Statistical Analysis of Presence in Crisis Response Operations

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ABSTRACT

This is a sister paper to that by Richard Cousens entitled "The Doctrinal Implications of Presence in Crisis Response Operations." Both papers describe work originally done by *SCS* (Systems Consultants Services Limited, UK) under contract to NATO Consultation, Command and Control Agency (NC3A), Operations Research Division (ORD) during 2003/04. Crisis Response Operations (CRO), including Peace Enforcement, Peacekeeping Implementation, and Crisis Containment, represent an important new class of Mission Type, which tend to drive the numbers of forces required in defence planning calculations. The NC3A defence planning methodology involves the use of comprehensive Force Allocation Rules (FAR). The analysis described in this paper is concerned with comparing the outcomes of the FAR for various CRO Planning Situations (mission/country scenarios) with recent historical experience of NATO operations from SFOR and KFOR.

The paper describes an input analysis, in which derived actual force data for these operations is correlated with geographical data to give a near complete account of force deployments by area (comprising 209 validated force/geographical records – 80 for SFOR and 129 for KFOR). It then describes an output analysis, which focused on generating an enumeration and classification of incident types, for the same period (927 relevant incident reports – 400 for Bosnia, 527 for Kosovo). Based on these input and output analyses, the paper describes the formulation of a simple predictive model, which was then used to calculate the numbers of force units required for each of seven different Planning Situations, i.e. the force sizes that would be required if the experience of SFOR and KFOR were typical

of CRO. The calculated numbers of force units compared favourably with those generated by NC3A's own methodology, based on the FARs. The historical analysis described in the paper thus produced a level of assurance for NC3A's methodology.

INTRODUCTION

This is a sister paper to that by Richard Cousens entitled "The Doctrinal Implications of Presence in Crisis Response Operations". Both papers describe work originally done by *SCS* (Systems Consultants Services Limited, UK) under contract to NATO Consultation, Command and Control Agency (NC3A) Operations Research Division (ORD) during 2003/04.

NC3A ORD undertakes the scientific analysis on behalf of Allied Command Transformation (ACT), which supports the biennial Defence Requirements Review (DRR). The DRR examines a broadly assessed security situation affecting NATO in the medium term (8 to 10 years ahead) and establishes the number and type of forces required to meet agreed levels of threat or risk. This is initially expressed as force requirements satisfying approximately 20 different Planning Situations, representing a smaller number of typical Mission Types. However, not all Planning Situations would happen simultaneously, so a large number of small combinations of Planning Situations are considered in turn, in order to generate a minimum sized Force Pool – minimally sufficient to satisfy all of the combinations.

Within the analysis, Crisis Response Operations (CRO) represents an important new class of Mission Type, which tend to drive the numbers of forces required in the Pool. CRO include Peace Enforcement, Peacekeeping Implementation, and Crisis Containment. The analysis described in this paper focuses on CRO.

Within the DRR methodology, once the Missions have been decomposed into 'Key Tasks', it is necessary to assign (generic) force units to undertake these tasks. Several tasks may be satisfied by one force unit, e.g. if the same or a similar task is required to be undertaken sequentially or if different tasks overlap in space and time and a force unit could reasonably handle more than one of these tasks. At a detailed level of operational planning, such allocations are referred to as Troops-to-Task Rules. At this more aggregated level of defence planning, these allocations are referred to as Force Allocation Rules (FAR). The analysis described in this paper is concerned with comparing the outcomes of the FAR for various CRO missions with recent historical experience of NATO operations, from SFOR in Bosnia and KFOR in Kosovo.

KEY TASKS AND FAR

Within CRO missions, typified by Peace Enforcement and Peacekeeping Implementation, the group of Key Tasks, which drive the numbers (and to an extent the capabilities) of forces, are typically:

- Control of urban areas.

- Control of rural areas.

- Control of Zones of Separation and of border areas (countering infiltration, smuggling, etc).

