

# **Eagle, Globe, and Blockhouse**



**Issue 1-01**

**May 2001**

**A publication of the Marine Corps Artillery Detachment**

**Fort Sill, Oklahoma**

# Eagle, Globe, and Blockhouse

Issue 1-01

May 2001

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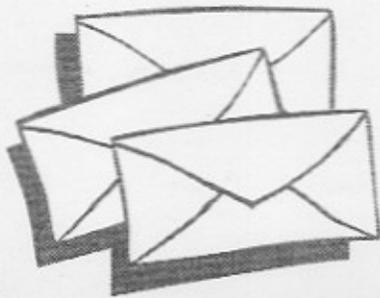
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### IMPORANT DATES:

OAC-5-01 GRAD- 23 OCT 01  
4-01 GRAD- 5 OCT 01  
3-01 GRAD- 17 AUG 01

OBC-4-01 GRAD-7 NOV 01  
3-01 GRAD-8 AUG 01



## UPDATE FROM THE SURVEY BRANCH

I want to take this opportunity to introduce myself and give you all some insight into our goals and current projects here at the survey branch.

I recently arrived here from 11<sup>th</sup> Marines as a replacement for CWO3 Mark Barnes who is retiring. Our mission is unchanged, that is to continue to provide Marine Artillery with survey training that is real, viable and enhances our war-fighting capabilities. My commitment and goal is to ensure we, artillerymen, synchronize and balance our future surveying/positioning technologies with the requisite training and TTPs to allow us to continue to be mission capable in all climes and places in order to truly remain the Kings of the Battlefield. We here at the schoolhouse can only make this happened with support from the force in the way of shared knowledge-we are all in this together! Some of our current projects are:

The IPADS. The replacement for the aged PADS, we are working with all involved to ensure we get an improved product in order to facilitate our current and future employment doctrine.

The GLPS. An information brief is being prepared for our community in order to examine this systems capability and potential employment. Look for an article in next quarter's issue.

The MCWP 3-16.7 Marine Artillery Survey. MSgt Heinz has been working to no end to wrap this product up and get it out to the fleet. This project is on it's final editing stage here and our friends in Quantico are awaiting its arrival to put it to press. Hard copies will be mailed out directly out to the fleet. E-mail us for the distribution plan.

GPS Job Aid. Our plan is to put something together that resembles the little PLGR Handbook and will address Real Time Kinematic On The Fly procedures only. The handbook will serve as the survey sections quick reference emphasizing methods to conduct RTK OTF for battalion level operations. Our goal is to have a product in your hand by next summer.

All survey related instructions are being reviewed to ensure current and standard based instruction is being provided to our Marines. The Marine Artillery Survey Course needs your support to be prepared for our future. Student enrollment has dwindled due to no doubt high operational tempo, but who will have the requisite knowledge for tomorrow if we don't educate our Marines today?

These are but a few of the survey related projects we are attacking. Each and every one of them requires that we all work as a team to solve or produce the best for our community. I ask that anyone having recommendations, suggestions, or comments please forward them to us here at the schoolhouse. Finally, our web page is currently be updated and can be visited by going to Ft Sill's home page to the Training Command link and working your through the FSCAOD home page to the "Survey Information Center." Thank you, my team and I look forward to serving you all well.

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## AFATDS OPERATORS COURSES

The world of AFATDS instruction has changed again, this time for the better. The US Army is making a transition of all of its 13C (Cannon Fire Direction Specialist) and 13E (Automated Fire Support Systems Specialist) soldiers into a new MOS designated 13D (Field Artillery Tactical Data Systems Specialist.) This transition is being facilitated by specialized versions of the AFATDS Operators Course based upon MOS. This will allow those soldiers with MOS's different than 13C and 13E to get more MOS specific training. This will greatly aid the Marine Corps in making sure we get the right Marines to the right class.

All the classes will start by covering the same material, but as they get further into the period of instruction, the different MOS's will fall out in order to receive their specialized training. Listed below are the class schedules for both AFATDS Operators Course and the Command and Staff Course. The actual course length has increased by three weeks for the Operators course and by a week for the Command and Staff. This is to account for the addition of Technical Fire Direction that has been included in classroom instruction starting FY 02.

The schedules show the class number, the start and end dates and the number of seats available for the Marine Corps in that particular class.

### AFATDS Operators Course (85 seats)

001	01 Oct 2001	20 Nov 2001	10
002	30 Oct 2001	19 Dec 2001	9
003	27 Nov 2001	29 Jan 2002	9
004	08 Jan 2002	27 Feb 2002	10
005	21 Feb 2002	10 Apr 2002	9
006	27 Mar 2002	14 May 2002	9
007	02 May 2002	20 Jun 2002	10
008	06 Jun 2002	25 Jul 2002	9
009	18 Jul 2002	05 Sep 2002	6
010	21 Aug 2002	09 Oct 2002	4

### AFATDS Command and Staff (15 seats)

001	02 Oct 2001	23 Oct 2001	3
002	01 Nov 2001	23 Nov 2001	2
003	04 Jan 2002	25 Jan 2002	2
004	20 Feb 2002	12 Mar 2002	3
005	11 Apr 2002	01 May 2002	2
006	07 Jun 2002	27 Jun 2002	1
007	29 Jul 2002	16 Aug 2002	2

