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Title: The Marine Corps' Future Prepositioned Network: Beneath the Oceans and Beyond

Author: Major Sean T. McCarragher, United States Marine Corps

Thesis: Adversary standoff capabilities make the current Marine Corps prepositioning programs inadequate for the future fight. To support new operational approaches in a contested environment will require a prepositioned network of smaller, redundant, and hardened nodes exploiting different domains.

Discussion: From its inception until today, the prepositioning program has served the Marine Corps well. The existing program, however, lacks the survivability necessary for operations in a contested environment against a peer competitor, for which it was never intended. Its assets are fixed, known, vulnerable to long-range strike capabilities, and would be priority targets for an adversary. New operating concepts, such as Expeditionary Advanced Base Operations, require prepositioned support. The Marine Corps must develop new programs, systems, and techniques to provide it.

Conclusion: Flexible, resilient, and innovative approaches to prepositioning will sustain Marine Corps operations within a peer competitor's Weapons Engagement Zone. This capability will complicate the adversary's operational calculus, thus enhancing deterrence.

I. INTRODUCTION

Future concepts for the Marine Corps to maneuver around the battlespace will continue to be challenging due to restricting adversary weapon systems and surveillance capabilities. These challenges create an even greater need for prepositioned forces to encompass survivability, flexibility, and sustainability when called upon. According to the 3rd edition of the Marine Corps *Prepositioning Program Handbook*, “The primary purpose of the MPF program is to enable the rapid deployment and engagement of a MAGTF anywhere in the world in support of our National Defense Strategy.”¹ However, Marine Corps leaders have debated the premier Maritime Prepositioning Force (MPF) program's relevance. This questioning of relevance is due to the notion that the current MPF cannot survive in a contested environment. *MCTP 13-10D*, the Marine Corps Maritime Prepositioning Force Operations doctrine, states a secure environment needs maintaining throughout all phases of MPF operations. The proliferation of Anti-Access/ Area Denial (A2/AD) capabilities makes that security unlikely, and thus the current prepositioning program unviable.

This discussion topic will first examine the geopolitical environment and how changes in this realm may impact prepositioning. It will then transition to observing changes in the operational environment and discuss how future challenges will affect the way the Marine Corps prepositions assets. Along with a changing operational environment come new operational concepts and support processes, which this paper will address. A review of the current prepositioning program and an examination of inadequacies within this program further support the need for an overhaul. Lastly, an assessment of future alternative concepts and support assets for the program need further consideration.

This paper intends to explore our past, current, and future concepts to determine what the future Marine Corps prepositioning program should look like if one should exist at all. This paper will also examine innovative ways to preposition assets and employ assets from their positions forward as needed. The research tests assumptions, identify shortfalls in the Marine Corps' prepositioned force's capabilities, and justify a change proposal. Widening the scope of literature for discovery beyond MPF and those concepts outlined above is needed. This scope will include research in the latest technologies and future capabilities regarding logistics and connectors. Predominantly focused in two domains, the Marine Corps' prepositioned forces rely on land and sea surface projections. This research shows that the program must expand its horizons including concepts and research as Space-Based Logistics (SBL) and venture to exploit sub-surface capabilities.

The Marine Corps should develop doctrine to support the prepositioning program's usage in contested environments. This development bases itself on needing a secure environment to operate and assumes future adversary capabilities pose significant concerns throughout a geographic combatant commander's theatre and well beyond. Not requiring a secure environment does not negate the fact that MPFs will not require security. However, long-range missile security overall will be most challenging to provide if these ships remain defenseless. Limitations foreseen in the program's future enhancement are fiscal like many current and future programs throughout the DOD. Some recommendations for envisioning a future prepositioned network in this paper may assume limitations such as funding not being so constricted.

The future Marine Corps prepositioning program needs flexibility, sustainability, speed, and reliability more significantly than its current state. Before going into detail about changing the prepositioning structure, this paper will assist in answering key questions that help frame the

need for change. What is the purpose of the current Marine Corps prepositioning program? Is a prepositioning program needed for the future force? What provisions will the future prepositioning program require? Should the mission of the program change? Are other options available versus prepositioning?

As previously stated in the opening paragraph, the purpose of the Marine Corps' prepositioning program is to reduce response times and ensure timely support of the Geographic Combatant Commander's (GCC) operations. These prepositioning programs can support up to a Marine Expeditionary Brigade (MEB) for 30 days. This MEB or any Marine Air Ground Task Force (MAGTF) element is contingent on the unit's Fly-In Echelon (FIE) of personnel and equipment. This FIE organic support may very well be the Achilles heel to the prepositioning program in the future. Relying on a significant airlift plan for consolidation to connect units and prepositioned equipment should be reconsidered, but that is beyond the scope of this paper.

Lessons from World War II (WWII) logistics suggest that not having prepositioned assets is a logistician's nightmare in today's current environment. Many battles in the Pacific relied upon logistic trains, supply dumps, and logistic forward operating bases. Today, logistic trains such as the MPS and large forward operating bases are considerably more vulnerable than during WWII. A book on WWII Logistics titled *The Big L: American Logistics in World War II*, written by Alan Gropman, gives credit to logistics for winning the Pacific War. In his conclusion, he states, "One thing is certain, the key decisions of the war were logistical decisions dictated by logistics considerations," these words of the past are just as valid in planning for the future.² Leaders should take note that the realm of logistics considerably drives limitations in planning. As referenced earlier in his chapter on the Pacific, Gropman stated two major logistical problems: first, getting there, and second, sustaining forces at great distances. These remain two of the most

significant considerations today. Requirements to deploy and maintain forward military presence will drive the need for a network of prepositioned systems.

