

REPORT DOCUMENTATION PAGE		FORM APPROVED - - - OMB NO. 0704-0188	
PUBLIC REPORTING BURDEN FOR THIS COLLECTION OF INFORMATION IS ESTIMATED TO AVERAGE 1 HOUR PER RESPONSE, INCLUDING THE TIME FOR REVIEWING INSTRUCTIONS, SEARCHING EXISTING DATA SOURCES, GATHERING AND MAINTAINING THE DATA NEEDED, AND COMPLETING AND REVIEWING THE COLLECTION OF INFORMATION. SEND COMMENTS REGARDING THIS BURDEN ESTIMATE OR ANY OTHER ASPECT OF THIS COLLECTION OF INFORMATION, INCLUDING SUGGESTIONS FOR REDUCING THIS BURDEN, TO WASHINGTON HEADQUARTERS SERVICES, DIRECTORATE FOR INFORMATION OPERATIONS AND REPORTS, 1215 JEFFERSON DAVIS HIGHWAY, SUITE 1204, ARLINGTON, VA 22202-4302, AND TO THE OFFICE OF MANAGEMENT AND BUDGET, PAPERWORK REDUCTION PROJECT (0704-0188) WASHINGTON, DC 20503			
1. AGENCY USE ONLY (LEAVE BLANK)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED STUDENT RESEARCH PAPER	
4. TITLE AND SUBTITLE The Spike NLOS Missile System: Restoring Operational Maneuver to the Modern battlefield		5. FUNDING NUMBERS N/A	
6. AUTHOR(S) Major Judd Finger			
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) USMC SCHOOL OF ADVANCED WARFIGHTING 2076 SOUTH STREET, MCCDC, QUANTICO, VA 22134-5068		8. PERFORMING ORGANIZATION REPORT NUMBER NONE	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) SAME AS #7.		10. SPONSORING/MONITORING AGENCY REPORT NUMBER: NONE	
11. SUPPLEMENTARY NOTES NONE			
12A. DISTRIBUTION/AVAILABILITY STATEMENT NO RESTRICTIONS		12B. DISTRIBUTION CODE N/A	
ABSTRACT (MAXIMUM 200 WORDS) The time has come for the Army to exploit the full potential of precision guided missile (PGM) technologies to allow distributed forces to strike at extended ranges, mass fires from across the maneuver force, and facilitate operational maneuver. One such opportunity is the highly lethal Spike NLOS system, a long-range anti-armour missile capable of destroying targets out to twenty-five kilometers. While the Australian Army has traditionally viewed NLOS missiles as the domain of offensive fires, the highly versatile Spike provides a potent deep strike capability that can be used by maneuver elements, reducing the reliance on artillery and joint assets. <i>By redefining the current offensive support paradigm and equipping maneuver forces with PGM technology such as the Spike NLOS, the Australian Army can enable extended range C2-ISR-Strike networks, facilitate Distributed Operations, and restore operational maneuver to the battlefield.</i>			
14. SUBJECT TERMS (KEY WORDS ON WHICH TO PERFORM SEARCH)		15. NUMBER OF PAGES:	
		16. PRICE CODE: N/A	
17. SECURITY CLASSIFICATION OF REPORT UNCLASSIFIED	18. SECURITY CLASSIFICATION OF THIS PAGE: UNCLASSIFIED	19. SECURITY CLASSIFICATION OF ABSTRACT UNCLASSIFIED	20. LIMITATION OF ABSTRACT

*United States Marine Corps
School of Advanced Warfighting
Marine Corps University
2076 South Street
Marine Corps Combat Development Command
Quantico, Virginia 22134-5068*

FUTURE WAR PAPER

*The Spike Non-Line of Sight Missile System:
Restoring Operational Maneuver to the Modern Battlefield*

SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
OPERATIONAL STUDIES

Major Judd Finger, Australian Army

AY 2016-17

Mentor: Doctor Bradley Meyer

Approved: Bradley J. Meyer

Date: 25 May 2017

EXECUTIVE SUMMARY

Title: The Spike NLOS Missile System: Restoring Operational Maneuver to the Modern Battlefield

Author: Major Judd Finger

Thesis: By redefining the current offensive support paradigm and equipping maneuver forces with PGM technology such as the Spike NLOS, the Australian Army can enable extended range C2-ISR-Strike networks, facilitate Distributed Operations, and restore operational maneuver to the battlefield.

Discussion: Technological growth and the proliferation of affordable military technologies continue to degrade the asymmetric superiority once enjoyed by western militaries. Persistent battlefield surveillance, unmanned aerial vehicles, massed fires, and long-range missiles significantly threaten the Australian Army's traditional operational advantages. So how can the Army restore operational maneuver on the modern battlefield? Moreover, are there any current or future technologies that can assist land forces in regaining an asymmetric technical advantage?

A leading military concept in restoring land maneuver is Distributed Operations, centered on lethal combined arms teams that maneuver independently, avoid massed fires, and concentrate at decisive points. The problem is that while this is necessary to counter enemy targeting, small force disaggregation significantly increases the risk of isolation and destruction. Combat elements can no longer provide direct fire mutual support once dispersed and rely heavily on offensive fires to support isolated elements. To overcome these issues, Distributed Operations rely on the integration of command and control (C2), intelligence/surveillance/reconnaissance (ISR), and strike networks to facilitate maneuver over extended ranges. However, while the Army has invested significantly in capable C2 and ISR systems, land maneuver forces do not possess the integral non-line of sight (NLOS) lethality to strike at extensive ranges, enable mutual support, and facilitate concentration.

The time has come for the Army to exploit the full potential of precision guided missile (PGM) technologies to allow distributed forces to strike at extended ranges, mass fires from across the maneuver force, and facilitate operational maneuver. One such opportunity is the highly lethal Spike NLOS system, a long-range anti-tank missile capable of destroying targets over twenty-five kilometers. While the Australian Army has traditionally viewed NLOS missiles as the domain of offensive fires, the highly versatile Spike provides a potent deep fire capability that can be used by maneuver elements, negating the reliance on offensive fires.