The following are the periods of instruction for each of the classes that will be pertinent to the Marine Corps. Although there are others, they are Army specific. Each pipeline does not require the entire seven weeks that are slated for the class, and graduation dates for each one of them were not available at the time of publishing. **Completion dates for each of the classes by MOS will follow in a naval message.**

0844/0848

LESSON	TITLE	HOURS
TTF3AA	Hardware and Software Set-up	4
TTF3AB	Basic AFATDS Operations	8
TTF3AC	AFATDS Communications	20
TTF3SA	System Administration and the Master Unit List	8
TTF3AO	Introduction to Army Battle Command System	2
TTF3AJ	Introduction to NON-AFATDS Messages	2
TTF3AD	Unit Database Management	12
TTF3AF	AFATDS Data Distribution	4
TTF3AE	Battlefield Geometries	12
TTF301	Examination	4
TTF3AM	AFATDS Unit Movement	4
TTF3AG	Commander's Guidance	16
TTF3AH	Tactical Fire Mission Processing	34
TTF3C1	CPX	20
GDF3AB	AFATDS Technical Fire Direction	26
TTF302	Examination	2
<b>TOTAL</b>		<b>178</b>
<b>COURSE LENGTH</b>	<b>05 Weeks</b>	<b>00 Days</b>

#### 0861/ ALL NON-ARTILLERY MOS'S

LESSON	TITLE	HOURS
TTF3AA	Hardware and Software Set-up	4
TTF3AB	Basic AFATDS Operations	8
TTF3AC	AFATDS Communications	20
TTF3SA	System Administration and the Master Unit List	8
TTF3AO	Introduction to Army Battle Command System	2
TTF3AJ	Introduction to NON-AFATDS Messages	2
TTF3AD	Unit Database Management	12
TTF3AF	AFATDS Data Distribution	4
TTF3AE	Battlefield Geometries	12
TTF301	Examination	4
TTF3AM	AFATDS Unit Movement	4
TTF3AG	Commander's Guidance	16
TTF3AH	Tactical Fire Mission Processing	34
TTF3C1	CPX	20
TTF3TA	Target Acquisition	16
TTF3FS	Fire Support Planning	30
TTF304	Examination	2
<b>TOTAL</b>		<b>198</b>
<b>COURSE LENGTH</b>	<b>05Weeks</b>	<b>03 Days</b>

The class lengths have been based off the actual 13D transition course and they do not require the full seven weeks of instruction. Updated graduation dates will be published as soon as they are known.

Administrative issues have plagued students attending these courses in the past and they must be addressed. Any Marine attending either of these two courses must have a Government Credit Card and/or travel advance to pay for lodging and food. There is no government messing available, so their orders must include the appropriate allowances. The location of the berthing with respect the classroom is a considerable distance, so a rental car must be authorized for the student or group of students as well. Funding for seats is now the same as any other Marine Corps course. All requests for seats must go through the unit schools chain, not directly to the Marine Detachment here at Ft Sill.

These courses are very effective in forming a good knowledge base for the students that complete them successfully. They will be ready to go back to their units and become productive members of the new and more automated FSCC's and FDC's throughout the Marine Corps. With the conclusion of system fielding throughout the Marine Corps scheduled for the end of July, it should be stressed that as many Marines as possible should be attending these courses. This will allow for a more successful transition into the use of AFATDS in the Marine Corps.

The point of contact for these courses and other AFATDS matters is Capt Garrett Benson, OIC MCFSS, DSN 639-3811/2592 Comm: 580-442-xxxx, email: [bensong@sill.army.mil](mailto:bensong@sill.army.mil)

## MARINE CORPS SYSTEMS COMMAND

### UPDATE FROM MARCORSYSCOM

Compiled by Mabel M. Edwards

#### Maj Garay - High Mobility Artillery Rocket System (HIMARS)

In March 2001 the United States Army and United States Marine Corps signed a Memorandum of Agreement that documented the United States Marine Corps (USMC) participation in the HIMARS program. In response to the Commandant of the Marine Corps "Fix Fires" initiative, HIMARS will provide ground-based, General Support and General Support-Reinforcing indirect fires that accurately engage targets at long range with high volumes of lethal fire under all weather conditions. The HIMARS is a C-130 transportable, wheeled, indirect fire, rocket/missile system capable of firing all rockets and missiles in the current and future Multiple Launch Rocket System Family of Munitions. The basic system will consist of a launcher (with fire control system and launcher-loader module that will perform all operations necessary to complete a fire mission mounted on a Family of Medium Tactical Vehicles chassis); two resupply vehicles (Medium Tactical Vehicle Replacement based with materiel handling equipment) and two trailers.

With FY01 Congressional funding, the Marine Corps has placed two prototype launchers, rockets, and parts on contract. Two resupply vehicles and trailers will also be placed on contract prior to the end of FY01. Additional plans include the contracting for and development of a resident and distance-learning program of instruction that will establish the rocket artillery Military Occupational Specialty skill set within the Marine Corps. Significant upcoming initiatives include a Fleet Marine Force evaluation and developmental testing that will ensure that HIMARS addresses current/future fire support requirements. The Marines of Battery F, 2<sup>nd</sup> Battalion, 14<sup>th</sup> Marines will play an integral role in this phase of HIMARS development.

