



UNITED STATES MARINE CORPS
I MARINE EXPEDITIONARY FORCE
U.S. MARINE FORCES, PACIFIC
BOX 555300
CAMP PENDLETON, CA 92055-5325

I MEFO 4300
G-4

FEB 7 2018

I MARINE EXPEDITIONARY FORCE ORDER 4300

From: Commanding General, I Marine Expeditionary Force
To: Distribution List

Subj: INTERIM I MARINE EXPEDITIONARY FORCE ADDITIVE MANUFACTURING POLICY

Ref: (a) MARADMIN 594/17
(b) Additive Manufacturing Concept of Employment v. 0.1
(c) Marine Corps Systems Command (MCSC) Additive Manufacturing Approval Process v. 3.3.3
(d) UM 4000-125
(e) GCSS-MC Supplemental Training for Additive Manufacturing
(f) MARADMIN 176/17

Encl: (1) MCSC Additive Manufacturing Approval Request Form
(2) Risk Assessment Form
(3) I MEF Additive Manufacturing Quarterly Report

1. Situation. I Marine Expeditionary Force (I MEF) is employing emerging technology in repair part prototyping and production through additive manufacturing (AM) methods. AM is a rapidly advancing manufacturing process with direct application to improve ground equipment readiness. I MEF will maintain visibility and participate in the Marine Corps AM initiative by quickly expanding appropriate AM capability throughout I MEF in accordance with reference (a). AM is not an additional source of supply, however, it is a means to improve maintenance cycle time through production at the point of need. This Order provides guidelines for the integration of AM capability throughout I MEF in order to maximize its full potential as the Marine Corps develops the capability into a sustained Program of Record. This policy only applies to I MEF ground equipment.

2. Mission. This Order provides interim guidance for implementation of AM capabilities throughout I MEF. I MEF will employ and advance AM to its fullest capacity in order to reduce maintenance cycle times (MCT), flatten the supply chain, and improve combat readiness in garrison and during expeditionary operations.

3. Execution

a. Commander's Intent and Concept of Operations

(1) Commander's Intent. I MEF exploits AM to the maximum extent to reduce maintenance cycle times, decrease supply chain backlogs, and place manufacturing capability closest to the point of need. AM provides an opportunity to avoid long lead times due to part non-availability and/or adverse distribution channels in emergent combat or training situations. Personnel safety, equipment damage, risk assessment, and mission accomplishment concerns remain paramount throughout the AM process.

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(2) Concept of Operations(a) Additive Manufacturing Scope

1. AM is the process of creating a component that is produced through Computer Aided Design (CAD) software, per reference (b). While the term "Additive Manufacturing" is specific, I MEF AM also recognizes that other manufacturing methods exist as separate programs within a unit's current capability. These traditional capabilities may also be utilized to produce items through the AM program, which may be applied to Military Equipment (ME). These traditional methods include:

- a. Subtractive manufacturing: Removal of material.
- b. Casting: Pouring a liquid material into a mold.
- c. Molding: Shaping a pliable material.
- d. Joining: Welding or riveting material.

2. These manufacturing methods are subject to the policy requirements outlined in this Order when they are being used as part of the AM process. I MEF units will focus on using AM for prototyping, tooling, repair, and part manufacturing. I MEF will develop and expand AM manufacturing in a garrison and expeditionary environment.

3. 1st Marine Logistics Group (1st MLG) is the main effort for AM within I MEF. Combat Logistics Regiment 15 (CLR-15) provides AM General Support (GS) to all I MEF units for manufacturing items beyond using unit capabilities. 1st MLG will engage and coordinate with Department of Defense and civilian AM organizations to close the gap in AM production capabilities and sustain the momentum for innovation and exploitation of industry technology.

(b) Manufacturing Guidance

1. I MEF units will follow the established color bin guidance (green, yellow, and red) established in reference (a) that sets the minimum requirement standards for enterprise manufacturing opportunities.

2. Intermediate activities, Supply Management Unit (SMU) and 1st Maintenance Battalion, will produce a supplemental list of long-lead time and back-ordered National Item Identification Numbers (NIIN) for potential AM production, beyond using unit capabilities, on a regular basis. This list will guide efforts to maximize AM production within current capabilities and identify opportunities for long-term development.

