The Strategic Force Density Problem: A Historical Perspective for Operations in Afghanistan

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ABSTRACT

This paper presents results from a UK historical analysis study undertaken to compare the robustness of Force Density (Security Forces per thousand civilians) and Force Ratio (Security Forces per Insurgent) measures as scaling factors for stability operations. Consideration is given as to whether different classes of Security Forces (police, paramilitary or military) are more effective than others, and whether indigenous forces have greater or lesser effectiveness in conducting stabilisation campaigns. Also included is a discussion of the inherent sensitivity of these sorts of models to coding choices and other factors, and the implications of this sensitivity for both future work and policy decisions. Finally the results of this study have been applied to current operations in Afghanistan. The outcome is intended to inform the debate on the necessary size of the Afghan National Security Forces, as well as longer-term force-planning guidance for indigenous Security Force requirements and the appropriate balance between external and indigenous Security Forces.

INTRODUCTION

THIS PAPER

This main body of this paper outlines work undertaken in FY09/10 by operational analysts in the Defence Science and Technology Laboratory (Dstl) of the UK Ministry of Defence (MoD) attempting to quantify Security Forces' force level requirements in different classes of stabilisation campaign in order to develop force-sizing tools for operational-planning purposes. The latter part of the paper describes the implications of the results of this study on current operations in Afghanistan[1]. This section provides some work in progress indications of the implications of the analysis for current Operations in Afghanistan. However, it is based only on available open source data and takes no account of context specific factors which may have wider reaching implications than the research presented here. As such it should not, at this stage, be taken as providing firm results.

HISTORICAL ANALYSIS IN UK MOD

Since 1983, Policy and Capability Studies (PCS) Department Dstl and its predecessor organisations in UK MoD have undertaken operational analysis studies focusing on the statistical analysis of data drawn from real world campaigns As previously noted (Hossack 2007) this "historical analysis" (HA) approach is not the same as academic historical research or attempts to draw lessons learnt from historical case studies but is rather a type of classical, quantitative operational analysis undertaken to provide advice for decision-makers and is subject to the usual trade-offs between completeness and timeliness, and between accuracy and robustness.

BACKGROUND TO THE RESEARCH REPORTED IN THIS PAPER

In stabilisation operations, as in warfare, it seems sensible to assume that a lack of sufficient forces will all but guarantee failure. However, it is less clear what force levels provide a reasonable chance of success when undertaking or planning for different types of stabilisation operation. The first significant attempt to quantify Security Force requirements for stability operations was undertaken by Mr James Quinlivan at RAND in the mid 1990's. His "20 troops per thousand inhabitants" rule of thumb strictly states that *"…successful strategies for population security and control have required force ratios either as large or larger than 20 security personnel (troops and police combined) per thousand inhabitants"* (Quinlivan, 2003). However, this observation is based on comparison of no more than 6-8 heterogeneous stabilisation campaigns, some of which were stabilisations undertaken in the absence of any active terrorist or insurgent threat.

Another major study in the area, by John McGrath, emphasises the importance of civil policing activity in successful stabilisation operations[2]. McGrath's conclusion comes in two parts. First; that 13.26 troops per thousand population is an acceptable basic-planning factor for determining necessary, but not sufficient, troop densities in stabilisation operations, and second; that 30% of those troops should be dedicated to

[1] Data used is current February 2010

[2] McGrath actually uses the term *contingency operations* in alignment with US Army doctrine of the time.

policing roles (McGrath, 2006). McGrath's analysis based on six military campaigns and five US municipal police departments. As in Quinlivan's study, some of the military campaigns had no active insurgent threat, and it is unclear that a civil police force in a generally stable country can be compared to any stabilisation campaign that requires a military component.

Neither of these rules-of-thumb provide any information about by how much risk of failure increases as the level of Security Force deployment decreases, and although McGrath does consider other cultural, demographic and geographic factors in his analysis he suggests no way of using these factors to modify the estimate.

Quinlivan (1995) asserts that *" a number of states have populations so large that they are simply not candidates for stabilisation by external forces"*, in addition he notes that many countries are large enough, in population terms, that cooperation between the *"great powers"* and/or significant contribution of Security Forces from many countries would be required to stabilise them. The most recent estimate of the population of Afghanistan is 28.4 million. If Quinlivan's 20-per-1000 rule is correct then c.570,000 troops would be required to successfully stabilise Afghanistan. This would represent a twofold increase over the Security Forces currently available, and is more than any country would likely be willing to deploy. The difference would necessarily be made up from the Afghan National Security Forces (ANSF). If on the other hand McGrath's 13.26-per-1000 rule is correct, c. 380,000 troops, 30% of which would be devoted to policing tasks, would be required, representing a 20% increase in current Security Force levels. This figure is likely still too high to be achieved by the deployment of international troops and would again require a substantial increase in the size of ANSF.

Finally, previous Dstl research (Hossack 2004, Hossack and Sivasankaran 2005, Hossack 2007) into Counter-Terrorist/Counter-Insurgency (CT/COIN) campaigns have shown that, within this particular subset of stabilisation campaigns, the "force ratio" between security forces and insurgents is marginally statistically significantly associated with certain measures of campaign outcome, but found no evidence that the "force density" of security forces controlled by size of the population being stabilised was so associated. In addition, this research has shown that several Security Force and insurgent success factors can have a much stronger impact on the campaign outcome than a change in the scale of Security Force deployment[3].

OUTLINE OF STUDY ANALYSIS METHODOLOGY

STUDY SCOPE

The theoretical scope of the study reported here was intended to have been "stabilisation" campaigns undertaken at least partially by the Security Forces of Nation-States to restore or impose effective governance upon the populations of,

[3] Strictly this null result for "force density" was only established on a preliminary subset of c. 18 CT/COIN campaigns, not on the full dataset of 34 completed COIN campaigns later used to establish the "force ratio" correlation (Hossack 2007).

possible de facto, states that are currently experiencing disorder[4] within at least sections of said population caused by a, possibly null, cause of instability .

However, the practical scope of the work undertaken in FY09/10 was in the end largely restricted to the sub-sample of stabilisation campaigns that were fought as counter-insurgencies (COIN) or as major counter-terrorist (CT) campaigns[5]. Apart from the obvious topicality of such a focus, this restriction was also a consequence of constraints imposed upon data collection activities and of the need to obtain a relatively large but homogeneous sample for analysis purposes.

TERMS AND DEFINITIONS

Throughout the research reported here, Force Density (FD) is defined as the Security Force size weighted by the size of the local civilian population. Force Ratio (FR) is defined as the Security Force size weighted by the Insurgent force size.

Military Security Forces are taken to be those permanent, organised, armed forces of a state whose primary purpose is to use force to advance that state's external national interests and to defend its territory. Paramilitary Security Forces are those permanent, organised, and armed forces whose primary purpose is to regulate behaviour and maintain order amongst the population within the state. Police personnel, conversely, are those permanent, unarmed[6] forces whose primary purpose is to regulate behaviour and maintain order amongst the population within the state. All other types of Security Force, including militia, homeguards, village patrol forces, citizens' vigilance committees, mercenaries and private military contractors, were grouped into a single holding category of "other" Security Forces for the purpose of analysis.