Current plans are to field two battalions in the 14<sup>th</sup> Marines with 18 launchers each. The 14<sup>th</sup> Marines, who have the wartime mission of Force Artillery Headquarters in support of Marine Expeditionary Force-level operations, are ideally suited to receive this component of the next generation of Marine Artillery. A Marine Corps production decision will be made in early FY06 and Initial Operational Capability achieved in FY08. Questions regarding HIMARS can be addressed to Major Roger Garay, USMC at [garayra@mcsc.usmc.mil](mailto:garayra@mcsc.usmc.mil).



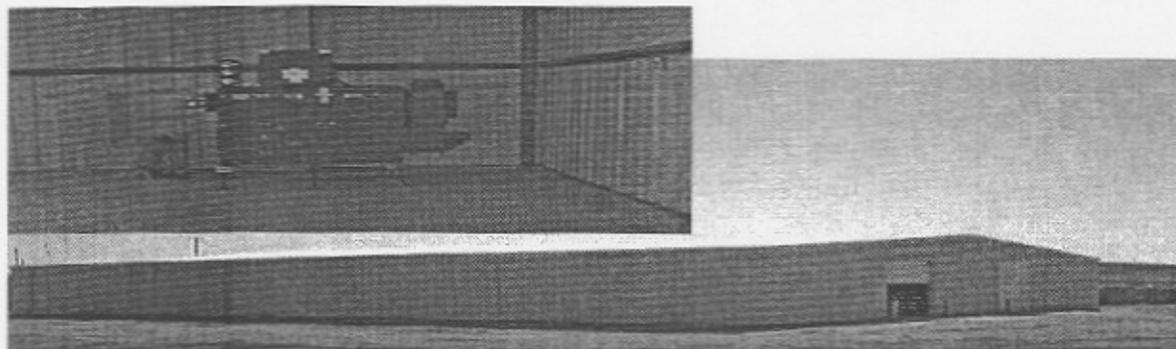
### Maj Garay - KJ4000

The KJ4000 Oil Transfer System (KJ4000) is a commercial oil pump that will be used to supplement the M3 oil pump currently used to service the M198 Howitzer. Manufactured by the Mandus Group Ltd., the KJ4000 will significantly improve the process of filling recoil mechanisms, buffers, and replenishers. Anticipated benefits include a reduction in maintenance man-hours and reduced likelihood of contaminants in the recoil mechanism and associated reliability. The KJ4000 will be a component of the currently fielded E1712 Artillery Shop Set in the Force Service Support Group.

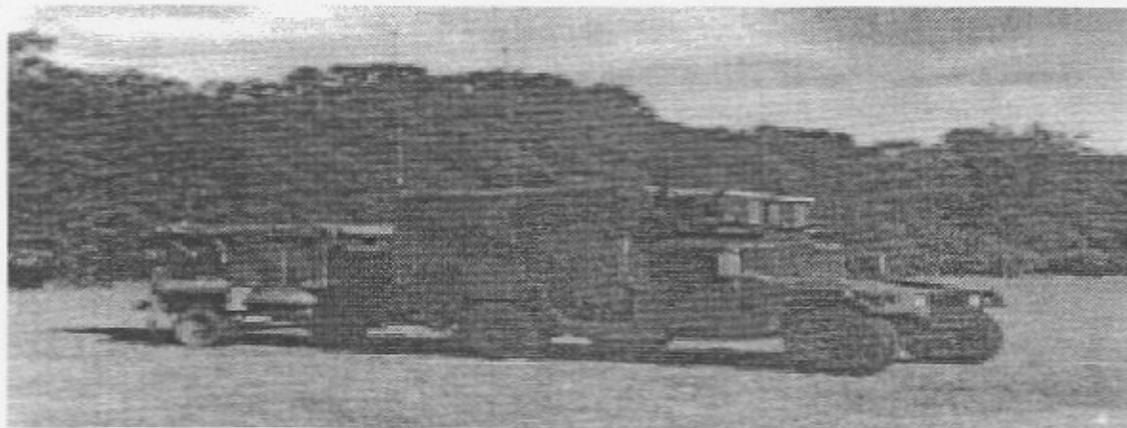
Current plans are to field the KJ4000 to the intermediate level maintenance shops beginning in FY01 with an anticipated Initial Operational Capability in 4<sup>th</sup> Qtr FY01. Questions regarding the KJ4000 can be addressed to Major Roger Garay, USMC at garayra@mcsc.usmc.mil.

### MSgt Frank - Environment Stabilization System (ESS)

The ESS is a fully automated preservation system designed to provide long and short-term humidity control and protection to critical assets. These systems will be installed at the Counter Battery Radar sections of each Artillery Regiment. Delivery will begin at 10<sup>th</sup> Marines on 18 April 2001. Subsequent deliveries are scheduled as follows: 14<sup>th</sup> Marines, May 2001; 12<sup>th</sup> Marines, August 2001; and 11<sup>th</sup> Marines, September 2001.