Conclusion: The Spike NLOS is a highly capable system that can significantly enhance the Australian Army's lethality and maneuver capacity. Importantly, this technology is a proven system that is currently employed by forces around the world. The Australian Army must investigate this opportunity if it is to truly reap the benefits of precision land-to-land missile technology and regain a technical asymmetric advantage on the future battlefield.

DISCLAIMER

THE OPINIONS AND CONCLUSIONS EXPRESSED HEREIN ARE THOSE OF THE INDIVIDUAL STUDENT AUTHOR AND DO NOT NECESSARILY REPRESENT THE VIEWS OF EITHER THE MARINE CORPS SCHOOL OF ADVANCED WARFIGHTING OR ANY OTHER GOVERNMENTAL AGENCY. REFERENCES TO THIS STUDY SHOULD INCLUDE THE FOREGOING STATEMENT.

QUOTATION FROM, ABSTRACTION FROM, OR REPRODUCTION OF ALL OR ANY PART OF THIS DOCUMENT IS PERMITTED PROVIDED PROPER ACKNOWLEDGEMENT IS MADE.

Illustrations

	Page
Figure 1. Spike NLOS Missile.....	3
Figure 2. Spike NLOS Mounted on B-Vehicle.....	3
Figure 3. Spike NLOS Tank Mount.....	3
Figure 4. Spike NLOS M113 Mount	3
Figure 5. Spike NLOS Mounted on All Terrain Vehicle.....	3
Figure 6. Spike NLOS on a Trailer	3
Figure 7. Spike NLOS Small Craft Mount	3
Figure 8. Spike NLOS Helicopter Mount.....	3
Figure 9. Combined Arms Team in the advance using Spike NLOS	10
Figure 10. Combined Arms Team “Eating Through the Defense” using Spike NLOS	11
Figure 11. Exploitation Force using Spike NLOS in the ‘Breakthrough’	12

Table of Contents

	Page
INTRODUCTION	1-2
THESIS	2
SPIKE NLOS CHARACTERISTICS	2-3
ENABLING EXTENDED RANGE C2-ISR-STRIKE NETWORKS AND DISTRIBUTED OPERATIONS	3-7
RESTORING OPERATIONAL MANEUVER TO THE MODERN BATTLEFIELD	7-14
CONCLUSION.....	14-15
CITATIONS AND FOOTNOTES	16
BIBLIOGRAPHY.....	17-18

REPORT DOCUMENTATION PAGE		FORM APPROVED - - - OMB NO. 0704-0188	
PUBLIC REPORTING BURDEN FOR THIS COLLECTION OF INFORMATION IS ESTIMATED TO AVERAGE 1 HOUR PER RESPONSE, INCLUDING THE TIME FOR REVIEWING INSTRUCTIONS, SEARCHING EXISTING DATA SOURCES, GATHERING AND MAINTAINING THE DATA NEEDED, AND COMPLETING AND REVIEWING THE COLLECTION OF INFORMATION. SEND COMMENTS REGARDING THIS BURDEN ESTIMATE OR ANY OTHER ASPECT OF THIS COLLECTION OF INFORMATION, INCLUDING SUGGESTIONS FOR REDUCING THIS BURDEN, TO WASHINGTON HEADQUARTERS SERVICES, DIRECTORATE FOR INFORMATION OPERATIONS AND REPORTS, 1215 JEFFERSON DAVIS HIGHWAY, SUITE 1204, ARLINGTON, VA 22202-4302, AND TO THE OFFICE OF MANAGEMENT AND BUDGET, PAPERWORK REDUCTION PROJECT (0704-0188) WASHINGTON, DC 20503			
1. AGENCY USE ONLY (LEAVE BLANK)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED <i>STUDENT RESEARCH PAPER</i>	
4. TITLE AND SUBTITLE <i>The Spike NLOS Missile System: Restoring Operational Maneuver to the Modern battlefield</i>		5. FUNDING NUMBERS <i>N/A</i>	
6. AUTHOR(S) <i>Major Judd Finger</i>			
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) <i>USMC SCHOOL OF ADVANCED WARFIGHTING 2076 SOUTH STREET, MCCDC, QUANTICO, VA 22134-5068</i>		8. PERFORMING ORGANIZATION REPORT NUMBER <i>NONE</i>	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) <i>SAME AS #7.</i>		10. SPONSORING/MONITORING AGENCY REPORT NUMBER: <i>NONE</i>	
11. SUPPLEMENTARY NOTES <i>NONE</i>			
12A. DISTRIBUTION/AVAILABILITY STATEMENT <i>NO RESTRICTIONS</i>		12B. DISTRIBUTION CODE <i>N/A</i>	
ABSTRACT (MAXIMUM 200 WORDS) <i>The time has come for the Army to exploit the full potential of precision guided missile (PGM) technologies to allow distributed forces to strike at extended ranges, mass fires from across the maneuver force, and facilitate operational maneuver. One such opportunity is the highly lethal Spike NLOS system, a long-range anti-armour missile capable of destroying targets out to twenty-five kilometers. While the Australian Army has traditionally viewed NLOS missiles as the domain of offensive fires, the highly versatile Spike provides a potent deep strike capability that can be used by maneuver elements, reducing the reliance on artillery and joint assets. By redefining the current offensive support paradigm and equipping maneuver forces with PGM technology such as the Spike NLOS, the Australian Army can enable extended range C2-ISR-Strike networks, facilitate Distributed Operations, and restore operational maneuver to the battlefield.</i>			
14. SUBJECT TERMS (KEY WORDS ON WHICH TO PERFORM SEARCH)		15. NUMBER OF PAGES:	
		16. PRICE CODE: <i>N/A</i>	
17. SECURITY CLASSIFICATION OF REPORT <i>UNCLASSIFIED</i>	18. SECURITY CLASSIFICATION OF THIS PAGE: <i>UNCLASSIFIED</i>	19. SECURITY CLASSIFICATION OF ABSTRACT <i>UNCLASSIFIED</i>	20. LIMITATION OF ABSTRACT

Technological growth and the proliferation of affordable military technologies continue to degrade the asymmetric superiority once enjoyed by western militaries. Persistent battlefield surveillance, unmanned aerial vehicles (UAVs), massed fires, and long-range missiles significantly threaten the Australian Army's traditional operational advantages. Australian academic, Doctor Albert Palazzo, notes that "at the tactical level the rise of precision threatens to shift the balance between the attacker and the defender decisively in the direction of the defence, with the result being a denial of the offence's ability to manoeuvre, close, and force a decision."¹ So how can the Army restore operational maneuver on the modern battlefield? Moreover, are there any current or future technologies that can assist land forces in regaining an asymmetric technical advantage?