Is a prepositioning program needed in the future? Yes. Even more so than it is today. This answer stems from increases in adversary capabilities, continued reliance on large amounts of logistical needs, and the requirement for more responsive planning to emergent situations. These issues challenge our logistical lines of communication and current power projection.

The current Marine Corps' prepositioning program structures around two globally responsive squadrons and two land-based programs, however many limitations constrain the potential for the future of this program. Loading gigantic warehouses and ships with combat-ready gear will not give the Marine Corps the effectiveness in the future it desperately needs. The ability to disrupt Command and Control (C2) and logistics is a serious action an adversary would take when conflict arises. Risks considered by Marine leadership of the current prepositioned programs lead to vulnerabilities that resemble large targets of opportunity for our adversaries.³ The problem is our current prepositioning program efficiently supports the massing of forces but at significant risk. The future massing of troops around aerial ports of debarkation and Seaports of Debarkation (SPOD) will be considered less due to the threat of near-peer adversary capabilities. The adage of not putting all your eggs in one basket closely resembles future concerns if this program stays unchanged. To mitigate this, provisions of hardening and redundancy need significant consideration in the future. Taking a stance adding these provisions reduces efficiency in the program's budget; however, they will gain efficiencies and effectiveness in support when executed correctly.

The program's mission to support MAGTFs across a wide Range Of Military Operations (ROMO) is consistent with current and future needs for the Marine Corps.⁴ This vague purpose

leaves flexibility for the program to support new concepts, MAGTF units, and missions. Until a portal like Stargate (SG-1) is available for tasking, the only other option over prepositioning assets and supplies is to logistically move them from the United States via air and shipping nodes as required. Given the scope of future requirements, if prepositioned assets were not available, then the reaction time given to Foreign Humanitarian Actions (FHA) from Marine Corps forces would increase. However, the main reason for prepositioning such large quantities of assets is solely due to the lack of Air Force and Civil Reserve Air Fleet (CRAF) airlift compounded by the lack of Naval sealift ships from the US Navy, Voluntary Intermodal Sealift Agreement (VISA) entities, and Ready Reserve Fleet (RFF) to support service-wide requirements in wartime scenarios.⁵ These reasons above are why prepositioning is necessary and why it is a proponent of the strategic mobility triad.⁶

II. CHANGE IN THE GEOPOLITICAL ENVIRONMENT

The geopolitical environment for centuries has revolved around predominantly resources and geography. Today a rapidly changing climate further complicates the above two elements in geopolitics. Linking global warming to water shortages, natural disasters, and refugees' migrations is no stretch of the imagination. Tomorrow's geopolitical environment will continue to revolve around resources and geography while the world's population continues to increase. Continuing growth coupled with finite resources and geography, if unmanaged, will complicate and destabilize the future.

The current Interim National Security Strategic Guidance echoes these concerns and more. "Pandemics and other biological risks, the escalating climate crisis, cyber and digital threats, international economic disruptions, protracted humanitarian crises, violent extremism and

terrorism, and the proliferation of nuclear weapons and other weapons of mass destruction all pose profound and, in some cases, existential dangers.”⁷ Many of these threats are not bounding themselves within borders and complicate the geopolitical environment further.

From natural disasters to international disputes, prepositioned Marine Corps assets continue to give GCCs an advantage. For FHA, responding first on the scene and coordinating support and capabilities with USAID and host nation governments buys credibility and builds partnerships with the said nation. Geography and resource quarrels may be put in check and even deterred by the location of prepositioned assets near the point of use. Having a ready, capable force within an area of operations can discourage actions and respond to emerging crises which is why prepositioned assets will continue to be worth their weight in gold.

III. CHANGE IN THE OPERATING ENVIRONMENT

The future operating environment 2030 and beyond will experience many shifts. Resource competition, increased global connectivity, advanced applications, and demographic movement to megacities along the littorals are areas where significant shifts will occur. These shifts and other critical factors will change how strategists think of the future's operating environment. Technology evolution continues to advance at an increasing rate.⁸ This rate is evident with the growing advances in A2/AD capabilities possessed by various adversaries. As the environment gains complexity and competition increases, this calls for flexibility and feasibility of forward-deployed and forward stationed units. Prepositioning assets and various classes of supply beyond current capabilities are crucial to react timely in a crisis.

Many cases for change over the past decade have called to question MPF ships' practicality. Commandant of the Marine Corps, General David H. Berger, stated, "Those giant roll-on, roll-

off ships are not survivable, they're not compatible to the places where we're going to have to pull them in the future because of their deep draft."⁹ This statement questions two distinct aspects of our current MPF ships. Are they survivable? And are they compatible?

Are they survivable in the current and future environment? It depends, is the answer. In our current environment, Maritime Prepositioning Squadrons (MPSRON) use the sea as maneuver space when they leave their home port or Port of Embarkation (POE).¹⁰ Also, they often travel along Sea Lines of Communication (SLOCs) patrolled by friendly forces or travel under a designated Battle Group (BG) that provides security. The current employment concept requires construction for a sea-base to enable Joint Logistics Over the Shore (JLOTS) or development at a SPOD. These scenarios both require "a secure area where force introduction is unopposed."¹¹ according to doctrine. With current near-peer capabilities encompassing an entire theatre, this assumption in doctrine would be challenging to maintain.

