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Peak Oil And The Australian Army

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Abstract

This paper discusses the impact of the peaking and then decline in world oil production—commonly known as Peak Oil—on the Australian Army from a Raise, Train and Sustain perspective. Peak Oil is described as the implications of Peak Oil at a global and national level. Th e likely impacts of Peak Oil on the Australian Army are then analysed against four of the inputs to military capability, being personnel, equipment, training and doctrine. The paper suggests a number of actions that can be taken to reduce the impact of Peak Oil on the Australian Army.

INTRODUCTION

Oil is vital to virtually everything modern industrial societies do, yet it is mostly taken for granted. It provides 90 per cent of our transport fuel, 95 per cent of the goods in shops use oil and 95 per cent of our food products require oil use.1 Oil is a fi nite resource—one day we will run out. While this will no doubt be a long time off, what is becoming clear is that global oil production will peak and then commence a terminal decline almost certainly within decades and quite possibly within the next few years.2 While some official organisations, such as the US Government's Energy Information Administration (EIA)3, make optimistic predictions and see oil production continuing to increase in the short to medium term, there is increasing concern among elements of the oil industry that the peaking in production is imminent or has already passed.

The implications of the peaking in global oil production are enormous. Predictions vary from a global economic recession to the collapse of modern industrial societies. Despite this, there is relatively little emphasis placed on preparing for the onset of Peak Oil by governments, the media, businesses or individuals, with some notable exceptions.4 In the event of an early peak, this will be to society's great detriment and is something that should be of grave concern to all. The magnitude of this problem for defence forces is summarised by the following excerpt from a Boston Globe report on the US Department of Defence:

A new study ordered by the Pentagon warns that the rising cost and dwindling supply of oil—the lifeblood of fighter jets, warships, and tanks—will make the US military's ability to respond to hot

spots around the world 'unsustainable in the long term'.5

If rising costs and dwindling supplies of oil have the potential to do this to the US military, it is likely that the Australian Defence Force (ADF) will face similar problems. The ADF will not be immune to the impacts of Peak Oil. All three Services are heavily dependent upon oil as demonstrated in Financial Year 2005–06, where the Services submitted bids for liquid fuels totalling $340 million (including unfunded, non-ADF requirements). All three Services are heavily dependent upon oil. Stuart McCarthy from the Australian Association of the Study of Peak Oil and Gas (ASPO) believes that increasing consumption and rising prices triggered by Peak Oil could see ADF fuel costs increase to 4 or 5 per cent of total Defence expenditure in the foreseeable future.6 The impact of Peak Oil on all three Services is likely to be severe and will challenge the ADF's ability to conduct joint operations. For example, in a liquid fuel constrained environment, the ability to conduct strategic lift and provide close air support could be severely hampered.

Although Peak Oil presents significant implications for the wider ADF and Australia's military strategy, this paper will focus on the implications of Peak Oil for the Australian Army from a Raise, Train and Sustain perspective. If the Army is unprepared for the challenges that Peak Oil presents, it risks becoming 'functionally dislocated', with inappropriate doctrine, equipment and an inability to train or possibly perform the tasks that the Government requires of it. This is the motivation for this paper—to ensure that the Army does not become 'functionally dislocated' and that it can continue to serve the Australian people in the same manner as it has throughout its history. The aim is to provide a starting point from which discussions and informed decisions can be made in planning and preparing for an uncertain future.

WHAT IS PEAK OIL?

Oil is a fossil fuel and a finite resource. Since its discovery, the production of oil has steadily increased. Table One highlights world oil discoveries and production. Despite significant advances in technology and diligent exploration of the earth, the long-term downward discovery trend is evident and unlikely to change.