The above is supplemented by forces (numbers and capabilities) needed to maintain:

- Force protection (within and away from garrisons).

- Security of entry points, movement routes and Lines of Communication

Each of the above tasks need to be further qualified by:

- Size/capability of local threats.

- Size/type of urban areas (e.g. population, area, etc).

- Size/type of rural areas (e.g. area, terrain type, boundaries, etc).

- Disposition of neighbouring governments – to the Mission and to the extent of control of their borders.

The above tasks all involve force *presence*, e.g. through patrolling, movement control, response to incidents, demonstration of deterrence, etc. CRO mission tasks do not include combat or warfighting, however the force numbers and capabilities in CRO need to be able to respond to, deter and if necessary defeat pockets of resistance. The doctrinal basis of force *presence* is discussed in detail in the sister paper by Richard Cousens entitled "The Doctrinal Implications of Presence in Crisis Response Operations".

The Force Allocation Rules (FAR) assigning force units (numbers and types/capabilities) to the Key Tasks, in NC3A's methodology, are quite aggregated – illustrative examples are:

- Initial force to control a town/city (up to 500,000 population) is 1 battalion of 'mechanised or light infantry.'

- Initial force to control a rural area (up to 10,000 sq. km.) is 1 battalion of 'light infantry with tactical mobility.'

AIM AND RATIONALE OF STUDY

The aim (and challenge) for this study was to compare these FAR with 'norms' obtained both from a study of doctrine and from an historical analysis of recent NATO CRO, with a view to either supporting the reasonableness of the FAR or to suggest how the FAR should be adjusted.

The sister paper by Richard Cousens, titled: "The Doctrinal Implications of Presence in Crisis Response Operations," explores comprehensively the notions of *presence* and *security* within NATO and national doctrine. The SFOR Mission includes a specific reference to

presence, implying that it is a means whereby tasks may be achieved. It is argued that presence is an input rather than an output of an operation, however it assumes successful outcomes. Security is closely related to presence and is arguably an outcome. From the doctrine study it was not possible to provide more specific evidence to support, or to suggest adjustments to, NC3A's FAR.

Turning to the recent NATO CRO, SFOR, and KFOR, ideally we would have undertaken an historical statistical analysis at the same level of resolution as the FAR. This might have been possible if very comprehensive and accurate data (at NATO UNCLASSIFIED level) were available from these operations. This proved not to be so.

Alternatively, we could generate an empirical predictive model, based on more aggregated data from the SFOR and KFOR operations, and use this model to test the force unit outcomes of the Planning Situations. In the event this approach was followed, owing to the limited extent of the data, the classification, timescale and resources of the study.

STATISTICAL ANALYSIS

SFOR (1997 – 2003), KFOR (1999 – 2003) and ISAF (2002 – current) provide three examples of successful contemporary NATO-led CRO. For SFOR and KFOR it was possible to obtain quantitative data, though this was a time-consuming process, also as the classification of any files must not exceed NATO UNCLASSIFIED. For ISAF, it was not possible to obtain quantitative data. Instead an interview was conducted with a former Commander ISAF.

INPUT DATA ANALYSIS

Input data analysis was performed on SFOR and KFOR data. The aim was to compile a validated data set, providing a reconstruction of SFOR and KFOR unit deployments, by time and location/operational area and then to relate this to corresponding geographic and demographic data.

In the event this proved a huge task. Firstly there was a problem in matching – the former data were based on individual national Battlegroup (BG), Multinational Division (MND) and Operation (SFOR, KFOR) categorizations, whereas the latter data were based on municipal areas (Opstinas). One set did not map precisely into the other. Secondly, the data availability across all of these categories was very patchy with some inconsistencies. The full reconstruction drew on ½ GB of accumulated shape files, briefings, Excel spreadsheets Word documents and images.