For the purposes of this study, Security Forces were classified as being either internally- or externally- raised, dependent upon whether or not the personnel of those forces would have grown up living amongst, or in close proximity to, the indigenous population of the state experiencing instability[7]. This categorisation allowed a distinction to be drawn between purely external colonial/imperial Security Forces in colonial stabilisation campaigns, and those Security Forces raised from amongst the colonial settler population, as well as the indigenous "native" population[8.]

CONCEPT OF ANALYSIS

For convenience, the conceptual CT/COIN model used in the previous Dstl analysis of CT/COIN campaigns (Hossak & Sivasankaran 2005) was used, adapted to provide

[4] It was assumed for simplicity in this study that disorder within a state could be taken to be synonymous with the existence of unauthorised lethal violence within that State.

[5] For the purposes of this study, these terms are defined as in Hossack (2004) for a fuller discussion of the terminology of "terrorism", "insurgency" etc, see Hossack & Sivasankaran (2005).

[6] In the sense of not generally possessing any heavier, crew-fired or indirect-fire weapons. Personal firearms, up to the level of rifles etc, are not sufficient to indicate an "armed" force in this context.

[7] The broad rule-of-thumb used here for classification purposes was whether the Security Forces possessed sufficient linguistic and cultural familiarity with the indigenous population of the state experiencing instability so as to be able to accurately "read" the "mood on the street" by correctly identifying abnormal behaviour, atmosphere amongst said population etc.

[8] So the European colonial settler/planter communities in Kenya and Rhodesia, for example, would be regarded as Internal Security Forces for the purposes of this study.

a conceptual model of generic stabilisation campaigns (Figure 1). The expanded stabilisation model includes an explicit WHITE entity representing the population of the Area of Conflict[9] (AOC) being stabilised and the RED Entity is taken to represent the principal cause of, lethal, violence within the BLUE State[10]. The BLUE and GREEN entities within the generic stabilisation campaign represent the internal state executive and the internal and external state Security Forces respectively.

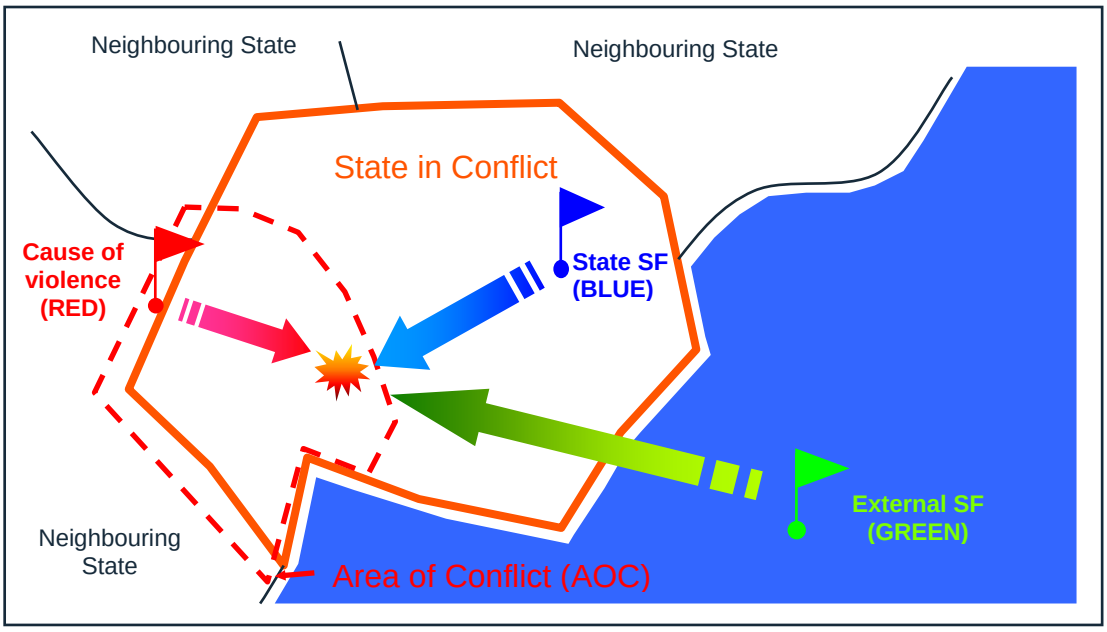

Figure 1: Conceptual Campaign Model

It was assumed in the study, as a simplifying analytical assumption, that campaign success in imposing or restoring governance to a state could be taken to be equivalent to the acquisition by the state of an effective monopoly of lethal violence throughout its territory. This assumption allowed the existing CT/COIN campaign "military success" variable to be re-used in this study as the measure representing stabilisation campaign success. Military/stabilisation success by this definition is assumed to be a zero-sum system with military success for the Security Forces being matched by insurgent failure and vice-versa. However, an intermediate "drawn" outcome state was allowed for campaigns where both combatants still possessed some effective capacity for violence at the end of the campaign.

The principal analyses were undertaken using aggregated totals of Security Force numbers only, making no attempt to differentiate between any classes of Security Force. Subsidiary analyses were then undertaken to determine whether different types of security forces are more effective than others and whether indigenous forces have greater or lesser effectiveness in fighting stabilisation campaigns.

[9] Previously, if less elegantly, referred to as the Area of Conflict Location (ACL).
[10] Thus, in the extension of the conceptual model to humanitarian relief or peacekeeping operations, the RED entity could theoretically be a null entity; for internal security or law-and-order scenarios, might be the AOC population itself or an organised crime syndicate; and in cases of invasion by a third-party external state, could even be a State, as opposed to Non-State, Actor.

DATA COLLECTION AND CODING

To minimise the potentially laborious and expensive data collection requirements for this study, the data analysed was collated as much as possible from existing datasets including a version of the US Army's Analysis of Counter-Insurgency Database (ACID)[11]. Campaigns to be included were reviewed on a case by case basis, and any necessary recoding completed before entry into the new dataset.

By the end of the study, information had been collected for 58 historical, mostly CT/COIN, campaigns from 1919 onwards (Table 1). Each campaign is coded as a single entity, with equal weighting given to all campaign phases. This approach applies an artificial homogeneity to the campaigns, which may obscure the importance of context-specific factors, which may be non-military.