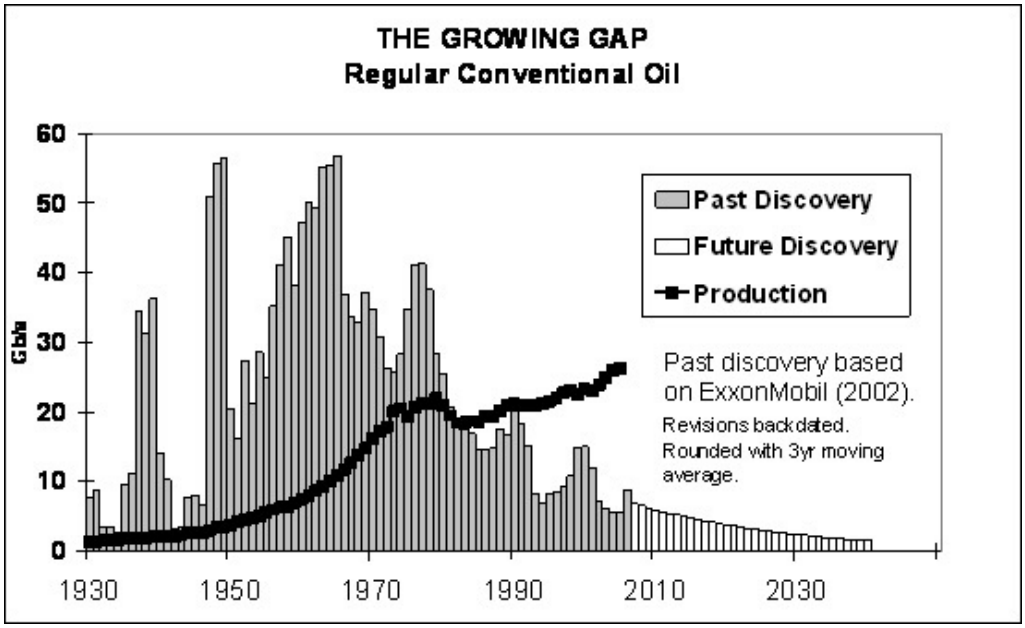

Table One: World Oil Discovery and Production7

Obviously one can not extract oil until it has been discovered. This implies that at some point

after the peaking of discovery, there will be a corresponding peak in production. As can be seen in Table One, oil discovery peaked in the mid-1960s. Since the mid-1980s, the world has been consuming each year more oil than is being discovered. The trend of increasing demand is expected to continue for the foreseeable future. The EIA predicts that global demand for oil will grow by 47 per cent from 2003 to 2030.8 Th e Australian Senate's interim report into Australia's future oil supply predicts that Australia's demand for oil will increase by 2 per cent per annum between 2006 and 2030.9 Increased demand and contracting supply will have a significant impact on fuel prices and availability. Due to the complexity in predicting future oil production, it will not become clear when global oil production peaks until some years after the fact. Despite this, many organisations and individuals have developed predictions on the timing of Peak Oil. The recent Senate Committee Inquiry into Australia's future oil supply listed twenty-five predictions by industry players, experts and academics of the timing of Peak Oil. Twenty responses predicted a peak within fifteen years and of those, twelve predicted a peak within five years.10 Some of the predictions suggest that the peak has already passed. It is quite possible that this is the case. For example, the International Energy Agency (IEA) reports total liquid fuel production at 84.28 million barrels a day in June 2007, which is 1.85 million barrels a day lower than the all-time high reached in July 2006.11 Have we passed the peak? Possibly, but it is too early to be sure. The IEA in its latest Medium Term Oil Market Report has stated that by 2012 there will be increasing tightness in the oil market and that 'it is possible that the supply crunch could be deferred—but not by much'.12 When the peak occurs is of relatively minor importance. Peaking is inevitable and the long-term implications are of far more significance than the actual timing.