3. I MEF G-4 will conduct a quarterly review of AM opportunities to meet using unit requirements.

(c) Approval to Procure AM Capability

1. Deputy Commandant, Installations and Logistics (DC, I&L) funded AM equipment/software requires both MSC and MEF G-4 approval.

2. MSC funded AM equipment/software purchases for less than \$150,000 require MSC G-4 approval.

3. I MEF /MSC funded AM equipment/software purchases valued at greater than \$150,000 require I MEF G-4 approval via the I MEF Acquisition Review Board (MARB) process.

4. The below additional guidelines must be met to purchase AM equipment.

a. Units must select equipment from the Marine Corps approved list of AM equipment. The approved list is not published and remains in a state of flux as the AM initiative is working through the various options. I MEF G-4 AM Action Officer can provide a list of the currently approved Logistics Vision and Strategy Branch (LPV) list of AM equipment.

b. The unit must possess, as part of their Table of Organization and Equipment the ancillary equipment and personnel necessary to complete the AM process. Examples of other necessary equipment include a machine shop, welding equipment, Computer Numeric Control (CNC) equipment, etc. Examples of personnel include machinists and metal workers.

(d) Tiers of AM Capability. I MEF establishes the following AM capability levels to provide initial guidelines as the AM concept matures.

1. Tier 1 Plastic and 3D Scanner: Units without machinists and welders.

2. Tier 2 Metal: Intermediate activities, Supply Management Unit (SMU) and 1st Maintenance Battalion (1st Maint Bn) are currently evaluating metal production capabilities to include applicability for units with machinist capability.

3. Tier 3 Fabrication Laboratories (FABLAB): 1st Maint Bn.

(e) Manufactured Item Approval Process. References (a) and (c) establishes the approval process using a green, yellow, and red bin construct. Examples of associated documents, enclosures (1) and (2), reside in the Information Exchange Portal (IEP).

1. Green (Printing Authorized): Manufactured items may be produced without prior approval. See reference (a).

2. Yellow (O-5 or Above Commander Determination): Commander determines the risk level is commensurate to the mission or training requirement. See reference (a).

3. Red (Prior Approval Required): Poses a significant risk to personnel safety or mission accomplishment should the item fail. Marine Corps Systems Command (MARCORSYSCOM) is the approval authority see enclosure (1). Reference (a) provides additional guidelines for O-5 or above commanders during combat operations.

4. Information Exchange Portal (IEP). The IEP will be used as the primary means to support the digital thread requirement for the approval process and sharing status. Items not resident in the IEP, or when the IEP is down, will follow an alternative process like the Recoverable Items Report (WIR) process. A task will be created in IEP to request authorization. Once approval has been granted via a signed authorization letter, the letter will be uploaded into the AM service request. For requests requiring Program Office approval, a task will be forwarded to the MSC G-4, where the information will be reconciled and consolidated into an AM production package for forwarding to MARCORSSYSCOM. The IEP portal can be found at <https://mm.md5.net>. The IEP contains examples of associated approval process documentaton, enclosures (1) through (5).

(f) Training. I MEF personnel will pursue all training opportunities available to ensure unit AM capability remains current with the leading edge of AM technology. I MEF will use a tiered training program using a train-the-trainer methodology. A Marine who has completed certified training will be able to perform product design and manufacturing. Training documentation will be added to the Marine Individual Training Record (ITR) within Marine Corps Training Information Management System (MCTIMS). The tiered training program is outlined below.

1. Tier 1 (Familiarity Training). Tier 1 training consists of on-the-job training (OJT). A Marine selected for Tier 1 training will attend OJT at one of the AM units. A Tier 2 or 3 qualified Marine will provide OJT for a period no less than ten days. This will allow the student to gain a basic understanding of the AM program prior to attending formalized training. Upon completion of Tier 1 training, the Marine is qualified for Tier 2 or 3 training.