Start Date	Campaign Identification	Start Date	Campaign Identification
1919	The Irish War of Independence	1968	Red Army Faction
1920	The Great Iraqi Revolution	1968	Tupemaru Insurgency
1941	Axis Occupation of Yugoslavia	1969	The Troubles in Northern Ireland
1944	Lithuanian Anti-Soviet Resistance	1972	Rhodisian Civil War
1944	The Jewish Insurgency in Palestine	1974	Sandinistas
1944	Ukrainian Independence Movement	1975	Angolan Civil War
1946	Greek Civil War	1975	East Timorese Independence Struggle
1946	Huk Rebellion	1976	Aceh Conflict
1946	Indonesian Independence Struggle	1976	Mozambique Civil War
1948	The Malayan Emergency	1977	Egyptian Fundementalism
1950	Puerto Rican Nationalist Uprising	1978	Vietnamese Intervention in Cambodia
1952	Mau Mau Rising	1979	Soviet "Occupation" of Afganistan
1954	The Algerian War of Independence	1979	Polisario
1955	The Cyprus Emergency	1980	El Salvador Civil War
1956	26 July Movement	1980	The Shining Path Insurgency
1958	Tibetan Revolt	1981	The Nicaraguan "Contras" Campaign
1960	Thai Communist Insurgency	1983	The Tamil Insurgency
1961	Katanga	1984	PKK Kurdish Rebellion
1963	FLQ Terrorism in Quebec	1987	First Intifada
1963	Guinea-Bissauan War of Independence	1991	UN Peacekeeping in Cambodia
1963	Aden Emergency	1992	Algerian Islamic Insurgency
1963	Borneo	1992	UN/US in Somalia
1964	Colombian Civil War	1993	Rwanda
1964	Struggle for Mozambique Independence	1994	Chechnya 1
1965	Namibian War of Independence	1996	Maoist Insurgency in Nepal
1965	Vietnam 1965-1973	1997	Peacekeeping in Sierra Leone
1965	Chad Civil War	1999	2nd Chechen War
1966	Guevara Guerilla Campaign	2000	Second Intifada
1967	Cabanas	2004	Burundi 04-05

Table 1: Campaigns considered in this analysis

Numerical data was collected for the median annual force size of the internal and external Security Forces used in each campaign, broken down by type, as well as for

[11] Version 16.

the insurgent opposition and for the population within the conflict area. Unfortunately, in many cases, lack of data availability led to such "median" force sizes being estimated from a single numerical point-estimate only. In addition, it was also extremely difficult to obtain reliable estimates of the strength of police, paramilitary and other, especially citizen militia, types of Security Forces at all.

METHOD

Logistic regression analysis, ordinal and binary, was used to construct a series of models using different combinations of the logarithms of Force Ratio, Force Density, and Insurgent Density (ID). Ordinal logistic regression was employed initially, assuming a natural ordering from (Security Force) Failure, through Partial Success (i.e. Draws), to Success. However, following assessment of a parallel US study into force-sizing metrics, discussed below, this analysis was subsequently expanded to include binary logistic regression analyses of Lose/Not-Lose and of Won/Not-Won. These being. failure vs. either partial success or success and success vs. either partial success or success, respectively.

The logistic regression analyses of overall, that is, total Security Force sizes were undertaken in Minitab, using standard regression modules. However, when separate relative-effectiveness weights were introduced for the different types, or origins, of Security Force component, a complication arose since Minitab only regresses models expressed as linear combinations of model factors, albeit possibly transformed and/or combined. Unfortunately, the logarithm of a linear combination of model factors, the problem faced [1], cannot be formally expressed as any linear combination of the logarithms of these factors, the software-optimisable form of logistic regression [2].

$$Logit\left(\Pr\left(Success\right)\right) \cong Ln\left\{\sum_i \alpha_i FR_i\right\} \cong Ln\left\{\left(\sum_i \alpha_i SF_i\right) \Big/ RED\right\} \qquad [1]$$

$$Logit\left(\Pr\left(Success\right)\right) \cong \sum_i \alpha_i \left\{Ln\left(FR_i\right)\right\} \qquad [2]$$

Two approaches were attempted to address this analytical problem. At first, attempts were made to derive the mathematical Log-Likelihood function for the desirable regression analysis form, [1] above, by generalising the known Log-Likelihood function of a binary logistic regression model. However, attempts to then optimise over this function during the first tranche of analysis, either by genetic algorithm, or using simple spreadsheet-based numerical optimisation, consistently led to implausible behaviour of the optimisation. Consequently, during the second tranche of analysis, the formally incorrect specification of the regression problem, [2] above, was used despite its poor fit to the nature of the problem being studied as an acceptable first-order analytical simplifying approximation.

This analysis was undertaken in two separate blocks of work, driven by a requirement to provide advice to the planning of a NATO exercise. The initial block of work was therefore undertaken in August 2009 and was limited to a review of Quinlivan's FD

rule-of-thumb for a preliminary data sample of 41 mostly COIN campaigns only. Preliminary work was also undertaken at this time to investigate the relative importance of internal vs. external Security Forces and of different types of Security Force. The second block of work was undertaken in February 2010 on the larger dataset of 58 campaigns and was originally intended to extend both the number of campaigns used and to the number of data fields considered per campaign. In the event, however, this second block was largely superseded by the investigation of, and liaison over the somewhat conflicting results apparently produced by a US force-sizing study that ran independently from and in parallel to the Dstl study reported here.

STUDY RESULTS

FORCE DENSITY AND FORCE RATIO VS. OUTCOME

Logistic regression analysis of the 58 mostly COIN campaigns researched for this study indicates that there has been a statistically significant relationship between FR and the probability of stabilisation campaign success (Pr(Success)) at 90% confidence (Figure 2). Allowing for the inherent problems in accurate estimation of insurgent strength even in historical campaigns, this is a reasonable result. No evidence has been found to suggest a significant relationship between FD and Pr(Success) on any outcome coding choice (Figure 3).