Are these ships survivable in the future environment? The previous answer of it depends, changes to less likely. General Berger commented in his case for change, "(the) rise of the precision strike regime, gray zone strategies, and the imperative of the maritime campaigning" have given us preconceptions of the problems the Marine Corps is to face in the future.¹² Hampering the MPSRON's use of the sea for maneuver will be a growing adversary naval presence and increased security threats. Anti-ship cruise missiles (ASCMs) whose capable range continues to grow will contest MPSRONs inside their home fleet port and possible POEs. Can the USMC afford to continue investing in large non-survivable platforms, as General Berger and many others have addressed?

IV. NEW USN-USMC OPERATING CONCEPTS

Ideas to change to the MPF program have developed throughout the past decade. Connecting these ideas to the latest Marine Corps concepts and ensuring relevancy for the future can be challenging. Sinking countless amounts of time and treasure into programs that support a nearsighted plan would be foolish. With the change in emphasis from counterinsurgency and counterterrorism operations in the Middle East to great power competition in the Indo-Pacific, the Navy and Marine Corps team has developed new operating concepts. These concepts are Littoral Operations in a Contested Environment (LOCE), Expeditionary Advance Base Operations (EABO), and Sea Basing to support the Navy's vision of the Global Fleet Station (GFS).¹³ All of these concepts require prepositioned materials and a robust logistical system to support their existence. More recently, MPF (F) has taken steps in challenging prepositioned concepts of operations along with how they deploy them. These ideas have come to question the very existence of the need for certain types of ships, as stated above.

New Naval and Marine Corps operating concepts bring new ideas for the Marine Corps' prepositioned program, and it is needed. Since its conception, the world has witnessed the Marine Corps use the MPF program numerous times, and it hasn't changed its playbook once. If it is not broken, then don't fix it is one adage, but given the high stakes in this great power competition realm staying stagnant will equate to losing.

An Air Force RAND report in 2019 studied distributed operations regarding the service and stated:

"The USAF will likely use a range of operating locations in a contested environment. As will be detailed below, greater distribution increases support and defense costs; as a result, a distributed basing plan will likely require trade-offs between maximum disaggregation for survival and some concentration for efficiencies. One way to manage this trade-off is to temporarily use austere bases to increase survivability in conjunction with a network of fixed bases with more infrastructure."¹⁴

These ideas are similar to what the Navy and Marine Corps teams have in their combined concepts of Distributed Maritime Operations (DMO), LOCE, and EABO. The Marine Corps' Force Design 2030 states it must "create the virtues of mass without the vulnerabilities of concentration."¹⁵ Across the services, distributed force layout is required for survivability and is just as applicable to prepositioned forces today and in the future.

V. LOGISTICS REQUIREMENTS FOR THE NEW OPERATING CONCEPTS: THE NEED FOR PREPOSITIONING

Although new classes of United States Naval ships and connectors to support the Marine Corps' prepositioning program are needed, this alone will not solve the added issue of getting to the fight. Prepositioning capabilities are required within the first rings of certain adversaries' abilities to compete and deter. Just this year, Army Materiel Command chief, Gen. Edward Daly, commented on Army Pre-positioned Stock (APS) and his intent to change the way their program operates. The program focused mainly on the great power conflict with Russia and China that had their pre-positioned supplies massed, waiting for a war the U.S. did not wish to face. Looking to stay "left of bang," Gen. Daly stated, "Now, based on the Army senior leaders' intent, we want to focus it as much on great power competition, to use those stocks in great power competition as much as we had planned on using those stocks for great power conflict."¹⁶ He later suggests using prepositioned assets during overseas exercises with partner nations, something the Marine Corps has been doing for years.

The Army plans to use their partnership-building exercises and other relationship-building talks to gain access to potential land for future prepositioning land stock use. Gen. Daly stated these additional nodes are key when focused around the Pacific to

support Army forces. This article did not cover any changes within APS-3 and their squadrons' shipboard prepositioned supplies. It did, however, shed some light on how the Army is considering leaning towards a more proactive stance in prepositioned agility. This stance is similar to a 2010 RAND report on Air Force pre-positioning. The Air Force report spoke of a robust and reliable prepositioning construct postured to support their forces mutually. The RAND report notes, "Loss of access to a prepositioning site could occur for a number of reasons. (These reasons need not solely rest upon kinetic and hostile actions.) A host nation that was not willing to support U.S. involvement in a particular contingency could deny the Air Force access to its assets."¹⁷ Redundancy built into the system gives prepositioned stocks reliability when use is needed. Smaller redundant sites also prevent building iron mountains that present a higher target and case for adversary disruption or destruction. A concept similar to this will work in the Marine Corps' favor.

If distributing forces for survivability is a concern, the need to incorporate redundancy and position assets closest to the point of use is paramount. This redundancy will help posture forces with readily available assets when needed. However, this will come at a higher cost due to increases in supporting infrastructure, vessels, connectors, and in some cases, the assets themselves. The placement of prepositioned material is just as crucial to ensuring the most efficient means are available. Our Nations ready forces rely upon material and equipment sets to meet them when needed, and the speed of relevance can mean the difference between a failed mission and a successful one. Continuous program refinement of this system is required to maintain its relevancy.