2. Tier 2 (AM Instructor). Tier 2 consists of Tier 1 training and successfully completing additional AM training. A Tier 2 Marine has the ability to design and manufacture items on their own and is authorized to train Tier 1 Marines. A Marine completing Tier 2 training is a qualified AM Instructor (AMI) or Marine Manufacturer (Designer/Printer). Additional AM training is available from several sources.

a. 1st Maint Bn provides Tier 2 training.

b. Building Momentum, a United States Marine Corps (USMC) contracted training organization, provides AM training and is sponsored by NexLog. Request for Building Momentum training is coordinated through Next Generation Logistics (NexLog), Demonstration & Assessment Team (DAT) through the Major Subordinate Command (MSC) and I MEF G-4.

c. The FABLAB at Marine Corps Air Ground Combat Center (MCAGCC), Twenty-Nine Palms, and a potential Maker Space at Camp Pendleton will provide AM training in the future.

d. There are civilian on-line courses that provide a certificate of completion at the conclusion of the course.

e. Certificates are currently under review and will be included in the next iteration of this AM policy.

3. Tier 3 (AM Trainer). Tier 3 consists of Tier 1 and 2 training with an additional six months of practical application in design and printing items at any AM facility. Tier 3 Marines will be considered an AM Trainer (AMT) and a Marine Corps' leading Subject Matter Experts on AM.

(g) Inventory

1. Organizational units will not create inventory using AM capability. No AM manufactured items will be held in the unit's Demand Supported Items (DSI).

2. 1st MLG will coordinate minimum inventory levels for long lead time items.

(h) Quality Control (QC). (QC) is the final step in the production cycle before the item can be put into service. It is imperative that the QC process be deliberate, systematic, and fluid. I MEF's QC program will consist of three layers of verification and validation. Layer 1 and Layer 2 QC may be performed by the same individual. Layer 3 requires a separate QC individual. Units requiring assistance due to insufficient personnel will request support from 1st Maint Bn. All QC actions will be documented on the Global Combat Support System - Marine Corps (GCSS-MC) Service Request.

1. Layer 1 (Design Comparison): The Manufacturing Marine will validate the printed item matches the specifications of the CAD file and ensure the continuity between the design and printing processes. Once Layer 1 is complete, the Manufacturing Marine will annotate "QC complete, manufactured item meets design specification and there were no errors in the production process" in the GCSS-MC task notes.

2. Layer 2 (Product Comparison): The AMI/T qualified Marine will validate that the printed item not only matches the CAD file but also match it to the specifications of the Key Supporting Documents (KSDs). Once Layer 2 is complete, the AMI/T will annotate "QC complete, manufactured item meets design and requested specifications" in the GCSS-MC task notes.

3. Layer 3 (Testing): The requesting unit will perform a visual, physical, and functional check of the manufactured item to ensure printed items meet all associated KSDs. At the completion of Layer 3 QC, the requesting unit will annotate "QC complete, manufactured item meets requested specifications and performs equally if not better than the original item" in the GCSS-MC task notes.

(i) Funding

1. Units will fund AM equipment procurement and sustainment.

2. Units will use a Special Interest Code to track AM costs.

3. Units are encouraged to seek DC, I&L, funding for purchasing AM equipment sets. Requests for I&L funding will be routed through the MSC G-4 to the MEF G-4 for submission to I&L.

4. Parts manufactured by 1st Maint Bn and the SMU currently will be free issue. Costs for items manufactured via contract will be passed to the requesting unit.

(j) Accountability. Units will maintain property accountability in accordance with reference (a).

(k) Documenting AM. All AM actions will be captured in GCSS-MC in accordance with references (d) and (e).

1. Requesting AM Support. Requests for AM support will be submitted to a supporting AM facility via service type task in GCSS-MC. For instances where the AM item supports repair of ME, a service type task will be created on the maintenance service request. When the AM item is not in support of maintenance (e.g. training aid), a service type service request will be opened and the task will be created to request the item be manufactured. The subject line of the task will state "Manufactured Part Request", the task description box will include: National Stock Number (NSN), Part Number, Commercial and Government Entity (CAGE) code, quantity required, item description, the ME NSN to which the part will be applied, and justification for manufacturing. A drawing, Stereo Lithograph (.STL) file, picture, and additional information may be attached to the task to assist in manufacturing the item. A Technical Data Package (TDP) will be developed by the manufacturer and attached to the service task.

