Scoping a flexible deployment framework using adversarial scenario analysis

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Abstract: To aid with Australian Army deployment planning we propose a flexible deployment concept developed using adversarial scenario analysis. This novel technique begins with a simple scenario and a core strategy. Iteratively, the scenario is modified to defeat the existing strategy and the strategy is altered to cope. This process results in the deployed force being structured as a set of cohesive functional teams that provide emotional support to their members, suffer stress at different rates and are able to be rotated independently of each other. An accumulator model of deployment stress is assumed and continuous time-in-theatre is minimised subject to realistic constraints. The concept is focused on stable long term commitments to small wars, insurgencies and peacekeeping operations within four time-zones of the deployment source and with forward bases near usable airfields. To plan specific deployments, the same process could be expanded upon with appropriate detail.

Keywords: military deployment; flexible personnel management; force effectiveness; retention; quality of life; adversarial scenario analysis; ASA.

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1 Introduction

Prior to the break in large scale deployments from 1972 until 1999, Australian soldiers deploying on task force sized operations travelled primarily, or exclusively, by sea. The practice of shipping soldiers by boat made transit times too great for short duration deployments to be practicable. Thus Australia deployed combat units for a year to Vietnam, Malaya and Korea and for-the-duration to Korea[1] and the World Wars. Air transport of troops has facilitated six month deployments of combat forces in recent Australian operations, a duration partly motivated by the lengths of UN mandates during this period. This trend from for-the-duration to one-year to six-months was reversed in 2008 when standard deployment lengths were increased to eight months (ADF to Extend Troop Deployment Time, 2008) in order to provide "time to train in the broad range of capabilities that a modern army requires to be successful in the contemporary security environment" (Department of Defence Media Release MSPA 159/08, 2008) and "allow soldiers more time to develop and maintain cohesive relationships with both the local population and coalition partners, and to better understand the environment in which they operate" (The Soldiers Army, 2008). This paper was motivated by the discussions leading up to that change.

We consider the factors affecting deployment lengths and propose a concept that makes deployments permanent but rotates units within them based on the principle of minimising continuous time in theatre subject to the needs of the role filled. This concept seeks to improve force effectiveness at the same time as improving the quality of life of soldiers and their dependents. One of the main features of this paper is the way that this concept is co-evolved with a complex deployment scenario through use of a technique developed by one of the authors (Pincombe et al., 2006): adversarial scenario analysis (ASA). ASA begins with a core strategy. In this case, the core strategy is to minimise the length of deployment in order to reduce the time over which stressors accumulate whilst allowing sufficient time between deployments for stress dissipation. The scenario in which this strategy is set is then altered to make the strategy fail, in a manner similar to 'strategy scrutinising' (Mintzberg, 1994), by introducing a confounding factor such as the training needs of soldiers. Risk management measures are then introduced to produce an altered strategy that copes with the new scenario. We suggest changes in training (in line with the trajectory of forces command) and limitations on the minimum deployment time. This process of introducing complicating factors into the scenario is repeated multiple times to produce a complex scenario and a robust strategy. At each stage a simple summative equation is developed describing the minimum deployment time in terms of the scenario complications that have been introduced. These complicating factors are based on our reading of the literature. As mathematicians we are but arithmeticians in this area, like Cassio [Shakespeare, (1990) Act I, Scene I, Lines 19–26], so broader consultation with subject matter experts is necessary before the adoption of any suggestions made here.

Through an iterative development process we deal with the complexity conundrum that besets scenario planning: managers want a single scenario but many scenarios are needed to deal with complexity (Wilson, 2000); scenarios themselves are simple, covering a single element of the situation, and the complexity lies in developing a strategy that is robust against all scenarios; and no scenario has much chance of ever actually occurring. ASA compresses the complexity of the situation into a single scenario in which all scenario elements and their interactions can be considered. These scenario

elements are situations that need to be dealt with by generalised processes constrained by the need to protect the core strategy. The final definition of these processes would need to be undertaken prior to an actual deployment, when some of the uncertainties (e.g., how many time zones is the deployment area away from the basing area) will have been resolved. This could involve scenario planning with a detailed scenario, employing significant numbers of people and periods of time and guided by this framework.

Our outcome is a framework based on a deployment duration of D and inter-deployment duration of $(n - 1)D$, where the total number of deployable personnel in the Army are n times the number of deployed personnel (e.g., for the aspirational army-of-threes $n = 3$ with a third of deployable personnel deployed and two thirds between deployments). The minimum length of D is defined by the requirements of the role while on deployment and, more so, by the activities that need to be fitted into the inter-deployment period.

2 Scenario planning and the complexity conundrum

Scenario planning tests multiple strategies against each other in a variety of simple scenarios to determine the most robust strategy across the totality of these scenarios (Ringland, 1998). This is generally a strategy which performs well for all scenarios (Liebl, 2002) but it may be the strategy offering the least chance of a disastrous outcome. While scenario planning has had some high profile successes (Wack, 1985) there is anecdotal evidence of numerous poor or tepid results (Mintzberg, 1994; Postma et al., 2005). Although there is little published evidence of scenario planning failures (Mintzberg, 1994; Postma et al., 2005), negative results are rarely published (Easterbrook et al., 1991; Scherer et al., 1994; Dickerson, 1997; Stern and Simes, 1997; Callaham et al., 1998) and, given the undoubted popularity of scenario planning, the scarcity of success stories is eloquent. Hypotheses concerning the reasons for failures of scenario planning range from technical inadequacies (Postma et al., 2005) through fundamental failures of the methodology (Mintzberg, 1994) to non-adoption of results due to managerial reluctance to admit that the future is not pre-determined (Wilson, 2000).

At the technical end, failures have been attributed to the simplicity of scenarios when compared with the complex events which actually unfold (Postma et al., 2005). Suggested remedies include: making scenario elements more general, via the use of trends (Postma et al., 2005; Ahn and Skudlark, 2002); using recombinations of scenario elements to uncover critical interactions (Postma et al., 2005); and the inclusion of opposing trends (e.g., globalisation and localisation) in a single scenario (Postma et al., 2005). Complex events are dominated by interaction effects and complex scenarios need to include elements that interact. Complexity is also evident in the interactions between scenario elements and strategies. Ideally, strategies should be adaptive to scenarios but this is not part of the standard scenario planning process. The closest that scenario planning comes to this is the suggestion that the strategies considered should be the set of perfect strategies for each of the scenarios considered (Ahn and Skudlark, 2002). All of the suggested technical solutions to perceived failures in scenario planning revolve around the idea that scenarios should be more complex. Yet, scenario planning has to remain simple because it usually involves many people, most of whom are subject matter experts rather than analysts (Postma et al., 2005; Wilson, 2000). These critiques of

scenario planning can be summed up in the statement that we need to deal with complexity while retaining simplicity.

While simplification is necessary in scenario planning, we cannot avoid the complexity surrounding strategic decisions. Such decisions are multi-faceted and these facets need to be simplified by creative synthesis (Mintzberg, 1994) to produce models that can deal with complex issues. From this point of view, the failure of scenario planning is seen as almost inevitable since it is an analytical process whereas the formation of good strategies requires creative synthesis (Mintzberg, 1994) to produce a mental model which simplifies decision processes and which is shared by all participants. There are well established processes for eliciting and scrutinising mental models (Grinyer, 2000). This line of thought extends to considering the mental models of adversaries (Cornelius et al., 2005; Schoemaker and van der Heijden, 1992) and exhortations to include adversarial aspects, such as the behaviour of competitors, and use risk analysis (Cornelius et al., 2005; Schoemaker and van der Heijden, 1992).

The managers who contribute to the development of scenario planning and are presented with its results typically exist in a culture where certainty about the future, as opposed to redundant preparation for eventualities, is rewarded but the accuracy of that certainty is rarely tested (Wilson, 2000). Some managers have a linear view of the future and feel that there must be a way to see *the* historically determined path shining into that predetermined future (Wilson, 2000; Giffin and Reid, 2003; Reid, 2005). Scenario planning, which puts forward multiple possible futures (scenarios) and espouses that a strategy robust enough to cope all of these is most likely to cope with the actual future (which, it proposes, is unlikely to be closely similar to any of the scenarios), is alien to historical determinism and its outcomes are often not adopted (Wilson, 2000). Many of the managers who accept the premise that there are multiple possible futures are loath to put effort into developing multiple strategies, because of the time this takes, and feel that a single robust strategy should be the real aim (Wilson, 2000).

Scenario planning thus has several complexity conundrums. It needs to deal with the complexity of the world and the interactions between scenario elements while retaining sufficient simplicity to be implemented by practitioners and subject matter experts. It also needs to develop shared mental models while retaining the diversity necessary to cope with the future that actually occurs. Finally, it also has to develop multiple scenarios and strategies with participants who want to put their efforts into a single strategy and are philosophically inclined towards a single scenario. For these reasons we have chosen to use ASA (Pincombe et al., 2005).

3 ASA: Socrates does scenario planning

In the dialogues that Plato and Xenophon attributed to Socrates, the central technique was *elenchus*: cross-examination, testing and scrutiny for the purpose of refutation. Picking holes in others arguments through *elenchus* led to Socrates' execution. ASA makes use of the fact that, even after the example of Socrates, people still like to criticise models that are presented to them.

ASA starts with the definition of a simple scenario and a core strategy for dealing with the problems in that scenario. The scenario should be based around an issue considered important by the practitioners. The core strategy needs to be simple: in our case it refers to only a single aspect of one of our major objectives. This does not mean

that one objective has been pursued at the expense of the others. The final strategy will contain the core strategy and several risk management processes which both constrain and improve on it. This has the advantage of simplicity; very little preparation is required: in our case the preparation involved a study of the relevant literature. The core strategy is then augmented with risk management processes to support the achievement of its objective, producing an initial strategy.

After the definition of the initial strategy an adversarial method is employed to select an addition to the scenario (i.e., another scenario element) that challenges or, preferably, defeats the strategy. The aim is to simulate an enemy who will constantly be looking for weaknesses to exploit. The detailed effects of the change to the scenario are then analysed with both the independent effects of the new scenario element and its interaction effects with existing elements considered. The phrasing of the change is revised to ensure the most general scenario retaining an effect on the strategy.

Once the new scenario has been understood, we devise a risk management process to minimise or eliminate the impact of the changes on the core strategy. Managing the risk by minimising the effect of any scenario element is, in general, a simpler process than modelling the effect of the scenario element. If the effect of each change is nullified then there will be no interaction effects other than those uncovered in the scenario planning stage. This is not the only possible approach to improve robustness, but it is relatively simple.

