THE COMBAT ENGINEER REGIMENT – A MECHANISED OUTLOOK INTO 2030

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"Breaching a complex obstacle covered by enemy fire is the toughest attack mission a unit can get[1]."

General (Retired) Frederick Franks Jr.
Commander, VII Corps, Operation Desert Storm

Background

1. The Combat Engineer Regiment (CER), in line with Plan Keogh, is undergoing a modernisation process whereby significant new capability will be delivered through investment into new equipment and personnel with specialised skillsets. The modernisation process aims to provide Forces Command with an agile, mounted, protected and networked manoeuvre force capable of winning future conflicts in an increasingly complex operational environment[2]. Under the Land 8160 project, Defence is seeking to acquire an armoured engineering system in order for the Army to provide under armour obstacle breaching and bridging capability to support mounted forces[3].

Aim

2. The aim of this essay is to outline the current construct of the CER in a mechanised context, and the challenges that are being experienced through the transition from the smallest unit size to the largest. It will also investigate the potential construct of the CER based upon the expected engineering platforms to be delivered within the next decade, and how best to develop the framework to allow for a more seamless transition. An analysis of how the contemporary combat engineer adapts to future Multi Domain Operations and technologically advanced threats will also be considered.

Scope

3. This essay will explore the future construct of the CER into 2030 through a discussion of the developing under-armour breaching capability in the context of future mobility and counter-mobility concepts. Land 8160 is one of several major projects in various stages under the Australian Army's modernisation plan for the Royal Australian Engineers (RAE) and aims to provide mobility support to the Joint Land Force through the ability to rapidly breach obstacles as part of a combined arms fighting force. Multi Domain Operations will be considered to understand how todays combat engineer and current engineering capability can develop in mindset and culture to establish a strong foundation in the gradual progress of being able to counter real and emerging threats on the battle space. Ultimately, the CER must remain malleable during the implementation period of proposed armoured vehicles so that the increasing sophistication of adversaries can be critically considered and adapted to.

CURRENT FORCE STRUCTURE AND CAPABILITY

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[1] Lieutenant Colonel Donald P. Kotchman, Wesley I. Glasgow and Lieutenant Colonel Harry Greene, "The Grizzly: Mobility Support for Force XXI", Engineer Bulletin, February 1998.
[2] Australian Army HQ Forces Command – COMD FORCOMD DIRECTIVE 46/17. Forces Command Modernisation (Plan Keogh) FY 17/18 – 18/19. 2017, p2
[3] Reporter UNK. *Billion-dollar LAND Projects open for business*. Defence Connect Website, 11 Jan 2018

4. Mechanisation of the CER is not a new concept or capability. The tactics, techniques and procedures (TTPs) were developed during mechanisation of the 1st CER to support the armoured manoeuvre element from 1st brigade, which formed the early foundations for mounted engineers and was applied in operations while attached to 5th/7th Battalion like the International Force for East Timor[4]. Then and now, engineer crew commanders are continuing to be trained by the Royal Australian Armoured Corps (RAAC), the professionals within the mechanised realm and hence relied upon to establish and develop Standard Operating Procedures to enable traditional mobility and counter-mobility actions. Notwithstanding their historical mastery however, the course does not appear to address engineering actions in a mechanised environment, largely leaving this development to trial and error through exercise, corporate knowledge and experience gained from other Corps and nations. While the practice of this cross-training approach underpins the nature of combined arms warfighting, the redirection and specialisation of corps specific mechanised courses will only further grow a modern, agile and versatile combat force capable of undertaking a variety of tasks from high-end warfighting to humanitarian and disaster relief assistance[5].

5. Along with more focused courses, a redesign of the training template is required. The current template of how the training is conducted under the Force Generation cycle resonates strongly with the original mechanisation of engineers. Within this framework came the transition of the M113 Armoured Personnel Carriers (APCs) along with their operating and maintenance responsibilities from the RAAC into the hands of the Royal Australian Infantry and RAE. In order to enable this transition, armoured crews were blended with those of the new custodians, ensuring the cross-levelling of all vehicle skills and knowledge, coupled with teaching a high level of equipment husbandry required to operate armoured vehicles effectively[6]. Nevertheless, the transition has experienced its own challenges, seeing delayed timeframes requiring some armoured crews to remain embedded for up to 18 months, hindering both trainer and trainee. Notwithstanding this, the ideal solution of having Corps centric instructors, thereby both focusing the course and not heavily relying on the RAAC, will not take place until the delivery of the course is at a level whereby the Learning Management Package and delivery is fully owned by an infantry training team, with scope to have an engineer embedded, and can be delivered at the School of Armour in Puckapunyal. Maintaining this mindset of more effective, focused and efficient training for the current transition, will be critical to take forward in anticipation of the future transition and arrival of Armoured Breaching Vehicles (ABVs) and Armoured Engineering Vehicles (AEVs).