2. AM Facility Requirements

a. Capturing Manufacturing Efforts. The AM section will document the following information in a task note: type of material used to manufacture the item, the item's color, and any additional value-added post production details. The CAD file, authorization letter, or any other Key Supporting Documentation will be attached to the manufactured item task. For items that possess a valid NSN, the AM section will debrief Labor and Material used during the manufacturing process.

b. Adding Manufactured Parts to the GCSS-MC Inventory. Manufactured items will be introduced to the inventory via a Service Activity Code "Return to Inventory" and use War Reserve System (WRS) code "99". Inventory will automatically be placed in the 01F and require transfer to the requesting commodity or activity. In cases where the supporting AM facility and the requester are separate activities, a Material Redistribution will be used to transfer the item to the requesting activity. Once in the requesting activity's inventory, AM items are managed as any other requisition.

(l) Considerations. AM is not a source of supply but is an alternative solution to meet emergent situations. Marines and Sailors will conduct an analysis during the AM development process to determine if 3 Dimensional (3D) printing material will be sufficient to meet the emergent military specifications.

b. Coordinating Instructions

(1) Repair parts will be requisitioned through GCSS-MC prior to using AM for fabrication.

(2) Product Quality Deficiency Reports (PQDRS) will be used to report quality issues for AM production similar to PQDRs for OEM parts.

(3) Legal/intellectual property concerns are addressed in reference (a).

(4) I MEF units procuring AM capability must submit an Information Technology (IT) Waiver to the I MEF G-6 for laptop, 3D printer, scanner, and software in accordance with paragraph 3.H of MARADMIN 176/17, reference (f).

5. Administration and Logistics

a. Quarterly Reports. MSCs will provide quarterly reports listing which units possess AM equipment, type of AM equipment, number of trained personnel, and list of NIINs unit has produced since the previous report. Reports are due the first day of the quarter. See enclosure (3).

b. Maker Space Facilities. DC, I&L intends to provide most bases and stations with a "Maker Space" AM facility. Maker Space provides a significant AM capability to enable Marines and Sailors to explore, exploit, and innovate AM manufacturing.

c. 1st MLG AM Sharepoint Portal. Units should reference this I MEF repository for current policies, procedures, existing CAD files, and training opportunities.

6. Command and Signal

a. Command. This Order is applicable to all personnel, to include civilians attached, assigned, or supported by I MEF.

b. Signal. This Order is effective the date signed and should be reviewed against the references every six months to ensure consistency and currency.

c. Point of Contact. The point of contact is Lieutenant Colonel Christopher Eichner, I MEF Materiel Readiness Officer.


LEWIS A. CRAPAROTTA

MCSC AM Approval Request Form

Instructions:

(i) This MCSC AM Approval Request Form is provided to the user after the program office approves request to 3D print the proposed AM part.

(ii) After user prints 3D part, the user completes this form and sends to MCSC Systems Engineering, Integration, Architecture, and Technology (SIAT) to request approval to use the printed AM part.

(iii) When internal MCSC assessment is completed, program office notifies user of approval to use AM part.

1.0 Initial Information: (filled out by MCSC (SIAT))

1. (a) Date print request via email received:
1. (b) SIAT tracking number (yyyyddmm_00x):
1. (c) Date program office approved print request via email:
1. (d) Special print instructions / cautions from program office:
1. (e) Date request form sent to user via email:
1. (f) Responsible MCSC Program Office:
1. (g) Responsible MCSC Program Office POC:

2.0 User Information: (filled out by user)

2. (a) Date MCSC AM Approval Request Form prepared:
2. (b) Requesting unit:
2. (c) POC (User):
2. (d) POC contact information:
 - (i) Email:
 - (ii) Phone number:

3.0 Existing Part Information: (filled out by user)

3. (a) Existing part information: (if not replacing an existing part, go to section 4.0)
 - (i) General description:
 - (ii) Nomenclature (item description, TAMCN):

(iii) Serial number of platform/next higher assembly and end item where used or installed:

(iv) NSN:

(v) P/N:

(vi) CAGE:

(vii) Cost:

(viii) Material:

(ix) Source, Maintenance, and Recoverability Code (SM&R):

3. (b) Picture or drawing of existing part (attach if available):

3. (c) Rationale for request (problem/issue with existing part):

(i) Background / relevant facts:

- Any Product Quality Deficiency Report (PQDR), Supply Deficiency Report (SDR), or Request For Engineering Support (DLA 339) form previously submitted:

(ii) Backorder status or reliability information:

3. (d) Technical Data Rights Questions

(i) Was or will any technical data from the existing part Original Equipment Manufacturer (OEM) be used?