After Peak Oil, it is unlikely that oil will be evenly distributed across countries. The current high oil prices are already demonstrating this in developing countries as widespread as Myanmar, Kenya, Zimbabwe and Nepal, where oil is already unaffordable

for large parts of the population.13 Th ere is no guarantee that Australia will be able to obtain its requirement of liquid fuels post-Peak. According to Geoscience Australia, Australia's self-sufficiency in oil and petroleum products will decline from 84 per cent to 20 per cent (using a middle-range estimate of future production) over the next twenty years.14 Th is will result in Australia relying on significantly greater imports, and hence competing with the rest of the world. Countries such as China have stated that they will pay anything for fuel15, and the United States, as the world's biggest oil consumer, is likely to follow a similar path. This has the potential for Australia to be unable to purchase its fuel requirements or having to pay exorbitant amounts for its oil imports. In addition to the significantly higher cost of oil, there is the potential for disruptions to oil supplies. Historically, there has been excess capacity within the oil industry that has ensured the flow of oil (known as 'swing producers') despite disruptions to oil production in an individual region. Over recent decades this has been primarily provided by OPEC nations and in particular Saudi Arabia. There is doubt however, that Saudi Arabia can still boost production, with one study arguing that Saudi production declined by 8 per cent in 2006.16 Once global oil production peaks and commences its decline it will no longer be possible for 'swing producers' to make up for demand shortfalls. Any disruptions to supply, such as a hurricane in the Gulf of Mexico, internal conflict in Nigeria or geopolitical events such as a conflict in the Middle East has the potential to result in physical shortages. The impact of extended shortages of fuel supply in an industrialised nation would be catastrophic and are likely to result in significant social and economic instability.

Alternatives

With future oil supplies declining and being unable to keep up with demand, the question of alternative fuels must be considered. There are many alternatives to oil. These include biofuels (ethanol and biodiesel), hydrogen and reforming gas or coal to liquid fuels. Unfortunately, none of them are capable of replacing oil as our primary source of liquid fuels at our current fuel usage rates for a number of reasons. The first reason is the low starting base for alternate fuel

production when compared to oil consumption. As a result, it would take a significant period of time for the production of alternative fuels to increase to a level where they can replace conventional oil. As an example, the Australian Government has set a biofuel production target of 350ML by 2010. Even if this could be increased by 25 per cent per year indefinitely, which is unlikely, it would take over twenty-two years for biofuels to match current Australian oil consumption. There also comes a point when a choice must be made on whether land is used to grow food or to grow feed stocks for biofuels—for example, the grain required to fill a typical four-wheel drive vehicle with ethanol could feed one person for a year.17 The Chinese Government has recognised the link between increased biofuel production and food security. As a result, its National Development and Reform Commission has significantly reduced its ethanol production target.18

The second major reason that alternate fuels will not make up for potential future oil demand is due to a ratio known as the Energy Return on Energy Investment (EROEI). This ratio is critical in understanding energy and why it is unlikely that alternate fuels will never be able to replace oil. Th is ratio expresses the energy gained as an output versus the energy required to produce a given energy source. Many alternate fuels have a ratio

that is just over one (e.g. you only get a little bit more energy as an output than is used to produce the energy). Th is compares to the ratio for oil which is generally an order of magnitude, or more, greater than that for alternate fuels. As an example, hydrogen, which is an energy carrier, not an energy source, will always require more energy to create it than is released when it is used as a fuel—its Energy Returned on Energy Invested ratio is less than one.

While it is possible that there may be a technological breakthrough in the future, alternative fuels are unlikely to be able to make up for the decline in global oil production. Even if there is a technological breakthrough, it will still take a considerable period of time for the new technology to make an impact. For example, to replace just half of the US vehicle fleet would take ten- to fifteen-years19 and would cost trillions of dollars. Th is implies that for the next one to two decades at least, we will be relying on the oil fuelled internal combustion engine as the primary locomotion source for transportation.