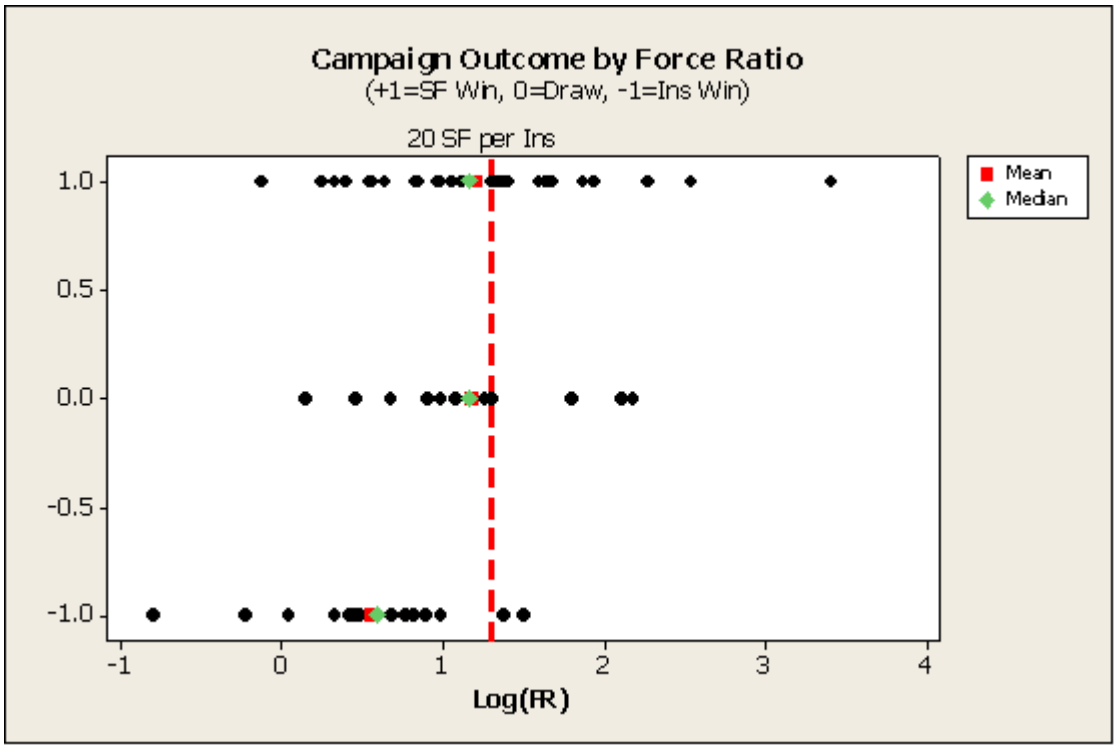

Figure 2: Campaign Outcome by Force Ratio

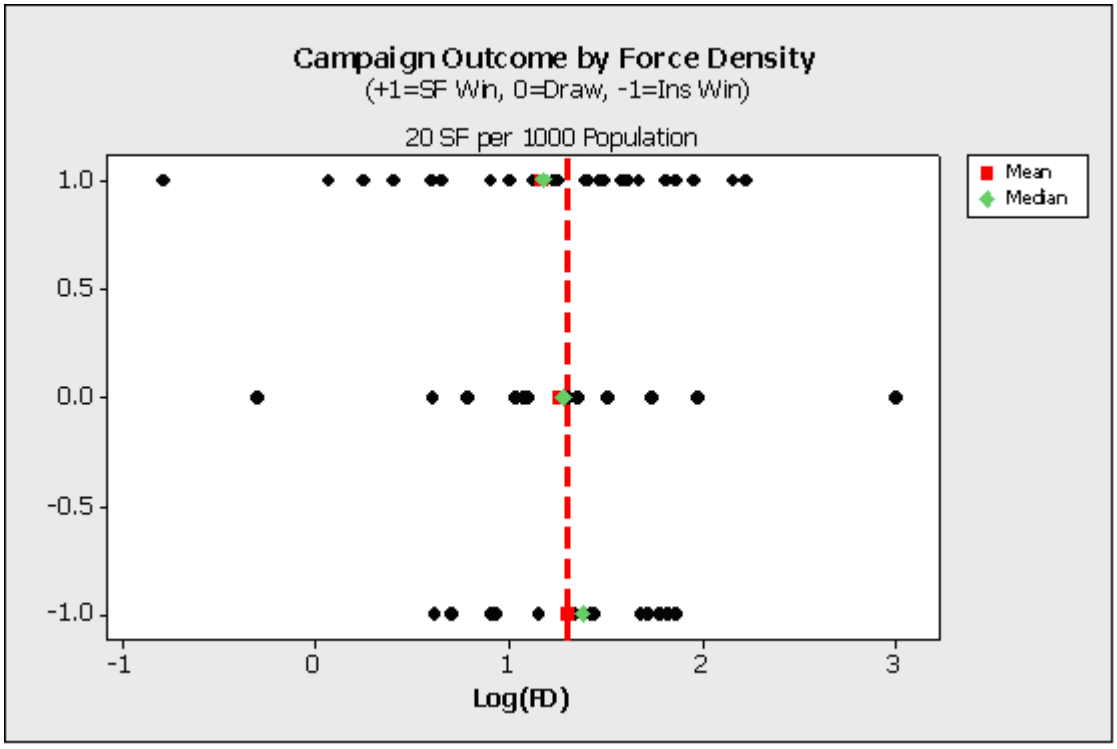

Figure 3: Campaign Outcome by Force Density

FR is positively associated with an increased Pr(Success) under all groupings of outcome state considered. A tenfold increase in FR is estimated to improve the odds of campaign success x2.8 times on average, a value that is comparable with the estimate found in the earlier CT/COIN research (Hossack 2007). However, when campaign outcomes are grouped into binary Win/Not-Win and Lose/Not-Lose pairings, the odds of Not-Losing increase by x5.6 times with each tenfold increase in FR, whereas the odds of Winning only increase by x2.1 times.

In isolation, this result might seem to suggest that the Quinlivan "force-density"-based rule-of-thumb should be discarded in favour of a "force-ratio"-based rule instead. However, following discussions with both Stakeholders and US agencies, it is now recognised that practical objections exist to such a move, because of the difficulty of obtaining data relating to insurgent strength in ongoing campaigns.

EFFECTIVENESS OF DIFFERENT TYPES OF SECURITY FORCES

Preliminary regression analysis currently provides no reason to suppose that different types of Security Forces are more effective than others in stabilisation campaigns. This may be a result of the way forces have been grouped together (Military with Paramilitary and Police with Other) and merits further investigation.

EFFECTIVENESS OF INTERNAL VS. EXTERNAL SECURITY FORCES

Preliminary analysis suggests that a statistically significant positive relationship exists between Pr(Success) and the force ratio of internal Security Forces to insurgents, but that there is no significant relationship with the force ratio of external Security Forces to insurgents. Conversely, the same preliminary analysis also suggests that a statistically significant negative relationship exists between Pr(Success) and the force

density of external Security Forces within the conflict area, but that there is no significant relationship with the force density of internal Security Forces within the conflict area. The meaning of this confused and contradictory pattern of association is currently unclear and requires further investigation.

EFFECT OF INSURGENT DENSITY ON OUTCOME

When a two-factor binary logistic regression of Lose/Not-Lose outcomes was undertaken using both FD and ID as simultaneous independent model parameters, a, marginally, statistically significant relationship was found between each such factor and the probability of Not-Losing a campaign.

Under this model each tenfold increase in FD increases the odds of Not-Losing x3.8 times and each tenfold increase in ID increases the odds of Losing by x5.9 times. No attempt has been made to date to determine whether these two factors are entirely independent of, or interact with, each other and no evidence was found to suggest the existence of any statistically significant relationships with these factors on either the probabilities of Winning (as opposed to Not-Winning) or of Failure vs. Partial Success vs. Success considered as a continuum of outcomes.

Similarly, when a two-factor binary logistic regression of Lose/Not-Lose outcomes was undertaken using FR and ID as the model parameters a, marginally, statistically significant correlation with the probability of Not-Losing a campaign was found for FR, but not for ID. As before, each tenfold increase in FR increases the odds of not-losing x3.8 times in this model, no attempt has been made to date to determine whether the FR and ID factors interact with, each other and no evidence was found to suggest the existence of any statistically significant relationships with either factor on either the probabilities of Winning (as opposed to Not-Winning) or of Failure vs. Partial Success vs. Success considered as a continuum of outcomes.

