The Case for a Medium Tank to Be Incorporated into the Joint Force

by MAJ Jeremy Zollin

"It's the best main battle tank in the world – if you can get it there." – 1st Infantry Division tank-battalion commander's wry remark as he stands watching his fleet of 70-ton M1 Abrams heavy tanks sitting, parked, unable to patrol in his area of operations because they are too heavy for the primitive road nets.[1]

*(**Author's note:** The following article is a synopsis of a larger research study into the requirement of the U.S. Army and the U.S. Marine Corps (USMC) to field a medium tank built to operate in future operating environments (OEs) as identified by the Chief of Staff of the Army's (CSA) Future Studies Group. The full study can be viewed at the Ike Skelton Combined-Arms Research Library Website under the 2018 masters of military arts and science (MMAS) collection. The supporting research from the case studies that determined the requirements is omitted for brevity in this article, which will focus on the study's conclusions to spark debate into the need for a new medium tank designed for urban and littoral combat.)*

The Abrams, although highly successful to date, was built for a different type of warfare and different doctrine, and it has already displayed capability gaps when operating in urban and amphibious environments during the past 15 years. Further, during the 2014 Unified Quest exercise, the CSA's Future Studies Group predicted that in the future, megacities (cities with more than 10 million people) will dominate the OE. Whether because of the strategic importance of the cities' location or the operational objectives lying within the cities, these megacities will likely become future OEs.[2] As these environments increase in importance, size and frequency, it's probable that a new platform will be needed to fill the gap.

The M1 Abrams main battle tank (MBT) was developed in the mid-1970s to replace the aging M60 MBT. Tanks have served as the centerpiece platform for the U.S. Army and USMC and are designed to provide mobility, protection and firepower to a rapidly advancing force that delivers shock and awe to the enemy. As part of the U.S. Army's "Big 5" weapons platforms, the M1 Abrams was developed to fight a defensive battle in Western Europe against overwhelming numbers of Soviet and Warsaw Pact T-72 tanks.

Using AirLand Battle doctrine, the Army's first commander of Training and Doctrine Command, GEN William E. DePuy, believed the key to success against a Soviet invasion was a decisive early victory.[3] Field Manual (FM) 100-5, ***Operations*** (dated 1976), emphasized this concept, stating, "The U.S. Army must, above all else, prepare to win the first battle of the next war."[4] The "Big 5" was designed to provide that initial victory, while the Air Force, Artillery Branch and Special Forces prevented the Soviets from bringing their reserves forward and overwhelming the weakened defenders.[5]

Army's Abrams experience

During the development of the AirLand Battle doctrine, the U.S. Army had two tanks: the M60 MBT and the M551 Sheridan Light Airborne Tank. The aging M60 MBT, which was falling behind the Soviet MBTs, did not have the required protection to survive the 125mm T-72 fires and anti-tank weapons being developed.[6] With the massive Soviet threat and AirLand Battle doctrine in mind, the XM1 Abrams was built to survive Soviet tank fires and be able to continue engaging the Soviet tanks. These requirements led to a U.S. tank design that is heavily armored to the front, very quiet to maneuver but with extended range, and able to engage enemy tanks accurately with hypervelocity rounds over long distances.[7]

Over time, the M60 MBTs were retired from service in both the U.S. Army and the USMC. The U.S. Army continued to maintain the M551 Sheridan Light Airborne Tank until 1996, when it was scheduled to be replaced by the M8 Buford Armored Gun System (AGS). However, in 1996, both the M551 was retired from service and the M8 Buford AGS procurement was cancelled, making the M1 Abrams the only U.S. tank.[8]

When operating in open fields and with an abundance of fuel and parts, the Abrams has dominated in maneuver warfare. The first and second Gulf Wars have demonstrated how effectively the M1 Abrams can destroy opposing mechanized and armored forces. During the initial invasion in Operation Iraqi Freedom (OIF), 3rd Infantry Division maneuvered through the desert to Baghdad, securing critical lines of communication while continuing north. The 3rd Infantry Division Soldiers isolated cities until infantry and USMC units could replace them.[9] Once the Iraqi army surrendered, the M1 Abrams entered a new phase: urban and counter-insurgency warfare.