There are those who attempt to ‘debunk’ the Peak Oil theory or predict that Peak Oil will not occur for decades. These views are championed by ExxonMobil and Cambridge Energy Research Associates (CERA). A US Army Major, Daniel Davis, in his paper ‘On the Precipice’ has dissected the claims made by CERA in particular, that technology and unconventional sources of oil, such as oil shale and tar sands, will make up for both increased demand and declining conventional oil production. In July 2005, Mr Daniel Yergin, the President of CERA, detailed how technology would provide solutions to declining global oil supplies. As an example, he stated that the share of ‘unconventional oil’ would rise from 10 per cent of total capacity in 1990 to 30 per cent by 2010. Th e actual results, however, have not supported this. In 2005 the EIA reported that the percentage of unconventional oil was approximately 13.0 per cent of total daily oil production, while in 2006 the daily average was 13.2 per cent—virtually unchanged.20 While it is possible that global oil supply will continue to expand and keep up with demand growth, through technological advancements, it is far from guaranteed that this will occur.

Unfortunately there are no quick fixes or ‘silver bullet’ solutions to our oil dependency. With world oil demand increasing and supply commencing a terminal decline there will be significant economic, social and political implications on a global scale that this paper will now consider so as to understand why Peak Oil is such a problem.

THE IMPLICATIONS OF PEAK OIL

Left unmitigated, Peak Oil has the potential for major global economic and social disruption. The Hirsch Report stated that the economic loss to the United States from Peak Oil could be

measured on a trillion-dollar scale.21 It also found that without timely mitigation, the peaking of world oil production will almost certainly cause major economic upheaval.22 This section describes the likely impacts of Peak Oil at a macro level so as to set the context for the impacts of Peak Oil on the Australian Army. One of the most immediate impacts of the onset of Peak Oil will be significant increases in both the cost of oil and its price volatility. As demand outstrips supply, there will be significant price increases. Th is in turn will result in demand destruction. As demand falls, the price of fuel will temporarily reach equilibrium between supply and demand until decreasing oil production repeats the cycle. We can expect each repetition of the cycle to become increasingly severe (eg. greater price increases and increased volatility). The impact of increasingly volatile and higher fuel prices on the economy is expected to be asymmetrical—the 'negative economic effects of oil price increases are usually not off set by the economic stimulus resulting from a fall in oil prices.'23 This could have a significant impact on defence industry and its ability to support the Army and ADF. The importance of oil to modern economies cannot be overstated. Oil and products derived from oil are used in nearly every sector of a modern industrial economy, from transportation fuels, to feed stocks for fertiliser used in modern agriculture to everyday plastic products. As a result, the price of oil directly impacts on inflation and interest rates, as stated in the Hirsch Report:

Higher oil prices result in increased costs for the production of goods and services, as well as inflation, unemployment, reduced demand for products other than oil, and lower capital investment. Tax revenues decline and budget deficits increase, driving up interest rates.24

These second-order economic impacts are likely to have significant ramifications for both the global and Australian economies. This view is supported by the US Government Accountability Office (GAO), which recently completed a report into the peaking of world oil production. It found that previous disruptions to oil supply caused unprecedented increases in oil prices and were associated with worldwide recessions.25 This is supported by the Oil Shockwave simulation activity carried out in the United States, which found that even a 4 per cent disruption to global oil supplies would be sufficient to increase the price of oil by 177 per cent.26 Th ere have been five oil price peaks since 1965, all of which have caused economic downturns of varying severity.27 The two most significant—the OPEC oil embargo of 1973 and the Iranian Revolution and Iran/Iraq War of 1980—resulted in widespread panic and miserable economic recessions.28 These findings are based on experience from temporary disruptions to oil supplies. The impact of permanent demand shortfalls, after the onset of Peak Oil, is therefore likely to be much more severe and far longer in duration. The Hirsch Report provides a sobering warning when it states that waiting until world oil production peaks before taking action with crash programs action would leave the world with a significant liquid fuel deficit for more than two decades.29 Unfortunately, we may only have years until the peak, and there appears to be very little recognition of the need for crash mitigation programs of the type envisioned by the Hirsch Report. The Australian economy, which is heavily dependent upon the export of resources and tourism, will be particularly vulnerable to the onset of Peak Oil. Oil-inspired recessions result in lower government revenue from taxes while costs increase. This will provide significant pressure to reduce the Defence budget. Thus it is likely that the Army will be faced with a situation of decreased funding, increased costs for goods and services in general and liquid fuels in particular. This in turn will force decisions to be made on issues such as readiness levels, training, equipment acquisition and equipment operation. These factors make planning for the onset of Peak Oil of vital importance to the Australian Army.