(ii) If YES and that data was hard copy or electronic, was or will that OEM data marked with, or accompanied by another writing or oral statement that expressed, either a proper restrictive legend such as "Limited Rights," or with other wording restricting or limited the use of that data, such as "proprietary" or "confidential?"

(iii) If YES and the data were transmitted orally, did the OEM person transmitting the data express any restricted use conditions? If YES, provide your best recollection of what the restrictive conditions were and when & where that communication took place.

3. (e) Patent Questions

(i) Are there any patent numbers indicated on either:

(1) the existing part you are replacing;

(2) any larger subsystem or the overall system in which your replacement component will be installed; or

(3) any technical manual, advertising material or other publication, or verbal indication from the OEM?

If yes, please provide each patent number and indicate where each patent number was found.

(ii) If you know of any other information about potential patents related to either the existing part or the overall system, please provide it. Otherwise, indicate no other patent information is known.

4.0 New Part Information: (filled out by user for part to be 3D printed and used):

- 4. (a) New part description:
- 4. (b) Rationale for new part (especially if not replacing an existing part):
- 4. (c) Picture or drawing of new part (attach if available):
- 4. (d) New part features or benefits over and above existing part (doesn't have to be any):
- 4. (e) New part design time (hours, minutes, etc.):
- 4. (f) How was new part designed (scanning, caliper, tape measure, etc.):
- 4. (g) New part material:
- 4. (h) Existing analysis or testing on printed part:
- 4. (i) New part estimated cost:
- 4. (j) 3D printer used (brand, model, etc.):
- 4. (k) Fabricator (if not user) training or experience with 3D printing / printer used:
- 4. (l) Special instructions (if any):
- 4. (m) Fabrication (print) time (hours, minutes, etc.):
- 4. (n) 3D printer file name:
- 4. (o) 3D printer file location in MCSC AM Parts repository:



UNITED STATES MARINE CORPS
Unit Information Here

4300
CO

From: Commanding Officer
To: S-4 Officer

Subj: RISK ASSESMENT FORM FOR ADDITIVELY MANUFACTURED PART MEMORANDUM

Ref: (a) Unit MMSOP Policy Letter XXXX
(b) MCO 3500.27C
(c) MARADMIN 594/17

1. Memorandum in the case of additively manufactured [NOMEN]. This item is / is not intended to serve as a part [if intended to serve as a part, add: "in the place of NIIN [enter NIIN] for the [end item TAMCN and NOMEN]"].

2. In accordance with the reference, the following is submitted for the record. You are hereby directed to accomplish any tasks detailed below.

a. Safety. The risk assessment code (RAC) per reference (b) associated with the usage of this part/item is: (1, 2, 3, 4, or 5). Based on this RAC this is classified as a (green, yellow, or red) bin item per reference (c). [If it has a RAC of 1, 2, or 3, add: "Safety concerns are mitigated as per enclosed risk matrix." Then add the enclosure to the heading of the memorandum.]

b. This is / is not known to be the subject of a patent. [Omit subparagraphs 1. through 3. if not known to be the subject of a patent.]

1. Patent number:

2. This has / has not been submitted for legal review. [If not submitted, add: "Submit for legal review NLT" (date no more than 96 hours in the future).] The legal review's status is complete / pending. [If complete, add: "The legal review's results are enclosed" then list the enclosure in this memo's heading.]

3. Justification: [add reasoning behind the decision to implement despite patent.]

c. This item was / was not designed or created with original equipment manufacturer (OEM) restricted data. [Omit subparagraphs 1 through 3. if not created with OEM restricted data.]