6. While an understanding of how training and courses are currently focused is important, in order to fully comprehend the future of mechanised engineering, a further analysis of the actual breakdown of each unit is required. At present, each CER within the Brigades have been allocated the first tranche of APCs to allow for the gradual growth and development of the capability at these early stages. The ideal order of battle (ORBAT) for a CER includes a mechanised Squadron, of which two troops are fully manned with four M113's each – one per section and Troop Headquarters, or an Armoured Logistics Variant, which is the vehicle used by the Troop Sergeant. Squadron Headquarters maintains their position within Battlegroup Headquarters using a Command Variant M113[7]. The supporting elements including the Forward Repair Team and Combat Service Support at the A1 echelon are required to drive and crew variations of the M113, such as the Tilly. The standard operating procedures (SOPs), although in the development stage now, dictate where the engineering troop or section is situated within the force element, this largely depending on the

[4] Australian War Memorial – Photo: Australian Soldiers of 1st Combat Engineer Regiment (Mechanised) 1999
[5] Daniel Miller, Transition to the future Defence Publication: Army Newspaper Ed 1414 03 March 2019, p2
[6] Daniel Miller, Transition to the future Defence Publication: Army Newspaper Ed 1414 03 March 2019, p3
[7] 1st Combat Engineer Regiment Standard Operating Procedures Version 2.3, 15 October 2016, p25

type and level of the threat, as well as command decision. It may be considered to preserve engineering capability until such time that a breach is required, and hence only pushed forward then and to achieve that specific tactical action at the critical time in the battle.

7. Going more in depth, a troop, if required, can break down into section size in support of individual manoeuvre callsigns within a Combat Team, effectively enabling a hasty response to a threat requiring engineering skills and capability. This practical mission command also allows for suitably skilled members at the Lance Corporal and Corporal level to provide advice as the subject matter experts to the commander of the manoeuvre element; characteristic of the centralised command, yet decentralised execution of Combat Engineers[8].

8. The limitations that are being faced, and which will continue through the reintroduction of mechanised capability, fall under the notion of raise, train and sustain. Being able to suitably implement an old platform, but largely new capability to a unit requires the personnel to complete the extensive and time intensive training through courses, furthermore, it requires serviceable vehicles and capable personnel who are invested in the long-term future of the Army. These individuals will be required to re-establish and even re-work the SOPs for a mechanised engineer unit. The number of engineers currently undertaking mechanised courses is not substantial at this time. As a result, there is a heavy reliance on the few who are qualified to teach, train and maintain the vehicles. While this is not lost on those undertaking the transition, it has taken some time to increase course sizes, thereby substantially delaying the transition of a capability that was planned to be handed over completely in early 2018. Building momentum has taken longer than expected. If this has been a major friction point with a vehicle that has been in the Army since the early 1960's[9], then there needs to be critical consideration into the problems that may be experienced when a completely new platform is brought into service. It is critical that training on the expected platform starts as early as possible. With nations such as Britain and America already having established practices for the use of ABVs and AEVs, these having been tested in various battle spaces from WWII to Afghanistan; Australia could only benefit from sending combat engineers overseas to study how a future Australian capability is currently being employed. Notwithstanding the early development of TTPs; international cross border training will further standardise these procedures across Armies learning from one another's successes and mistakes alike, improving our overall effectiveness as a fighting force.