THE AUSTRALIAN ARMY AND PEAK OIL

The Army's mission is to win the land battle. Peak Oil has the potential to make this mission increasingly difficult and creates a number of vulnerabilities for the Australian Army. These vulnerabilities will be identified and explored against the building blocks of the Army's capabilities, in particular personnel, equipment, training and doctrine.

Personnel

Soldiers are the backbone of the Army. Th is has been the case throughout history and will continue to be so, no matter what new technological advances take place. Peak Oil is likely to result in significantly higher unemployment. This is one of the few bright aspects of Peak Oil from the Army's perspective. As a secure form of employment, the Army will become increasingly attractive. With high unemployment, this should result in an increased number of recruits. Peak Oil should also assist with retention as civilian employment becomes increasingly competitive and less secure.

Equipment

While soldiers are the backbone of the Army, our equipment provides the tools through which the Army's mission is achieved. Modern mechanised military forces use an enormous amount of fuel. As an example, a single US division during Operation Desert Storm consumed 9.6 million litres of fuel a day.30 This equates to over 6 per cent of Australia's current daily fuel consumption. The dependence of mechanised forces on oil exposes the Australian Army to a number of vulnerabilities. The first is the price of fuel. While the Army's consumption of fuel compared to both ADF and the wider community's consumption of fuel is relatively small, increases in cost due to Peak Oil will result either in an increasing percentage of the Army's budget spent on fuel purchases or reducing the amount of fuel consumed. There are very few options for reducing fuel consumption other than reducing operating hours for vehicles and limiting training. Given Australia's growing demand for imported oil, it is probable that in the years after Peak Oil, there will be disruptions to supply. The Liquid Fuels Emergency Act 1984 31 is the legislation by which the Australian Government will manage disruptions by prioritising the allocation of liquid fuels. In the event of disruptions to fuel supply, it is possible that severe restrictions will be placed upon the Army's use of liquid fuels for situations other than direct attacks against Australia. This will be a significant limiting factor on all aspects of the Army. Just as fuel is required to move tanks, trucks and helicopters, there is a huge support network of industry that provides the maintenance and spare parts required to keep the Army's fleet of equipment operational. Modern logistics systems are largely based upon the 'just-in-time' principle for reasons of efficiency. This works in a system where there is cheap and plentiful oil ensuring a reliable transportation system. Peak Oil has the potential to disrupt transportation systems. In turn, this has the potential to delay both the repair of equipment that needs to return to deeper-level maintenance and in obtaining spare parts in a timely manner. For example, many items of communications equipment must be returned to the United States for maintenance and repair. Of even more concern is the availability of parts. Even a relatively simple item of equipment, such as a generator, consists of over 700 separate items.32 The repair parts for all of the Army's equipment numbers millions of items. The industry that supports the Army's fleet of equipment will be susceptible to the same financial pressures as the Army. It is possible that many of these businesses will not survive the impacts of Peak Oil. The combination of a disruption to transportation systems and the unavailability of parts has the potential to render much of the Army's equipment unsupportable in the medium- to long-term.