"Tightening the Chain," a Center for Strategic and Budgetary Assessment (CSBA) research paper, is an Inside-Out Defense concept in deterring China. This credible concept in the Western

Pacific would rely on prepositioned stocks inside the first island chain for inside forces to fall in on and survive for an extended period unassisted. A sustainment plan outlined in this paper would consist of pre-positioned stocks and a combination of smaller air and sea connectors to assist forces in resupply efforts. Connectors such as Unmanned Underwater Vehicle, Unmanned Surface Vehicle, and Unmanned Aerial Vehicle (UUV, USV, and UAV) concepts can support resupply and redistribution efforts amongst the first island chain. These vehicles will provide attritable cargo capabilities while giving the flexibility of mutual support. The CSBA study is another recent recommendation calling for a revamp in the Marine Corps' prepositioning program. The CSBA states,

"Planners should explore innovative approaches to support distributed units, including greater use of pre-positioned stocks of munitions and sustainment material, manned and unmanned air and sea assets for mobility and resupply, and emerging technologies such as 3D printing to fabricate replacement parts."¹⁸

If current leaders are looking for a legitimate deterrence program that delivers results, they should consider what this CSBA report states as necessary for change. This concept will require dynamic support within the first island chain to succeed. The Marine Corps prepositioning networks' future must provide agility and speed to meet the requirement for sustaining the forces under this construct.

VI. CURRENT USMC PREPOSITIONING PROGRAMS

In 1977 the Carter administration conducted the "Force Posture Study (PRM 10)." This study revealed an increased need for a forward military presence to deter Russia. Additionally, this would address crisis response shortfalls in East Asia.¹⁹ This forward postured presence required prepositioning assets closest to the point of use. In the 1980s, the Near Term Prepositioning Force (NTPF) came together with seven ships from the military sealift command (MSC).²⁰ This

is the first prepositioning capabilities afloat that the USMC possessed. The MPF program took over for the NTPF as ship purchases and conversions became available to replace leased vessels. The first squadron, MPSRON 1, became operational in 1984 and established a forward presence in Europe. MPSRON 2 replaced the NTPF vessels at Diego Garcia in 1985, and MPSRON 3 became operational in 1986, establishing a forward presence in the Pacific.²¹

The NTPF ships require port facilities to unload. These capabilities left them vulnerable and predictable due strictly to large port requirements for employment. The need for flexibility, surprise, and survivability drove inventions and innovations for the program. The first significant change in the program acquired new ships to give forces mobility by not restricting them to port facilities. Also, with this came a name change, the Maritime Preposition Force. The MPF program introduced new capabilities such as in-stream offload and bulk liquid discharge. Due to success in using prepositioned forces over the past decade, a call for more capabilities in the early 2000s raised the need for newly embarked units to the MPF program. With this increase in ability came MPF enhanced (E). MPF (E) included ships capable of handling large quantities of Navy Mobile Construction Battalions (NMCBs) assets, Navy fleet hospital (NFH) systems, and Expeditionary Airfield (EAF) assets. Unknown amounts of tonnage were added, but these capabilities were so significant in square footage they required distribution across the entire squadron to incorporate this new requirement.²²



Photo of USNS Pililaau with stern ramp secured to RRDF and INLS ferry.

The desire for greater Naval integration and interoperability brought about the next phase of MPF changes. The creation of MPF Sea-basing Enabled (SE) included newer class support ships and Mobile Landing Platform (MLP) ships. These ships increased sea-basing effectiveness and efficiency by providing options for multiple connectors like the Landing Craft Air Cushion (LCAC) to interface simultaneously with this new sea-base structure. Older Improved Navy Litterage Systems (INLS) restricted previous in-stream offload capabilities due to their pace. The speed of ten knots in optimal conditions was the best they could achieve. Additionally, the Roll-on/ Roll-off Discharge Facility (RRDF) would only support one ferry INLS system safely at a time, severely constricting the flow of logistics. Comparing the LCAC to the INLS, the LCAC can carry up to three times the tonnage of the INLS and travel up to four times faster. For the last

decade, the Navy and Marine Corps have experimented with concepts for an MPF Future (F), to support their new operating concepts.



MLP with LCACs ready to deliver equipment ashore during Pacific Horizon 2015.

The above summarized MPF's past and current programs; in addition to the MPF construct, the Marine Corps' prepositioning program consists of MCPP-N. The DOD directed this program in response to posturing forces in Europe responding to then Cold War threats. The program supports a MEB sized MAGTF with the storage of equipment and supplies inside numerous caves throughout Norway.²³ Additionally, the Marines have a non-program of record establishment of forces in Kuwait. This notional program is called Marine Expeditionary Unit Augmentation Program – Kuwait (MAP-K). The program consists of an enormous, enclosed warehouse that serves intra-theater equipment requests from the Marine Expeditionary Unit

(MEU) and Special Purpose Marine Air Ground Task Force (SPMAGTF) forces.²⁴ The capabilities between the MPF, MCPP-N, and MAP-K currently make up the Marine Corps Preposition Network (MCPN).



Marine Corps Preposition Program – Norway (MCPN) storage caves at Bjugn.

VII. INADEQUACY OF CURRENT PREPOSITIONING CONCEPTS FOR THE FUTURE MISSION AND OPERATING ENVIRONMENT

The MSC and Marine Corps' lack of envisioning a realistic view for employing prepositioned forces may cripple expectations in real-life scenarios. A RAND capability assessment in 2010 found the Marine Corps' MPF (F) deficient logistical connectors such as LCACs and A/C sufficient enough to move a planned MEBs worth of equipment. This study relied on relevant 2010 plans and future envisionment for the program. Since this reports' conducting, drastic changes did not occur to the MPS and Amphibious Task Force structure as considered throughout their report. The RAND report simulated Marine Corps operations with

the MPS consisting of three LHA/LHDs and a mix of LMSRs, T-AKs, and MLPs. The report overall suggests that the notional MPS structure outlined above would support one to two MEBs sustainment-wise. The ground maneuver elements of one MEB would be capable of offload in one night given the full 14 ships MPF(F) Squadron. RAND studies then simulated stripping one LHA/LHD at a time and compared the sustainment capabilities that would remain and considerations that need further research. Taking two LHA/LHDs away would restrict capabilities to supporting one MEB and would require a heavy emphasis on LCAC throughput. Eliminating all LHA/LHDs would severely restrict capabilities to support the MEB from a seabase construct.²⁵