LAND 8160 PLATFORMS, CAPABILITY AND IMPLEMENTATION

9. The project to be delivered before 2030 aims to remediate the enduring engineer capability gap in mobility support to the Combined Arms fighting system[10]. The Land 8160-Under Armour Breaching Phase One project falls within the Armoured Fighting Vehicle Program under the Engineer Systems Cell and is expected to reach Gate 2 by 2021 and Initial Operating Capability by 2023/2024[11]. The capability to be delivered is based on the M1A2 chassis, the capability that is aligned with the Land 907 Phase 2 – Main Battle Tank upgrade. The current plan is that combat engineers will crew these under armour breaching platforms, however, there has been discussions within the Capability Acquisition and Sustainment Group (the organisation within the Australian Department of Defence, responsible for acquisition and supply chain management of military equipment and materiel) as to whether the Armoured Corps should maintain control of these vehicles by crewing, storing and maintaining them. A counter to this notion is that the engineer, being the subject matter expert in breaching, should maintain this capability and platform within the RAE. The successful

[8] Land Warfare Doctrine 3-6-1 Employment of Engineers 2008, p1-10
[9] Australian Army, 50 years service for M113 Media Release, 06 September 2019
[10] Engineer Systems Sub-Program Presentation, delivered at 3 CER, Lavarack Barracks 2019, slide 9
[11] Engineer Systems Sub-Program Presentation, slide 9

mechanisation of the CER today should be documented as lessons learnt to prepare for the future transition into 2030 as it pertains to the Land 8160 fleet.

10. While the project and technology is largely new, it is easy to understand that the use of these types of platforms is not a new idea or capability. There are multiple experiences that can be drawn upon throughout the history of armoured vehicles, particularly through innovation of unusually modified tanks. One such historical example is drawn from the landings in Normandy in WWII, where the allies were faced with 'The Atlantic Wall', a series of obstacles, minefields, bunkers, coastal batteries and pillboxes built by the Germans to prevent the Allied landing[12]. Out of necessity, the Armoured Vehicle Royal Engineers (AVRE) were created from a modification of the Churchill tank. These armoured platforms were capable of carrying and operating a variety of task specific equipment such as a carpet laying attachment to provide stability for vehicles on beach sand, and an attachment to the rear which could store fascines, used for similar purpose in providing stable foundations to maintain mobility. This concept, of creatively and uniquely using vehicles to achieve such tasks has since carried forward. Showing that a simple understanding of history will not see a complicated repetition of mistakes.

11. The British Army can be singled out in its historical, mechanised applications as they pioneered the employment of the armoured military engineering vehicles. These specific vehicles used a tank chassis for the purpose of protecting engineers during frontline battle operations. In protecting engineers, the vehicles also became a mobile platform for a variety of engineering purposes, mounting large calibre weapons for demolition purposes, carrying stores, mine clearance explosives, mounted a variety of deployable roadways and modified engineering bridges for gaps. One such vehicle, The Chieftan AVRE, was successfully deployed in Operation Granby in the 1991 Gulf War[13], a war characterised by fortified lines along the Kuwaiti border with Saudi Arabia. This was a formidable obstacle which required extensive engineering assets to breach. The methodology employed then, as with the Allied forces in Normandy, are very similar to the TTPs that are used today, the main difference being the absence of the Mine Clearing Line Charge (MICLIC), which will be a feature of the ABV selected for the Australian Army. In 2010, the Trojan mine plough was introduced to the British Army as counter Improvised Explosive Device (IED) belts in Afghanistan. This vehicle has thermal imaging, low light vision cameras and long-range magnifying devices[14]. Again, these specially converted platforms are designed on a Challenger 2 Tank chassis, a very similar platform type that the Army is looking to deliver through the Land 8160 project. Once again showing how linked the old and new will be.

ABILITY TO TRAIN FOR 2030

12. As addressed earlier, the early exploration of the use and maintenance of the new suite of engineering vehicles should be addressed early and thoroughly. Exposure to mechanised vehicles now and in the near future will provide a foundation to build on at the minimum however, without the physical platforms themselves, much of the training that can currently be undertaken will only be the start of Australia's development potential. The practical shortfall and in depth understanding of overcoming complex future obstacles with capable mechanised engineers will only be overcome when a full coherent course of action is ascertained from current discussion. Once done so, questions such as where in the ORBAT will this capability be held and by whom, can be answered.