Taken together, these results suggest that insurgent strength does have some significant effect upon Security Forces' chances of Not-Losing a CT/COIN campaign. Where the proportionate size of a Security Force deployment is expressed relative to the size of the population being contested in the insurgency campaign, the measure that encodes information about the scale of the opposition to this campaign, the insurgent density factor, is statistically significant and of greater magnitude than the Security Force scale factor (FD). However, where this information is encoded directly into the Security Force scale factor, i.e. as FR, this same opposition scaling factor, insurgent density, loses its significance as a predictor of probability of military campaign failure.

PARALLEL WORK UNDERTAKEN IN THE US

In late 2008 the Cost Analysis and Programme Evaluation Directorate of the US DoD's Office of the Secretary of Defense (OSD CAPE) commissioned a study on force-sizing rules-of-thumb for COIN campaigns. This was undertaken as part of the Quadrennial Defense Review and was intended to estimate the cumulative force-sizing demands of future stability operations. The study was contracted to The Institute for Defense Analyses (IDA), and although they liaised with Dstl in April 2009, their study was otherwise conducted independently of the UK research. IDA's

study results serendipitously were reported concurrently with Dstl's interim findings. IDA's results are at variance with both Dstl's interim findings produced in September 2009 and the final results reported here. Specifically, IDA's analysis of 41 COIN campaigns finds a statistically significant positive correlation between force density and the probability of Not-Losing a campaign..IDA did not test for the significance of outcome probability with force ratio, and did not find any statistically significant correlations between force density and either the probabilities of Winning, or of Failure vs. Partial Success vs. Success considered as a continuum of outcomes.

In order to understand these differing results, Dstl and IDA participated in a "Force-Sizing Workshop" sponsored by OSD CAPE in December 2009. From this workshop, and from subsequent one-to-one discussions between Dstl and IDA analysts, it is assessed that the principal source of disagreement between the two studies are due to:

- Subtle differences in choices of how and when within a campaign "success" should be assessed, particularly as regards whether or not simply containing without defeating an insurgency should be viewed as military "success" or not.

- Differences in the level of resolution of estimates of the size of the civilian population being contested within an area of conflict

Several pertinent US observations about the general problem of force-sizing were also made during the course of this workshop as follows:

- In current COIN operations the concern of the military component of the COIN effort is solely with the establishment of sufficient stability with the conflict area to allow a political solution to the campaign to be reached (or not).

- The US military COIN community prefers to use force density as the measure of Security Force size on the philosophical grounds that this is more appropriate to the current population-centred nature of US COIN doctrine (FM3-24)

- The US military COIN community also believes that force ratio has no value in any operational COIN force-size estimation tool since it is regarded as being practically impossible to accurately estimate insurgent strength for any ongoing, real-world CT/COIN campaign.

IDA has stated to Dstl that *"Statistical significance of force density depends on use of both IDA outcome codings and population figures."* (Adesnik 2009) A limited analysis was therefore conducted by Dstl seems to confirm this statement, and explores the robustness of both studies results. This was undertaken on a comparison dataset of 29 campaigns common to both studies. This sub-sample can be regarded as a representative sub-sample of the overall Dstl sample, with neither Student t-tests nor Levene's tests showing any statistically significant difference between the means or variances of the logarithms of force density, force ratio and insurgent density

variables between Dstl overall sample and comparison sub-sample[12]. However, it is noticeable that not all of the full-sample patterns of association of either master sample are entirely replicated within the comparison dataset (Table 3).

Straightforward comparison of the data used in the two studies shows that the estimates of Security Force size used by each are in relatively good agreement, with a Pearson correlation coefficient (R^2) of 0.95. Unsurprisingly, there is considerably less agreement between the estimates of insurgent force size used in each study, with a Pearson correlation coefficient of 0.47. This reflects the known difficulties in determining whom to count as insurgents, even for historical campaigns assessed after the fact, as well as differences in how representative single-point estimates of "size" are calculated across long-running, highly dynamic COIN campaigns[13].

There is a relatively good correlation between the estimates of population within the area of conflict for the two datasets, Pearson correlation coefficient 0.82, although IDA's estimates are generally lower than are Dstl's. There are two reasons for this:

- In several cases for which IDA has estimated the area of conflict as being sub-national, Dstl has defaulted to a country-wide area of conflict where a more detailed breakdown of the campaign was unavailable within the limited research budget allocated for each campaign in this study.

- In a number of cases, IDA have applied an additional sectional, such as ethnic or religious, filter to their estimates of the population being contested by Security Forces and insurgents in addition to the geographic filter of the area of conflict[14].

There is a greater disagreement between each studies' assessment of the degree of success or otherwise achieved by the Security Forces in any given campaign (Table 2). IDA assessed the success of ten campaigns differently to Dstl, when using comparable three-point categorisation schemas in both cases, with six of these campaign assessments being more favourable to the Security Forces than were the Dstl assessments. These disagreements in campaign outcome are largely due to different choices between studies as to when each COIN campaign ended and different choices between studies as to when and how to evaluate campaign outcome.

[12] Unfortunately, Dstl did not have access to a copy of IDA's full dataset and so could not confirm the homogeneity of the comparison dataset to their overall sample. IDA's dataset is based upon v18 of the ACID dataset, subsequently modified and, in some cases, re-coded, by IDA following further case-specific research.

[13] For example, Dstl has chosen to use estimates of "median" Security Force and insurgent size in its studies; IDA (following the ACID database) has preferred to use "peak" estimates instead.

[14] For example, in the case of the Malayan Emergency, IDA has only considered the ethnic Chinese sub-population of Malaya in their estimates of force density, not the overall population of Malaya.

29 campaigns common to both datasets		Dstl Outcome Assessment		
		L	D	W
IDA Outcome Assessment	L	7	1	1
	D	2	4	2
	W	0	4	8

Table 2: Comparison of Outcome Assessments. Shaded cells indicate where IDA's assessment is more favourable to the Security Forces than Dstl's

Specifically, the Dstl study, by reusing the military success variable from the earlier CT/COIN research programme (Hossack & Sivasankaran, 2005), implicitly assessed campaign outcome for the State and its Security Forces, at the grand-strategic level, at or immediately after the end of the campaign. Conversely, IDA assessed military COIN "success" as being the avoidance of military defeat at the operational level during the campaign by the Security Force alone, taking the view that the concern of the military contribution to CT/COIN is only with the creation of a sufficiently "stable" environment within the conflict area so as to allow a political solution to the overall insurgency to be implemented.

Consequently, in a few key cases[15], historical CT/COIN campaigns that were relatively successful in containing or suppressing insurgent violence militarily during the campaign but where the insurgents still ended up in control of the state at or after the end of the campaign were classified as being *Partial Successes* for the Security Forces by IDA and as Security Force *Failure* by Dstl[16.] These coding disagreements were then further exaggerated when campaign outcomes were simplified into Lost/Not-Lost cases, which created diametrically opposed outcome assessments between the two study datasets for these key campaigns.