This process of adversarial scenario change followed by risk management informed strategy change to protect the core strategy is then iterated. As extra components are added to the scenario, interaction effects may occur and these must be controlled to prevent any impact on the core strategy. The strategy becomes robust in a similar, albeit simpler, way to living organisms, by preventing external factors from interfering with the core process (Kitano, 2004).

Each addition to the scenario has an associated change driver and there is a limit to the number of change drivers that an analyst can cope with. This limit varies between individuals and between problems. When that limit is reached, a new scenario can be started using the final strategy from the first run as the initial strategy. In this article we describe the development of a single complex scenario for the deployment of forces to conflict zones and the co-evolution of a strategy based on the core idea of minimising the time spent continuously in theatre.

The scenario elements have been generalised and so are quite likely to occur even though the scenario itself, composed of many such elements, is unlikely to occur. That the scenario itself has little likelihood of happening is of no consequence as it is the scenario elements which affect the strategy, either singly or in small groups, and it is highly likely that many of these will occur.

4 The problem: it is stressful to have people try to kill you

> "I would very much like to know, who is the total idiot who has never been afraid" – Marshal Ney, "the bravest of the brave" [trans. Smith et al., (2003), p.95].

The primary goal of those scoping, planning and managing a military deployment to a conflict zone must be to ensure that the force is effective in its role. In a combat deployment, combat effectiveness is of greatest importance. There are many ways in

which deployment lengths and schedules can alter effectiveness. Scenario analysis would attempt to identify these upfront and build scenarios based on variations along important dimensions. However, using ASA we start with a single observation: deployment is a stressful experience. People are trying to kill you; you are far from home; and you are working long hours, often with little or poor quality sleep. Stress impairs cognitive performance (Stetz et al., 2007) and thus reduces effectiveness. It also increases the chances of developing combat stress response (CSR) (Weisenberg et al., 1981; Solomon et al., 1986) and post traumatic stress disorder (PTSD) (Solomon et al., 1988a; Solomon and Mikulincer, 1987; Solomon, 1988, 2001, 1987; Solomon et al., 1988b, 1987; Jones and Wessely, 2003). CSR, a severe form of acute stress, leads to an immediate loss of effectiveness (Weisenberg et al., 1981; Solomon et al., 1986) as well as subsequent lower combat effectiveness (Weisenberg et al., 1981) and higher chances of repeat CSR (Solomon et al., 1987). Shorter deployments are thought to reduce the rate of CSR (Jones and Wessely, 2003). PTSD is a highly debilitating illness thought to be caused by acute stress, including CSR (Solomon et al., 1988a). Once crystallised, PTSD is very difficult to treat, leading to high personal costs on veterans and high monetary costs on health care systems. Initially, we explore the literature on acute stress in combat situations and conclude that stress accumulates while on deployment at rates that vary based on the individual, the role and the situation at the time (i.e., the intensity of the conflict). We produce an initial, simple, scenario based on a structurally flexible Australian task force capable of being reorganised depending on the scale, intensity and duration of deployment rather than the traditional brigade based structure (Ryan, 2003). A core strategy of reducing the time for stress to accumulate by minimising the length of continuous deployment is proposed. From this point a more complicated initial strategy is built through the addition of risk management processes aimed at ensuring that stress is, indeed, reduced.

4.1 Longer deployments are associated with greater final stress levels

Management of acute stress is either primary, aimed at preventing acute stress occurring in the first place, or secondary, aimed at treating acute stress once it has occurred. Complicating matters, stress reactions appear to differ based on previous combat experience. Those with combat experience exhibit repression and thus experience relatively lower affective and greater somatic complaints (Solomon, 1988; Killgore et al., 2006) – without a change in subsequent PTSD rates (Killgore et al., 2006). Acute stress is even experienced in peacekeeping operations. In Bosnia the causes (Bacon and Staudenmeier, 2003) were unclear/varying deployment lengths; marital or relationship difficulties; sleep deprivation; boredom; and fear of mines. Each of the issues identified for a particular deployment can be dealt with on a case by case basis but there are a number of general rules for primary acute stress management. In the accumulator model, stress builds up more rapidly than it dissipates during deployments. Flexible deployments built around the concept of minimising the continuous time in theatre of people in given roles while still allowing them to be effective in that role allow shorter term rotations for those who are more likely to build up stress more rapidly. It also allows the flexibility to give some groups more time between deployments by using more rotation cohorts of that role. So that there may be four rotation cohorts for an especially stressful role but only two for a relatively stress free role.

People who respond with fear, helplessness or horror to a traumatic event involving (at least) the threat of serious harm are considered to have PTSD if they persistently re-experience the event in at least one of five specific ways (recollection, dreams, feeling of recurrence and either psychological distress or physiological reactivity on exposure to cues related to the event); avoid stimuli associated with the event in at least three of seven ways (avoidance of mental or physical reminders of the event, inability to recall aspects of the trauma, diminished interest or participation in significant activities, detachment from others, restricted range of affect and sense of foreshortened future); and show increased arousal in two or more of five ways (difficulty sleeping, irritability or anger, difficulty concentrating, hypervigilance or exaggerated startle response) for at least one month in a manner that causes distress or impairment of social, occupational or other functioning (Diagnostic and Statistical Manual of Mental Disorders, 1994). PTSD is considered acute if symptoms have lasted less than three months, chronic if more than three months and delayed if symptoms appeared at least six months after the incident (Diagnostic and Statistical Manual of Mental Disorders, 1994).

PTSD is both real and serious. The amygdala of PTSD sufferers appears to label certain memories as particularly terrifying. However, the emotional responses of the amygdala are regulated by the rostral anterior cingulate cortex (Etkin et al., 2006). People with more voluminous rostral anterior cingulates are more likely to recover from PTSD and less likely to develop PTSD in the first place. A problem for planners of military deployments is that mild traumatic brain injuries, such as those from concussion (e.g., from explosions), preferentially damage the rostral anterior cingulate because of its position in the brain. Thus, soldiers deployed to combat operations in which they are close to explosions (e.g., IED's, mines or artillery) are likely to be more prone to PTSD than a control group.

The measured prevalence of PTSD varies[2] (Study, 1988; Kulka et al., 1990; O'Toole 1996), and questionnaires tend to overestimate PTSD rates compared to clinical interviews (Engelhard et al., 2007), but all sources agree that PTSD is a serious problem for military veterans. Even veterans of peacekeeping operations are at increased risk of PTSD, particularly if they are exposed to combat or witness atrocities (Sareen et al., 2007; Maguen et al., 2004). As acute stress is thought to lead to PTSD (Solomon et al., 1988a; Solomon and Mikulincer, 1987; Solomon, 1988, 2001, 1987; Solomon et al., 1988b) and the reduction of acute stress is thought to be the best way to reduce the future incidence of it (Solomon et al., 1988a; Solomon and Mikulincer, 1987; Solomon, 1988, 2001, 1987; Solomon et al., 1988b). The important predictors of PTSD for soldiers are exposure to combat (Solomon et al., 1988a; Solomon et al., 1988b; Murdoch et al., 2003; Solomon et al., 1987; De Montleau et al., 2000); lengthy continuous deployment (Okulate and Jones, 2006); severe drug abuse (Maguen et al., 2004; Okulate and Jones, 2006); and pre-exposure to civilian trauma (Maguen et al., 2004). Stress reactions appear to differ based on previous combat experience with those who have it exhibiting repression and thus experiencing relatively lower affective and greater somatic complaints (Solomon, 1988; Killgore et al., 2006) without a change in PTSD rates (Killgore et al., 2006). Primary PTSD prevention aims to reduce stress and anxiety by making soldiers feel more supported and removing known stressors. Secondary PTSD prevention aims to promote an adaptive response to trauma in order to treat the symptoms of acute stress to prevent them crystallising into PTSD.

It is important to reinforce that we are not proposing that there is a stress threshold above which people get PTSD. Reality is much more complicated, nuanced and personal than this. We are interested in a broad model that is appropriate for this problem in this context and not in modelling the prevention, prediction or treatment of stress in a specific case.

4.1.1 Stress prevention

Primary PTSD prevention aims to provide an environment that reduces the likelihood of combat stress reactions that might lead to PTSD (Armfield, 1994; Feldner et al., 2007). Since acute stress impairs cognitive performance (Stetz et al., 2007) the reduction of acute stress would be a worthwhile goal for deployed forces even in the absence of its utility in PTSD prevention. Appropriate training, adequate sleep and limitation of periods of continuous combat (Bacon and Staudenmeier, 2003) are the most important stress reducers and the duration of a deployment is the most significant indicator of potential strain (Okulate and Jones, 2006; Adler et al., 2005).

While armies aim to prevent PTSD by providing social support (Birmes et al., 1999) through ensuring unit cohesion (Bacon and Staudenmeier, 2003), building teams (Armfield, 1994) and creating esprit de corps (Armfield, 1994), the greatest social support is typically found in small, informal, 'primary groups' of peers [Smith et al., (2003), p.98]. The main factors influencing small unit cohesiveness are previous familiarity, individual hardiness and good leadership with eight people being an upper bound on the size of a cohesive unit (Bartone et al., 2002). The Vietnam War era US policy of individual rotation into active combat units is thought to have reduced cohesiveness and social support and, possibly, increased PTSD rates (James et al., 1983; Vaitkus, 1994). In reaction the COHORT trial was introduced where units were kept stable for years and rotated together. This stabilisation produced small units scoring better than non-stabilised units on measures of psychological readiness for combat, adaptation to new deployments, changes in leadership, organisational reconfiguration, adoption of new equipment and changes in fighting doctrine (Smith and Hagman, 2004; Ardison et al., 2001; Bartone et al., 1986; Marlowe et al., 1985; Kirkland et al., 1987). The US unit focused stability manning system is a more recent attempt to enable soldiers to assemble, train and deploy together throughout the operational cycle of their unit (Smith and Hagman, 2004). While unit cohesion before and during deployment is accepted as a way to reduce acute stress, it also appears that units that stay together after combat have lower PTSD rates (Noy et al., 1984). In Iraq the UK deployed regulars as units but reservists as individuals to be slotted into pre-existing units in the field. In line with the hypothesis that unit cohesion protects from PTSD, reservists deployed to Iraq in 2003 had worse mental health and PTSD outcomes than regulars even though the base rate of mental illness and PTSD amongst non-deployed reservists was lower than that amongst non-deployed regulars (Hotopf et al., 2006). Of course, there are other group differences between reservists and regulars such as age, marital status, number and age of children and having a job outside the army that they are neglecting while at war.