Figure 1. M1A1 Abrams MBTs from 3rd Armored Division move out on a mission during Operation Desert Storm. An M2/M3 Bradley can be seen in background. *(Photo by PHC D.W. Holmes II, U.S. Navy)*

From the inception of the armored force in the 1940s, U.S. Army doctrine stressed that "[a]rmored units avoid defended towns and cities."[10] FM 100-5, ***Operations,*** published in 1993, continued to list urban areas under obstacles that "[c]ommanders plan to negotiate or avoid."[11] Following the invasion of Iraq in OIF, commanders could no longer avoid urban areas. During this phase, the M1 Abrams performed adequately and adeptly in urban environments while conducting counterinsurgency operations with periods of high-intensity fighting during the battles of Najaf, Sadr City and Fallujah.

However, these operations identified several inherent problems with the M1 Abrams' open-European-battlefield design. The enemy had the ability to choose when and how they would attack, favoring improvised explosive devices (IED), rocket-propelled grenades (RPG) and deep-buried bombs. This allowed them to attack the M1 Abrams against its weaker top, rear and underbelly. For example, on Oct. 29, 2003, the author witnessed the first U.S. tank crewman killed by hostile fire while the crewman was inside the protected crew compartment of an M1A2 Abrams MBT. The insurgents buried 500 pounds of C-4 explosive in a dirt road, detonating it when the tank from Company A, 3rd Battalion, 67th Armor Regiment, rolled over the bomb. This was the first use of a large deep-buried bomb to destroy an M1 Abrams.

Another example of an inherent problem with the M1 Abrams' open-European-battlefield design comes from Christmas Eve 2005, when an M1 Abrams from 1st Battalion, 64th Armor Regiment, traveling along Route Brewers in East Baghdad, was struck by an IED. The explosively formed penetrator was close enough to travel under the heavily armored Chobham tank skirts and cut a fuel line, burning the tank to the ground.

Combined with the ability of the enemy to circumvent the Abrams' protection, the size and weight of the tank itself created new difficulties. The width, height and length of the gun tube prevented the Abrams from operating in many of the urban areas in Iraq. Narrow alleys and roads, crowded with parked vehicles, low-hanging power lines and the abundant deadspace (area near the tank that the crew cannot observe) around the M1 Abrams prevented it from operating effectively off the major roads inside cities.

When operating on smaller roads, the M1 Abrams' weight and ground pressure easily damaged the substructure and road networks of the local cities and towns, creating animosity toward the United States. During several deployments, units received complaints from locals about the damage the tanks had caused.

These limitations, combined with its massive fuel requirement, led to the M1 Abrams being used primarily in static overwatch positions along main supply routes or from the outskirts of urban areas, where it could provide observation. During the limited maneuvers through the tighter neighborhoods, the tank commander was forced to stand well out of the turret to observe the deadspace near the tank and guide it effectively. This exposed the commander to enemy small-arms fire and IEDs.

USMC's Abrams experience

The USMC also outfits its three tank battalions with the M1 Abrams MBT. The many islands and large waterways of the littoral environment have led to the USMC's primacy when conducting land operations in the Pacific (Korea being the anomaly). Because of the great distances and the lack of intermediate staging bases, the USMC has maintained most of its forces afloat in expeditionary units capable of conducting amphibious assaults and in prepositioned sites. Their forward-positioned stocks and floating expeditionary units often include companies of M1 Abrams.

Bringing the M1 Abrams ashore in contested or non-established ports requires deliberate and time-consuming operations. Because of the size, weight and large logistical tail of the M1 Abrams, the USMC amphibious-assault commanders have to make special considerations with regard to employing the M1 Abrams. The Landing Craft Air Cushioned (LCAC) can only carry one tank and cannot be pre-boated, while the Landing Craft Utility (LCU) can only carry two tanks if the seas and beach are suitable for the landing and the LCU is not overly worn from age. During the Ssang Yong 13 exercise in the Republic of Korea, the USMC had to build a Trident Pier system to use cranes to offload eight M1 Abrams. Because of the limited number of LCACs, only two M1 Abrams could be brought ashore during the amphibious assault.[12] Due to these limitations, Marine commanders often will choose to forego the M1 Abrams in favor of more amphibious-assault vehicles or Light Armored Vehicle 25s,[13] greatly limiting the combat power ashore during the most critical portion of an amphibious assault. With a probable increase in amphibious operations as the importance of the littoral regions increases, is the M1 Abrams the appropriate platform for the USMC?