A leading military concept in restoring land maneuver is Distributed Operations, centered on lethal combined arms teams that maneuver independently, avoid massed fires, and concentrate at decisive points. The problem is that while disaggregation is necessary to counter enemy targeting, small forces are vulnerable to isolation and destruction. Dispersed combat elements can no longer provide direct fire mutual support and rely heavily on indirect support such as artillery. To overcome these problems, Distributed Operations rely on the integration of command and control (C2), intelligence/surveillance/reconnaissance (ISR), and strike networks to facilitate maneuver over extended ranges. However, while the Army has invested significantly in capable C2 and ISR systems, land maneuver forces do not possess the integral non-line of sight (NLOS) lethality to strike at extensive ranges, enable mutual support, and facilitate concentration.

The time has come for the Army to exploit the full potential of precision guided missile (PGM) technologies to allow distributed forces to strike at extended ranges, mass fires from across the maneuver force, and facilitate operational maneuver. One such opportunity is the highly lethal Spike NLOS system, a long-range anti-armour missile capable of destroying

targets out to twenty-five kilometers. While the Australian Army has traditionally viewed NLOS missiles as the domain of offensive fires, the highly versatile Spike provides a potent deep strike capability that can be used by maneuver elements, reducing the reliance on artillery and joint assets. *By redefining the current offensive support paradigm and equipping maneuver forces with PGM technology such as the Spike NLOS, the Australian Army can enable extended range C2-ISR-Strike networks, facilitate Distributed Operations, and restore operational maneuver to the battlefield.*

Spike NLOS Characteristics

The Spike NLOS is part of a suite of systems incorporating line of sight and NLOS models and is operational in a number of countries including Israel, Britain, and South Korea. Two missiles in a launch canister weigh seventy-one kilograms and have a range of twenty-five kilometers. Although the missile is primarily an anti-armour weapon with a high explosive anti-tank round, it also includes blast and fragmentation options against dismounted forces. The missile is launched and controlled by an operator using a remote control station that communicates by radio frequency to a camera in the nose of the round.²

The system is a highly accurate and lethal strike capability that can maneuver mid-flight and abort if required.³ The Spike NLOS increases force lethality through its modular design that can attach to multiple platforms including armor, all-terrain vehicles, trailers, helicopters, and small naval vessels (figures 1-8). The operator does not have to be located at the missile firing point and can remote launch the munitions from a separate location. The system can be used across the entirety of the combat force, providing maneuver elements massed and networked fires over extended ranges. The Spike NLOS is an ideal combat proven PGM system that can integrate with the Australian Army's existing fleet of land and aerial platforms, while providing the necessary weapon capability to enable an integrated C2-ISR-Strike network.

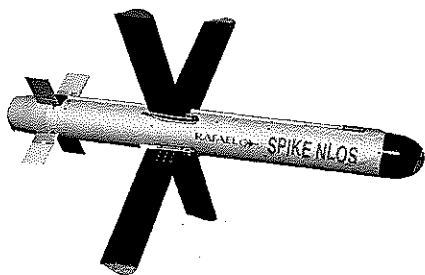


Figure 1. Spike NLOS Missile

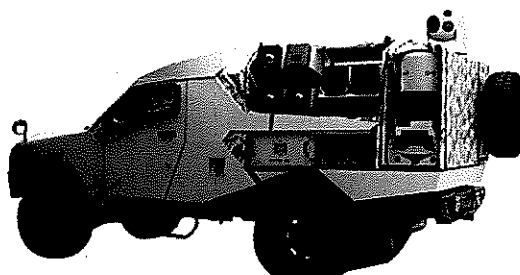


Figure 2. Spike NLOS B-vehicle mount



Figure 2: Spike NLOS tank mount



Figure 4: Spike NLOS M113 mount

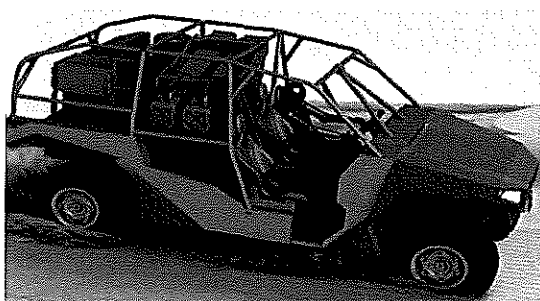


Figure 5: Spike NLOS mounted on an ATV

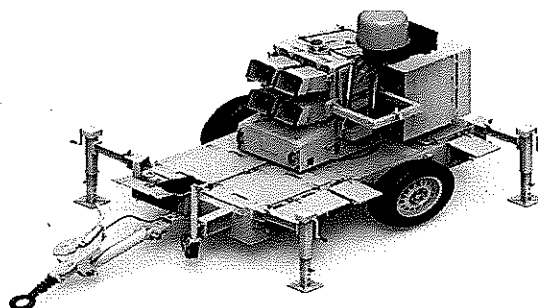


Figure 6: Spike NLOS on a trailer

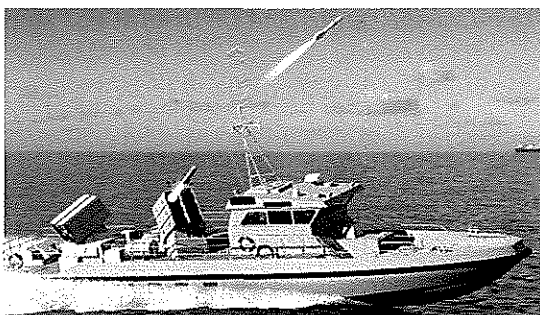


Figure 7: Spike NLOS small craft mount



Figure 8: Spike NLOS helicopter mount

Enabling Extended Range C2-ISR-Strike Networks and Distributed Operations

The growing threat of persistent ISR and precision strike capabilities has significantly increased the risk of force concentration on the modern battlefield. As showcased in the 2014 Ukrainian Battle of Zelenopillya, Russian troops used tactical UAVs and Grad missiles to