1. Nature of OEM restricted data and how accessed:

2. This has / has not been submitted for legal review. [If not submitted, add: "Submit for legal review NLT" (date no more than 96 hours in the future).] The legal review's status is complete / pending. [If complete, add: "The legal review's results are enclosed." Then add the enclosure to the heading of the memorandum.]

3. Justification: [add reasoning behind decision to either utilize OEM restricted data or to utilize the part despite the use of OEM restricted data in its creation.]

Enclosure (2)

d. This items is / is not an explosive, ordnance, bio-medical, or any other lethal item component. [If it is an explosive, ordnance, bio-medical, or any other lethal item component add: "Legal review submitted on (date); response received on (date) is enclosed." Then add the enclosure to the heading of the memorandum.]

e. An approval request to MARCORSYSCOM was submitted on / will be submitted NLT [add date. In the case of "will be submitted," date will be NLT 96 hours in the future]. The request's status is approved / disapproved / pending.

3. Use of the above item in question is approved / disapproved.

I. M. COMMANDER

FIRST ENDORSEMENT

From: S-4 Officer
To: Commanding Officer

Subj: ADDITIVELY MANUFACTURED PART MEMORANDUM

1. I completed all actions required by the tasks listed in the above memorandum for the additively manufactured [NOMEN] on [date].
2. A copy of the memorandum and this endorsement will remain on file for no less than one year, beginning from the time the additively manufactured item ceases to be used.

M. B. LOGO

I MEF Additive Manufacturing Quarterly Report

A. Unit: _____ Date: _____
 POC: _____

B. Equipment Possessed

Model	Equipment Type
LulzbotTAZ6 (SAMPLE)	Printer
Artec Space Spider Handheld 3d Scanner (SAMPLE)	Scanner
Dell (SAMPLE)	Computer

C. Trained Personnel

Training Level	Numbered Trained
Tier 1	
Tier 2	
Tier 3	

D. Manufactured Items

NIIN	Qty Manufactured

E. New Designs

NIIN	Nomenclature



UNITED STATES MARINE CORPS
I MARINE EXPEDITIONARY FORCE
 Box 555300
 Camp Pendleton, CA 92055-5300



1. DATE February 5, 2018

2. OPERATION CODE

X ORIGINATOR
 A APPROPRIATE ACTION
 B SIGNATURE
 C CONCURRENCE
 D INFORMATION
 E RETENTION
 F RETURN TO:
 G COMMENT(S)

3. SUBJECT: INTERIM I MARINE EXPEDITIONARY FORCE
 ADDITIVE MANUFACTURING POLICY

9. NATURE OF ACTION REQUIRED	ORIGINATOR INITIALS	DUE DATE
ROUTINE	ANM	

10. ACTION OFFICER (NAME, GRADE, SECTION, EXT)
 C. Eichner, LtCol, 763-6817

11. REMARKS AND SIGNATURE:

PURPOSE:

Routed to CG for signature.

DISCUSSION

Routed through the proper G shops and MSCs.

Don Tracker attached inside.

RECOMMENDATION:

Routed to CG for signature.

4. RTNG	5. OPR CODE	6. ADDRESSEES	7. DATE		8. INITIALS	
			IN	OUT	CONC UR	NON CONCUR
7	B, C	CG				DC
		DCG				
6	C	COS		2/6		JR
		SERGEANT MAJOR				
		CMD MASTER CHIEF				
5	A, C	SSEC	2/6	2/6		JPR
4	C	SSEC CHIEF	2/6	2/6		DAF
3	C	AC/S G-1	2/5	2/5		PDY
	C	AC/S, G-2				
2	C	AC/S, G-3		2/5		✓
	X, C	AC/S, G-4				
	C	AC/S, G-5				
	C	AC/S, G-6				
	C	AC/S, G-7				
	C	AC/S, G-8				
		COPS				
		FOPS				
1	C	ADJUTANT		2/5		NP
		ADJUTANT CHIEF				
		RLO				
		IMA				
		SJA				
		PAO				
		INSPECTOR				
		SURGEON				
		CHAPLAIN				
		CAREER RETEN SPEC				
		SECURITY MANAGER				
		SGTMAJ DRIVER				
		COMPANY CDMR, IMIG				
		COMPANY OFFICER, IMIG				
		I MIG				