USNS *Lewis and Clark* (T-AKE) notice the flight deck and lack of stern or side vehicle ramps

Additional requirements which were relied upon were four MLPs and subsequent LCAC numbers sufficient to utilize these platforms and keep logistics flowing. This report uncovered a heavy reliance on LCAC support for the movement from the seabases. The report also highlights the limited capabilities of the T-AKEs within the squadron. Currently restricting these vessels are an over-reliance on vertical aircraft sustainment operations. A connector to interface the T-AKE and MLP needs further exploration. "In order to realize the full potential of the MLPs' LCACs, we recommend the Navy and USMC investigate ways that the T-AKEs could interface more closely with the LCACs, either by directly offloading onto the hovercraft themselves or by transloading supplies from T-AKE to MLP, and then into the LCACs."²⁶ The Navy and MSC should consider existing interfacing issues with the planned future Light Amphibious Warship (LAW) before solidifying it into the future connector construct of the MPF program. Much of this report is irrelevant due to MPF (F) Squadrons not upgraded with the LHA/LHD options highlighted above. However, it does highlight constraints and connector issues within the program that need attention in future endeavors.

More recently, in 2017, MSC, during exercise Pacific Horizon employed an expeditionary transfer dock ship (MLP), the USNS *John Glen* (ESD-2), and moored it with another MPF vessel. They simulated combined logistics over the shore (CLOTS) operations between Navy and Marine Corps teams off California's southern coast. This exercise honed the combined group's skill, and in four days, completed 72 landing craft loads, not bad by any standard, but not nearly a complete offload of the USNS *Dahl* occurred.²⁷ Ship-to-shore movements such as this are time-consuming. Docking a Roll-On/ Roll-Off (RO/RO) ship into a sufficient port and offloading just RO/RO contents would require 36 hours running 24hr operations. Significantly adding to the timeline are

Lift-On/ Lift-Off (LO/LO) operations if incorporated. While offshore or within a SPOD, these vessels create an exploitable vulnerability while remaining almost motionless. If exploited, MPF operations can then be delayed and result in culminating efforts within an area of operations depending on their support. The time it takes to loiter on the station and offload support is the Achilles heel when it comes to vulnerabilities concerning MPF current operations. Exploiting this vulnerability more in the future can only be expected. Designs for future ships, connectors, concepts, and technology that can justify the program's tempo need serious consideration to limit this exposure.

The USMC's *Force Design 2030* might shed some light on current leaders' visions for the future combined Naval and Marine Corps team designs. In it is a call for "smaller, low signature, and more affordable amphibious ships and ...affordable, distributable platforms that will enable littoral maneuver and provide logistical support in a challenging theater."²⁸ This places the Navy and MSC at a crossroads with programs that have been in the making. Col Andrew Bergen, Commanding Officer of Blount Island Command (BIC), stated, "The vision of smaller and increasingly survivable prepositioned assets is currently incongruent with the CHAMP plan and others being currently analyzed by the Navy and will be expensive."²⁹ The latest addition considered to the MPF(F) phase is the Common Hull Auxiliary Multi-Mission Platform (CHAMP) class ship and due for delivery FY2026 at the earliest.³⁰ However, at an estimated one billion dollars per hull, the Trump administration did not provide funding for it within the proposed FY2021 budget.³¹ A platform that does fit the build outlined in *Force Design 2030* is the Navy's new Light Amphibious Warship. Currently considered for design are variants of this concept in intra-theater connectors to support maneuver and logistical forces. At an

estimated unit cost of \$100 million, this platform nests well within affordable amphibious ships' requirements.³²

Another recent article with observations and reflections from Col. John P. Sullivan Jr. highlights his experience as Chief of Staff, 2d MEB for exercise Trident Juncture. He stated MPF ships are great for transiting oceans with numerous tons of equipment most proficiently. But they lack the effectiveness to deploy across the spectrum of ports that commanders in the future may require. Adversaries will target large ports to deny MPF capabilities, and this would compound the current process. Consequently, transitioning material from these large ships to smaller ferries for exercise Trident Juncture 18 took place. Future capabilities are needed to reduce the number of hand-offs while gaining versatility in an ever-changing environment. Col. Sullivan referenced this metaphor of balancing your football offense with an effective running and passing game. An efficient offense uses the least number of touches in football while focusing a trajectory through less congested areas. He suggested the Marine Corps take this stance by bringing balanced logistics through less crowded areas. Meeting this vision will require balancing assets with deep-water vessels and large shallow draft connectors like the LAW to enable the distribution of forces. These actions will increase the potential ports and landing sites available. In turn, the adversary will be less confident of where he can expect troops to arrive, complicating his decision-making and spreading his defensive forces thin.³³

Col. Sullivan also commented on the need for a robust, dynamic, and flexible prepositioning network supporting future Marine Corps operations. He states,