Figure 2. A Marine M1A1 offloads from an LCAC.

Future warfare

Each year, the U.S. Army Capabilities Integration Center conducts analysis on what warfare will consist of in the future as part of the CSA's Title 10 Future Study Plan. This analysis is used to guide the formation of U.S. doctrinal and procurement planning.

As mentioned, during Unified Quest 2014, the Army predicted that in the future, megacities will dominate the OE. Currently 24 megacities exist, with half a dozen metro areas of 100 million already existing in the Asia-Pacific region. These massive urban areas will account for more than 60 percent of the world's population and 70 percent of gross domestic product by 2030.[14] Unlike the relatively flat and simple cities of Iraq, these urban areas will include many high rises, suburban areas, tunnels, subways and underground complexes, as well as mass-transportation systems and complex terrain.

As these megacities grow in importance, the Army and USMC must consider if its current combat platforms, and specifically the M1 Abrams, are suitable to conduct operations within the new OE, or if a new medium tank – smaller, lighter and more versatile – is required. Design considerations must include the characteristics of the future battlefield environments that will impact the operation and employment of tanks in relation to mobility, firepower and protection.

To facilitate the conversation, the author conducted a research study analyzing historical cases of tanks and specifically the M1 Abrams in urban and amphibious operations, and then contrasted this with the anticipated future environments. This comparison was used to determine the M1 Abrams' suitability and to identify gaps in its capabilities.

Case studies, research results

The MMAS thesis analyzed the performance of MBTs in multiple battles and compared their primary functions of mobility, firepower and protection to determine strengths and weaknesses of tanks in general in urban battles. These strengths and weaknesses were then compared to the M1 in recent urban battles and finally compared to the anticipated future OE to determine if the M1 is suitable for projected battles of the next decades.

Case Study 1. The first case study was the Battle of Hue. This battle highlighted the capabilities of a heavy tank operating in an urban environment against a determined and effective enemy force. In Hue, the North Vietnamese Army attacked and fought for 33 days against the USMC equipped with the M48 in the city of Hue. The Marines used the tanks' protection and mobility to bring precision low-angle firepower forward to engage enemy strongpoints. The size and weight of the tank limited its use. This case study relied on historical texts and scholarly sources.

Case Study 2. The second case study examined the Israeli experiences in the Second Lebanon War and during Operation Cast Lead. This case study represented a recent offense by similarly equipped heavy armored units into an urban environment against a determined enemy. The evolution of Israeli doctrine between the two battles highlighted the need for all-around protection, mobility provided by tracked vehicles and the need for precision direct fire provided by a tank. This case study also relied on scholarly publications.

Case Study 3. The third case was a set of battles during OIF and provided the comparison of the strengths and weakness of the M1 in urban battles. Although this operation encompassed 10 years and half a dozen independent battles across different cities, the general characteristics of each city in Iraq were very similar and the operations were conducted by similarly equipped U.S. forces. The study examined several battles within OIF for commonalities across the battles. It used both scholarly publications and interviews with U.S. Army and USMC armor officers regarding their observations about the performance and limitations of the M1 Abrams during these battles. These battles highlighted the M1's dominance with regard to protection, precision firepower and mobility; however, it also highlighted the M1's weaknesses with regard to all-around protection, size, weight and limited angles of fire from the main weapon systems.

Figure 3. A Merkava ("Chariot") Mark IVm tank from the Israel Defense Forces' 401st Brigade patrols the Gaza border. The tank has the Trophy protection system installed. *(Photo by Natan Flayer)*

Case Study 4. The fourth case for analysis was recent USMC amphibious-assault exercises. These exercises highlighted the performance of the M1 Abrams as the primary tank of the USMC with superior firepower, mobility and protection once it was ashore. The case also highlighted the limitations of the M1 as an amphibious platform with major considerations regarding the transportation, resupply and landing of the tanks before they can be employed. The study used both USMC after-action reviews and interviews with USMC amphibious-warfare experts experienced with the deployment of the M1 Abrams during amphibious assaults.

