Department of the Navy (DON) Additive Manufacturing (AM) Implementation Plan

Dr. John Burrow
Deputy Assistant Secretary of the Navy Research, Development, Test and Evaluation
(DASN RDT&E)

VADM Philip Cullom, USN
Deputy Chief of Naval Operations for Fleet Readiness & Logistics (OPNAV N4)

LtGen Michael Dana
Deputy Commandant, Installations & Logistics
(I&L)

Distribution Statement C. Distribution authorized to U.S. Government agencies and their contractors; Administrative or Operational Use; May 2016. Other requests for this document shall be referred to the Office of the Assistant Secretary of the Navy for Research, Development and Acquisition.

THE SECRETARY OF THE NAVY
WASHINGTON DC 20350-1000

September 3, 2015

MEMORANDUM FOR CHIEF OF NAVAL OPERATIONS
COMMANDANT OF THE MARINE CORPS
ASSISTANT SECRETARY OF THE NAVY (RESEARCH, DEVELOPMENT AND ACQUISITION)

SUBJECT: Additive Manufacturing/3-D Printing

The United States (U.S.) Navy and Marine Corps team is realizing the potential of Additive Manufacturing (AM) and 3-D Printing (note: these terms will be used interchangeably), to transform our future maintenance and logistics supply chains, increase logistics resiliency, and enable true self-sustainment for our forces during operations. AM affords extraordinary agility over traditional manufacturing, procurement and acquisition methods, and will lead the Department of the Navy (DON) in radically enhancing fleet life cycle logistics, increasing the operational availability of our forces, and reducing total ownership costs.

Around the fleet, our Sailors and Marines are embracing AM. Our scientists and engineers are developing AM processes and controls, experimenting with AM produced parts, and planning a secure network for optimized digital production and information sharing. The incorporation of 3-D printing capabilities on the amphibious assault ship USS ESSEX, the use of AM to make rapid repair of aircraft at MCAS Cherry Point, or the use of custom 3D printed cranial plates for wounded warriors at Walter Reed clearly demonstrates the significant benefits from rapid AM technology development, use, and implementation.

To maintain this momentum and broaden our efforts, a DON-level coordinated effort is necessary to assist, accelerate, and enable AM implementation across the DON Enterprise, and provide the training needed to harness its full potential.

To realize the potential of AM, drive innovative change, and facilitate adoption within the DON, Assistant Secretary of the Navy (Research, Development and Acquisition) (ASN (RD&A)) shall, in coordination with the U.S. Navy and Marine Corps, develop an integrated and detailed implementation plan that will achieve the following:

- Increase development and integration of additive manufacturing systems.
- Develop the ability to qualify and certify AM parts.

DEPARTMENT OF THE NAVY
HEADQUARTERS UNITED STATES MARINE CORPS
3000 MARINE CORPS PENTAGON
WASHINGTON DC 20350-3000

IN REPLY REFER TO:
1000
LPV

From: Deputy Commandant, Installations and Logistics Department Headquarters, U. S. Marine Corps
To: Deputy Commandant, Concept Development & Integration Department, Headquarters, U. S. Marine Corps

Subj: ADDITIVE MANUFACTURING (AM) DEMONSTRATIONS IN SUPPORT OF MARINE CORPS IMPLEMENTATION AND SUPPLY SYSTEM INTEGRATION

Ref: (a) Department of the Navy (DON) Additive Manufacturing (AM) Implementation Plan

Encl: (1) Candidate List - Final (MCSC)
(2) Candidate List - Final (NAVAIR)

1. Purpose. Continue the collaborative efforts between all additive manufacturing (AM) stakeholders and partner to execute AM demonstrations. The intent is to explore the "art of the possible" technologically and to inform future requirements. The candidates listed in the enclosures were reviewed by NAVAIRSYSCOM, MARCORSYSCOM, and AM technology subject matter experts for suitability and have our support.

2. Mission. In conjunction with all stakeholders, DC I&L will monitor additive manufacturing demonstrations in order to assess the suitability of using additively manufactured items in programs of record and the supply system.

3. Execution. In concert with the demonstrations, we will work collectively with your team to prepare for the following events:

a. Modern Day Marine - 27-29 September 2016: This event will serve as the "kick-off" demonstration to showcase how emerging technology can influence parts obsolescence risks, long-lead times, and early failure challenges.

b. Formal Report - January 2017: This presentation will discuss the demonstrations' findings and inform a path forward.