destroy two concentrated Ukrainian mechanized battalions within a matter of minutes.⁴ The 2016 United States *Marine Corps Operating Concept* clearly identifies these threats and acknowledges that “tomorrow’s fights will involve conditions in which ‘to be detected is to be targeted is to be killed.’ Adversaries will routinely net together sensors, spies, UAS, and space imagery to form sophisticated ‘ISR-strike systems’ that are able to locate, track, target, and attack an opposing force.”⁵ To overcome these dangers, it is imperative that distributed maneuver forces are equipped with ISR and C2 assets to independently detect and track threats at extended ranges. These same combined arms teams must also possess a PGM capability such as the Spike NLOS that enables deep strike, assists forces to avoid decisive engagement by maintaining distance, and facilitates physical concentration for decisive operations by destroying armored forces. Furthermore, from a fires perspective, PGMs are critical to cohesive C2-ISR-Strike networks that enable commanders to control and shape the close and deep fight.

A maneuver strike network, integrated with C2 and ISR, builds lethality and resilience across the combat force and reduces the reliance on offensive fires. As outlined in the Australian Army’s *Australian Concept Series Volume One* the future land force must be “able to function dispersed in relatively small groupings, infiltrating through difficult terrain and using it to advantage to avoid destruction...”⁶ More specifically, to restore operational maneuver through Distributed Operations, combined arms teams must be equipped to exploit ISR advantages, able to make informed decisions through C2 systems, and strike with organic long range lethality. Although current Army force structures are not prepared for such a transition, significantly improved ISR and C2 networking over the last ten years provide a blueprint for establishing the required network. While the Army has developed sophisticated C2 and ISR systems, future efforts must focus on developing the complementary strike capacity to enable Distributed Operations.

In 2005, the Australian Army implemented the Hardened and Networked Army concept, which sought to “increase the size and firepower of the land force, improve the protection provided to our troops, and allow them to communicate better on the future battlefield.”⁷ Central to this transformation was the implementation of a networked enabled force, featuring improved ISR and digital C2 architectures. The concept relies on enhanced C2 structures, improved decision-making cycles, and superior operational tempo. However, while the Army possesses formidable ‘sense’ and ‘know’ networks that enhance observation, orientation, and decision, combined arms teams must be equipped with PGMs to force a decision, fight independently, and contribute as mutually supporting nodes within an overarching strike network.

Networks are a combination of nodes, connectors, and hubs. Nodes are individual elements within a network and interact to form clusters. Clusters are brought together by connectors, which in turn link through dominant hubs.⁸ Importantly, in the C2 and ISR realm, modern technologies such as digitization, global positioning systems, and battlefield management structures have replaced out-dated analogue communications and linked every node through immediate information distribution, greatly increased situational awareness and decision making. Today, Army vehicles act as digital nodes that provide critical connectivity and intelligence to the primary network. C2 is no longer entirely dependent on traditional stove-piped information hubs such as a higher headquarters. Advancements have enabled nodes to deliver real-time situational awareness and provided combat forces resilient and networked communications.

In stark contrast, the Army’s strike capabilities are still dependent on analogue style networks. Land forces mutually support one another through direct fires and rely on joint fire controller ‘connectors’ to gain offensive fires through centralized strike ‘hubs’ such as artillery and air support. Although offensive fires operate over a digitized communication and

targeting network, offensive support still relies on fires hubs or high-value assets such as aircraft. A vulnerability of Distributed Operations is that isolated combined arms teams can no longer mutually support one another through direct fires until forces have physically concentrated, increasing the reliance on external fires. Crucially, any threat to offensive support hubs exposes dependent forces to isolation.

Distributed Operations require technologies such as the Spike NLOS to provide lethality, build resiliency, and limit the dependence on offensive fires. Furthermore, the Spike enables distributed elements to mutually support one another through NLOS fires. Extended range strike, critical in the close fight, also makes the Spike NLOS a formidable complementary capability to shaping the deep battlespace and supporting littoral operations as part of a maritime strategy.

Integrated deep fires are essential to the joint battle and supporting ADF operations as a whole; a role traditionally dominated by the Air Force and Navy. However, as outlined in the *Australian Land Concept Series Volume One* the Australian Army has for far too long remained a joint consumer, in particular, in the deep fight.⁹ While planned acquisitions such as the High Mobility Artillery Rocket System (HIMARS) remain crucial to the future of the Army's offensive fires capability, other weapons must be embraced to enhance land force deep lethality. A key vulnerability for the Army in deep shaping is an over-reliance on high-value assets such as fixed and rotary wing aviation, offensive support, and joint assets. While the Australian Defense Force has invested in world leading future strike capabilities such as the F-35, land forces must look to systems such as the Spike NLOS to provide complementary fires. PGMs are critical to the future fight, increasing strike capacity across the joint force and enabling larger offensive support assets to focus in greater depth.

With a focus on deep fire systems such as HIMARS, an opportunity exists to implement complementary capabilities such as the Spike NLOS. With an exponential

increase in PGM ranges, operational engagements areas now encompass entire theaters. With a growing expectation for offensive fires to operate at ever-increasing ranges, a need remains for supporting capabilities to reinforce the traditional artillery realm. Systems such as the Spike will become progressively important to reinforcing deep fires and enhancing service and joint strike capacity. Moreover, the Spike is not only essential to effecting deep land targets but provides a flexible niche option for land forces conducting potential operations in the littoral environment.

A cornerstone of Australia's defense remains a strong maritime strategy securing vital lines of communications in the near region and contributing to missions within the Asia-Pacific. Accordingly, the Army has continued to develop capabilities to support the maritime strategy through land-based effects. With the development of the Australian Amphibious Force (AAF), the Army must look to the future of land expeditionary activities such as the United States Marine Corps Expeditionary Advanced Basing Operations (EABO). This concept involves the insertion of land forces into the coastal regions along vital straits to gain control of maritime lines of communications through land-based strike operations against enemy vessels.¹⁰ The Spike NLOS is ideal for small force insertions and provides a robust strike capability to undertake such tasks. While systems such as the HIMARS play a central role, weapons such as Spike can deliver a complementary option to support tiered targeting and striking enemy vessels in narrow waterways. Through the clever maneuver of land forces in the maritime environment and the use of lightweight and easily deployable missile systems, the Army can undertake lethal and valuable niche operations as part of a joint expeditionary force.