An example from the full input data set is given below (Table 1). For each Operation (in this case SFOR) it gives the Year, BG Name, MND, No of BG (usually 1), No of Coy (from this is possible to calculate No of troops/BG), Pop per BG, Area per BG, therefore the Pop Density per BG and the No of Incidents (obtained from the Output Data Analysis – see below). In all, there were 209 such validated records (80 for SFOR and 129 for KFOR).

This data set is a valuable resource in its own right. (Note – data shown below for Population, Area, and Density are rounded.)

SFOR	1997	Norwegian	N	2	6	597024	6070	98	15
SFOR	1997	Russian	N	2	6	165602	1537	108	11
SFOR	1997	Turkish	N	1	3	232478	979	237	2
SFOR	1997	US #1	N	1	4	193880	1727	112	10
SFOR	1997	US #2	N	2	6	528165	4591	115	35
SFOR	1997	French #1	SE	1	3	147417	2558	58	21
SFOR	1997	French #2	SE	1	4	63803	1744	37	10
SFOR	1997	Italian	SE	1	3	192772	375	514	12
SFOR	1997	Multi #1	SE	1	3	264992	2228	119	12
SFOR	1997	Portugal	SE	1	3	112540	2389	47	1
SFOR	1997	Spanish #1	SE	1	3	377342	4795	79	30
SFOR	1997	Spanish #2	SE	1	4	38590	2184	18	
SFOR	1997	Canadian	SW	1	4	245669	6073	40	14
SFOR	1997	Czech	SW	1	3	258084	2695	96	5
SFOR	1997	Dutch	SW	1	3	160593	2043	79	5
SFOR	1997	Moroccan	SW	1	3	74100	2628	28	1
SFOR	1997	UK #1	SW	1	3	327302	3945	83	11
SFOR	1997	UK #2	SW	1	4	118931	2570	46	8

Table 1: An example from the full input data set.

OUTPUT DATA ANALYSIS

Output data analysis was performed in parallel, using independent sources. The aim was to examine incidents by time, location, category/type and to relate these to a measured background 'level of insecurity'. These variables provide crude proxies for 'level of success' in the respective operations.

Both conflicts had been settled by peace agreements. In order to achieve consistency in data collection across the two operations, similar periods of (operational) time needed to be compared. It was decided to undertake data collection for four years from the initial period of deployment of multinational forces, thus for Bosnia 1 Jan 96 to 31 Dec 99 and for Kosovo 15 Jun 99 to 15 Jun 03.

A consistent (across both operations), comprehensive, unbiased and unclassified source for these data was required. After much research, broadcasts by Radio Free Europe/Radio Liberty (RFE/RL), which covered all of the Balkans, were used. These constituted pre-filtered reports by regional experts, comprising 1710 days of news for the respective four year periods. There were an average of 4.75 stories/day from which over 8000 news records were mined. Items not relating to the 'presence' of NATO forces were then disregarded, e.g. purely political activities, etc. In all there were 927 relevant incident reports for the period (400 for Bosnia and 527 for Kosovo). Each incident report was of the form presented in Table 2.

Date	Opstina	Place	Event
11.03.1996	Mostar Zapad	Mostar	An elderly Muslim woman is shot by a former Croatian soldier as he attempts to forcibly evict her from her apartment in Croat-controlled Mostar.

Table 2: An incident report. (Note – a sample correlation of RFE/RL news items with NATO briefings of the corresponding time-period was also undertaken – this demonstrated that the NATO reported incidents were adequately covered by the RFE/RL broadcasts.)

The incident 'event' was subsequently categorized by one of the ten Incident Categories used by the SFOR Incidents Database (e.g. Attack – see below) and further described by Type of Incident (e.g. Shooting). Finally research was undertaken into the literature of conflict resolution, to examine the relationship between tension levels and de-escalation of conflict, in post-war societies. From this research a simple categorization of 'insecurity level' of HIGH, MEDIUM and LOW was applied to the ten Incident Categories, mentioned.