“an increase in the lethality, range, and accuracy of adversarial ballistic missiles; an upsurge in the proliferation and sophistication of sea mines; a diminishment in the United States' subsurface competitive advantage; an increase in the frequency and magnitude of storms at sea; and potential foes who have longer range and more persistent intelligence, surveillance, and reconnaissance capabilities than ever before,”³⁴

will contest maritime prepositioning operations in its current state. Direct action is needed to update the Marine Corps' prepositioning program to make it relevant, agile, and survivable in the future. Similar to the RAND study on Air Force prepositioning, Col Sullivan notes that individual states, although our allies, could limit support due to backlash from their population given dynamic scenarios. Inconsistent support, he states, confounds and often constrains military deployment options, thus requiring flexibility in prepositioning and sustainment operations to succeed. His experience in Trident Juncture 18 confirmed the need for a mix of afloat and shore-based prepositioning to provide commanders with redundancy and flexibility supporting their operations. Situations such as delays in shipping of home stationed equipment and similar shipping constraints led to these decisions. Additionally, he concluded that large MPF and commercial ships compounded the requirements for operations throughout the theater due to the additional requirements needed to employ them.³⁵

VIII. REVIEW OF ALTERNATIVES AND RECOMMENDATIONS

Futuristic designs should incorporate autonomous versions of the LAW. Throughout the past years, the Navy has extensive research and development in USVs, including the USN *Sea Hunter* and Ghost Fleet Overlord programs.³⁶ These test vehicles and programs have successfully incorporated autonomous operations in various exercises such as Dawn Blitz to trials in multiple fleets.³⁷ If not full autonomy comparable to these programs, the Navy and Marine Corps team should consider autonomous vessel fleetings. This idea stems from FedEx and its futuristic endeavor to provide efficiency with truck platooning technology. This platooning provides FedEx with autonomous trucks capable of reducing gaps between their line haul on the highway, thus providing greater fuel efficiencies.³⁸ For the United States Navy, this fleetings would consist of one lead vessel controlled by

direct human actions, while the rest of the vessels within the fleet would follow in trace autonomously. Their ship to shore or ship to ship maneuvers should call for human-machine teaming in some scenarios, but movement between objectives should very well be autonomous for the most part.

Future design considerations for the Marine Corps' prepositioning network should also incorporate multiple land-based nodes interconnected by smaller survivable naval shipping means. In the USAF RAND study, numerous smaller land-based nodes have highlighted the versatility and survivability expected from such a network. These land-based nodes would consist of various rolling stock or containerized units ready for employment. Sites containing rolling stock would require a regional representative to survey these assets for accountability, inspection, and start-up requirements. Given future capabilities, it is speculative, but some or even most of these functions remotely could be accomplished.

In 2019, the Marine Corps Logistics Command teamed up with Georgia Technology Research Institute, demonstrating autonomous robotic collection applications within a warehouse. This "Roomba on steroids" conducted RFID asset verification tagging and took snapshots of vehicles' undercarriage.³⁹ Initially engineered to reduce human workload within MARCORLOGCOM, this unmanned robotic capability shows excellent potential for remote management of these land-based nodes. Containerized equipment may not possess ready equipment due to most of the contents braced for shipping; however, the management of these assets is notably easier. RFID tagging and container seals likewise can autonomously be verified from remote locations with drones. Additionally, interrogators set amongst entrance and exit locations will help identify asset movement; this applies to both containers and rolling stock.

Containerized units properly preserved can endure longer on-station times before a rotation of assets is required.

As outlined above, future capabilities and management systems will reduce or eliminate the need for on-station representatives. The management systems for these land-based nodes should reside at a regional support network capable of coordinating with the Marine Corps and MSC to assist in stock rotation, provide technical expertise, and employ assets as needed. The Marine Corps is considering and will benefit significantly by having a forward prepositioning land-based network capable of supplying, repairing, logistically moving, and training to keep prepared assets forward and more readily available in the Pacific theatre. Guam has been a hot topic for years regarding Marine Corps basing in the Pacific and may very well fill this need.⁴⁰ With MCPN-N in Europe and MAP-K in the Middle East, it only makes sense to have a similar land-based node as these on the Western front.

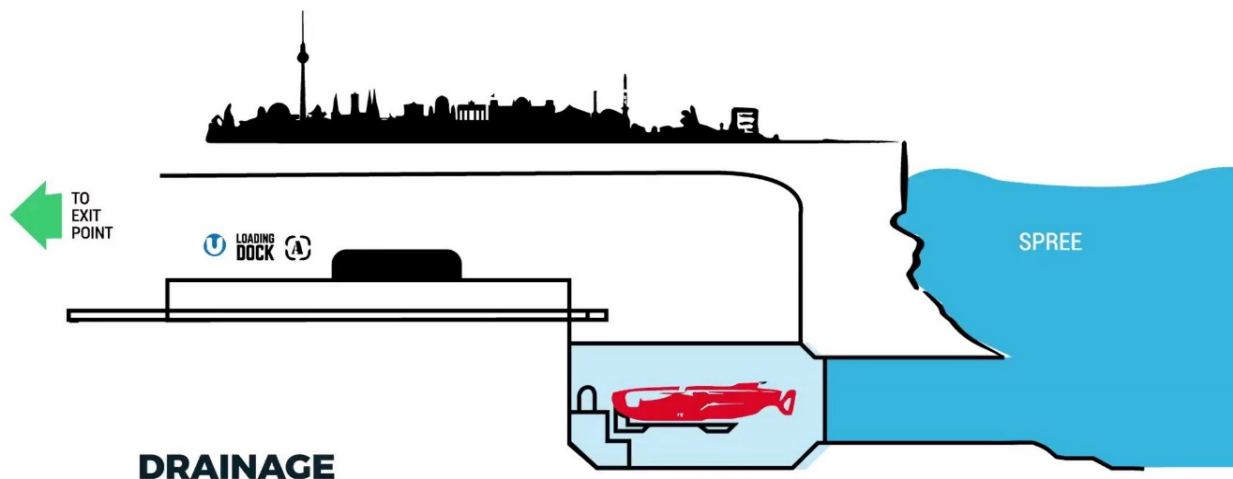
NEW DOMAINS BRING NEW WAYS OF THINKING

Joint exercises, partnership building, and crisis response preparedness will benefit from a more robust prepositioning capability forward. However, increasing military strength too much within a particular area would nest too many assets together, thus posing a significant target for any adversary. This is a true statement for any theatre when massing forces for effectiveness and has been a reoccurring theme amongst leadership and research report concerns. If dispersing forces are not attainable, then hardening assets and capabilities to provide greater survival chances need consideration. This hardening for survivability is significant for prepositioned equipment and their logistical connectors since these same assets will support blunt and surge forces.