Restoring Operational Maneuver to the Battlefield

Recent technologies continue to favor the modern defence by degrading offensive maneuver at ever increasing standoff ranges. Distributed Operations aim to overcome this

challenge and restore operational freedom of action, mobility, lethality, and dispersion. Capabilities such as the Spike NLOS will play an essential role in enabling C2-ISR-strike networks and overcoming current Army force structure limitations that constrain effective Distributed Operations. In 2012, the Army restructured its conventional forces under Plan Beersheba to remediate systemic organizational issues.¹¹ While necessary, the amalgamation of the Army's existing light, medium, and heavy formations into mixed brigade structures posed substantial challenges.¹² The primary concern with the new Combat Brigades remains the ad-hoc combination of cavalry, mechanized, and light units. Light forces lack the necessary speed, cross country maneuverability, survivability, and firepower to undertake armored operations. Despite future fighting vehicle acquisitions, the Army will be unable to completely mechanize the Combat Brigades, making it imperative to seek out other technological opportunities such as the Spike NLOS to offset these vulnerabilities. While the Spike is not an overall solution, its extended range can substantially support armed cavalry maneuver, enable assault force breakthrough operations, assist successful exploitation, and aid amphibious assault.

Offensive maneuver on the modern battlefield requires highly mobile, flexible, and lethal armored cavalry forces. However, under Plan Beersheba, dedicated cavalry forces have reduced to squadron size in support of each Combat Brigade. While the cavalry's aging fleet of LAV-25s is set for replacement, the new vehicles will still rely on direct fire weapons, providing no standoff capability to avoid isolation and destruction. The ability to fight in a distributed manner to counter modern threats while still conducting the full range of tactical tasks is critical to the cavalry's employment. As an offset, the Spike NLOS provides proven standoff lethality, allowing for greater cavalry dispersion, increased ISR coverage, improved survivability, and enhanced strike capacity.

The Spike NLOS can enable cavalry forces to prosecute targets for neighboring call signs at extended ranges, allowing quick repositioning to avoid counter-battery fires. By integrating Spike within a sophisticated ISR network, these same forces can detect enemy elements at extended distances through multi-layered surveillance, track targets through UAVs, and strike with an organic NLOS missile. For reconnaissance missions, the cavalry works closely with light infantry reconnaissance, which are highly vulnerable beyond the forward edge of the battle area (FEBA). With Spike, light forces can operate independently and mutually support armored reconnaissance with an extended range fires capability, significantly improving combined arms integration. The Spike provides standoff for vulnerable ISR elements and enables the Combat Brigade commander to prosecute important targets and shape the battlespace without unmasking high-value assets.

Cavalry forces capable of independently destroying armored threats can undertake effective Guard tasks and enable greater operational maneuver for follow-on combat forces. Future operational advances will involve theater level shaping via multilayered ISR and deep strike before handing over targets to advancing cavalry elements. These forces will then detect and track threats via a combination of joint, service, and organic unmanned ISR platforms well forward of the FEBA and commence deep strike through NLOS PGM (figure 9). These actions will become increasingly critical to providing the necessary battlefield shaping for combat forces conducting breakthrough operations.

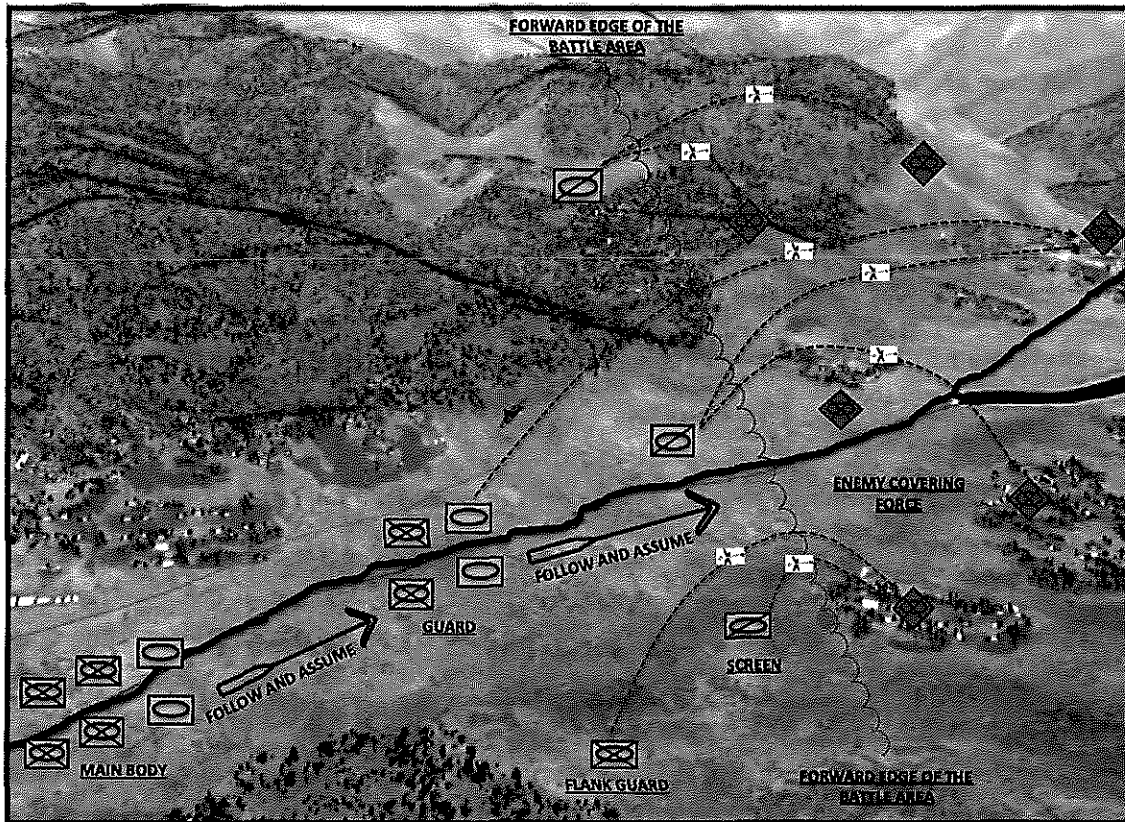


Figure 9. Guard and Screen Forces using the Spike NLOS in the Advance.