An idea of the relative importance of these several causes of disagreement between the two studies can be gained from Table 3 below. These show that, for the 29-campaign comparison dataset for which data from both studies was available:

- Neither the force density nor force ratio measures of Security Force size achieve statistical significance when Dstl assessments of outcome are used:

[15] These key cases are understood to include the Portuguese COIN campaigns in Mozambique and Angola in the 1960s-1970s, where the Portuguese security forces had succeeded by the latter stages of both campaigns in suppressing or containing insurgent activity with the colonies in question, but without eliminating either insurgent force. In both cases, these forces subsequently gained control of the contested territory following Portuguese withdraw in the aftermath of the 1974 "Carnation Revolution". The ambiguity in assessing the outcome of these campaigns for the security forces lies in the choice of when to assess the outcome, and in whether to consider the Carnation Revolution itself as being exogenous to, or at least partially arising out of, the several COIN campaigns that Portugal was fighting simultaneously.

[16] This difference of perspective can be thought of as arising out of the conceptual ambiguity being the concept of stabilisation as a process undertaken during a campaign vs. stability as a state achieved (or not) at the end of a campaign.

- The most statistically significant associations with controlled Security Force size occur when a distinction is made between campaigns that were military victories for the Security Forces as opposed to not-victories.

- Force density is only significantly associated with Pr(Success) when both IDA's outcome assessments and their population data are used;

- Force ratio is significantly associated with probability of campaign success for most combinations of Dstl and IDA Security Force and insurgent size when IDA's outcome assessments are used.

These results together suggest that force ratio estimates of Security Force size are more robustly useful predictors of COIN campaign outcome than are force density measures, at least for historical campaigns where some reasonable attempt can be made to estimate insurgent strength with the benefit of hindsight. Force density measures are less robust and are sensitive to both outcome coding assessments and civilian population estimation methods, whereas force ratio measures are sensitive only to the former.

	Force Density Measure				
Outcome Coding		Dstl SF Data Dstl POP Data	IDA SF Data IDA POP Data	Dstl SF Data IDA POP Data	IDA SF Data Dstl POP Data
	Dstl Values F vs P vs S	0.91	0.33	0.49	0.89
	Dstl Values [F+P] vs S	0.53	0.51	0.87	0.85
	Dstl Values F vs [P+S]	0.63	0.17	0.21	0.60
	IDA Values F vs P vs S	0.92	0.11	0.19	0.94
	IDA Values [F+P] vs S	0.61	0.04	0.06	0.61
	IDA Values F vs [P+S]	0.52	0.46	0.70	0.72
	Force Ratio Measure				
Outcome Coding		Dstl SF Data Dstl INS Data	IDA SF Data IDA INS Data	Dstl SF Data IDA INS Data	IDA SF Data Dstl INS Data
	Dstl Values F vs P vs S	0.38	0.18	0.35	0.34
	Dstl Values [F+P] vs S	0.95	0.23	0.55	0.66
	Dstl Values F vs [P+S]	0.11	0.13	0.20	0.13
	IDA Values F vs P vs S	0.04	0.02	0.04	0.05
	IDA Values [F+P] vs S	0.10	0.02	0.04	0.13
	IDA Values F vs [P+S]	0.08	0.05	0.14	0.07
SF = Security Forces; INS = Insurgents; POP = Civilian Population					

Table 3: P values for single variable ordinal and binary logistic regression

ANALYSIS OF CURRENT OPERATIONS IN AFGHANISTAN

CAVEAT

As stated in the introduction, this section provides some work in progress indications of the implications of the analysis for current Operations in Afghanistan. However, it is based only on available open source data and takes no account of context specific factors which may have wider reaching implications than the research presented here. As such it should not, at this stage, be taken as providing firm results.

QUANTIFICATION OF THE AFGHAN CAMPAIGN

As of March 2010, 44 nations have contributed troops to the International Security Assistance Force (ISAF) in Afghanistan, 32 of these nations have made contributions of more than 50 troops. The total number of international Security Forces in Afghanistan is c. 116,000[17] (Livingston, 2010), the majority of these being American (66%), with the UK providing the next most substantial contribution (of c. 10,000 troops, 9%) and with nine other nations[18] contributing over a thousand troops each. Figure 4 below shows that although the foreign troop presence (OEF and ISAF) in Afghanistan has increased since 2001, the indigenous contribution to the total Security Force (ANA and ANP) has built rapidly and extensively since 2003.

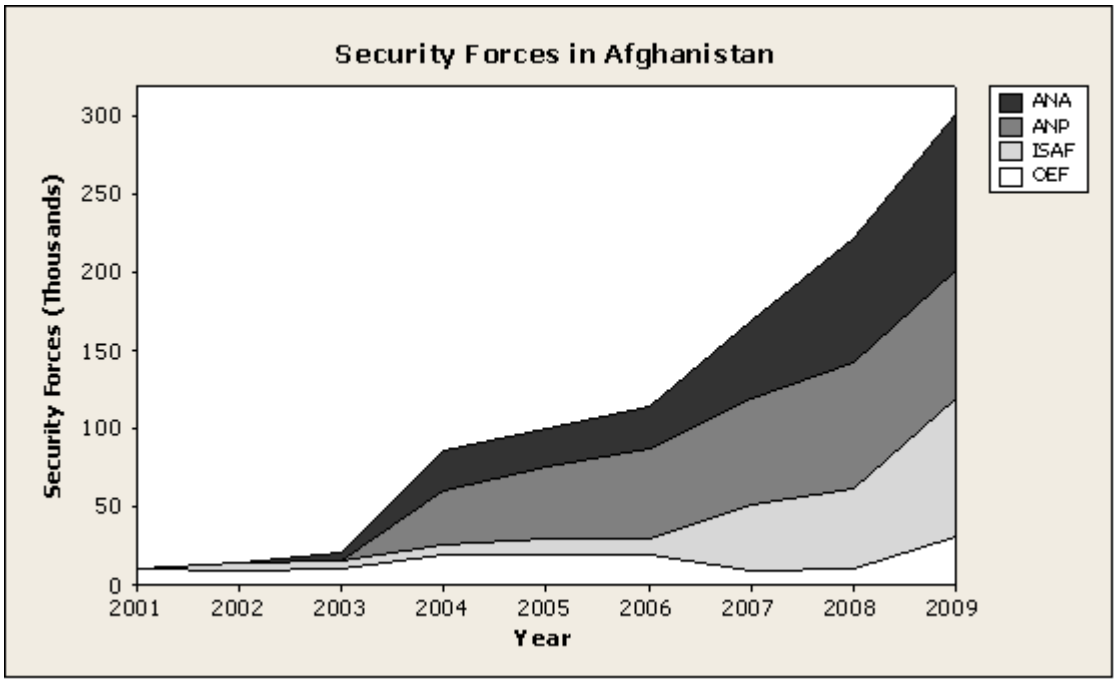

Figure 4: Security Forces in Afghanistan 2001 - 2009

The ANSF can be though of as comprising three separate services as indicated in Table 4 (Livingston 2010). It can be seen that by October 2009 the *notional* overall strength of these forces was approx. twice the size of ISAF. The Afghan National

[17] Approx. 86,000 ISAF plus approx. 30,000 Operation Enduring Freedom (mostly American.)
[18] Australia (1550), Canada (2830), France (3750), Germany (4335), Italy (3160), The Netherlands (1880), Poland (2140), Spain (1075), and Turkey (1835). (Livingston, 2010)

Army (ANA) is generally held to be more effective and less corrupt that the Afghan National Police (ANP), but no single metric exists for judging this analytically (Cordesman, 2009)[19].