5. Point of contact for this Department is Captain Christopher Wood, LX, (571) 256-2740, Christopher.j.wood@usmc.mil.

M. G. DANA

INTERIM POLICY ON THE USE OF ADDITIVE MANUFACTURING (3D PRINTING) IN THE MARINE CORPS
Date Signed: 9/16/2016
MARADMINS Active Number: 489/16
R 161443Z SEP 16
MARADMIN 489/16
MSGID/GENADMIN/CMC LP WASHINGTON DC//
SUBJ/INTERIM POLICY ON THE USE OF ADDITIVE MANUFACTURING (3D PRINTING) IN THE MARINE CORPS//
REF/A/ MSGID:DOC/ASTM/01MAR2012//
REF/B/ SECNAVINST 4410.23, JOINT REGULATION GOVERNING THE USE AND APPLICATION OF UNIFORM SOURCE MAINTENANCE AND RECOVERABILITY CODES//
AMPN/ REF A IS ISO/ASTM 52900:2015, STANDARD TERMINOLOGY FOR ADDITIVE MANUFACTURING TECHNOLOGIES. REF B PRESCRIBES THE STANDARD POLICIES FOR THE ESTABLISHMENT AND MAINTENANCE OF SOURCE, MAINTENANCE, AND RECOVERABILITY CODES WITHIN THE SERVICES.//
POC/NANCY SPRINGER/COL/UNIT: HQMC IL LPV/-/TEL: 571-256-7173/EMAIL: NANCY.SPRINGER(AT)USMC.MIL//
POC/CHRISTOPHER WOOD/CAPT/UNIT: HQMC IL LPV/-/TEL: 703-439-7489/EMAIL: CHRISTOPHER.J.WOOD(AT)USMC.MIL//
POC/MR. JOE BURNS/CIV/ UNIT: MARCORSYSCOM SIAT/-/TEL: 703-432-3099/EMAIL: JOSEPH.C.BURNS(AT)USMC.MIL//
GENTEXT/REMARKS/1. PURPOSE. To provide initial policy and guidance regarding the use of additive manufacturing (AM) equipment, design and fabrication processes for the production and use of AM-derived parts and other items. This interim policy does not apply to aviation-related parts or other items used in-flight or in support of aircraft, such as Ground Support Equipment (GSE). This message addresses AM process categories as defined in REF A and other AM-related process categories that may emerge in the future.
2. DISCUSSION.
A. REF A defines AM (also known as 3d printing) as the process of joining materials to make objects from 3d model data, usually layer upon layer, as opposed to subtractive (traditional) manufacturing methodologies.
B. AM technologies have the potential to advance the expeditionary capabilities of the entire Marine Air Ground Task Force (MAGTF). The AM technology domain is made up of many different enabling technologies that, in most instances, tie together a 3d design file with a specific process and a specific material. As of the publication date of this message, AM materials include plastics, metals, rubbers, energetics, concretes, foods, and organic tissues. Currently, AM processes are used for prototyping, tooling, repair, and manufacturing. Worn and broken parts can be improved through additive repair technologies, existing parts can be redesigned for decreased weight and increased strength, and entirely new parts can be re-designed to take advantage of AM in ways that are not possible with conventional manufacturing technologies. Furthermore, AM can "print" prosthetics, electronic components, large scale decoys, unmanned aerial vehicles, and expeditionary shelters. The uses and limits of AM have only just begun to be discovered – the AM technology domain continues to grow at an accelerated pace and in unpredictable ways.
C. Headquarters Marine Corps (HQMC) recognizes that the near-term application of AM can result in innovative solutions, improved responsiveness to Marine Forces (MARFOR), reduced acquisition and total life-cycle cost, and, ultimately, improved readiness. However, such gains are susceptible to concerns regarding safety, warranties, and intellectual property issues (such as voided warranties when using AM-produced components). Even though AM has advanced rapidly since it began commercial adoption in 1987, there still remain several technical and procedural challenges to be resolved. Currently, the maturity of an AM solution to produce an item is highly dependent upon the specific design, process and material used to produce that item, as well as the intended end use of the item. For example, an AM-derived part can look and feel similar to a conventionally manufactured part, but may have better or worse physical properties (strength, flexibility, weight, etc.), in addition to concerns regarding reliability and suitability.

Candidate Part Demonstration Criteria

Category A Demonstrations

Demonstrate the ability to use **alternate materials** for parts and components that support little or "no load" during normal operation in order to determine potential material exchange principles and possibilities. The desired endstate is to return the PEI to operational condition, using an AM printed stop gap solution, until the original manufactured equipment (OEM) can be obtained and replace the AM'ed part.

Category B Demonstrations

Demonstrate the ability of AM to address **obsolescence risks** and challenges associated with existing programs of record (POR) in order to reduce requirements for independent fabrication or acquisition as well as increase supply system responsiveness. The desired endstate is to return the PEI to operational condition with an AM part able to meet PEI performance requirements.

Category C Demonstrations

Demonstrate the ability of AM to address **long-lead times and limited sources of supply** for higher demand, lower density parts and components. The desired endstate is to return the PEI to operational condition by enhancing and supporting the existing supply system with an alternate source of supply when the OEM is either unavailable or will require significant wait periods (I.e. greater than 90 days in garrison or greater than 30 days when deployed.)

Category D Demonstrations

Demonstrate the ability of AM to address known (and documented if available) **early failure challenges** with OEM parts, tools and components. An example prerequisite for use of AM in this regard would be a documented history of Product Quality Deficiency Report (PQDR) submissions. The desired endstate is to determine if AM can enhance or in a measureable way improve the PEI by "fabricating out" the defect addressed and return the PEI to operational condition.