Finally, the study analyzed the future OE for both the USMC and the U.S. Army. The case study examined megacities and their likely impacts on maneuver forces, specifically tanks, operating within them. The case examined the anticipated growth of megacities, the characteristics of megacities and how megacities will influence doctrine and operations. The study evaluated the requirements these impacts will generate for the force. The results are captured and consolidated in Table 1. They highlight the need for smaller, lighter and evenly armored tracked platforms that still provide precision, direct, high-explosive firepower.

Conclusions

The first four case studies identified examples of urban and amphibious environments where MBTs have operated in similar environments. Each case identified strengths and weaknesses for tanks in the historical environments as listed in Table 2. These environments shared many of the characteristics of the future OEs. The scale and density challenges of the future environments did not exist in the historical cases and mitigated several of the weaknesses demonstrated by the tanks in those cases.

Mobility	-Tracked -Power to push through walls, tow tanks -Breach equipment -Narrow* -- roadways	-Narrow* -- traffic -Fuel – sustain on landing -Light enough*-- terrain -Speed* of vehicle sufficient
Protection	-Armored- anti-tank -All-around armor*	-Little reliance on active defenses
Firepower	-Main gun with HE -Advanced optics with night and thermal sights* -Short barrel* -Super elevate/depress* -Multiple machineguns	-Available on demand -Secondary sights, improved laser targeting -Short-range optics requirement -Target discrimination*
* Denotes requirement that is significantly increased in megacity environment		

Table 1. Requirements for the future OE.

	Previous	Future	M1 Abrams
Mobility	-Tracked -Power to push through walls, tow tanks -Breach equipment @ -Narrow – roadways -Fuel – sustain on landing@ -Light enough – terrain -Light enough -- landing@ -Smaller cube space requirement@	-Tracked -Power to push through walls, tow tanks -Breach equipment -Narrow* -- roadways -Narrow* -- traffic -Fuel – sustain on landing -Light enough* -- terrain -Light enough – landing -Smaller cube space -Speed* of vehicle sufficient	S – Tracked S – Power **W – Width, buildings** **W – Width, traffic** **W – Weight, terrain** **W – Weight, landing** **W – Fuel requirements** W – Space requirement on ARG *S – Speed*
Protection	-Armored – anti-tank -All-around armor -Exposure protection	-Armored – anti-tank -All-around armor* -Little reliance on active defenses	S – Withstand anti-tank **W – Top, rear, under** W – Does not exist
Firepower	-Main gun with HE -Advanced optics with night and thermal sights -Short barrel -Super-elevate/depress main gun -Multiple machineguns -Available on demand	-Main gun with HE -Advanced optics with night and thermal sights* -Short barrel* -Super elevate/depress* -Multiple machineguns -Available on demand -Secondary sights, improved laser targeting -Short-range optics requirement -Target discrimination*	S – Main gun with HE *S – Optics, thermals* **W – Unable to traverse** **W – Limited vertical capability** *S – 3 separate machineguns* S – Integrated into maneuver forces S – Manual-sights backup S -- 3x sight **NA – only .50-cal has single-round capability**
Notes: W = Identified weakness of M1, S = identified strength of M1. * Denotes requirement that is significantly increased in megacity environment. **Bold denotes M1 weakness corresponding with a significantly increased requirement.** *Italics denotes M1 strengths corresponding with a significantly increased requirement.* @ Identifies requirement from amphibious-assault case that remains for future OE.			

Table 2. Comparison of the M1 Abrams to previous and future OEs.

With regard to mobility, tanks in the previous OEs demonstrated strengths in the ability to traverse rubble and debris, push through buildings and operate along major thoroughfares. However, these tanks each had limitations with regard to size and weight. They were unable to cross bridges and canal causeways or to traverse many of the smaller roadways. The USMC amphibious operations were also limited in the

ability to transport tanks to the shore in a rapid and timely manner because of the weight of the tank and the capacity of the landing craft.