For primary PTSD prevention, no matter what rotation concept is in place, soldiers need to be appropriately trained so that they are less likely to find themselves in situations where they feel events are spinning out of their control (Bacon and Staudenmeier, 2003).

As inadequate sleep is a risk factor for PTSD, flexible rotation concepts must ensure they do not disrupt sleep more than the alternatives presently in use. This should not be too difficult as periods of military deployment are not renowned as restful interludes and soldiers quickly build up significant sleep deficits. For example, 75% of USAF personnel deployed in a non-hostile environment slept significantly worse than they did at home; 13.5% managed less than the 270 minutes a day of sleep considered the long term minimum; and the average respondent met the criteria for insomnia while deployed (Peterson et al., 2008). The major self-reported reasons for not sleeping were loud noises, uncomfortable beds and worry about family left at home (Peterson et al., 2008). While there are large individual inferences in responses to sleep deprivation (van Dongen et al., 2004) it seems plausible that shorter deployments could produce a deployed force that was more rested because of the frequent respite periods out of theatre.

A flexible scheme that concentrates on minimising the length of rotations in conflict zones will limit periods of continuous combat by its nature. Flexibility allows shorter rotations for units that will obviously be in more stressful situations. For example, members of the security detachment (SECDET) protecting Australian diplomats in Baghdad (and commonly driving the dangerous airport-embassy route) seem more likely to accrue stress at a greater rate than their colleagues in the same operation instructing Iraqi officers on how to use PowerPoint – and in line with the principles of primary PTSD prevention should have a shorter in theatre rotation.

Most important in primary PTSD prevention is the support of cohesive teams both during (James et al., 1983; Vaitkus, 1994) and for some weeks after (Noy et al., 1984) stressful events. Therefore, flexible deployment concepts should rotate units rather than individuals and keep these units together both in the non-deployed phase of rolling deployments and for some weeks after the last deployment.

4.1.2 Stress remediation

Stress remediation methods are used for secondary PTSD prevention. Different types of techniques are used on those who have been exposed to traumatic events that may trigger PTSD (Campfield and Hills, 2004) and those who have developed some symptoms of acute stress but have not developed PTSD (Cigrang et al., 2005). A flexible deployment concept that attempts to minimise rotation lengths needs to do no harm to those techniques administered after traumatic incidents and offers some advantages in remediating acute stress that is not clearly linked to any particular incident.

Soldiers are regularly treated to minimise the chances and levels of acute stress following emotionally distressing incidents such as the death of a unit member, death or extreme suffering amongst non-combatants, handling of dead bodies or friendly fire. Many psychological debriefing methods, like critical incident stress debriefing (CISD) (Mitchell and Everly, 1995; Budd, 1997), use a single session with a unit within hours (Campfield and Hills, 2004) of the incident. An experienced soldier and a psychologist work with the unit to reinforce the normalcy of their feelings and facilitate mutual support. Exposure therapy (Cigrang et al., 2005) methods differ in that they tend to work with individuals and extend over several sessions over the course of several weeks. There is some controversy over whether any of these techniques work at all and, if they do, which works best in what situation (Feldner et al., 2007; Cigrang et al., 2005; Everly and Boyle, 1999; Walsh and Lewis, 2002; Nagae and Kim, 2005). These are questions for

people qualified to study them and not for us. The important issue for deployment concepts is that they are used and their use needs to be planned for.

All of these techniques are best started within a day of the traumatic incident so psychological intervention cannot be left for the 'home' part of the rotation – psychologists either need to deploy with the force or a convincing case for the efficacy of telemedicine needs to be built. Some of these techniques have treatment regimes of many weeks (Cigrang et al., 2005). On short duration deployments there is more chance the treatment regime will not be completed before return home. Therefore, protocols for case handover (which must be present in longer deployments as psychological staff will, typically, return to a different home than other deployed units and some cases will be referred shortly before the end of the deployment) are more important and there is a stronger reason to investigate whether there are effective programs that can be remotely delivered by the same psychologists to both deployed and home locations. Other techniques rely on facilitating and engendering mutual support within small units (Mitchell and Everly, 1995; Budd, 1997). This is yet another reason why small units should not be broken up in the process of rotation.

However, acute stress still occurs in soldiers. Screening systems (Bacon and Staudenmeier, 2003) have been used to catch those suffering stress at an early stage so that they can be sent to stress recovery centres since World War I (Smith et al., 2003; Jones and Wessely, 2003; Feldner et al., 2007). An example intervention is the Proximity, Immediacy and Expectancy (PIE) approach (Jones and Wessely, 2003) which aims to bolster self confidence, boost identification as a soldier, reinforce the normalcy and commonality of their experiences and reduce individualism (Armfield, 1994) during a one (Bacon and Staudenmeier, 2003) to four (Armfield, 1994) day stay at a treatment centre. Mechanistic adherence to performance metrics like days-in-centre and percentage-return-to-duty gave PIE centres a reputation for churn in World War II (Jones and Wessely, 2003; Feldner et al., 2007) but both psychology and psychiatry have advanced since then (Bacon and Staudenmeier, 2003). More modern treatments include exposure therapy (Cigrang et al., 2005) and cognitive behaviour therapy (Bryant et al., 2007; Nixon et al., 2006), both of which bring PTSD checklist risk-scores back within the normal range (Cigrang et al., 2005).

Soldiers receive psychological assessments at the end of their deployments. Shorter deployments can mean more frequent assessments – hence acute stress can be caught at an earlier stage and there can be less reliance on superiors noticing it and referring soldiers to psychologists.

PIE sends soldiers to a supportive but safe environment. Going home with your close colleagues places soldiers in a supportive and safe environment – effectively doing what some PIE programs do but without the stigma of having been sent to recover.

4.2 Initial scenario: acute stress leads to CSR and PTSD

The initial scenario is that an army centred expeditionary task force is deployed into a zone of low intensity war-like activity to carry out a long term mission. This mission may be counter insurgency, peace keeping, nation building or something else. The ability to, rapidly and without interference, move troops and supplies by sea and air to an area of operations is assumed for Australian expeditionary task forces (Ryan, 2003). The scenario is set in the future so that the Australian army will have had time to implement both the army-of-threes, whereby there will be three times as many soldiers in the army

as there are soldiers deployed, and a structurally flexible taskforce organisation, capable of being reorganised depending on the scale, intensity and duration of deployment rather than the traditional brigade based structure (Ryan, 2003). However, the major assumption of the scenario, on which the core strategy is based, is that stress accrues while soldiers are deployed and dissipates while they are between deployments. The rates of accrual and dissipation depend on the personalities and personal situations of the individuals, their roles, the intensity of the conflict and the quality of inter-deployment time for stress dissipation.

4.3 Core strategy: reduce stress by minimising deployment duration

The core strategy is simply that we reduce stress by minimising the duration of continuous deployments. The simple mathematical description that can be used to arrive at the minimum deployment length is:

$$(n-1)D = R(D, I)... \tag{1}$$

where $(n - 1)D$ is the inter-deployment duration and R is the recovery period, a function of the duration of deployment, D, and the intensity of conflict, I. The assumption is that deployments of longer duration or higher intensity require a greater recovery period and hence a greater inter-deployment period. At this stage, the core strategy may be seen as applicable to individuals based on their individual needs. However, there are good reasons why this and other details need to be changed. These nuances to the core strategy form the initial strategy.

4.4 Initial strategy: add risk management processes

The core strategy of shorter continuous deployment durations aims to reduce the negative effects of stress. While the duration of the deployment has been identified as the most significant predictor of stress in soldiers, inappropriate training, inadequate sleep and long periods of continuous combat have also been identified as major risks (Okulate and Jones, 2006; Adler et al., 2005). To arrive at an initial strategy we augment the core strategy with risk management processes to increase its robustness. The risks identified are that: support from close peers in an inner-group of eight or less is important to reduce stress (Smith et al., 2003; Bartone et al., 2002); stress accrues at different rates depending on individual characteristics, the role filled and the situation; lack of sleep is a very important contributor to stress (Okulate and Jones, 2006; Adler et al., 2005); deployment schedules should not interfere with psychological help being provided to soldiers to help reduce stress; there should be enough inter-deployment time, and sufficient quality of rest in that time, that stress actually does dissipate before soldiers are again deployed; handover periods should be considered; personal finance concerns need to be addressed; and transport costs should be taken into account.

There are four issues that were easily identified at this stage but needed to be considered in more detail and were, thus, left to the adversarial stage of the process. The first was the issue of how training will fit into the deployment schedule. Inappropriate training is a risk factor for stress accrual while on deployment (Okulate and Jones, 2006; Adler et al., 2005) and the need to fit training into the inter-deployment schedule was a primary reason for extending deployments from six to eight months (Department of

Defence Media Release MSPA 159/08, 2008). This is such a complex issue that it needs its own section in the adversarial stage of the process. The second issue is that of relationships with locals and coalition partners as well as understanding the environment into which they are deployed (The Soldiers Army, 2008). Again, this needs to be given the space to address it in detail. The third of these was that married soldiers are more likely to suffer acute stress (Bacon and Staudenmeier, 2003) and more likely to develop PTSD (Solomon et al., 1987). Deployment schedules effect families in complex ways, with at least two opposing drivers: leaving and returning are stressful within the family; and people who are apart grow apart. The former appears to indicate longer but less frequent deployments and the later shorter deployments. These complications meant that we left this issue to be considered in more depth latter. The other issue was that of jet lag. It is obvious that this will be a problem for short duration deployments across many time zones. Again, this is a complex issue as there are processes that can be undertaken that minimise the effects, but these are complex to describe and fade in effectiveness as more time zones are crossed.

The stress reducing effect of being surrounded by a cohesive and supportive team made up of people whom you know and trust is well known. Various schemes, such as COHORT and the unit focused stability manning system have been implemented in an attempt to reduce stress (and increase effectiveness) through provision of social support (Birmes et al., 1999), ensuring unit cohesion[3] (Bacon and Staudenmeier, 2003), building teams (Armfield, 1994) and creating esprit de corps (Armfield, 1994). Most soldiers find the greatest social support in a small, informal, primary group of peers [Smith et al., (2003), p.98] and the upper size of cohesive units has been found to be around eight people (Bartone et al., 2002). The deleterious effects of deploying individuals indicate that personnel should be rotated as units so that they enter and operate in the conflict zone in the company of people they know well. This may require the teaming of some specialists into groups who move together and can support each other. The small units that form the minimum blocks for moving people to and from deployments should base together and train together so that they can stay together during their period away from the theatre. This provides the capacity for support from peers with shared experiences away from deployment as well as on deployment. Lastly, army reserve (ARes) personnel should also be used as units rather than as individuals dropped into a unit to make up for shortfalls. Moving people as parts of units does not change the details of equation (1), only its interpretation. In place of seeing it as a formula for a person it becomes a formula for a small team.