Training

The third input into capability that underpins the Army's ability to generate forces capable of winning the land battle is training. Hard, realistic training is imperative to the Army's mission. As has already been identified, the cost and availability of fuel and the maintenance of the Army's equipment will provide significant challenges to the Army, in particular its ability to train. This will be exacerbated by the increased costs associated with training at a time when there will be significant pressure on the Army to reduce its expenditure as the Australian Government struggles to manage the broader response to Peak Oil. Th e inflationary pressure caused by Peak Oil will result in most products and services rising in cost, including such vital requirements as rations and ammunition. Th is in turn will force reductions in the amount and level of training that

the Army will be capable of undertaking. Peak Oil will also impact upon Army's individual training system. Currently this relies heavily on domestic airlines for the movement of trainees to and from training institutions. As fuel prices rise, so too will the cost of air travel. At some point, possibly not long after Peak Oil, this may no longer be a viable means of transport. Dr Samsam Bakhtiari, formerly of the Iranian National Oil Company, has stated that '[a]eroplanes will be the first casualty' of Peak Oil.33 If airlines do become the first victim of Peak Oil, the ability to move soldiers around the country to conduct training will be severely disrupted. The Australian Army's low casualty rates in recent operations are a result of the high standards of training, both individual and collective, that the Army is currently capable of providing. The combined impacts of higher fuel costs and limited availability, equipment serviceability and the increased costs of training, at a time when there will be increased pressure on the Army's budget, lead to the conclusion that it will be difficult, if not impossible to maintain current standards after the onset of Peak Oil. In turn this implies that the Army can expect more casualties on operations, lower readiness levels and potentially the inability to provide a full range of capability options to Government.

Doctrine

The final aspect of capability that will be considered is doctrine. While discussed last, doctrine is arguably the most critical aspect of the Army's—and indeed the ADF's—response to Peak Oil. Th e Army's keystone doctrinal document, LWD1 The Fundamentals of Land Warfare, describes factors that are shaping land warfare, including globalisation and technological change.34 Although the impact of unsustainable resource usage is mentioned briefly, nowhere does this document mention the implications of the global peaking of oil production. Our formation and battle group tactics are all based upon an underlying un-stated assumption that there will be the fuel available to operate as a modern Army. As has already been identified this may not be the case. By envisioning how we expect to fight, doctrine drives the capability acquisition cycle. The Hardened and Networked Army model is aimed at providing a modern, highly capable Army based around key capabilities such as the Bushranger Infantry Mobility Vehicle, M1A1 Abrams Main Battle Tank and Tiger Armed Reconnaissance Helicopter. These capabilities will be with the Army for significant periods of time; the equipment purchased under projects Land 907 (Main Battle Tank replacement) and Land 121 (Field vehicles and trailers) are expected to be in service until 2030 and 2040 respectively.35 Military equipment traditionally has low fuel efficiency. This raises the question of how appropriate is the Army's current equipment acquisitions, given that many of these items of equipment will potentially be in service for

decades after the onset of Peak Oil, when the cost and availability of fuel becomes a major issue? The first step in preparing for Peak Oil should be a review of Army and ADF doctrine in a Peak Oil context.

RISK MANAGEMENT

The Hirsch Report, commissioned by the US Department of Energy, described Peak Oil as an unprecedented risk management problem.36 It also found that the risks are asymmetrical. Mitigation actions initiated prematurely could result in a poor use of resources; however, late initiation of mitigation may result in severe consequences.37 The Hirsch Report goes on to state that:

The world has never confronted a problem like this, and the failure to act on a timely basis could have debilitating impacts on the world economy. Risk minimization requires the implementation of mitigation measures well prior to peaking. Since it is uncertain when peaking will occur, the challenge is indeed significant.38

The Army faces similar asymmetrical risks. For example, if mitigation measures are instituted early (e.g. changes to doctrine, equipment acquisition, etc.) and peaking does not occur for several

decades, the changes will be premature. On the other hand, in the event of an early peak, the Army risks being 'functionally dislocated' with mechanised forces that cannot train or deploy due to the cost and availability of liquid fuels. Prudent risk management would suggest that planning for the onset of Peak Oil be initiated as early as possible.

WHERE TO FROM HERE?