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[12] Imperial War Museum The Funny Tanks of D-Day, photograph (B 14518) IWM Website 05 February 2018
[13] Simon Dunstan, Chieftan Main Battle Tank 1965-2003, Osprey Publishing, 25 September 2003, p47
[14] Forces TV Afghanistan Trojan Anti IED News Report, Lieutenant Colonel Matt Bazeley, Commanding Officer 28 Engineer Regiment, 16 February 2010

13. The lack of vehicles and ongoing debates, however, does not have to fully hinder an early introduction of training for current, aspiring mechanised engineers. Alongside training overseas, a more cost-effective method finds itself imbedded in the improving technology in simulation centres. With advanced operating systems, there lies an effective method to build early upon future standard operating procedures. The wide range of scenarios, equipment, weapons systems and vehicle platforms allows for early familiarisation. Training within the simulator has allowed new drivers and crew commanders to visualise, from either a Birdseye view or internal to the M113, the manoeuvre force on the ground conducting methods of movement and tactical actions, producing a more collaborative understanding. This method of training is done exceptionally well by Armoured Corps, who have adapted to limitations related to operating costs of armoured vehicles. The engineering vehicles available through the simulation program allows for learning capabilities and understanding the potential engineering armoured platforms to be acquired under Land 8160, or further past 2030. The platforms that are the most relevant and can be used by a troop sized element under a combat team construct for simulation are variations of assault breaching and engineering vehicles, including armoured construction machines such as bulldozers and loaders. The use of these vehicles is somewhat limited in demonstrating tangible outcomes, for example, pushing mounds of dirt into an anti-tank ditch, or blowing a hole in a wire fence with the use of a bangalore, however, the mechanics can still be practiced and the simulation operator can provide outcomes to suit the scenario.

14. Even with the available equipment, engineers still require the time to conduct this training. The battle rhythm the troops adhere to in accordance with the force generation cycle can be relatively prescriptive and during high tempo periods, allows for limited time in trade specific training. The implementation of the mechanised engineer is time intensive and in order to achieve a standard of effects that is conversant with the live, move and fight functions within the operating environment a full suite of courses is required. Courses such as the Battle Management System, basic communications and primary weapon system courses for both mounted and dismounted roles are all prerequisites to both driver and crew courses, requiring a substantial investment of individual and unit time. While the current training requirements are heavy, future requirements will be more intensive due to the foreign nature of a completely new platform hence, time within the force generation cycle will be a critical friction point.

15. The ability to maintain all skills required of Combat Engineers, as mentioned, is proven as challenging, particularly with the requirement to operate the upgraded M1A1 Abrams Tank – the M1A2 platform. One method of alleviating the training time pressure is to ask whether all skills need to be maintained by all Combat Engineer squadrons or is there the ability to transfer some of these skills and capabilities to a specific squadron, therefore specialising it. For thought, is the combat engineer within the mechanised squadron required to practice building bridges, or should they be trained only to understand the use of bridging for breaching through complex obstacles? Furthermore, in addition to the breaching vehicles, learning how to operate and apply the use of the Heavy Assault Bridging platform will mitigate the requirement for personnel on the ground and is a much hastier method to employ.

16. With resources and time being two identified friction points, space becomes another. The training being undertaken within the mechanised squadrons through the growing of the mechanised capability is somewhat limited due to lack of space to move and operate in the immediate and available area of the barracks environment. The small patches of land available allow for basic training and slow movement, however, is limited in covering more complex scenarios that will benefit training. In order to allow for application and solidification of mechanised theory, while not deployed on exercise, it should be seen to that a large area specifically designed for semi-complex APC tactical movement is constructed as

close as practical to the barracks. This will alleviate the space, time and logistical liability for simple, yet effective training on armoured platforms.

EVOLVING THREAT AND ADAPTING AS ENGINEERS IN 2030

17. Addressing current friction points and enabling a robust transition towards mechanisation across the Army will hopefully prepare RAE for the rapid speed of advancement into the modern battlespace. Australia can expect greater uncertainty in the strategic environment as we approach 2030 as a consequence of: the changes in the distribution of power in the Indo-Pacific and globally; the continuing threat of terrorism from groups like Daesh and from foreign terrorist fighters; the modernisation of regional military capabilities; the introduction of new military technologies such as cyber-systems and the proliferation of weapons of mass destruction and ballistic missile technology[15]. The increasing possibilities through the improvement of technology creates adversaries who are capable of synchronising multi domain operations to create multiple dilemmas for the enemy.