Software changes continue to improve the radar's performance. In March 2001, Marine radar sections evaluated the latest version of software, 12.007, at 29 Palms, California and Ft Bragg, North Carolina. This software then passed a Mini-Table 14 shoot in April 2001 at Yuma Proving Grounds, Yuma, Arizona. Official certification is expected by June 2001. This software is scheduled for delivery to Marine radar sections by July 2001. The next version of software is scheduled for release in FY03.



### **Capt Lovelace - Firefinder Antenna Calibration System (FIFACS)**

FIFACS is a near-field antenna measuring system which will provide FMF units with a portable capability to determine far-field antenna patterns and gain of the AN/TPQ-46A Firefinder antenna. FIFACS received a procurement/production decision on 23 February 2001. It is anticipated that production of the FIFACS will be completed by 30 September 2002. Fielding will be complete by 15 October 2002, and the system will reside at the Marine Corps Multi-Commodity Maintenance Center, Barstow, CA.

### **Maj Rogers - Target Location, Designation, and Hand-off System (TLDHS)**

The TLDHS is a modular, team-portable equipment suite that will provide forward observers, forward air controllers, and other observers/controllers with the ability to detect, recognize, locate and designate targets in their areas of interest. TLDHS will also provide the capability to digitally request and coordinate target engagements by field artillery (FA), close air support (CAS), and naval surface fire support (NSFS).

The TLDHS is comprised of and integrates two major subsystems (and associated ancillary components): the Lightweight Laser Designator Rangefinder (LLDR) and the Target Hand-off System (THS). Both the LLDR and THS can be used on a stand-alone basis, and they can be connected using the system cable to operate as a fully integrated TLDHS.

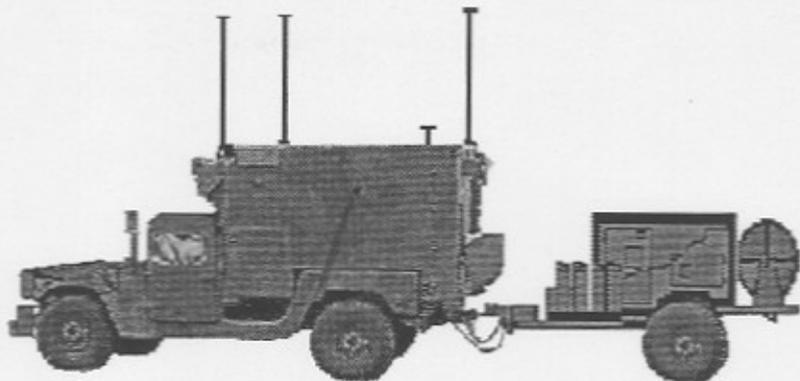
The LLDR has entered Operational Testing (OT) and should complete OT by mid-May 2001. A Marine Corps production decision is planned for September 2001, and the USMC expects to reach Initial Operational Capability (IOC) for the LLDR during the second quarter of fiscal year (FY) 2004.

The THS FA and CAS mission software is scheduled to undergo OT during the first and second quarter of FY02. The fielding decision for THS is scheduled for the third quarter of FY02 and IOC is expected in the first quarter of FY03.



#### CWO4 Lawrence – Meteorological Station Group (MSG)

The Meteorological Measuring Set Upgrades have been completed and the remaining MMS's have been shipped to Barstow for conversion to Meteorological Station Groups. This conversion should be complete by the end of FY02. This conversion will ensure the commonality of the six remaining MSG's to the MSG configuration presently in use in the operation forces. This conversion of the MMS's to MSG's will allow the operating forces to release their float systems, which have been in storage at MCLB Albany. During the last quarter of this FY, a software upgrade for the MMS will be released to the operating forces. Subsequent to the software release, Ft Sill representatives will visit each Regiment to ensure proper software installation. Upon completion of the AFATDS fielding, all of the MMS will have a similar software configuration. Questions regarding the MSG can be addressed to CWO4 Lawrence, USMC at [lawrencer@mcs.usmc.mil](mailto:lawrencer@mcs.usmc.mil).



#### CWO4 Lawrence – Electronic Meteorological Theodolite (EMT)

The Electronic Meteorological Theodolite (EMT) is the replacement for the current manual and electronic theodolite. Warren Knight Industries is in the process of building (2) theodolites with the mechanical and electronic scales. These systems should be ready for fielding by 4<sup>th</sup> quarter FY01. The evaluation of these systems will begin in first quarter of FY02. Questions regarding the EMT can be addressed to CWO4 Lawrence, USMC at [lawrencer@mcs.usmc.mil](mailto:lawrencer@mcs.usmc.mil).

## M795: Marine Artillery's First Step in the 21<sup>st</sup> Century

Capt J. P. Dunne

### I. Introduction

The mission of the field artillery (FA) is to destroy, neutralize, or suppress the enemy by cannon, rocket, and missile fires to help integrate all fire support assets into a combined arms operation. The M795, an HE munition soon to be utilized by the Marine Corps as a replacement to the M107, is an innovation that will allow Marine Corps artillery to better accomplish this objective.

This paper has a four-pronged intent. This composition will discuss why this new High Explosive (HE) Munition, the M795, is necessary; an overview of the M795 will be provided, to include a glance at the Research and Development, Procurement, and Testing of the munition; the capabilities and limitations of the M795 will be discussed; finally, a vision of future needs of artillery munitions will be created.