The impact of Peak Oil on the Australian Army, especially a peak within the next few years, has the potential to be tumultuous. Preparations for the onset of Peak Oil will require momentous change and pose considerable leadership challenges on the Army. However, leadership is something on which the Army prides itself. The Army can provide the broader Australian community with leadership through its actions in preparing for Peak Oil. There are numerous preparatory activities that can and should be undertaken. The first of these is education and awareness raising of energy issues. This provides the basis from which an understanding of the magnitude of the Peak Oil problem is developed and provides the motivation for change. Hopefully, this paper is the first step in this process. Th e establishment within Army of a Peak Oil study group would also be of great benefit. Th is would allow the coordination of Army's response both internally and with external organisations such as the Defence Material Organisation, industry and other government departments. The Army's doctrine must be reviewed and major thought put into how our Army will operate in a liquid fuels constrained future. While the Army will be reliant on oil for the foreseeable future, there are many methods by which this dependency can be lessened. Examples include introducing solar and wind electrical generation equipment to reduce the dependency on diesel fuelled generators and reducing the stores and equipment required to provide headquarters and support functions in the field environment, which in turn will reduce the requirement for vehicles and hence fuel. Th e increased use of simulation in training will be vital in ensuring that standards can be maintained in a liquid fuel constrained environment. For individual training, distance learning and computer-based training programs could be implemented to reduce the requirement for air travel. Widespread installation of video teleconferencing facilities can also reduce the requirement for travel.

A prudent risk management activity would be a review of repair parts schedules for all of the Army's major equipment systems. Identification of the critical components that have the potential to result in complete systems being rendered unserviceable would provide a basis from which appropriate repair parts stock holdings could be developed. Future equipment procurement programs must take into account the onset of Peak Oil and focus on fuel efficiency and alternate sources of locomotion, such as hybrids or electric vehicles. Engagement with the Defence Material Organisation, Defence Science and Technology Organisation and industry will be a vital part of ensuring the future serviceability and useability of the Army's equipment. Army barracks around the country have emergency plans for incidents such as fi re, bomb threats and protests. Disruptions to fuel supplies would be a sensible addition to barracks emergency plans. These emergency management plans could include increased fuel holdings within barracks fuel points as a preventative measure, prioritisation for the use of fuel in the event of a disruption to fuel supplies and planning for the movement of soldiers to and from their residences, possibly using military transport.

CONCLUSION

Peak Oil represents the start of a new era—a time that will require fundamentally different thought processes to that which the first half of the age of oil allowed. Peak Oil will have significant social, economic and political impacts at all levels, from global to local. The Australian Army will not be immune. Th e challenge is for the Army to commence planning and implementing mitigation measures that will allow it to continue to 'win the land battle' now and into the future, perhaps at a time where oil is the nation's most precious resource. Preparing for the onset of Peak Oil will be time consuming and costly. However, as has been described throughout this paper,

maintaining the status quo is not an option either. Waiting until there is a liquid fuels crisis to commence preparations will be too little too late. Preparation needs to start now.

Endnotes

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2 Oil industry figures who support the Peak Oil argument include Kenneth Deff eyes (geologist, lecturer at Princeton University), Colin Campbell (retired petroleum geologist and founder of the Association for the Study of Peak Oil and Gas (ASPO)), T Boone Pickens Jr (billionaire American businessmen with decades of oil industry experience), Chris Skrebrowski (editor of Petroleum Review) and Matthew Simmons (investment banker, oil industry insider and former adviser to US President George W Bush).

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4 At the national level, Sweden has announced that it aims to end its oil dependency by 2020, see: . At the regional level, a number of cities around the world have signed Peak Oil resolutions, such as Portland, Oregon and San Francisco, California. See: http://www.oildepletionprotocol.org/whosonboard/cities. At the town or village level, nineteen towns in the United Kingdom have adopted the 'transition towns' concept in response to the combined challenges that Peak Oil and Climate Change present, see: http://www.transitiontowns.org/.

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21 Hirsch, et al, Peaking of World Oil Production, p. 64.

22 Ibid.

23 Ibid, p. 31.

24 Ibid, p. 28.

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