The protection aspects of the tanks proved far better overall, with tanks surviving many engagements from IEDs and RPGs. The weakness of all-around armor was identified in each case and had been exploited by the enemy. With regard to firepower, the ability of each tank to traverse the turret laterally and to elevate or depress the main gun was identified as a weakness. Otherwise, the tanks provided a powerful, available main gun capable of creating large holes in walls, engaging strongpoints and identifying enemy personnel and caches.

The MMAS thesis determined that there were several critical characteristics within the future battlefield environments that would impact tanks' employment. The first set of characteristics, with regard to the mobility of the tanks, affect the size and weight of the tank. The inclusion of "old city" neighborhoods of megacities – urban canyons created by multi-story buildings and many small cross streets and alleyways – all limit the mobility of larger vehicles. The weight-bearing characteristics of roadways, canals, bridges and overpasses will also reduce the ability of large armored vehicles to operate freely.

Concerning protection, the interlaced surface, subsurface and super-surface will create many avenues for threat forces to surround and engage tanks from all directions. This will increase the likelihood of tanks being engaged from the top, rear and underbelly.

Finally, with regard to firepower, those same elevation changes, old-city walls, reinforced structures and the materials creating blinding surfaces will all affect the ability of weapon systems to effectively engage targets and have effects. The dense civilian populations will also restrict freedom of fires and force tanks to contend with traffic and a threat force capable of blending into the population.

Because of these characteristics, a tank operating in these future OEs will have several design requirements related to mobility, protection and firepower:

- The mobility requirements include having a tracked vehicle able to traverse rubble and debris, with enough power to push through walls and to tow other tanks.
- The tank needs to be narrow and light enough to traffic a sufficient portion of the city.
- The tank must maintain the ability to breach obstacles and maintain enough speed to aid in assaulting objectives.
- The vehicle's protection requires an all-around armor package able to withstand many engagements from anti-tank weapon systems and IEDs.
- Firepower requirements include a main gun capable of super-elevation and -depression, with ammunition able to penetrate reinforced structures and create holes large enough for infantry to attack through.
- The barrel must be short enough to enable lateral traversing to engage targets in narrow streets.
- The requirements remain for multiple machineguns able to focus on more than one avenue of approach and advanced optical systems with thermal and night-vision capabilities.

Future tank needs

The MBTs – and specifically, the M1 Abrams – demonstrated significant capability gaps compared to the future OE (see Table 2). Each MBT demonstrated weaknesses in mobility regarding the width and weight of the respective tanks. The ability to land combat formations from USMC Amphibious Readiness Group vessels and to traverse narrow roadways or cross bridges, causeways and road surfaces will significantly impact the MBT's mobility in future OEs. The other MBTs and M1 Abrams also demonstrated a protection capability gap regarding all-around armor and the ability to survive multiple anti-tank weapon engagements from all angles. Finally, there were firepower capability gaps in the ability to traverse the turret in narrow roadways, or to elevate and depress the gun tube sufficiently to engage targets in the relatively flat urban environments of the historical case studies. This gap increases significantly in the future megacity environment.

Based on the research, the study determined that the U.S. Army and USMC require a medium tank to operate in the anticipated future OEs of the global littorals and megacities. The M1 Abrams is not suited for projected mission requirements. The M1 Abrams proved itself a capable tank when operating in large cities with relatively flat terrain and little to no sub-terrain. Our experience when we encountered the cities of Iraq were relatively wide roads and open spaces with few tall buildings. Even in these environments, the tank's weakness became apparent for elements conducting high-intensity operations in Sadr City, Fallujah, Ramadi and Najaf.

Officers interviewed for this study identified several critical weaknesses that a more determined enemy could have exploited. These weaknesses are the same weaknesses that the megacity environment would naturally exacerbate. Because the M1 is not well suited to the task, if the Future Studies Group firmly believes that the future OE will include megacities, a new tank developed for those environments should be developed.