For combined arms teams conducting decisive breakthrough operations, the Spike significantly enhances tactical maneuver and cooperation. The Spike's combat power and flexibility enable infantry and armored forces to 'eat through' a sophisticated defense in depth. The Spike's extended range, precision, and lethality allow assault forces to target and shape a defense's outpost zone, battle area, and rear sector simultaneously. Through detailed reconnaissance and close integration with offensive fires, combined arms teams can use the Spike to target dismounted infantry, destroy armored counterattacks, and create corridors through the battle zone (figure 10). Concurrently, the Spike can be used to target counterattack forces and offensive support elements in the enemy rear zone while the assault is ongoing. By providing this capability to the maneuver force, precision fires can be massed quickly from multiple locations and fleeting opportunities exploited. Integrated correctly with a tactical UAVs and layered ISR, the Combat Brigade commander can build situational

awareness, implement a superior decision making cycle, and call upon a PGM networked maneuver force to strike targets in the close and deep fight while possessing the required redundancy and resilience across the combat force to survive targeted enemy fires.

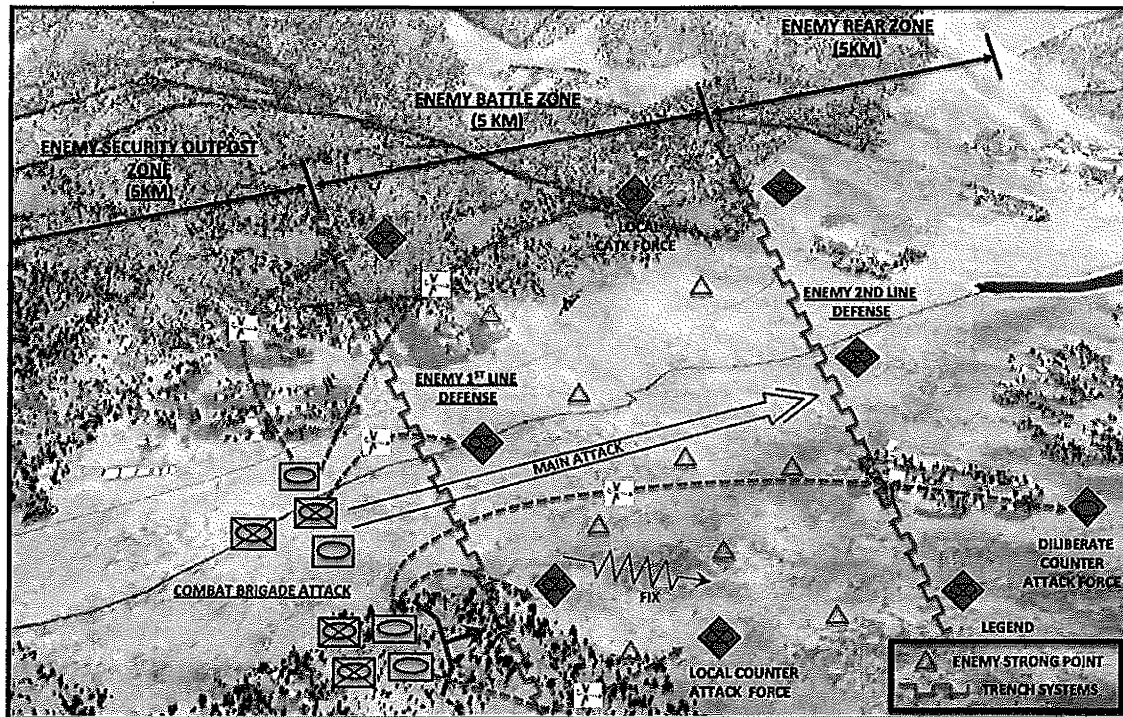


Figure 10. Combat Brigade ‘Eating Through the Defense’ using Spike NLOS

Following a breakthrough, the Spike provides a valuable standoff capability for exploitation forces operating in the enemy’s rear. The Army’s lack of self-propelled artillery severely constricts offensive support options for the exploitation. The Spike’s standoff capacity reduces this risk and shields maneuver elements against organized counterattack forces. Coupled with ISR assets, maneuver units can locate enemy forces well forward of the advance and destroy targets on the move with NLOS fires (figure 11). Furthermore, the Spike provides a potent capability for light infantry forces conducting airmobile operations to seize key terrain or crossing points forward of the exploitation force. As a flexible weapon system, capable of use amongst the varying elements within a combined arms team, the Spike

provides a powerful tactical asymmetry for combined arms operations.