For example, look to the Marine Corps' future prepositioning endeavor with Guam. This site has the potential to become the main spoke for an interconnected land-based prepositioning

network. That is assuming US forces being granted land access amongst our coalition and partner-building nations. Initially, the Marine Corps should consider coordinating efforts amongst other Joint service's prepositioned nodes to reduce funding and work off pre-existing Status of Forces Agreements (SOFA). Given our maritime nature, land-based nodes need to incorporate near SPODs for adequate follow-on transportation to the point of usage. As outlined in the CSBA study and throughout this paper, the Marine Corps' future requirement for the Navy and MSC is to provide logistical connectors sustainable, adaptable, and flexible enough to work in various sea conditions and increase capabilities.⁴¹ These capabilities are even more apparent when considering the Weapons Engagement Zones (WEZ) of competitors.

Planning for future platforms outside of the LAW concept should entail various types of UUVs. A conceptual underwater logistics network portrayed by Yanko Design consists of UUVs providing logistical support through underground loading docks while traversing entirely beneath the surface of the water. This concept further describes these vehicles as having capabilities to intercept packages or shipping containers at sea and then delivering them to their destinations.⁴²



Yanko graphic design of future UUV and underground docking station

MPF shipping and connector vessels capable of intercepting prepositioned assets at sea need serious consideration and exploration. The current MPF construct requires ships to operate in low sea states while traveling less than three to four knots or anchored to transfer assets. The most vulnerable situations ships find themselves in are parked in port or staged for seabasing. Possessing the ability for continuous movement of MPF transfers and dumping of containers would be expedient in this stagnant vulnerable situation. Future interception capability by a UUV or USV of floating or semi-submersible supply and asset caches would allow MPF ships to roll through an AO versus completely stopping in it.

Predominantly prepositioned assets exist within structures floating on the ocean or placed within land-based nodes. Prepositioned forces have not capitalized in the realm of subsurface, air, and space domains. A striking reason for this is the amount of tonnage and space required. As weapon systems become lighter and more efficient, these realms may offer more relevance to the force and need future exploitation. Additionally, as units consist of smaller stand-in forces, prepositioned allocations should comprise scalable smaller unit-sized support containers. This scalable content should differ from the sizeable Twenty-foot Equivalent Unit (TEUs) containers of breakbulk supply classes of I, II, V, and VIII. Perhaps more quad-con, tri-con, or new containers are needed to conceptualize modern platforms of prepositioned support. However, the large capacity requirements, coupled with the complexities of operating in these domains, may prevent serious exploration. Subsurface UUV connectors and underground support facilities open to the oceans would be the most realistic idea. This concept requires further investigation to compare the suitability, feasibility, and acceptability for this future.

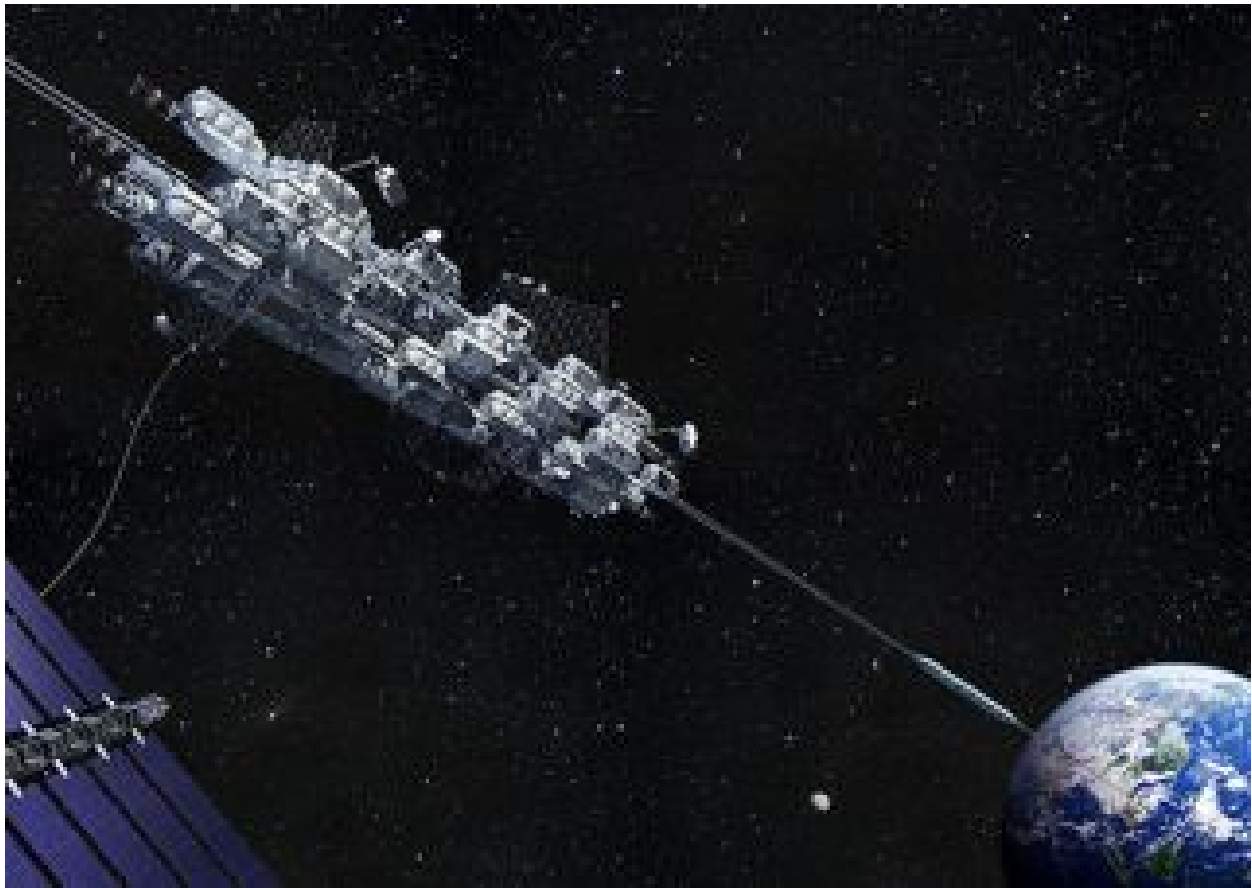
Focusing on the space domain, a research report on Space-Based Logistics from Maj Timothy Riemann outlines the narrative of current challenges the Marine Corps and Joint logistic fields are facing. He highlights the current DOD capability of not having flexibility coupled with timeliness. He suggests that the speed of relevance by prepositioning supplies in space will exploit the timeliness needed. Space is a domain not often referred to with logistics and is only generalized in *JP 4-0*. His research adequately shows a gap in forward-thinking leadership engagement in this arena; the same is valid with underwater logistics. However far-reaching this concept may seem, he suggests that shaping efforts towards technological advances in this future should be taken now.⁴³ Throughout the decades, infatuation with space has brought no shortage of public and government ideas to the forefront. SpaceX endeavors prove that advances in rocket and space ship technology within the civilian sector continue to make great strides.