Different small teams will accumulate stress at different rates. This depends on the personalities of the people in them, something that is difficult to assess, and the circumstances of the moment because being in combat is much more stressful than simply being deployed. However, it also depends on the role filled by the small team. Therefore, small teams need to be able to be rotated at different rates. In terms of equation (1) this may mean that some teams have a different value of D, the deployment length, to others. It may also mean that some teams have a different value of n to others as there is no need to keep n constant across the force. For particularly stressful roles there may be more teams per-deployed team than for relatively stress free roles. For example, it is easy to imagine a situation where there are three times as many deployable soldiers as deployed soldiers overall but there are four times as many in a particularly stressful role and only twice as many in a relatively low stress role.

Lack of sleep is a very important contributor to stress (Okulate and Jones, 2006; Adler et al., 2005) and any short rotation deployment scheme should not make sleep even harder for soldiers. A civilian example of this is that some contractors at remote mines in South Australia run four-day-on-four-day-off work practices with twelve hour days and allow their workers to sleep on a seven hour bus ride from Adelaide the night before the first shift and on another, similar, bus ride the night after their last shift. Travel time should not be substituted for sleep time in short duration deployments as sleep on deployment is already a difficult commodity to come by (Peterson et al., 2008). This does not alter equation (1) but is important to consider.

Deployment schedules should not interfere with psychological help being provided to soldiers to help reduce stress or implement stress remediation techniques. This does not effect equation (1) but means that those involved in the psychological well being of deployed soldiers should be consulted in the establishment of a deployment schedule.

It is important to make sure that the inter-deployment time, $(n - 1)D$, is actually sufficient for stress to dissipate before soldiers are again sent on deployment. Whether this is the case is partly dependent on the quality of that inter-deployment time and what else needs to be squeezed into it. Therefore, we need to make sure that the concept of the recovery time, R, in equation (1) really is recovery time while keeping in mind that some or all of this time can be used for doing other things (such as training).

There is a need for continuity during periods of change. Long term deployments have coped with this through using a handover period during which the members of two deployments are present in theatre. This presents accommodation problems during the handover period. For short term deployments, it is possible to move away from the traditional synchronous deployment model to a rolling change model. For a three week deployment length, for example, the force could be split into nine groups rather than three groups, with three groups being on deployment at any time. One group could be rotated each week leaving two thirds of the previous week's force in place. This also cuts down on the peak transport loads required and makes it more possible for some of the extra personnel transport costs to be saved by using excess capacity on existing supply flights. The staggering of short term deployments and the extra accommodation capacity needed in long term deployments allow some specialist teams to be deployed only as needed. This will only reduce the number of soldiers needed in the on-going deployment if there are specialist teams that are only required some of the time and the time they are needed can be planned. The handover period, H, needs to be considered in equation (1).

Changes in deployment schedules will have effects on personal finance issues such as bonus pay, tax free status and support costs. Any change of deployment scheme needs to be carefully monitored for its financial impacts on soldiers, especially in the way it relates to tax laws. One possible benefit of shorter but more frequent deployments is the evening out of deployment bonus payments and opportunities to spend them.

Finally, there are transport costs. It is important to remember that the ability to, rapidly and without interference, move troops and supplies by sea and air to an area of operations is assumed for Australian expeditionary task forces (Ryan, 2003). Short term deployments obviously entail more travel than long term deployments. For example, moving from 26 week deployments with a flight in at the start, one out at the end and a flight home and back again for leave in the middle to a three-week-on-six-week-off fly-in-fly-out (FIFO) schedule could increase the people-movement flights per-soldier from four to six over this period, an increase of 1 1/2 times. However, moving from a 39

week deployment with only a flight in at the start and one out at the end to a two-week-on-four-week-off FIFO deployment could increase the number of flights from two to 13, an increase of 6 1/2 times. Another benefit of the idea of staggering deployment rotations suggested in the paragraph above (i.e., moving small units at different times) is that the peak transport demand is reduced. Staggering may allow a greater ability to transport personnel by filling out unused space on supply flights. The more flights, the more costly they are and the greater the relative cost to the other costs of the mission the more the long term deployment strategy is superior to the short term one.

After considering these changes we see that equation (1) does not change very much to become:

$$(n-1)D = R(D,I)+2H... \tag{2}$$

but is interpreted differently to the way that equation (1) was. Thus the initial strategy is comprised of the core strategy 'to minimise deployment duration' and risk management processes. As we make this strategy more robust, these processes will interact with new processes, enabling the strategy to deal with extra complexity.

5 Improving the robustness of the strategy through ASA

The final stage of ASA is repeated application of the adversarial (*elenctic*-like) process of changing the scenario to make troubles for the strategy and then changing the strategy to cope with the new situation. Initially we looked at the four issues identified but not addressed (due to reasons of complexity) in the formation of the initial strategy: training; relationships; family; and jet lag. To these we add a further issue that was thought of in the process of challenging the strategy: step changes in conflict intensity. For each of these issues we investigate the literature, suggest a change to the scenario and suggest changes to the strategy.

5.1 Training: deep, broad and future focused

A major reason for increasing the standard Australian Army deployment length from six to eight months was the need to provide sufficient time between deployments to train soldiers in the broad range of capabilities that a modern Army requires to be successful in the contemporary security environment (ADF to Extend Troop Deployment Time, 2008; Department of Defence Media Release MSPA 159/08, 2008; The Soldiers Army, 2008). An 'army-of-threes' approach, where twice as many soldiers are in Australia as are deployed abroad, was built into this concept through the inter-deployment period of at least sixteen months (The Soldiers Army, 2008). Changes in technology and practices are one of the primary reasons that shorter deployments can be considered. Training command is moving towards a model of training delivery that maximises the convenience to those being trained. Online courses make distance education more possible as well as improving the quality of delivery. Attitudinal changes are increasingly meaning that the trainer travels to the group being trained rather than visa versa. Both of these changes make it easier to deliver training to soldiers while on deployment and to ensure that a minimal part of soldiers' time at base between deployments is spent away from base at a training site.

As alluded to in the title, training in the Australian Army can be split into three broad categories. These are: training for the role you are or are about to be deployed into; training for your role in potential deployments; and training to fill more advanced roles in the future. Each of these different types of training has different needs. Soldiers need to be deeply trained in the specific skills that they need for the deployment that they are on or are about to be sent on; they need to retain the breadth to be sent on an entirely different sort of deployment after an inter-deployment period; and they need to be trained both for their career development and to meet the future needs of the force.

The length and timing of training courses is an important factor in whether any deployment scheme is maintainable in the longer term. If the course delivery is flexible enough for training to be interleaved with deployments then short deployment duration concepts can work. If training is adaptable enough to be tailored to the needs of soldiers as identified in the deployment phase then their effectiveness could be increased by short deployment duration deploy-then-train patterns. The success of short deployment duration operations is also dependent on the geographical location of training. Soldiers leaving the army are much more likely to indicate a strong dislike of training requiring overnight stays than they are to indicate a dislike of deployment. For example, of soldiers leaving 1st division in the year to the end of September 2007, 12% said that spending too much time on deployment was a significant factor in their decision to leave yet 36% said that nights spent away for training purposes were a significant factor.[4] Bringing soldiers back from deployment to base only to send them off to training at a site remote from base is likely to cause dissatisfaction. So, online courses, on site course delivery and basing at training sites are important factors in whether short deployment durations are practical.

Medium term training, to reinforce and improve the broader skills of soldiers that allow the army to respond to all of the contingencies that it may need to respond to rather than just the deployment situations it is presently involved in, is more problematic than short term training. This is because it involves cases where exercises are undertaken that involve large numbers of participants and months of planning by headquarters.

Many longer term training courses already entail posting to non-deployable units. It is important to remember that the short duration deployment concept is similar to other deployment concepts in that not all members of the army are deployable. There will always be an element of the army undertaking training that is not affected by deployment. As of January 2009 the Australian Army was offering retention bonuses to people with the following qualifications: ECN[5] 270 (plant operator), ECN 377 (supervisor civil), ECN 269 (operator petroleum), ECN 273 (operator electronic warfare), ECN 002 (linguist intelligence special duties), ECN 008 (artificer avionics), ECN 412 (technician avionics), ECN 418 (technician electrical), ECN 421 (technician electronic systems), ECN 004 (aircrew loadmaster), ECN 029 (dental assistant), ECN 235 (metal smith), ECN 274 (operator specialist vehicle RACT), ECN 274 (operator specialist vehicle RAE) and ECN 404 (dental technician). These are the areas where long term training failed to deliver sufficient personnel who were interested in remaining in the Army. The areas that are undersupplied can be quite variable depending on the opportunities in the outside economy. However, one group that will always be needed are senior non-commissioned officers and warrant officers (Aylwin-Foster, 2005).

Training is necessary to progress the careers of soldiers and to ensure that the army maintains appropriate numbers of people with specialist skills. Training can be hard to

deliver on deployment due to the need to not distract soldiers from their mission and the costs and risks occasioned by the trainers, but it can be done (Mason and Slater, 2005).

5.1.1 Training based changes to the scenario

The scenario is further complicated by the need to ensure that those troops who are deployed are able to receive appropriate training. This includes training for the role that they are about to be deployed into; training for their role in potential future deployments of a different type; and training to fill more advanced roles in the future.

5.1.2 Training based changes to the strategy

Consideration of training means that it is necessary to add a minimum training period, T, to equation (2) to arrive at:

$$(n-1)D = max(R,T) + 2H... \tag{3}$$

Here, we assume that recovery is possible during training and that training is possible during recovery. Thus we use the larger of the two periods, T and R, in equation (3). This may not be a realistic assumption and it needs to be tested before any implementation of a short duration deployment model. There are, however, good reasons to think that training with the team that you deploy into stressful situations with is likely to be more effective at reducing stress than simply having a holiday (Solomon et al., 1986).