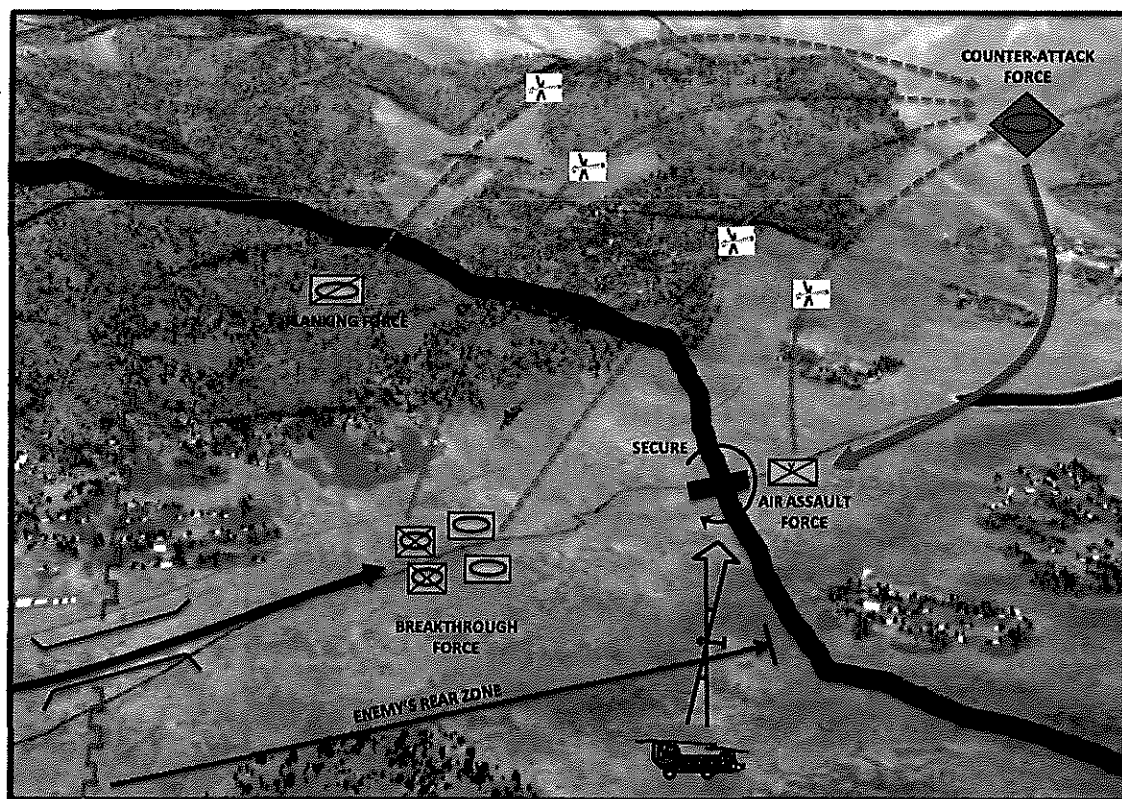


Figure 11. Exploitation Forces using Spike NLOS in the 'Breakthrough'

For light combat elements, the Spike NLOS represents an exponential increase in lethality and survivability across a range of tactical tasks in all environments. Whether it be the airmobile delivery of ATV's armed with Spike (figure 5) or an advance in light armored vehicles towing Spike mounted trailers (figure 6), the system enables light units to task organize strike capabilities for specific missions. Additionally, precision lethality and multi-option munitions allow light forces to conduct surgical strikes in complex terrain against varying target sets, reducing collateral damage.

The Spike provides the infantry teeth and standoff, critical to shielding vulnerable forces against armored threats. The ability for light forces to strike armor targets with integral assets out to twenty-five kilometers is an exponential increase in capacity and a complete game changer for the employment of infantry on the battlefield. Imagine a rifle platoon

mounted in Protected Mobility Vehicles towing trailers fitted with the Spike NLOS. Through the use of integral unmanned aerial ISR assets and PGMs a platoon can now, independently, locate, track, and strike armor forces out to twenty-five kilometers. The possibilities provided by the Spike's range and lightweight mobility are endless, including a necessary capability for light forces conducting expeditionary operations with the AAF.

The AAF has forced the Army to rethink survivability and lethality requirements for landing forces in a high threat expeditionary environment. The predominately light landing force, configured as either an airmobile or protected mobility element, will require a significant increase in integrated networked firepower to assist in the ability to strike, shape, shield, and adapt. As part of a joint force, the Spike NLOS is a multi-platform weapon that can provide the necessary deep fires to counter enemy offensive action. Light ISR forces can now forward deploy via helicopter with ATVs and Spike. These same ISR elements can mutually support one other, strike high-value targets, and contribute to joint fires shielding landing force insertions. Moreover, the Spike's extended range provides standoff strike for light landing forces against armored, mounted, or dismounted threats. The system provides significant depth by fire, critical to countering enemy action, securing points of entry, and undertaking offensive and defensive actions.

In support for the landing force, the Spike provides a standard weapon system for the AAF's attack rotary wing assets (figure 8) or a potential system for small naval and riverine vessels (figure 7). While the AAF is not equipped to undertake surface amphibious assault, it must be prepared to conduct vertical ship to shore, or ship to objective maneuver in high threat environments. These expeditionary missions will require the AAF to operate standard platforms and weapons systems to enhance strike and logistical interoperability. Systems such as a Spike NLOS mitigate serious vulnerabilities and increase the ability of both the Combat Brigade and AAF to carry out directed mission sets.

Looking to the future, the unique capabilities represented by the Spike NLOS will become increasingly important as the Army undertakes Land 400, the wholesale replacement of the armored reconnaissance and infantry fighting vehicle fleet.¹³ This investment in platform technology is a significant milestone towards the Army competing on the future battlefield. Importantly, the *Land 400 Concept of Operations* prioritized precision lethality, survivability, integration, and sustainability as central to the combined arms fight and further identified anti-tank guided missiles as an essential capability.¹⁴

The opportunity now exists for the Army to challenge the traditional views of missiles within a combined arms environment and recognize that these systems can provide much more than direct fire. The Spike NLOS's versatility and extended range make it an ideal fit for the requirements of the Army's future armored vehicles. Why should the Army limit future maneuver forces to direct fire weapons, when extended range munitions can significantly enhance lethality and survivability?

Conclusion

Now is the time for the Australian Army to redefine its PGM paradigm and recognize the requirement for extended range PGM technologies such as the Spike. Strike networks that cover vast distances and enable Distributed Operations are critical to Army's future fighting force. Potential non-state and state adversaries are already exploiting these technologies, and it is urgent the ADF take note of these advancements, invest wisely, and restore operational maneuver to the modern battlespace. As with the historical developments of the cannon, rifle, or machine gun, PGMs such as the Spike NLOS have become an essential element of modern war that must be embraced to support the combined arms and joint fight.

The Army must invest in systems such as the Spike NLOS to enhance land force capacity in both the close and deep fight. From a precision lethality and survivability perspective, the system's extended range is essential for combined arms teams operating in

highly contested and complex future operating environments. Moreover, with the rapid increase in lightweight extended range PGMs, the Army is quickly becoming an essential element in providing deep fires for the joint force. The prevalence and increasing technical sophistication of land-based missile technologies has now enabled land forces to play a significant role in deep targeting through highly lethal precision munitions. Coupled with the rapid expansion of ISR capabilities to find and track targets theatre wide, missile technologies are critical for land forces to strike at extended ranges and restore offensive parity against the modern defence.