### II. Why does the Marine Corps need the M795?

On 8 Oct 1997, General Krulak, then Commandant of the Marine Corps, published the United States Marine Corps Master Plan for the 21st Century. This document serves as a strategic and operational roadmap, providing guidance to Marine Corps planners and decision makers. General Krulak identifies the need for increased range and enhanced precision of munitions and their delivery systems. Specifically, General Krulak denotes as the Marine Corps' 14th Required Operational and Support Capability for the 21st Century: an enhanced family of munitions for ground and aviation operations. These munitions must be all-weather capable with increased lethality, accuracy, and range, allowing for a reduced logistical burden; more so, they must be produced within an institutional environment that rewards efficiency and cost-effectiveness.

If it is General Krulak that provided the vision and initiative to upgrade Marine Artillery to address 21st Century challenges, it is the current Commandant, General Jones that has provided the energy and fine-tuned focus. Shortly after assuming the post as Commandant, General Jones offers

*[The Marine Corps] 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 are out-gunned and out-ranged by just about everyone. So I am fixing the artillery - bringing robustness back to the Marine artillery.<sup>8</sup>*

Since General Jones has directed a review of Marine artillery, several initiatives have blossomed. The Marine Corps will change course from its singular M198 artillery delivery system to a firing system "triad". Two legs of the triad consist of the M777 155mm Light Weight Howitzer and the introduction of two Battalions of High Mobility Artillery Rocket System (HIMARS) to 14th Marines as soon as FY2007. The third leg, still in its infancy in terms of development, is termed the Expeditionary Fire Support System (EFSS), characterized with increased mobility, reduced size and weight, and characterized with a small logistical footprint, making it ideal to support the Marine Corps in its expeditionary role. Additionally, the improved integration of organic mortars, improved target acquisition assets and enhanced counterfire capabilities, and improved command and control systems dominate the thought of the Marine Corps Artillery community in its effort to develop and implement future technologies.

Why does the Commandant have such a sense of urgency to modernize and strengthen Marine artillery for the 21<sup>st</sup> Century? Certainly, it is evident to both the Artillery community and the infantry that we support. The Artillery, long absent of the technology advantages during the past two decades, now struggles to provide timely and accurate fires. In our traditional expeditionary environment, due to time-space constraints identified with OMFTS-STOM and the movement of the Marine Artillery Battery ashore, the battery no longer has the legs (mobility) or the arms (weapon/range) to adequately support the BLT's most mobile elements during sustained operations ashore. Friendly and enemy capabilities have grown while Marine Artillery's has not, and now we are facing a Battle Calculus problem that has become a very formidable foe. All said, the ability to support Marine infantry in the close fight and the ability to attack deeper targets to include command and control nodes, logistical resupply areas, refueling areas, and assembly is degraded and requires significant attention.

Of all the changes identified previously, it is a separate program that will make the first impression on Marine 21st Century artillery. Surprisingly, it utilizes late 1970's technology, and only in the past few years, in light of identified needs, has it gained the catalytic boost required to procure it as part of the inventory. The M795 High Explosive munition is the first step towards addressing the Marine Artillery's OMFTS/STOM Battle Calculus problem.

### III. History of the M795 Munition

In February 1976, the XM795 configuration was recommended for development in order to meet the M483A1 ballistic similitude requirement (this aspect will be discussed in length in the M795 accuracy discussion later in this composition) while maintaining its conventional fire support purpose - harassment and interdiction fires, fragmentation mining, and blast effect. By 1981, the M795 was operationally tested; however, the project as a whole was shelved due to a 1980's abundance of M107. In 1998, in light of the diminishing inventory of M107, and, more so, the need for a more capable High Explosive Round, a directive from Congress was put forth, mandating the M107 to M795 transition. On 30 Aug 1999, HQMC accepted the U.S. Army ORD requirements and signed an Operational & Organizational (O&O) concept that states M795 will replace the M107 HE as the primary artillery HE round. What could twenty-five year-old technology possible contribute the Marine Corps Warfighting capability on the modern battlefield?

### IV. Advertised Advantages/Characteristics of the M795 Projectile

The M795 Projectile has five "advertised advantages".

- **Increased Range:** The M795 will increase by 33% the range currently available to the MEU Commander/Maneuver Commander.
- **Increased Lethality:** The M795 is 30% more lethal than the M107.
- **Improved Accuracy of Artillery Munitions:** Since the M795 is ballistically similar to the M483A1 DPICM projectile, it can be utilized to determine registration corrections for the DPICM projectile.
- **Reduced Logistics/Supply Burden:** Due to the increased range, lethality, and accuracy, Marine Artillery will require less ammunition to achieve the desired results for the MEU Commander/Maneuver Commander, resulting in a smaller logistical footprint and resupply demand.
- **Fiscally Sound:** Increased lethality over the M107 and a cheap registration/MVV alternative to the M483A1 DPICM will result in long term cost savings to the Marine Corps.

These five advertised advantages will be analyzed.