Medium term training is the most difficult training issue for a short duration deployment concept. It is very hard to prepare members of a force to fight a different sort of conflict to the one that they are deployed on if they are constantly being recalled to their ongoing deployment. They are going to see that training associated with their present deployment can save their lives and those of their mates in the very near future and contingency preparations for other sorts of conflict are likely to come a very poor second. This either places a limitation on the fraction of the force that can be placed on short duration deployments or it means that there must be considerable change in how medium term training is done. With the move towards structurally flexible expeditionary taskforces rather than the traditional brigade based structure (Ryan, 2003) there are opportunities for different forms of medium term training. For example, when a battalion returns from a counter insurgency deployment it may be deemed that it needs to have its manoeuvre warfare skills renewed. The battalion headquarters then needs to plan, or at least be involved in planning, the exercises that will allow it to do so. However, if elements of that battalion are to be removed and inserted into a structurally flexible expeditionary taskforce for deployment, they should also be able to do this for training. It may be that the headquarters that commands a unit on deployment does not need to command it in the inter-deployment training phase.

There are other control measures that fit in with the general direction of training in the army being moved to be student centric rather than trainer centric. If training is able to be changed to fit in with a short deployment schedule then block release courses need to be considered. The blocks need to be short enough to deliver in the period that soldiers are at home base and still leave them time to relax whilst off deployment. Teaching should be delivered, as much as possible, at the base of the soldiers doing the learning either with mobile courses or distance learning. Units that are deployed together should train together as much as possible to increase their cohesiveness and place the training in

a human context similar to that it will be used in. Units with similar training requirements should be based together as much as is possible. To enable adequate time for training and for rest and to concurrently minimise the strain caused by the deployment cycle, units with different specialisations may need to have different deployment durations.

5.2 Local relationships and local knowledge

Another commonly quoted reason for the shift from six to eight month deployments is to "allow soldiers more time to develop and maintain cohesive relationships with both the local population and coalition partners, and to better understand the environment in which they operate" (The Soldiers Army, 2008). This particularly, but not exclusively, meets the needs of headquarters staff who have found six months insufficient to build and use the local relationships so important to success in the small wars and counter insurgencies they have been deployed to fight. Having listened to talks by the commanders of three recent Australian (six month) deployments it was evident that they felt that their average effectiveness (which was high) would have been improved by being in theatre longer. There were two main reasons for this. The first was that they felt that they took a couple of months to come to grips with the local conditions. While recognising that the enemy was adapting and the local conditions were changing they felt on-top of this rate of change and in control of the situation. The second reason was one of credibility – as commander you can make promises to local people but they have little confidence in some of these if they know that you are about to leave. Anecdotal evidence indicates that a considerable fraction of the headquarters staff on these deployments felt the same way. In present Australian practice the entire task group is tied together meaning that if the commander spends more time theatre then everyone spends more time in theatre. Our strategy disaggregates the elements of the task group so that each element can spend an appropriate time in theatre.

Developing and maintaining relationships with the local population is important not just to headquarters staff but also to all deployed soldiers, especially those who patrol. Good relationships with the local people are important in gathering high quality information (Zeytoonian et al., 2006; Mockaitis, 1990; Jackson, 2007; Teamey and Sweet, 2006 Kilcullen, 2006). Relationships and local knowledge are also important in picking up indirect cues that something is amiss from the obvious lack of civilian presence where it should be to the subtle avoidance contact where it normally occurs (Zeytoonian et al., 2006; Mockaitis, 1990; Jackson, 2007). Local relationships are much easier to build when soldiers have some understanding of the local language, even if interpreters still need to be involved. Australian forces are unlikely to deploy to fight in English speaking nations so speaking to locals means learning another language. There is, therefore, a strong interaction effect, through language training, between training and building local relationships. The ADF School of Languages uses intensive immersion courses to teach languages to soldiers and divide their offerings into three levels of difficulty. Conversational proficiency can be achieved for Tok Pisin, Solomon Islands Pijin or Bislama in five weeks. In Indonesian, Malay, French, Fijian, Filipino or Tetum[6] conversational proficiency takes twelve weeks. For languages such as Farsi, Pashto and Arabic it takes twelve weeks for soldiers to simply attain the ability to give directions. Qualification as a general linguist takes a full year for all languages. The intensive immersion nature of these courses means that soldiers cannot perform any other roles or

do any other training during them. Even the shortest course, five weeks preparation for basic conversation in regional pidgins, represents a substantial sunk cost in preparing soldiers for deployment to a particular region.

Developing and maintaining relationships with coalition partners is important across a variety of roles. This is most obvious in the headquarters where there are formal arrangements that need to be explained to replacements in an incoming rotation. There are informal relationships between individuals lubricating these formal ones, and these are harder to handover. Present deployment models use a handover period in an attempt to maintain official relationships. It is likely that a similar process occurs for some informal relationships during this handover period. An important unknown is whether the same quality of relationships could be built up by soldiers who spent two thirds of their time out of theatre. It is likely that this will be possible for some roles where knowing who to talk to and what to ask is all that is important but is unlikely to be possible for the majority of senior roles where issues of authority and consistency come into relationships with coalition partners. However, if it is appropriate, the model of rolling rotations with short durations in theatre but relatively rapid returns to theatre is that, after the pattern has settled into a steady state, there are no major discontinuities. It allows a diversity of individual relationships to cycle over a shorter period which may result in more information flow and cooperation.

Soldiers take time to understand the environment in which they operate. However, their mental model of that environment cannot be static because enemies adapt and change their behaviour and civilian conditions also change. This change, typically, happens slowly. But, over time, it can build up. Short duration deployments may not have sufficient time to fully apprehend the environment in a single deployment. However, rolling deployments, where time in theatre is minimised but soldiers return to the same deployment after their inter-deployment period, would bring soldiers back before too much had changed and allow them to fully come to terms with the environment over several rotations – as long as they were rotated back to the same area.

FIFO deployments (the norm in the mining industry) may be able to interleave language training with deployments to improve language skills. Staggering of the rotations should minimise the opportunities for discontinuity. This pushes towards longer periods in theatre as rotation staggering that might be difficult with one week periods in theatre becomes less problematic with three week periods. This strategy can be extended to other specialities, with each speciality having different training requirements. The critical factor for soldiers is an adequate period for rest and recovery.

5.2.1 Relationship based changes to the scenario

The flexible deployment concept needs to be assessed for its ability to "allow soldiers more time to develop and maintain cohesive relationships with both the local population and coalition partners, and to better understand the environment in which they operate" (The Soldiers Army, 2008).

5.2.2 Relationship based changes to the strategy

The minimum deployment length concept has already been developed to the point where it is recognised that different roles accrue stress at different rates and therefore need different periods of deployment, D, and inter-deployment periods, $(n-1)D$, to ensure that

accumulated stress is minimised. This idea of different deployment lengths for different roles needs to be extended to consider the effects of deployment length on relationship building for the role filled. There is considerable benefit from extending the lengths of deployment for commanders of the force and for headquarters staff who need not only the relationships with locals and coalition partners but also the assurance of consistency. A commander who is in theatre for a week and out of it for two weeks will not have authority or credibility. An infantryman who only patrols a particular area once every three weeks or so will not have problems, but one who patrols the same area daily might. A petroleum operator also does not have these problems. This means that we need a constraint on D based on the relationship needs of the role filled.

Although there are no changes to equation (3) indicated in this section there is an interaction effect with training. The director general training (DGT) is moving towards a model of training delivery that aims to maximise the convenience to those being trained through moving the trainer rather than the trainees and through delivering online content (Newton and Ellis, 2005a, 2005b). The UK Army has found (Foreman, 2001) that soldiers studying basic literacy skills have more time to study while they are operationally deployed than in their inter-deployment period. This raises the possibility that some language training could be delivered online to soldiers while they are actually deployed – when they can immediately put it into practice in the environment in which the language skills need to be put to use to improve effectiveness.

5.3 Family issues

The majority of Australian soldiers have a spouse and about a quarter have one or more children. These are disproportionately the older, more skilled and more experienced members: exactly the people the Army most needs to retain. Deployment places significant stresses on families (Foreman, 2001; Huffman et al., 2007 Rosen and Durand, 1995; Rosen et al., 1989; Gibbs et al., 2007; Rentz et al., 2007) and is a major contributor to separation from the military (Foreman, 2001; Huffman et al., 2007 Rosen and Durand, 1995). Qualitative evidence (Sherman, 2008) indicates that healthy families cope well with one lengthy deployment, cope with a second and struggle to stay together during (and especially after) subsequent deployments. Most people want children, want good relationships with their children and want partners who offer more than financial support. Long absences make stay at home partners less inclined to have children. Divorce or separation makes it considerably more difficult to have good relationships with children. Soldiers know this. Internal ADF separation interviews on an infantry biased subset show 36% had a dependent child or children; 36% said that caring for their child or children was a major factor in their decision to leave; and 28% said that the desire to have a child was a major factor in their decision to leave. The difficulties that families experience during deployment are well known and the ADF has an extensive family support program in place (Foreman, 2001). Yet the conflict between the realities of military deployment and the responsibilities of being a partner and a parent remains.

The periods immediately prior to leaving and immediately after returning from long deployments are reported to be by far the most stressful on relationships (Krajeski, 2006) particularly in families with children (Krajeski, 2006). In the US military, these are the periods with large spikes in child mistreatment (Rentz et al., 2007). A flexible deployment concept that seeks to minimise the soldiers time in theatre will, perforce,

increase the number of departures and returns. This would be enough rule out such a concept were the trauma of leaving and returning and the effects of being absent the same for a deployment of two or three weeks as they are for one of six or eight months. However, it seems unlikely that this will be the case when the reasons for the relationship difficulties are considered. Those who are apart, grow apart. The longer that people are apart, the greater this gap becomes. Minimising time-in-theatre also minimises the continuous periods of time that families are apart.