The Spike NLOS is a highly capable system that can support Distributed Operations and assist in restoring operational maneuver to the battlefield. Importantly, this technology is a proven system employed by forces around the world today. The Australian Army must investigate this opportunity if it is to reap the benefits of precision land-to-land missile technology and regain a technical asymmetric advantage on the modern battlefield. The Spike's versatility and extended range are ideal for the Army's current Combat Brigades, AAF, and future fighting force. Moreover, the system can integrate with multiple joint platforms and aid both combined and inter-service interoperability. Ultimately, the Army must fully exploit the opportunities providing by technologies such as the Spike NLOS, and understand that if it does not, Australia will have ceded a critical advantage to our adversaries on the future battlefield.

Endnotes

¹ Doctor Albert Palazzo, "Precision and the Consequences for the Modern Battlefield," *Small Wars Journal* (2016): <http://smallwarsjournal.com/jrnl/art/precision-and-the-consequences-for-the-modern-battlefield>.

² "Spike NLOS: Multi-Purpose, Multi-Platform Electro-Optical Missile System," Rafael, accessed December 27, 2016, http://www.rafael.co.il/marketing/SIP_STORAGE/FILES/6/1026.pdf.

³ "Spike NLOS: Multi-Purpose, Multi-Platform Electro-Optical Missile System,"

⁴ Robert. H. Scales, "Russia's Superior New Weapons," *The Washington Post*, August 05, 2015, https://www.washingtonpost.com/opinions/global-opinions/russias-superior-new-weapons/2016/08/05/e86334ec-08c5-11e6-bdcb-0133da18418d_story.html.

⁵ Department of Navy, *The Marine Corps Operating Concept* (Headquarters United States Corps, Washington, D.C, 2016) p. 6.

⁶ Australian Department of Defense, *Australian Land Warfare Concept Series Volume 1: Coming to terms with the modern way of war: Precision missiles and the land component of Australia's joint force* (Canberra, Australian Army, August, 2016). 25.

⁷ Australian Department of Defense, *Australian Defense Force Report 200819: Hardened and Networked Army* (Department of Defense, Canberra, 2005): <https://ntrl.ntis.gov/NTRL/dashboard/searchResults/titleDetail/ADA481036.xhtml>

⁸ Albert-Laszlo Barabasi, *Linked: How Everything is Connected to Everything Else and What it Means for Business, Science, and Everyday Life* (First Plume Books, New York, 2003), 15-63.

⁹ Australian Department of Defense, *Australian Land Warfare Concept Series Volume 1*, 7-9.

¹⁰ Department of Navy, *The Marine Corps Operating Concept*. P. 13.

¹¹ Department of Defense, *Plan Beersheba*, (Australian Army, Canberra, 2016): <https://www.army.gov.au/our-future/modernisation-projects/plan-beersheba>.

¹² Department of Defense, *Multi-Role Combat Brigades*, (Australian Army, Canberra, 2016): <https://www.army.gov.au/our-future/modernisation-projects/plan-beersheba>.

¹³ Department of Defense, *Project Land 400*, (Australian Army, Canberra, 2016): <https://www.army.gov.au/our-future/modernisation-projects/project-land-400>.

¹⁴ Department of Defense, *Land 400: Land Combat Vehicle System Concept of Operations* (Australian Army, Canberra, 2016): http://www.defence.gov.au/dmo/Multimedia/Land400_C0-9-5564.pdf. 17-18.

Bibliography

- Australian Department of Defense. *Australian Defense Force Report 200819: Hardened and Networked Army*. Department of Defense, Canberra, 2005: <https://ntrl.ntis.gov/NTRL/dashboard/searchResults/titleDetail/ADA481036.xhtml>Albert.
- Australian Department of Defense. *Australian Land Warfare Concept Series Volume 1: Coming to terms with the modern way of war: Precision missiles and the land component of Australia's joint force*. Canberra, Australian Army, August, 2016.
- Australian Department of Defense. *Defence White Paper 2016*. 2016.
- Australian Department of Defence. *Developing the Australian Amphibious Force*. Canberra, Australian Army, June 03, 2015: <http://www.army.gov.au/Our-people/Units/1st-Division/Developing-the-Australian-Amphibious-Force>.
- Australian Commonwealth Government. *First Principles Review: Creating One Defence*. Canberra, Department of Defense, 01 April 2015.
- Australian Department of Defense. *Land 400: Land Combat Vehicle System Concept of Operations*. Australian Army, Canberra, 2016: http://www.defence.gov.au/dmo/Multimedia/Land400_C0-9-5564.pdf.
- Australian Department of Defense. *Multi-Role Combat Brigades*. Canberra, Australian Army, 2016: <https://www.army.gov.au/our-future/modernisation-projects/plan-beersheba>.
- Australian Department of Defense. *Plan Beersheeba*, Australian Army, Canberra, 2016: <https://www.army.gov.au/our-future/modernisation-projects/plan-beersheba>.
- Australian Department of Defense. *Project Land 400*. Australian Army, Canberra, 2016: <https://www.army.gov.au/our-future/modernisation-projects/project-land-400>.
- Glieman, Ken and Dean, Peter. *Beyond 2017: The Australian Defence Force and Amphibious Warfare*. Australian Capital Territory: The Australian Policy Institute Limited, 2015.
- Laszlo Barabasi. *Linked: How Everything is Connected to Everything Else and What it Means for Business, Science, and Everyday Life*. First Plume Books, New York, 2003.
- Nickles, Thomas. *Thomas Kuhn*. Cambridge: Cambridge University Press, 2002.
- Scales, Robert. "Russia's Superior New Weapons," *The Washington Post*, accessed 27 December 2016, https://www.washingtonpost.com/opinions/global-opinions/russias-superior-new-weapons/2016/08/05/e86334ec-08c5-11e6-bdcb-0133da18418d_story.html.
- "Spike NLOS: Multi-Purpose, Multi-Platform Electro-Optical Missile System." Rafael, accessed December 27, 2016, http://www.rafael.co.il/marketing/SIP_STORAGE/FILES/6/1026.pdf.