The tank should make use of new technology to increase protection while reducing the weight of the tank to be able to traverse a sufficient portion of megacity roadways and bridges. The exact weight requirements would need further study of potential future megacity battlefields to determine maximum weight limits. Although there is an all-around threat, most threat attacks still originate from the frontal arc, especially when the tank is moving forward to engage enemy strongpoints.

The Israeli Merkava tank demonstrated increased crew survivability with the crew located in the hull behind the engine. This design method should be considered. Regardless of the engine placement, the armor should be modified for even distribution from top, bottom, rear and frontal protection of the tank.

The main gun should be capable of super-elevation and -depression. This could be accomplished by removing the turret and suspending the weapon system above the hull with small magazine and ammo located in the hull. The main gun should be short-barreled to maximize lateral movements. To facilitate operations in non-urban terrain, an interchangeable longer barrel could be included. The tank requires a coaxial mounted machinegun as well as a large-caliber machinegun that can be operated by the tank's commander.

The tank requires tracks, but these should be narrow enough to traverse a sufficient portion of future megacity-environment roadways. The exact width and portion of a city the tank should be capable of traversing requires further analysis of possible future megacity OEs. The tank must maintain enough speed to enable rapid maneuver and reduce enemy targeting of the tank with anti-tank weapon systems. Ideally, an engine with a fuel economy similar to the M2 Bradley would greatly benefit the ability of both the U.S. Army and USMC to sustain operations and reduce refuel requirements and logistical tails.

The requirement for open-field battle and long-distance armored combat by the U.S. Army will not be alleviated by the increase in megacities. Based on the current employment of forces in predominantly Middle Eastern countries, Europe and Korea, the U.S. Army should designate one division as a medium urban division, fielded with the new medium tank. This division could test and develop megacity doctrine with platforms designed specifically for the urban megacity fight. Should the expectation for future operations expand in the number of megacity operations, further divisions could be converted. However, the U.S. Army needs to retain the M1 Abrams MBT or a similar heavy tank for large- scale combat outside of cities.

New medium tank

The secondary recommendation of the MMAS thesis is the adoption of the new medium tank by the joint force, specifically the USMC. The USMC would benefit from the lighter, smaller tank platform in the conduct of amphibious operations. With an interchangeable barrel, the USMC version of the tank would be capable of fighting in open terrain where targets may exceed the short distances of urban terrain. These smaller tanks would also increase the landing-craft capabilities to land tanks in pairs or platoons, increasing the ability to land combat formations and rapidly deploy forces from the ship to the objective. The greater fuel efficiency would enable the landing force to sustain operations for a longer period before

resupplying. The fielding of a medium tank to the USMC would lower the per-cost unit of each tank, improving development cost.

In addition to the USMC, the Army's airborne and light brigades would benefit from having a medium tank to support operations. Following the removal of the M551 Sheridan from the light brigades and the cancellation of the AGS, the light brigades were left without mobile, protected firepower to augment their formations. The U.S. Army is already working to develop a mobile, protected firepower platform for this role in the airborne brigades. The medium tank could be fielded to these brigades instead, further improving the development cost and per-unit cost of the medium tank and reducing the number of systems required to be maintained by the U.S. Army.

Research and an in-depth analysis of potential future megacity battlefields would help determine the exact requirements required for a medium tank. The weight, size and speed requirements identified in this study are undefined. Analysis of bridge and roadway weight capabilities, roadway widths and tunnel sizes will guide development of specific requirements for tank development.

In conclusion, this research study determined the U.S. Army and USMC require a medium tank to support operations in the future OE. Also, the joint force would benefit from the adoption of a medium tank to augment the USMC and U.S. Army airborne and light-infantry brigades. The exact specifications of this tank require further research into possible future megacity OEs.

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Notes

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Acronym Quick-Scan

ABCT – armored brigade combat team
AGS – Armored Gun System
CSA – Chief of Staff of the Army
FM – field manual
IED – improvised explosive device
LCAC – Landing Craft Air-Cushioned
LCU – Landing Craft Utility
MBT – main battle tank
MMAS – masters (degree) of military arts and science
OE – operating environment
OIF – Operation Iraq Freedom
RPG – rocket-propelled grenade
USMC – U.S. Marine Corps