### V. Increased Range

Field firing of the M795 has verified that the Marine Artillery will achieve an increase of 6 km to its maximum range, out to 22.5 km. Detailed below:

Characteristic	M107 Performance	M795 Objective	M795 Threshold	Achieved Value
Max Range*	18 km	24 km	22 km	22.5 km

\* Ranges computed utilizing the M203A1 propelling charge.

There are two specific reasons why the M795 HE round has an increased range over the current M107, one that influences interior ballistics and the other which improves the exterior ballistics of the round. The first pertains to the M795's rotating band. The M107 HE round has a rotating band, made of soft copper metal alloy, and is swaged to the projectile. To the contrary, the M795 rotating band is made of gilding metal composition (after tests with nickel and stainless steel did not produce the same consistency in field firing results) and is coupled with an improved, plastic obturating band.

The rotating band, which is thicker with the M795 munition, is welded to the projectile. This innovation enhances the forward obturation of the projectile and prevents the escape of gas pressure past the projectile. More energy is retained, translating into increased muzzle velocity and resulting increased range. Essentially, this new rotating band makes the potential-to-kinetic energy transfer more efficient.

Additionally, the range of the M795 is increased because of an aerodynamic design that reduces projectile drag. Drag is the component of air resistance in the direction opposite that of the forward motion of the projectile, resulting in a reduced muzzle velocity and subsequent loss of range. Simply put, M795 is more efficient through the air, achieving greater range than the M107 as a result.

This increase in range is significant. The Army has studied "target sets" in various scenarios and has determined 13% of the targets engaged will require M795 range. Improved range capability will permit the attack of deeper targets to include command and control nodes, logistical resupply areas, and assembly areas that currently may be out of range of the M107. The increased range will improve the synchronization and compatibility between the artillery and maneuver - we will be able to engage more targets and provide a greater degree of support to the infantry due to a reduction in battery displacements. Finally, the increase in range will create battle space for Marine units to operate within; specifically, Marine Artillery will soon have more flexibility in the selection of primary, alternate, and supplemental gun positions, increasing the survivability of our Artillery.

Marine Artillery will continue to retain the ability to engage targets within 3km of the battery location with indirect fires. The table below illustrates that Marine Artillery will continue to support the fight "close to home".

Characteristic	M107 Performance	M795 Objective	M795 Threshold	Achieved Value
Min Range, Low Angle Fire**		1.8 km	2.8 km	2.5 km
Min Range, High Angle Fire		2.6km	3.6km	3.0 km

\*\* Fired at 200 mils

These minimum range requirements facilitate the performance of critical self-defense and final protective fires for supported units or the battery itself.

#### VI. Increased Lethality

The lethality of the M795 has been described as having 19% more "military worth" than the M107. The primary reason is due to the increased payload of the munition. The M107 carries 14.6 pounds of explosive; the M795 carries nearly nine more pounds of explosive, weighing in with 23.8 pounds of conventional High Explosive Fill. Additionally, the M795 possesses a continuous cast, high fragmentation HF-1 steel body, reengineered since the M107 model, which increases fragmentation. The composition of the material, coupled with an internally etched nature of the casing, provides for a more uniform and destructive fragmentation pattern.

When the Army and the Marine Corps first considered the purchase of the M795, a lethality "goal" (objective) and a lethality "threshold" (tolerance or lowest acceptable performance) was established. During the field firing tests conducted with M795, the following "relative lethality" results were produced:

	M107 Performance	M795 Objective	M795 Threshold	Achieved Value
Lethality, Soft Targets	1.0	1.8	1.2	Exceeded 2.0
Lethality, Personnel	1.0	2.0	1.5	1.5

The ECR of this munition is still considered classified and, as a result, has not been released; however, based on the determination of a 19% increase in lethality worth, and the illustrated test results as detailed above, it is the author's estimate that the ECR of the M795 will exceed 60 meters, a 10 meter increase over the M107 kill radius.

## **VII. Increase Accuracy**

In an effort to provide support to the infantry with accurate, massed fires, artillerymen continually strive to achieve the five requirements for accurate predicted fire: accurate target location and size, accurate firing battery location, accurate weapon and ammunition information, accurate meteorological information, and accurate computational procedures. When the Battalion or Battery's Fire Direction Center (FDC) can fulfill these five requirements, the Battalion or Battery can achieve timely, first round fire-for-effect. The accuracy of these fires is then subject only to the mathematical laws of probability (Position Corrections - those elements that cannot be measured<sup>13</sup>).

The Marine Artillery currently has significant obstacles achieving the third requirement, Accurate Weapon and Ammunition Information, for the M483A1 DPICM munition. These obstacles are not likely to go away. With range regulations, safety concerns (significant dud rate of M483A1), and fiscal constraints, Marine Artillery does not fire M483A1 as part of its routine training. This is a current concern; the M483A1 is ballistically dissimilar to the M107 or any other cost efficient munition in our inventory. By definition, this places M483A1 within its own "projectile family". As a result, unless Marine Artillery, prior to combat operations, was to conduct a registration with DPICM to correct for deviations from standard, accurate massed fires would be an uncertainty.

The M795, however, is ballistically similar to the M483A1 DPICM round; it is in the same projectile family. Marine artillery will soon have a viable option to compute registration corrections for its primary warfighting munition, DPICM. The registration corrections will allow for the expeditious computation of range, deflection, and fuze setting corrections that will counter errors due to non-standard conditions. Marine Artillery, conducting routine training with M795, will soon have the ability to mass DPICM fires in combat.