18. Evolving threats within the engineering space, which largely involves the Land Domain, will directly influence the adaption and application of TTPs, use of equipment and soldiers to suit the threat. Many points can be drawn by only looking at the tactical action of breaching; where the threat is a complex obstacle, covered by fire. The commander accepts a risk threshold by sending engineers to conduct a breach as a mounted and dismounted force. With this in mind, it becomes extremely relevant to understand the leading technology that has been trialled and tested in autonomous systems and vehicles. Commercially, mining companies within Australia have been operating remote control and autonomous drills and trucks for almost a decade and have been doing so with significantly positive improvements in safety, efficiency and profit[16]. The US Army recently concluded an elaborate exercise at Yakima Training Centre to identify the ability for robots to take on dangerous work[17]. A robotic assault breacher successfully cleared mines during a combined arms breach, however, more complex obstacles are in the testing phase for these robotic combat vehicles. The future is about never having to send soldiers into the breach again, ultimately keeping friendly forces shielded from enemy actions and is a capability that is globally taking a leap forward.

19. In addition to autonomous combat vehicles, the new generation of Smart Mines will be a characteristic of the future battlefield. With sophisticated networked minefields, a commander can see from across the globe through satellite communications. The smart mines can be scattered in minutes, but also retrieved and reused when needed[18]. The future minefield systems and characteristic that are being developed now, is the ability to determine shaping terrain and 'scatter' accordingly, as a spider like system which covers a 360-degree sphere, denying enemy access to an area from all directions, all while networking with other systems and a common controller. The future minefield systems may have up to a 300km communications capability with a range of capabilities including self-destruction and deactivation, self-report and anti-tamper, as well as the ability to target as an anti-armour weapon, all while avoiding sensitive detonation. This poses a serious question for the ABV delivered through Land 8160, is the MICLIC function which clears a lane through a minefield going to be relevant with the new age of smart mines? Or is it more relevant to understand

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[15] Defence White Paper, Chapter One: The Governments Approach to Defence, Paragraph 1.13, Commonwealth of Australia 2016, p32

[16] Austmine Limited Autonomous Vehicles lead Rio Tinto and BHP Billiton into cruise control, originally published by Australian Mining, 2019

[17] Jen Judson Dirty work: Robots take on complex obstacles in US Army exercise Defense News website, 10 May 2019

[18] Todd South Army Researchers building 'smart' land mines for future combat, Army Times Publication, 12 July 2019

disruption of radio frequency to counter enemy effects in a breach, highlighting the relevance of synchronising multi domain operations.

20. Today's environment is evolving towards warfare coordinated across multiple domains, driving our forces to be more adaptable and coordinated in our responses[19]. By understanding the capability of our adversaries and acknowledging that they are competitive across domains simply displays that they will attempt to apply multi domain operations against friendly forces. If the use of smart land mines becomes a reality as 2030 approaches, then the critical capabilities for the Army and in particular, for engineers becomes how to counter such a sophisticated shaping device. The use of unmanned aerial vehicles (UAV) is dominating all militaries in current and emerging technology, including leaps into artificial intelligence and robotics. Coming up with systems that will allow for the identification of mines including ground penetrating radar incorporated into a UAV which will provide all information requirements to the commander about terrain and potential locations. Being innovative and creative in how we do business will significantly change and enhance the way we conduct under armour breaching in the future.

Conclusion

21. In summary, while the current training and resource capabilities for mechanised warfare do provide a practical and theoretical base for the reintroduction of mechanised combat engineering, there is much to be discovered by the way of potential. The delivery of Land 8160 will bring a new and proactive mindset, however, the focused instruction of Corps specific, mechanised training on the new platforms will only enhance its usefulness. Combat engineers must look to the future, as the historically slow adaptation of the Army's response to emerging threats does not compete with the exponential growth of technology and adversary's application to warfare. The use of robotics and AI highlights that we as a Corps must act quickly on what opportunities do present themselves. Early training, state of the art resources and a more in-depth analysis of what the enemy looks like in 2030 will provide the key to success. The future of the mechanised CER is certainly positive and with eyes wide open and a healthy appetite for expanding technologies, there is endless potential in what can be achieved to combat enemies on a global scale.

[19] Shany Seawright 5 Trends to Shape the future battlefield, The Modern Battlespace website, 29 January