Afghan National Security Forces Component	Estimated Strength as of Oct 2009
Afghan National Army (ANA)	100131
Afghan National Army Air Corps (ANAAC)	3628
Afghan National Police Service (ANP)	81020
TOTAL	**184779**

Table 4: Indigenous Afghan Security Forces strength as of September 2009

The size of the overall Insurgent threat in Afghanistan is almost impossible to quantify. Maj. Gen Mike Flynn, head of ISAF intelligence operations in Afghanistan, has estimated (Naylor, 2009) that there are anywhere between 19,000 and 27,000 insurgents operating in the region. Not included in this estimate are part-time fighters, bomb-makers, spotters, and general sympathisers. Also not included are foreign fighters operating both within Afghanistan itself, which Flynn estimates number *"less than a hundred"*, and from the Federally Administered Tribal Areas of Pakistan, estimated to be between 400-1500, but this number is thought to be growing.

The CIA World Factbook estimates the population of Afghanistan to be in the region of 28.4 million, of which around 34% are Pashtun. This has been significantly revised from a previous UN estimate of 31 million, a figure which was extrapolated from the last Afghan census held in 1979 but never completed due to the Soviet invasion. A new census is due to be carried out in 2010 (Burch, 2008).

FORCE MEASURES AND CAMPAIGN OUTCOME

FORCE RATIO AND OUTCOME PROBABILITY

As of March 2010, the whole-campaign force ratio in Afghanistan is estimated to be between 11.1 and 15.8. Using the Dstl binary Lost/Not-Lost model described above this gives an estimated probability of the Security Forces Not-Losing, that is Security Forces achieve Partial Success or Success, of 81-85%, depending upon which estimate of Insurgent strength is used (Figure 5).

[19] Figures are available for the Capability Milestones reached by individual police districts and the percentage of patrols which the ANA either participates or leads. (NATO 2009) Detailed investigation of the relevant weightings is beyond the scope of this analysis.

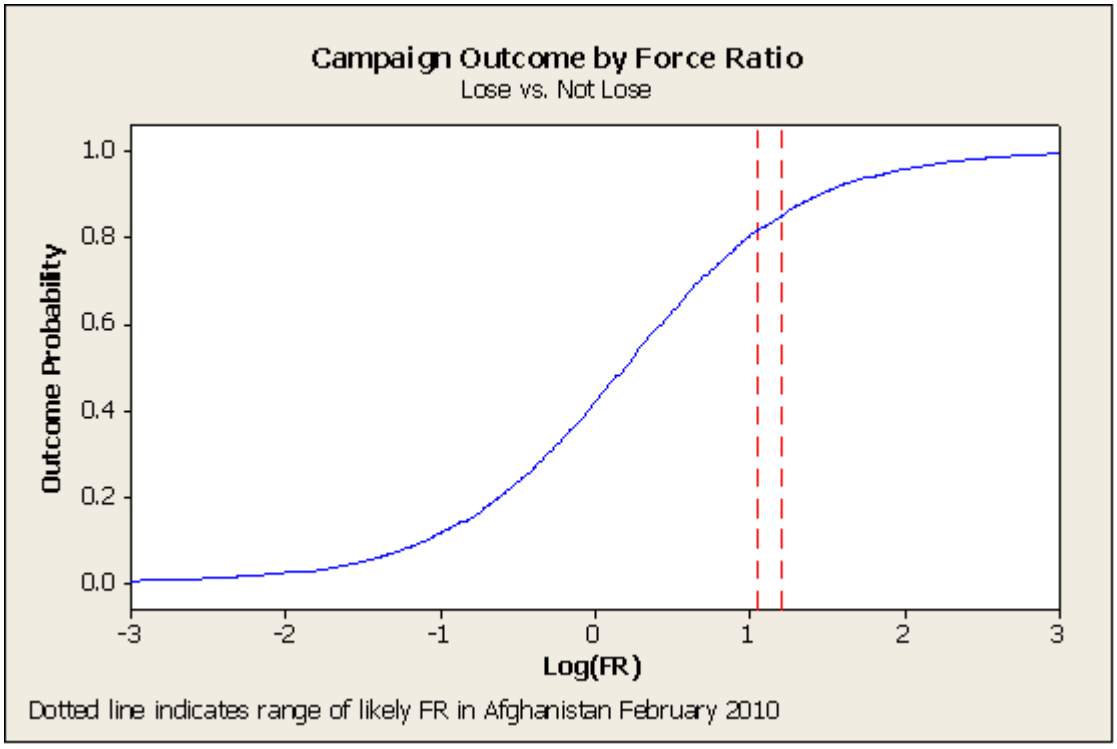

Figure 5: Campaign outcome by Force Ratio with indication of the current situation in Afghanistan.

FORCE DENSITY, INSURGENT DENSITY AND CAMPAIGN OUTCOME

As of March 2010, the whole-campaign force density in Afghanistan is estimated to be approx. 10.6. The whole-campaign insurgent density is estimated to be between 0.67 and 0.95. Using the Dstl two-factor binary Lost/Not-Lost model described previously this gives estimated probabilities of the Security Forces Not-Losing (i.e. Security Forces achieve *Partial Success* or *Success*) of 83-87%.

EFFECTIVENES OF ANSF AND OUTCOME PROBABILITY

As mentioned above, the operational effectiveness of the ANSF is somewhat unclear. The ANA currently participates in 90% of ISAF operations and leads 62% of joint operations. When judged against Capability Milestones (CM)[20], of 92 trained ANA units, 48% (44 of 92) are assessed in the highest category, capable of operating without ISAF support. Another 45% (42 of 92) are assessed in the second and third categories, capable of operating with ISAF support. Only 7% (6 of 92) of all ANA units are assessed in the lowest category, unable to operate even with ISAF support. (Radin, 2009)

[20] **CM4** Unit not capable of conducting operational missions, manning and equipping below 50%.
CM3 Unit capable of conducting operations at company level, manning and equipping between 50-70%.
CM2 Battalion capable of planning and executing operations, manning and equipping between 70-85%.
CM1 Battalion is *fully capable* of planning, executing and sustaining operations, manning and equipping are above 85%.

In June 2008, the United States Government Accountability Office (GAO) assessed the performance of the ANP (GAO, 2008). No Afghan police unit was found to be fully capable of performing its mission, over three-quarters (334 of 433) were thought to be at the lowest capability rating, and 16% of units (69 of 433) were either not formed or simply didn't respond. Equipment shortages and a difficult working environment, consistent problems with police pay and corruption have all contributed to the problems.

It is beyond the scope of this paper to present detailed analysis of the overall effectiveness of ANSF relative to ISAF; however it is clear that a one-to-one relationship is inadequate for any accurate calculation of Security Force strength in Afghanistan. For purely illustrative purposes, Table 5 shows the probability of the Security Forces Not-Losing in Afghanistan at three arbitrary levels of ANSF effectiveness.