A flexible deployment concept that concentrates on minimising the duration of each rotation into the conflict theatre resembles FIFO mining operations in there being many goodbyes and hellos. In other ways it does not resemble FIFO mining. The typical FIFO miner works two-weeks-on one-week-off but is on leave for their week off (Beach et al., 2003; Kaczmarek and Sibbel, 2008; Kaczmarek et al., 2003, 2007) whereas the ADF aims for the reverse ratio of deployed time to home time, eight months on and sixteen off (ADF to Extend Troop Deployment Time, 2008; Department of Defence Media Release MSPA 159/08, 2008; The Soldiers Army, 2008), but expects soldiers to turn up for work during (most of) their time back in Australia. In the absence of an existing short deployment duration task group there can be no studies comparing the family stresses generated by long and short duration deployments. There has, however, been work done comparing long term military deployments to FIFO mining absences with a community baseline (Kaczmarek et al., 2003, 2007; Sibbel et al., 2002, 2003; Sibbel and Kaczmarek, 2002). In these studies, family stresses are separated into stresses on children and stresses on the stay at home parent [in both the ADF and FIFO mining, the stay at home parent is almost always the mother (Kaczmarek et al., 2003)]. Children of all three groups have the same psychosocial well being as measured on the Children's Depression Inventory and Revised Children's Manifest Anxiety Scale and the same average perception of the functionality of their families on the family assessment device (FAD) (Kaczmarek and Sibbel, 2007). However, mothers in the FIFO mining families thought that their families were significantly less functional in communication, support and behaviour control as measured by the FAD (Kaczmarek and Sibbel, 2007). The periods of change, when a parent leaves or returns, are the most difficult times (Gibbs et al., 2007; Sharma and Rees, 2007) and this element of FIFO may be inherently worse for the stay at home partner. However, FIFO mining has been shown to have ill effects on less than a tenth of families (Taylor et al., 1985). There are a number of open questions that need research to address them. Firstly, military families and FIFO mining families are not matched populations so there may simply be more problems in the families of FIFO miners. Western Australian FIFO miners stay-at-home mining colleagues, who commute daily to their jobs also have more marital problems and wives with more mental health issues than control groups (Sharma and Rees, 2007). While limited opportunities in remote communities isolate women to domestic lives and contribute to these problems (Sharma and Rees, 2007) the patriarchal culture of the mining industry is also thought to lead to a higher rate of marginalisation of women to a secondary status within the family (Sharma and Rees, 2007), something equally applicable to FIFO and non-FIFO miners but not to soldiers. Secondly, the military puts a lot of effort into looking after the families of deployed members (Foreman, 2001; Kaczmarek and Sibbel, 2004) and this effort may pay off in lower rates of family problems. Thirdly, the after tax increase in remuneration is much greater when soldiers deploy than when miners take on FIFO work because soldiers get both deployment bonuses and tax exemption. Fourthly, partners of FIFO workers may find it more difficult to hold down a job and part-time work is correlated

with higher maternal well-being (van Rijswijk et al., 2004). Fifthly, most military families are childless whereas most FIFO families have children. Many of the employees in both industries see them as temporary jobs and the desire to have a child is a major factor in the separation from the army of many childless but married soldiers. So, military families that do not want one parent absent can delay childbearing until they are no longer military families whereas FIFO mining is viewed as normal enough for families that do not aspire to a carer-earner model to try it out. Sixthly, FIFO schedules leave much less time with families than the proposed short duration deployment concept. While there are still two-week-on-two-week-off workers the modal FIFO miner works two-weeks-on-one-week-off (an average of 56 hours per-week including the week off) and some work up to six-weeks-on-one-week-off (for an average of 72 hours per week including the week off) (Kaczmarek and Sibbel, 2007).

As already discussed, the wives of deployed fathers[7] are a somewhat self-selecting group. Almost all have chosen to marry a man who is already a soldier and to have children with someone they know will be deployed. It is extremely important not to disrupt the parts of the present system that work for existing military parents. There needs to be more study into what these are. It is important to consider those who find present military conditions so invidious to parenthood that they choose to leave the army when they want to become parents. Interviews with all soldiers from the 1st division of the Australian Army separating from the ADF in the year to the end of September 2007 found that 59% had a spouse or partner; 48% were living with their spouse or partner; 46% said their partners attitude to service life was important in their decision to leave; 55% said the impact of the job on their family was important in this decision; 36% had a dependent child or children; 36% said that caring for their child or children was a major factor in their decision to leave; and 28% said that the desire to have a child was a major factor in their decision to leave. It seems plausible that the partners of the 28% of separators who left to have a child would respond differently to partners of military parents.

Family stresses due to deployment are typically less than those associated with posting to a new region because posting involves moving the entire family whereas deployment involves the absence of one carer, typically not the primary carer (Foreman, 2001).

Just as soldiers report liking deployment more than training, in part because of the tax free status and bonuses of the former, the extra money brought into the family by deployment can smooth over problems.

Whether short duration deployments are viable from a family perspective comes down to the question of whether it is time apart that causes family problems when soldiers leave and return or whether it is simply the leaving and returning. If it is time apart then shorter deployments should cause a reduction in family stress. If it is leaving and returning, then shorter deployments will increase family stress.

5.3.1 Family based changes to the scenario

Deployment concepts need to be effective in the field but they also need to be humane on the soldiers undertaking deployments and on the families of those soldiers. There are intrinsic moral reasons for this. There are also practical reasons. Stress within the family is a major contributor to the decision to separate from the army. In this age of almost instant communications, stresses within the family can become well known to soldiers on

deployment. Soldiers often have no power to change the situation, leaving them both stressed and helpless. A happier family can improve the effectiveness of soldiers now and provide a situation where they, and their growing skills and experience, will be retained for future deployments. The scenario is revised to consider the stresses placed on the families of soldiers by deployments.

5.3.2 Family based changes to the strategy

As the times of transition are the most difficult (Krajeski, 2006), these should be minimised. We contend that soldiers should leave and return home as little as possible. Therefore, any training that needs to be done away from base should be done while in transit to or from the deployment zone as much as is practicable. This can be worked in with schemes to adjust the soldier's body clocks and to keep small units working together post-deployment as part of primary PTSD prevention. Exercises and multi-week away-from-home training courses should be treated as deployments as much as possible and inserted into the deployment part of the schedule. These units may be able to be replaced in their deployments through use of ARES units or it may be necessary to use a value of n in equation (3) that is less than the value that would be expected at first glance. If some of the 'deployment' rotations are used for training then n must be reduced commensurately.

Stability of family income is an outcome of shorter deployments. Long deployments give long periods in which families are relatively well off and even longer inter-deployment periods where families fall back to their base incomes.

5.4 Time zone differences

Circadian rhythms in our basal body temperature predispose us to sleep or wakefulness at certain times [Refinetti, (1999), p.131]. Travelling across time zones causes a mismatch between these rhythms and environmental reality. This is jet lag. It can be measured by inappropriate inattentiveness and sleepiness on instruments like the Columbia jet lag scale (Spitzer et al., 1999; Burgess et al., 2003; Revell et al., 2005; Eastman et al., 2005); variations in time of minimum body temperature (Refinetti, 1999; Baehr et al., 2000); or elevated levels of the stress hormone cortisol (Lemmer, 2007). Jet lag is considerably more debilitating than fatigue from travel. Recovery from lengthy trips within a single time zone only takes one nights sleep [Refinetti, (1999), p.129] whereas it takes just under a day per time zone to overcome jet lag [Refinetti, (1999), p.131]. For example, it has been shown that shifts of six time zones typically takes four days for full acclimatisation (Lemmer, 2007) and shifts of eight time zones take six [Refinetti, (1999), p.131] or seven (Lemmer, 2007) days for full acclimatisation. Jet lag is slightly less severe when travelling west [Refinetti, (1999), p.131] as we naturally find it easier to stay up late than to sleep early.

Some jet lag acclimatisation can be conducted before travel. Over three days before travel, waking exposure to bright (>3000 lux) light can shift circadian rhythms over two zones eastwards (Burgess et al., 2003) and afternoon ingestion of melatonin can produce a shift of almost three zones (Revell et al., 2005). Waking exposure to bright light has also been used to slightly reduce acclimatisation times [Refinetti, (1999), p.132]. Thus the perceived light dark cycle can be shaped to induce a phase shift in the circadian rhythm allowing total pre-travel re-entrainment for trips of almost three time zones

[Refinetti, (1999), p.132; Burgess et al., 2003; Revell et al., 2005]. Furthermore, the effects of a small mismatch between circadian rhythms and environmental reality are almost negligible. A two zone shift produces a statistically significant but extremely small reduction in team performance (Bishop, 2004) and individual performance is not detectibly affected out to four zones (O'Connor et al., 1991).

With minuscule team performance effects from a two time zone change and the ability to re-entrain circadian rhythms over almost three time zones prior to deployment it is possible that the flexible, and typically much shorter, deployment concept proposed would be feasible in cases where the deployment zone is up to four and a half time zones different from the basing zone. This is assuming that the personal cost of spending three days pre-acclimatising, by taking melatonin pills or waking to three and a half hours of bright light, and a few days re-acclimatising to the base zone post-deployment is acceptable. For shifts of five or more time zones the flexible deployment concept is less applicable as acclimatisation days need to be added at the start of the deployment or complex (and therefore non-robust) shift provisions (to use newly deployed people when they are alert) need to be added. Examining shows that, in the case of Afghanistan, this flexible deployment concept is applicable to troops based in the UK, Germany or Western Australia, marginal for those based in central or eastern Australia and inapplicable to those based in the US.

Table 1 Time zone differences between Afghanistan and various possible basing areas

To Afghanistan from:	*Time difference*	*Deployment direction*
UK	4:30 (3:30 DST)	East
Germany	3:30 (2:30 DST)	East
Perth (Australia)	3:30 (4:30 DST)	West
Darwin (Australia)	5:00	West
Townsville (Australia)	5:30	West
Ft. Bragg (NC, USA)	9:30 (8:30 DST)	East
Camp Pendleton (CA, USA)	11:30 (11:30 DST)	West (East for DST)

Note: Afghanistan, Darwin and Townsville do not use daylight savings time (DST).

5.4.1 Jet-lag based changes to the scenario

The initial scenario implicitly assumed that deployment would take place in the same time zone as the home area of the task group. Through explicitly stating in the scenario that the deployment may be in a different time zone to the base from which the task group is dispatched the possibility that task group members will be jet lagged upon their arrival in the deployment region is introduced.

5.4.2 Jet-lag based changes to the strategy

Time zone difference will have an effect on deployment performance if jet lag cannot be eliminated, and will otherwise be neutral. However, treatment is simply a matter of time and, in the worst case, that time would need to be spent re-entraining in the same time zone as the deployment. The circadian re-entrainment time, J, must be added to each end of the inter-deployment period. Treatments using lighting and artificial time changes can

help to close the gap before the soldiers depart from base. The level of disruption to the lives of soldiers acclimatising to different time zones before and after deployment is an important cost of these schemes. In particular we can estimate the portion of inter-deployment time that is taken by jet lag avoidance treatments and this contributes to an eventual estimation of the minimum feasible deployment length. The introduction of J changes equation (3) into:

$$(n-1)D = \max(R,T) + 2H + 2J \ldots \tag{4}$$

but we need to remember that J may be zero for differences in time zones of up to four and a half hours and that it may be feasible to do some or all of the required circadian re-entrainment during the hand-over period, H. At present, the re-entrainment of circadian rhythms occurs at a rear base outside the war-zone during reception, staging, on-forwarding and integration (RSO&I) and is entirely separate to the hand-over period, which occurs at the forward operating base (FOB) in the war-zone. RSO&I is also used for climatic acclimatisation (although the climate of the rear base and the FOB are often quite different).