Additionally, because of the fact that M795 and M483A1 belong to the same projectile family, more accurate DPICM fires will be possible because of management of muzzle velocities. Inferred subsequent lot calibration techniques allow a firing unit to quickly update muzzle velocity information for a given projectile family-propellant type combination, when firing a new lot of propellant. Updated muzzle velocity information equates to more predictable projectile ranges...and more accurate fires.

Despite the distinct "accuracy advantages" described above, there are some accuracy limitations or considerations of M795. As M483A1 if fired at its maximum range of 17.5 km, it is subject to a 40-meter probable error in range - 50 percent of the rounds fired will land within 40 meters of the intended target. M795, maintaining a linear relationship between range and PER, will experience even larger range deviations when fired at extended ranges. The Operational Requirements Document specifies that one probable error in range, utilizing standard propelling charges to include the M203, shall not exceed 0.30 percent of the maximum range. As a result, when M795 is fired at a maximum range of 22.5km, one probable error in range equates to nearly 70 meters. Simply stated, M795 is an accurate area fire munition - it is not the precision munition that the "cleaner battlefields" or urban terrain of 21st century require. M795 may become the last generation of "dumb rounds" - the generation of ammunition that comes after M795, presumably with even greater range capabilities, can no longer be entrusted to non-standard conditions during flight - PER will be too dominant. Human technology - specifically smart munitions - must be the next step before we add any more range to our HE ammunition. It is an issue of accuracy and an issue of efficiency.

## **VIII. Reduced Logistical Burden**

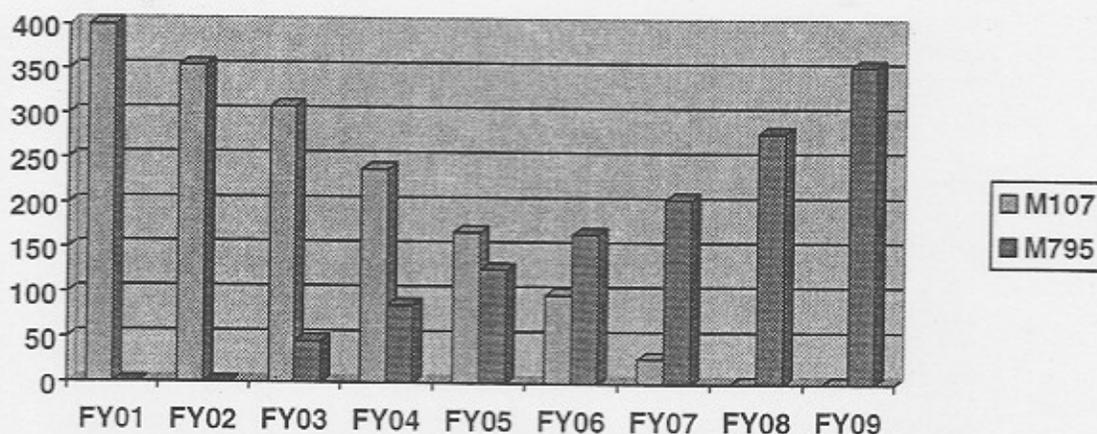
A published advantage to M795 is the reduced burden that this round will have on the logistics train. Because M795 is more lethal, it is theorized that less rounds of artillery ammunition will be required to accomplish the task and purpose of artillery fire. Additionally, because of the accuracy considerations of M795 - registration capability and muzzle velocity management for M483A1 - less ammunition will be required to allow for the massing of fires. Reduction in required ammunition equates to fewer ammo resupply operations and a greater continuum of available fire support.

Is this a valid argument? Certainly with our maneuver warfare doctrine, we hope to synchronize our effects with the maneuver at critical points in the battle vice fighting a war of attrition; we intend for better technology to make us more efficient in doing so. Conceivably, because of the much-needed increased range of M795, artillery will have more targeting responsibilities and will be relied upon more heavily to shape the battlefield for maneuver. More so, in light of the Probable Error Range issues at extended ranges (to engage deep targets that before were not within our capabilities), this advertised ease on the logistics becomes suspect. Despite the increased ECR of M795, the number of volleys fired at deep targets will not decrease because the large PER will dictate that more rounds are fired to place appropriate effects on a target. The author certainly does not envision BLT Commanders relying on less 155mm HE ammunition. The Commandant views M795 as a force multiplier for a watered down Artillery community; the objective of this munition is not to provide Field Artillery Battalion S4 and/or his GCE/MSSG counterparts significant relief in their resupply/logistics requirements. The Marine Corps' gain with M795 equates to improved range, lethality, and accuracy. The argument that M795 provides for an eased burden on the logisticians is flawed.

### IX. Fiscally Sound

While there are a number of purchasing and implementation plans still circulating throughout the Marine Corps, one thing is certain: the capabilities of M795 will come as an extremely affordable initiative. Currently the Marine Corps spends \$270 for each M107 HE Projectile. During the development of the M795, a threshold (high limit) of \$506 per projectile and an objective of \$460 per projectile were established. However, recent interest from Israel and two other nations in Europe may increase the Army-Marine "bulk purchase" to the point that M795 projectiles may become as affordable as \$370 per round.

