to be extremely lethal, largely due to the angle of fall of the projectile, and its projectile uniform fragmentation. NSWCDD lethality studies show that an 81mm mortar has equal to or better lethality then 105mm howitzer projectiles. Hence, bigger is not always better.

The 120mm class of mortars was an obvious candidate solution for the caliber of EFSS because the U.S. Army already has a fielded 120mm mortar in there system and it performed well in Afghanistan. The M120 U.S. Army system is a base plate fired smoothbore Mortar. The Army system is a very capable mortar that fits all of the threshold objectives of the EFSS. It is important to note that the Army system is smoothbore because the actual 120mm mortar that the Marine Corps chose for IOC is rifled. History has shown that rifled tubes are more accurate then smoothbore tubes. While that’s true with direct fire, with flat trajectories, it’s not true with high angle trajectories. During ascension of a mortar projectile, the tube rifling and velocity takes the projectile to apex at which time the

projectile slows down. With the smoothbore, U.S. Army M120 mortar the fin stabilization on both the ascension and dissension is the primary issue with accuracy. The 120RT mortar selected for as the material solution for EFSS is not fin stabilized, therefore; after the projectile reaches apex and slows down, weather has a lesser effect on the projectile making it more accurate. This is reflected in the firing tables for standard conditions where the probable error in range in deflection of the rifled mortar were better then the smoothbore mortar that the U.S. Army has fielded.

During lethality testing at NSWCDD, the 120mm mortars were overall the most lethal projectile pound per pound with respect to weapons considered. In some instances, the lethality of the 120mm mortar round was equal to or greater than a 155mm howitzer round. This is a critical piece of information in that a complete 120mm mortar projectile is approximately 40 pounds and a complete 155mm howitzer projectile is approximately 120 pounds. In some target sets you get a 2:1 ratio with the 120mm coming out on top. This is significant, not only in lethality, but the cube and weight when considering logical requirements of a vertical lift.

A Study conducted at the Marine Corps Warfighting Lab on life cycle cost of the two 120mm mortar systems was essentially a wash. One appealing piece of information was the average

number of rounds that an organization could put through the tubes before it was dead-lined. The U.S. Army smoothbore M120 tube life averaged between 15,000 and 20,000 rounds while the RT120 tube life average 100,000 rounds. Over the life of the mortars, the RT120 will be more cost effective.

One of the last systems considered was NetFires. This system was a pod of 150mm rockets that fit on the back of a High Mobility, Medium, Wheeled, Vehicle (HMMWV). While this system was appealing, the cost associated with this system was much greater than any other system analyzed. Life cycle cost and initial fielding cost, quickly put this out of the range of the Marine Corps.

When considering between a mortar and a howitzer, there are many factors that come to mind. Accuracy leans toward a howitzer. This is due to all the checks and balances to produce accurate predicted fires. Also, velocity and trajectory of a round doesn’t stop at apex leaving weather to have a greater effect on accuracy.

Range always leans toward a howitzer because of the amount of propellant and chamber pressure that the howitzer tube can handle vs. a mortar tube.

Lethality leans toward a mortar. This is due to the angle of fall of the projectile and uniform fragmentation of their projectiles in a uniformed circular sheaf.

Safety leans toward a Howitzer. Mortars are still not cleared for overhead fire in training and will continue to be a problem in the future. One myth is that its safety record is directly related to the fuzes and their safeties. The actual answer is that older caramel colored propellants bags were not reliable and became unstable with the least amount of inclement weather. Since mortars went to a silicone wrapped “C” shaped charge, Mortars have become extremely reliable. The new multi-option fuze, has three safeties and does not arm until shortly after apex.

The RT120, 120mm mortar will be the initial choice of the Marine Corps for its EFSS. This system is a 120mm rifled, base plate mortar. It has ranges of up to 14,000 meters with Rocket assisted projectile (RAP). It will come with the standard package of ammunition to include High Explosive (HE),Smoke (SMK), White Phosphorus (WP), Illumination (ILL), Rocket Assisted Projectile (RAP), and Dual Purpose Improved Conventional Munitions (DPICM). This system will be pulled by a jeep-like vehicle much like the old M151 military jeep. This vehicle is not robust in nature, but will do the job of pulling the mortar. This system is capable of fitting internal to the V22 Osprey and is a good initial capability provided to the Marine artillery community to support the infantry. Employing this system, will keep the artillery and organic fire support in

the fight in all clime and places.  There will be no more howitzers stuck on ship in a land-locked war.  The EFSS will be truly expeditionary and will bring back a helicopter-borne asset that we lost with the M101 105m Howitzer.

While Expeditionary Fire Support System will be new to the Marine Corps, a mortar is not a new concept to Marine artillerymen. As a welcomed addition to the artillery community, EFSS will bring back an expeditionary asset needed recently in Afghanistan and will be needed in future operation.

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