A large difference in time zones will affect short duration deployments much more than those of longer duration. There are several issues: lost time; increased costs; and longer response times. Lost time can be eliminated by increasing deployment time through the inclusion of a changeover period at each end. Part or all of this period may be used as a handover period. This will have the effect of increasing the demand for accommodation in theatre. It may be feasible to allay extra costs by reducing the number of soldiers deployed in the flexible strategy, say by deploying only those soldiers who are needed at that time and flying others in for particular activities. There are likely to be ways to profitably use the travel time in preparation for the activity that is to be undertaken, but the time will still elapse before the soldiers arrive. The problems associated with longer response times will be covered in the next section.

At present, in deployments that span several time zones, the ADF undertakes RSO&I at a safe rear base before soldiers move on to their deployed base. RSO&I is used to recover from jet-lag and to acclimatise to the local conditions and, in the MEAO, is officially five days long. The 'officially' is important because arrival is late on the first day and departure is early on the last. The first afternoon is mainly administrative briefs but includes initial coverage of the rules of engagement (ROE) and orders for opening fire (OFOF) as well as equipment sizing. The second day starts at 0800 (to help entrain to the local time zone) and covers the latest on improvised explosive devices, first aid, an environmental awareness lecture, communications training, an overview of the operations in the theatre, movement briefs (including for ROCL and ROCTFA) and issue of gear. The third day starts at 0730 (to continue re-entrainment) and sees fuller coverage of the ROE and OFOF as well as weapons testing and training. The fourth day is spent on firing ranges and doing first aid training. The fifth day is travel from the secure rear area near the deployment site to that site and ends with a force protection brief from the local task group. Thus, presently, the handover period commences once re-entrainment to the time zone has been completed. The principles of risk minimisation implicit in RSO&I indicate that J in equation (4) is unlikely to be used for a handover period.

Without treatment, FIFO deployment strategies are likely to be limited to two time zones either side of the base region. The activities associated with pre-deployment preparation and post-deployment debriefing could be conducted in the base region in an

environment shaped to alter circadian rhythms. This may be through moving clocks forward or back by an hour each day or by use of light and melatonin treatment or through a combination of these. While, all going well, there could be zero effect in theatre, shifts of more than three hours may require manipulation of the experienced time zone by changing the times of day that people perform activities. This means that there will be periods before and after each deployment in which soldiers cannot undertake a fully normal life. Longer periods between the deployed phases and deployments closer to the base time zone give more time at home operating on normal times. With three time zones available from light and melatonin treatment a ten time zone difference could require a week of abnormal hours at each end, making a one-week-on, two-week-off system difficult to manage. The degree of jet lag experienced upon deployment and return can be measured.

5.5 Step changes in conflict intensity

This, more demanding, scenario raises issues of deployed equipment as well as soldiers, but we cover only the issues involving soldiers. Historically, resources have been available, in theatre, to deal with the increased tempo. The flexible deployment strategy has minimal numbers of soldiers in theatre so the deployed force will have a limited capacity to deal with an increase in intensity, and there will be long delays in flying units in, even if those units are ready to move.

Deployed forces need to be robust to rapid changes in conflict intensity. This is particularly the case in small deployments where there is little capacity to shift forces from other areas to cover hot spots. Most militaries allocate one or more rapid response force(s) to cover crises. In Australia's case this is the ready company group (RCG) of 1RAR made up of the Battalion HQ and one Rifle Company and based in Townsville. Such forces are packed and waiting to deploy and so can be on the ground rapidly in the event of a crisis – but they tend to be small. This means that serious crises need follow-on forces that take longer to activate. The pool of home-rotation soldiers present in a flexible deployment provides a source for such soldiers and these people have the benefit of knowing the local situation well. No matter which non-deployed group of deployable forces is sent it will play havoc with their training and recuperation, so it might as well be the best suited group.

Operation ANODE, the ADF contribution to the Regional Assistance Mission to the Solomon Islands (RAMSI), presents a useful illustration. It has required RCG support twice. The first time followed the killing of AFP Protective Services Officer Adam Dunning on 22 December 2004. The RCG[8] reached Honiara 18 hours after it was ordered to deploy and returned home on 25 January 2005 after relief in place by B Company 3RAR and a day of weather delay (Shovell, 2005). No extra forces were needed. However, on 18 April 2006, the 63 soldiers deployed on operation ANODE proved insufficient to control massive rioting and the RCG[9] reached Honiara 16 hours after help was requested (Moore, 2006). Follow-on forces were needed in this case and by 20 April, A Company 3RAR, 45 personnel and two helicopters from 5th aviation regiment, air defence guards, logistic support elements and two patrol boats had arrived (Heyer, 2006) and had brought the deployed force to 430 Australian personnel (Wallis, 2006) and over 500 foreign military personnel (including non-Australians) in total (Heyer, 2006). Only 17 of the 110 soldiers of A Company 3RAR had been deployed to the Solomon Islands

before and the company had not expected to deploy (Heyer, 2006). It performed well (Heyer, 2006) but the lack of local knowledge could have had detrimental effects had the circumstances differed.

5.5.1 Intensity based changes to the scenario

The possibility of an abrupt change in enemy activity, possibly bringing a need for rapid response, is added to the scenario. This means that the concept that deals with the scenario must be robust enough, over the entire system, to cope with such rapid changes in the requirements on the deployed force.

5.5.2 Intensity based changes to the strategy

Traditional deployment concepts have dealt with the possible need for a rapid response to changes in conflict intensity by building tolerances into the deployment itself (i.e., having more soldiers deployed than are required under normal circumstances) and by keeping an emergency response force to cover gaps that arise. A flexible deployment concept needs to consider these two solutions, especially the former to cope with situations where the deployed force is cut off from rapid external reinforcement. This is at odds with the principal of keeping the number of soldiers deployed in theatre to a minimum to minimise logistical costs. Apart from these two options the concept explored here has a third option. In the aftermath of the deployment of an emergency response force, more permanent reinforcements are deployed. Soldiers between deployments present a source for such follow on troops with the benefit that they know the local situation well. No matter which non-deployed group of deployable forces is sent it will play havoc with their training and recuperation, so it might as well be the best suited group. Effectively, in times of unexpected changes in intensity, there will be a temporary lowering of the effective value of n in equation (4) to increase the numbers deployed at any given time through reducing the inter-deployment period.

5.6 Robustness and adaptability

Flexible deployment concepts need to be careful to retain the features of present deployment structures that make them robust and adaptive. One of the key features is a period of pre-deployment group-training.

Units that are effective on deployment typically undertake group training prior to their deployment. This has always been the case but is even more important now that armies like Australia's have moved from deploying pre-existing formations (e.g., companies, battalions or brigades) towards deploying formed-for-purpose formations (e.g., combat teams, task forces or battle groups) modularly composed of numerous smaller pre-existing formations.

For example, in the case of first Australian reconstruction task force to Afghanistan (1RTF), senior members began working together about eight months before deployment. They were progressively joined by others over the following five months. For the last three months 1RTF sought, through group-training and mission rehearsal exercises, to improve its processes by iteratively identifying and rectifying problems as well as though group mastery of these processes. However, this time also served to build informal

relationships between 1RTF members and allowed elements from different units and corps to gain a shared understanding of the mission goals.

An example of the importance of these shared mission goals comes from the addition of a second infantry company to 1RTF during its deployment. This company had not been through pre-deployment preparation with the rest of 1RTF. There were perceptions of frictions due to a desire to fill the traditional infantry role of aggressively finding and destroying the enemy rather than the role allocated to infantry in 1RTF of providing security to the reconstruction elements while not antagonising locals.

While unit cohesion facilitates shared understanding it is also critical in propagating lessons and changed behaviours throughout the deployed force. Cohesion is vitally important, specifically in terms of succeeding in the 'adaptation battle' (Ryan, 2007).

5.6.1 Robustness and adaptability based changes to the scenario

The scenario needs to take into account the importance of cohesion within the deployed force in making it robust and adaptive. Thus, the concept needs to allow the pre-deployment group training that presently instills this in Australian task forces and to provide similar training for units brought into the deployment rotation scheme at later times.

5.6.2 Robustness and adaptability based changes to the strategy

No deployed force will get it right from the outset, no matter how good their pre-deployment training and handover from previous rotations (if any). What is 'right' will also change over time as opponents adapt their actions to exploit your weaknesses and as exogenous changes occur. So, the ability of a force to adapt is critical to its success. The flexible deployment concept seeks to maximise the fraction of force time spent in continuous adaptation to the changing environment rather than in initial adaptation to the initial environment. However, it needs to be careful not to reduce overall adaptability.

This means that all of the small units brought together to form the flexibly deployed force need to undertake pre-deployment training, just as is done now with each of the rotations of an ongoing deployment. Processes also need to be established to train newly attached units before they are deployed as part of an ongoing flexible deployment. At present, units attached to a deployed force part of the way through the deployment cannot carry out pre-deployment training with it because it is deployed. With flexible deployment, the presence of elements of the deployed force at their bases while swapped out of the deployment zone should facilitate this training process and allow cohesion to be built prior to deployment.

5.7 Flight cost and availability

The exoteric reasons given by the ADF for extending deployment durations to eight months revolved around training and effectiveness issues (ADF to Extend Troop Deployment Time, 2008; Department of Defence Media Release MSPA 159/08, 2008; The Soldiers Army, 2008) but cost reductions are either an esoteric reason or a happy accident. The extension of deployments reduced overall costs by making deployed

soldiers available in theatre for a greater percentage of their deployed time. This seems counterintuitive until you consider the entitlements for relief out-of-country leave (ROCL) and relief out-of-country travel fare assistance (ROCTFA) shown in Table 2. Soldiers on six month or eight month deployment both only get one ROCL of two weeks plus travel time and one ROCTFA to pay for fares on this ROCL.

Table 2 ROCL entitlements for deployed ADF members

If it is intended that the employee be on duty in support of the deployment for this period:	*They are entitled to up to this many ROCL and ROCTFA's …*
Less than six months	0
Six months but less than nine months	1
Nine months but less than 12 months	2
12 months but less than 15 months	3
15 months but less than 18 months	4
18 months or more	5

At present, commanders typically push the single ROCL entitlement in an eight-month deployment into the middle of that deployment period so that the positions of those on ROCL can be backfilled by a special (short duration deployment) detail that flies in for a couple of months. Typically this detail is approximately a platoon per deployed company. This is an extra cost on deployment that does not need to be borne if all soldiers were on short duration deployments. Importantly, this means that the Australian Army has experience of integrating a platoon moving into an already deployed company for a couple of months. This means that the systemic mechanisms needed to undertake shorter duration deployments are in place.