Regardless to the purchasing intentions of non-U.S. nations, the Marine Corps M795 purchasing plan would be progressive in nature, gradually increasing as M107 purchases decrease. The long-term intent is to replace the current M107 HE round, first within the war stock. All M107 would be rotated into training ammunition supply, fired until depleted, and then completely replaced with M795 HE. By 2007, M795 would serve as the sole HE round for both training and war reserve stocks. Again, while timelines and specifics concerning the plan continue to be adjusted, the following chart is a generally accepted model, demonstrating the



purchasing plan of M795 and M107.

\*Y-axis represents FY quantity of purchase in increments of 1000.

In the DOD purchasing environment, where American currency serves as the rope in a large tug-of-war between specific project officers and program managers, M795 becomes an easy choice. The advantages of this round are clear, and the cost for these improvements can certainly be absorbed. The Marine Corps is getting more "bang for the buck" with the M795 acquisition.

## X. SIGNIFICANCE AND IMPLICATIONS OF M795

Again, M795 is simply a small step for Marine Artillery in the 21st Century. It is the introduction of the Light Weight Howitzer, HIMARS, EFSS, MACS, and future Command and Control/Fire Support Computer Systems that will serve as the technological pillars of future Marine Artillery. Nonetheless, the introduction of M795 will serve to bridge a significant gap - our current difficulties supporting the maneuver commander, and specifically the MEU and BLT Commanders in an OMFTS/STOM environment. The additional range will certainly help Marine Artillery "run with" LAR, CAAT, and/or Tank maneuver elements of the MEU. However, the problem of providing maneuver organic fires ashore from H-Hour to H+6 still exists. Currently, it requires hours to put a fire capable battery ashore once the lead BLT elements have hit the beach. While it is other initiatives (EFSS, for one) that will someday allow Artillery to get ashore more rapidly, the technology exists today to acquire the step-brother of the M795, specifically for employment in support of the MEU, that would further decrease the time-space limitation that cripples Marine Artillery in its support role of the amphibious assault and securing the initial objective.

The M795E1 is a variant of the M795 with even increased range capabilities. There are three variants - one is a Base-Bleed design, the second is a Rocket Assist variant, and the third is the combination of the two. While there are slight differences with each variation, the M795E1 essentially adds another 6km in range, out to 28.7 km while sacrificing 2 pounds in HE explosive fill, down to 22.0 pounds. The M795E1 would achieve the same range as the current RAP projectile in our inventory, the M549A1, while delivering 5 more pounds of payload. It is ballistically similar to the M825; the same accuracy advantages provided by M795 concerning DPICM would be gained in M825 accuracy by utilizing M795E1. Registration information, muzzle velocity management, and an ability to accurately and effectively employ M825. The cost of M795E1 would be \$100 per round more expensive than the less lethal M549A1.

If the Marine Corps were to purchase enough M795E1 to support the MEU commander, his BLT Commander would have much deeper support provided by the Artillery Battery. All the additional range advantages - ability to engage deep targets, creation of more Battle Space, enhanced survivability of the Battery, would apply.

Certainly, the concern with M795 Accuracy in terms of Probable Error in Range becomes magnified with the M795E1. While the two rounds are ballistically dissimilar, the M795E1 is exposed to an "additional 6km of non-standard conditions". The M795E1's threshold for Probable Error in Range has been published at .35% of the achieved range. If M795E1 is fired at its maximum range and this PE Threshold is achieved, that would result in a 100 meter probable error in range. Only 50% of all M795E1 fired at its maximum range would land within 100 meters of the target, well outside of its ECR.

Needing to produce accurate, even precision effects on the 21st century battlefield, it is clear that the Marine Corps has reached the range limit of our dumb-round, cannon fired ammunition. Dumb rounds, exposed to non-standard conditions over an extended range, will suffer probable errors in range that exceed the ECR of the munition, making the employment of that munition relatively inefficient. The Marine Corps' next artillery round, whether it some day replaces or more probably augments M795, will need to be precision guided. Excalibur, a 155mm Precision-Guided Extended Range Munition, is currently at the forefront. Copperhead is dying a slow death, and laser guided munitions, munitions capable of mid-air adjustments from GPS feeds, etc., need to be made available. Urban terrain and the desire for minimized collateral damage/minimized fratricide demands it, and the desire to create a lessened logistical burden on units will not be achieved when fighting the deep battle unless the efficiency/accuracy of the round is enhanced.

## XI. CONCLUSION

1970's technology, in the form of M795, is addressing the needs of Marine Artillery today. M795 will be a tremendous asset for us and those we support. While Marine artillerymen await the arrival of publicized firing platforms, propellants, fuzes, and command and control link, there is projectile technology that exists today that is needed today. M795 will assist the MEU Commander to complete his assigned missions, but we owe it to him and his Marines to empower him with projectiles that can achieve even greater range, lethality, and accuracy. We must continue to critically reassess what the artillery's role and capabilities are within an expeditionary environment and provide the artillery with the proper tools to conduct his job. M795 is a must, but M795E1, Excalibur, and other long-range, precision munitions need to be added to our inventory.