ANSF Effectiveness (%)	RED = 19,000		RED = 27,000	
	FR Single	FD Multi	FR Single	FD Multi
100	85%	87%	82%	83%
50	81%	84%	77%	80%
0	74%	79%	68%	74%

Table 5: Probability of the Security Forces Not Losing in Afghanistan at arbitrary levels of ANSF effectiveness.

CONCLUSIONS

It has been shown, at least for historical cases where some estimate of insurgent strength can be made, that either force ratio, or force density and insurgent density together, provide more statistically significant and robust predictors of CT/COIN campaign outcome than does force density on its own.

It is reasonable to assume that these relationships will continue to hold for current CT/COIN campaigns, even if insurgent density and thus force ratio are not reliably assessable for these campaigns whilst ongoing. Consequently, these observations should be of interest, even if not of practical value, to operational planners and frontline operational analysts.

The utility of force density as a predictor of CT/COIN campaign outcome is highly sensitive to the assumptions made about what is meant by campaign success, when outcome is assessed and how the population control measure is calculated. The IDA force density rule-of-thumb represents the most analytically credible force-sizing rule of thumb currently available to operational planners and should be used by them where necessary, but only:

- For assessing the probability of avoiding military defeat by the insurgent opposition; and
- When calculated against the relevant ethnic, religious section of the population within the campaign area of conflict from which the insurgency is predominantly drawn.

There is currently no strong evidence to believe that police personnel have greater or less value than military personnel. There may be some difference in the value of indigenous and external Security Force personnel, but at present the nature of the differentiation is unclear and further work is required to clarify the situation.

Both force density and force ratio appear to be more statistically significant predictors of the "minimal" force levels necessary to avoid military defeat in CT/COIN campaigns, than they are of the probabilities of avoiding military stalemate and achieving strategic military campaign success. This is especially true of force density, which is only a statistically significant predictor of the probability of suffering or not suffering military defeat.

Moreover, changes in force ratio have a greater effect upon changes in the probability of suffering military defeat than they do upon the probability of achieving outright strategic campaign success. This suggests that the existing process model underlying the previous CT/COIN research (Hossack & Sivasankaran 2005, Hossack 2007), which assumes that military failure, military partial success and military success represent three regions on a single spectrum of campaign outcome, may be subtly flawed and that a better conceptual model might be one that considers a CT/COIN campaign to be a two-process system (Figure 6).

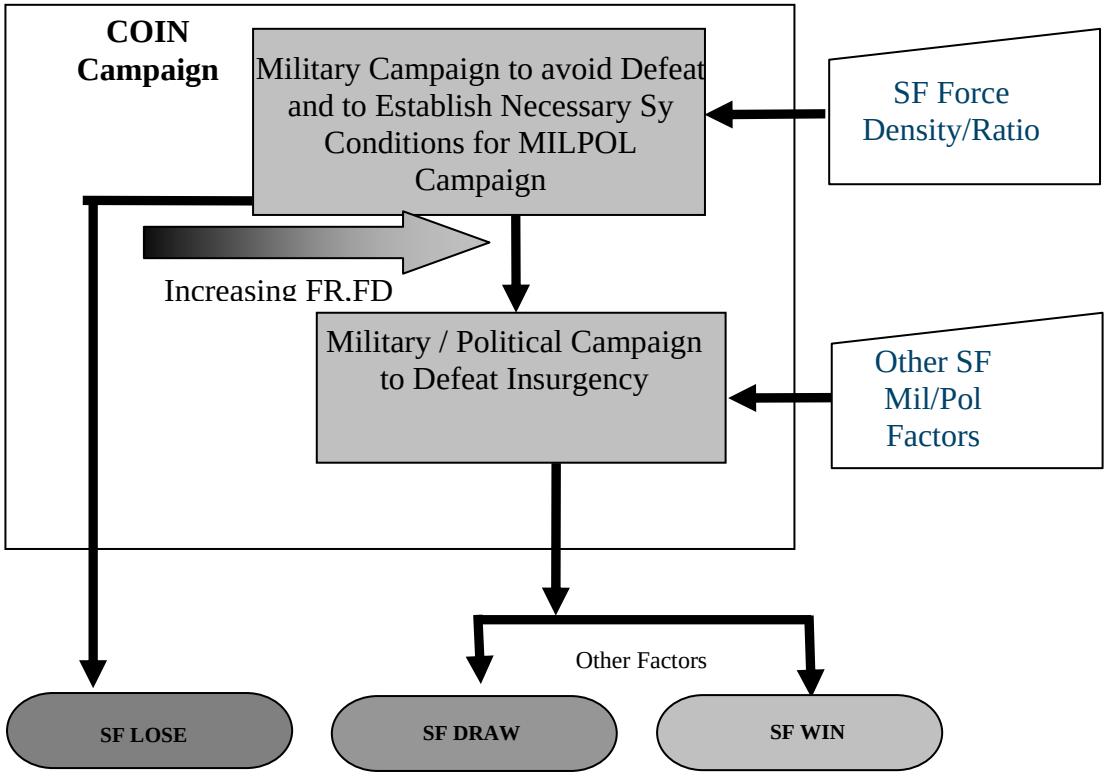

Figure 6: Conceptual model of a two-stage COIN campaign.

In this model a "military" campaign is fought which determines whether the state and its Security Forces are militarily defeated or not; Security Force density affects the probability of Not-Losing militarily. Then, as long as the state and its Security Forces continue to Not-Lose this military campaign, a "military-political" campaign is fought

alongside the military campaign to determine whether the eventual political outcome will include defeat of the insurgents or some form of negotiated compromise.[21]

A quick analysis was conducted to asses the probability of the Security Forces Not-Losing in Afghanistan, using the model as it currently stands and available data. This indicates that there is between 68 - 87% chance of the Security Forces Not-Losing the Afghan campaign[22], the mean chance of Not-Losing across all models is 79.5%. The wide spread is due largely to the uncertainty in the effectiveness of ANSF and of numbers of insurgents. Since the international component of the Security Force in Afghanistan is unlikely to increase much beyond the current level[23], active participation in stabilisation activities will be required by all elements of ANSF in order to maintain the security space required to move towards a successful outcome. It is stressed that this analysis has not considered context specific factors which may have wider-reaching implications for the Afghan campaign than the research presented here, and that these figures should therefore be taken as estimates only.

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[21] Whilst military forces presumably have a role to play in this "military-political" campaign as well as in the purely military campaign, they are one of only several factors that will determine the degree of concession that will eventually be made by both state and insurgency by the end of the campaign.

[22] It should be noted that this study has assessed Afghanistan as a whole at the grand strategic level. No consideration has been given to the heterogeneity of insurgent activity across the country or the variation in Security Force challenges between in individual provinces that result from this and the lower level tactical considerations required.

[23] Senior US officials have said that the total American force in Afghanistan will be around 100,000 by end 2010, substantial increase from other nations is unlikely. (Schmitt, 2009)

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