In the current deployment model, normal daily flights between a FOB and a rear base have an overcapacity. Partly this overcapacity is due to the need to deal with the maximum daily requirement rather than the typical daily requirement and partly it is due to the limited available aircraft types yielding choices between widely spaced numbers of personnel movements per flight. We expect that there will be some spare capacity although the amount of this present and the amount of extra capacity required by FIFO operations will be dependent on the details of the specific deployment. There is a strong possibility that some level of FIFO (e.g., for some units) can be achieved for no extra transport cost between the FOB and the rear base.

This is a complex issue that needs to be looked at in detail for each specific deployment.

5.7.1 Flight cost and availability based changes to the scenario

The scenario needs to take into account that there are costs to getting soldiers between their home base and their FOB and that there can be delays involved, especially due to adverse weather events at the FOB. The cost structure of flights is highly dependent on the exact details of the deployment. The scenario needs to consider that the costs of flights from Australian bases to the rear operating base are likely to vary directly with the number of troop movements whereas the cost of flights from the rear base to the FOB is likely to be on a more complex schedule.

5.7.2 Flight cost and availability based changes to the strategy

There may need to be financial limitations on the minimum length of all deployments or on the percentage of units to which short duration deployments are available, based on the cost of flights. Although it depends on the exact details of the deployment, it is very likely that some level of FIFO will be available for no extra transport cost between the FOB and the rear base. However, when the transport overcapacity of a normal deployment is exceeded there will be a step increase in this cost. Indeed, at each point that a larger aircraft or another flight is needed the marginal transport cost of one extra person on a FIFO schedule will be enormous. Subsequently the marginal cost will again fall to zero until the next step increase in requirements.

How well this strategy works is dependent on where the rear base is relative to Australia. The flight costs between the rear base and the Australian base are on a fully variable schedule and vary directly with the number of movements. If you are left with a considerable cost for commercial flights between the rear base and the home base, financial realities may intrude to make short duration deployments untenable. Again, this will be dependent on the exact details of the deployment but, generally, the further the rear base is from Australia the more likely that short duration deployments will be too costly.

Another problem with short duration deployments is that the airfields at FOBs are not necessarily operable in all weather conditions. Currently there is considerable flexibility in the start and end times of deployments and ROCL based on the availability of air movements to non-all-weather airfields adjacent to FOBs. This flexibility would need to be carried through into shorter duration deployments even though it will be a larger percentage of the total deployment time.

6 Discussion and conclusions

In this paper we have worked as practitioners and as theorists. As practitioners we have produced a framework, which we believe to be both simple and comprehensive, to guide deployment planning, but we do not claim success for the framework at this stage. As theorists, inspired by Mintzberg (1994), we set out to produce an instrument that was suitable for our purpose.

The framework is simply:

- to take each threat to the deployment and give a group of experts the responsibility to devise management approaches to minimise deleterious effects
- for each expert group to estimate the costs of their management approach, particularly the cost of the time taken from the deployment cycle
- try to minimise these costs
- sum the times taken from the deployment cycle while allowing any possible overlaps
- estimate the time that is needed for recovery in each deployment cycle
- estimate the size of the buffer time to cover contingencies
- estimate the minimum deployment cycle time that will enable recovery, allow the effects of threats to be minimised and cover any contingencies.

The framework could be applied using a form of scenario planning, based on a single detailed scenario and at a time when some of the uncertainties, such as the type of deployment activity and the number of time zones difference, have been resolved. The level of detail will support judgments about the numbers and types of soldiers who will be needed in theatre and in readiness at a nearby location. It also enables judgments on the training required, on issues for handover, and on approaches to jet lag treatment, avoidance and recovery.

This framework is expressed in the equation $(n-1)D = max(R, T) + 2H + 2J$ where:

- n is the number of times the deployed force that is available to deploy
- D is the deployment duration, $(n-1)D$ is the inter-deployment period
- R is the recovery time
- T is the training time
- H is the handover period
- J is the time dedicated to re-entraining circadian rhythms to the time-zone.

It is assumed that training and recovery can be conducted concurrently. It may even be possible to conduct some acclimatisation and re-entrainment to the time-zone during the handover period. The final concept is focused on stable long term commitments to small wars, insurgencies and peacekeeping operations within four time-zones of the deployment source and with forward bases near usable airfields.

One interpretation of this framework is that deployments could be made permanent with units rotating through them on different timeframes based on their needs and the requirements of the tasks they perform. This has a positive effect of increased flexibility at the possible cost of increased complexity in handover. At present the handover between rotations mostly occurs at a single time, although some handovers, such as that of the commander, take longer than others. Permanent deployments would require a handover between changing units and would need the same degree of cohesion between more units. This requirement for cohesive interactions between more units arises because the rotations will no longer be in blocks and are likely to be asynchronous. For example, if a battalion sized taskforce is required in theatre and three battalions of soldiers are needed to cover the rotations, each unit would need to be able to cooperate with three times as many units under a permanent deployment scheme. While very short duration rotations are likely to be limited to two time zones either side of the base region, the increased flexibility allows soldiers in different roles to be treated differently, e.g., the requirements on staff officers may be different to those on non-staff officers and stressors vary considerably between combat and non-combat roles (and within these roles).

It may be that a flexible rotation schedule, such as that shown in Table 3, could be developed for a particular situation. In this indicative table there are alphanumeric fillers for the role and corps of the unit rotating but, in an actual situation, these would be filled in. The stress, need for continuous time in theatre and changeover risk are all measured as being low (L), medium (M) or high (H). The rotation groups are specified within each role and, for roles with many people in them, it is shown that it is possible to have overlapping sets of rotation groups. Such a scheme allows different numbers of weeks in the rotation cycle based on the $(n-1)D = max(R, T) + 2H + 2J$ framework. A truly flexible model would allow the numbers in the ‘army-of-threes’ to be concentrated into

the roles needing the most time at home, whether due to the stress of their deployed role, the needs of training, or some other reason. Thus, the ratio of time spent in and out of the theatre varies between roles in Table 3. The basic framework is also modified by the need for continuous time in theatre and the degree of risk in the handover period (which governs the degree of overlap required between successive rotations). Therefore, high values of changeover risk, needs for continuous time in theatre, high values of recovery time required, need for considerable continuous periods of training and long periods to re-entrain to the local time zone all argue against short duration deployments but the exact deployment duration can be determined for each role separately.

Table 3 Indicative flexible deployment schedule

Role	1	2	3	4	5
Corps	A	A	B	C	D
Stress	M	H	H	M	L
Need for continuous time in theatre	L	H	L	H	L
Changeover risk	M	H	L	L	L
Rotation groups (by week)	1-2 2-3	1-12	1	1-12	1
	3-4 4-5	10-22	2	13-24	2
	5-6 6-1	20-32	3	25-36	
		30-42	4		
		40-50,1-2			
Weeks in cycle	6	50	4	36	2
Ratio of time in theatre	1/3	12/50	1/4	1/3	1/2
Ratio of time out of theatre	2/3	38/50	3/4	2/3	1/2

Despite strongly supportive feedback from subject matter experts, the framework can only be properly explored by a successful implementation. We hope to arrange an experimental test, using scenario planning. As practitioners we were struck by the large gap between the promise and the performance of scenario analysis, and by its bluntness as an instrument. The approach laid out for scenario analysis was little help to us in our original purpose, which was to make a strategy robust against the actions of an adversary.

We chose a single, simple, guiding core strategy and combined the ideas of ASA, generalised scenario elements, risk management processes and mental models to make the strategy robust. This approach is radically different to the normal approach of a complex strategy divided into sub-strategies. In our approach the strategy is guiding rather than prescriptive, adding a strategic objective to the goals of each functional group.

In our application we showed that it is the scenario elements, and their possible interactions, that are important, rather than the total scenario. Elements can only interact if they are in the same scenario and we maximised the chances of interactions by using giant scenarios with elements (additions to a scenario) which were focused on weaknesses in the overall strategy. This appears to be a major change which is supported by earlier comments about the importance of driving forces.

We also claim that the application demonstrates that strategic guidance can be provided to operations planners by a simple core strategy supported by a set of processes which are not, in themselves, strategies. The processes do not dictate approaches to any of the functional groups, who will use their own experience and ingenuity to achieve an

effective contribution in a way that helps to achieve the core strategy. Instead, the processes require the functional groups to make judgments about the constraints which their activities will place on the achievement of the core strategy.

Repeating this process using groups of subject matter experts would give more confidence and detail in the results. Looking into each of the sections in depth and building descriptive models would allow the formulation of an equation with sufficient detail to yield useful results under optimisation.

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Notes

1 In Korea 3RAR deployed 'for-the-duration' from September 1950 to July 1953 whereas 1RAR deployed operationally from June 1952 to March 1953 (on a 12 month in-theatre deployment) and 2RAR deployed April 1953 to July 1953 (on a 12 month deployment cut short by the ceasefire).

2 While combat veterans have experienced PTSD and other psychiatric problems for as long as there has been war the threshold for evacuating soldiers with psychiatric problems has varied over time (Jones and Wessely, 2003, 2006; Armfield, 1994). In US experience, over a third of medical evacuations were psychiatric in World War II whereas 6% were in Korea and 5% in Vietnam (Armfield, 1994). However, either 15% of US Vietnam veterans were diagnosed with PTSD at some time and 2% fulfilled the criteria in the late 1980's (Study, 1988) or 31% of male and 27% of female US Vietnam veterans were diagnosed with PTSD at some time and 15% and 8% fulfilled the criteria in the late 1980s (Kulka et al., 1990). Between 16.3% and

21.2% of Australian Vietnam veterans experienced PTSD at some time and those who self-reported combat exposure with significantly more at risk (O'Toole et al., 1996).

3 For those being bullied, unit cohesion means increased bullying rather than increased support (Ostvik and Rudmin, 2001).

4 Pay is probably a significant factor in this as soldiers receive deployment bonuses but do not receive training bonuses.

5 ECN is employment category number.

6 Tetum is the most spoken indigenous language in East Timor.

7 While deployed Australian soldiers more likely to be childless than US soldiers an even more major difference is that the ADF deploys mothers even more rarely relative to the US than you would expect from its lower level of parenthood. There are deployed ADF mothers but they are very rare. In contrast, the US Army has deployed more single mothers to Iraq and Afghanistan than Australia has deployed soldiers (Mulhall, 2009).

8 Based around A Company of 1RAR.

9 Based round D Company of 1RAR.