If the US government plans to explore and exploit this vast domain, they need to corroborate and combine efforts with the civilian sector. One vision spanning the past 40 years since the 1980s is to transport people and materials into space via the space elevator. Using this future concept to move materials into space could help establish a prepositioned node in this untapped domain. This concept would allow for the efficient rotation of goods. Coupling this elevator concept with efficient rockets launched from space-based nodes to predetermined locations would quickly and effectively support inside forces. The issues surrounding an idea such as SBL are the signatures given from rockets. When utilized, the landing of a SpaceX-style rocket would ultimately reveal the supported site. Using this construct to resupply locations already exposed would make the above comment a moot point.

According to a 2012 SpaceX article, they are the cheapest ride in town - cost per pound of cargo sent into orbit. The Falcon 9 rocket used equated to roughly \$2,500 per pound, and future

Falcon heavy rockets aim to lower the cost to near \$1,000 per pound.⁴⁴ Compare that to NASA and their average price to launch a shuttle into space, which is nearly \$30,000 per pound. NASA's space shuttle carries roughly five times the amount of current SpaceX cargo weight but comprises numerous life-supporting components.⁴⁵ Forecasts conducted by a workshop with NASA in 1999 concluded that a space elevator, once established, would cost less than a dollar per pound for a roughly 26,000-pound payload. These estimates focused on the energy costs required for the propulsion of the platform.⁴⁶ This description of a space elevator may sound more like science fiction. However, many foreign and domestic companies, other national enterprises, and even NASA have continued studies in molecular nanotechnology to envision this further.

Space rocks or debris can puncture systems and shut down operations in space. Operating an elevator from earth to space will deal with this and is even more susceptible to objects entering the earth's atmosphere. Additionally, entering the atmosphere generates greater speeds and temperature variants that pose even more of a threat. NASA and the ISS deal with space debris concerns by avoiding larger debris with collision avoidance systems. To counter smaller debris, they up-armor the station to withstand these impacts.⁴⁷ Lessons learned from those in space coupled with the projected future self-healing capabilities of nanotechnology keep the space elevator dream alive.



Space elevator transportation system concept.

IX. CONCLUSIONS

In conclusion, combining the concept for a web-like network of land-based prepositioned assets and updating MPF capabilities to include ships similar to the LAW and UUVs would give the Marine Corps' prepositioned network flexibility, survivability, and sustainability to support future operations. Smaller and numerous land-based sites and vessels are more difficult to target, requiring higher expenditure rates to neutralize, forcing an adversary to calculate his targeting options and slow his decision-making. This targeting dilemma offset by a robust prepositioning network would ensure future operations are supported throughout a denied and attrited environment. Our current structure does not support these requirements, and it will become paralyzed when constrained or attrited. The posing risk of not taking steps to harden, support,

and compound prepositioning efforts will be disadvantageous to our forces. This lack of preparedness could result in a protracted war due to our unwillingness to seize the prepositioning initiative.

The future requires visionaries to see the potential in capabilities that seem unrealistic and science fiction in nature. Envisioning this future will help guide our transition to support the warfighter more efficiently and effectively in upcoming conflicts and disasters. However, the steps taken to ensure growth should not rely solely on the United States government alone. The DOD should leverage their innovation and exploration along with the civilian sector and partner nations alike. Attaining visions of prepositioned forces infused with AI and operating in sub-surface and space-based domains requires an alignment of efforts and leaders willing to champion them.

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