Category/Type	Insecurity Level
Attack (all types)	HIGH
Movement of People (all types)	HIGH
Confrontation (Deaths/Physical)	HIGH
Criminal (Kidnapping)	HIGH
Transit Border (Armed Forces)	HIGH
Transit Border (Smuggle Arms/Men)	MEDIUM
Confrontation (Verbal/Voting)	MEDIUM
Demonstration (all types)	MEDIUM
Gathering (all types)	LOW
Violation (all types)	LOW
Smuggling (all types)	LOW
Threat (all types)	LOW
Criminal (Robbery/Counterfeit/Immigration/Narcotics)	LOW

Table 3: Categorization of 'events' by Insecurity Level.

Applying the Incident Event, Type and Insecurity Level to the example incident report produced the following (Table 4). All 927 incident reports were coded in this manner.

Date	Opstina	Place	Category	Type	Insecurity Level
11.03.1996	Mostar Zapad	Mostar	ATTACK	SHOOTING	HIGH

Table 4: Applying the Incident Event, Type and Insecurity Level to the example incident report.

Comparative analysis was then undertaken on these output data, over the respective 4-year periods (Bosnia 1 Jan 96 – 31 Dec 99, Kosovo 15 Jun 99 – 15 Jun 03). The main conclusions arising were:

- The number of incidents for Year 1 was considerably higher in Kosovo (331) than in Bosnia (199)
- For both Bosnia and Kosovo, the number of incidents decreased dramatically (by 90%) over the four year period.

- Of the incidents that continued to take place, a half or more were marked by a HIGH level of insecurity.

PREDICTIVE MODEL

The following description of the empirical predictive model and its use to test the force unit outcomes of the Planning Situations is written with the benefit of hindsight. At the point of completion of the input and output analyses, much exploratory statistical analysis was undertaken, using the input and output data sets described. Incident rates were positively correlated with BG (manoeuvre unit) deployments. This was to be expected. Many other correlations were sought but the data were too partial to generate a predictive model at BG or MDN level. By examining the data at the 'operational' (i.e. SFOR and KFOR) level, important factors were identified.

A key factor was population density. Kosovo's density ranged from 142 people per sq km in the first year to over 234 in the fifth, whereas Bosnia's density remained relatively stable at 80 people per sq km (actually dropping in the second year before beginning a very slow increase).

The incident rates (No per year) in Kosovo are also about 1/3rd higher than for Bosnia, however the rate of drop off (approx. 50% per year) is similar. If we define the first year of each operation as 'high risk', the third as 'medium risk' (25% of year one incidents) and the out years as 'low risk' then Tables 5, 6, and 7 are obtained. (Note the middle table is interpolated.)

Risk	Pop/Troops	Troops/BG
High	33.0	1621
Medium	56.4	1321
Low	101.9	1190

Table 5: High Density (KFOR) [Density range from 80 - 150 upwards, pop./sq. m].

Risk	Pop/Troops	Troops/BG
High	82.5	1549
Medium	116.0	1380
Low	224.1	1057

Table 6: Medium Density (Interpolated) [Assumed ranges from 50 - 80 to 80 - 150 pop./sq. m.].

Risk	Pop/Troops	Troops/BG
High	132.2	1476
Medium	175.5	1438
Low	346.3	923

Table 7: Low Density (SFOR) [Density ranges up to 50 - 80 people/sq. m.].

The model fitting now has two parts. Part one is a simple recalculation of the SFOR and KFOR data given the assumed factors above. These simply show the model application.

Year	Population	Area	Density	Risk	Calculated Troops	Actual Troops	Calculated BG	Actual BG
1	1550912	10887	142	High	46997	38100	29.4	29
3	2085271	10887	191	Med	37237	31400	28.6	28
5	2548430	10887	234	Low	24985	25550	20.8	21

Table 8: Model Fit to SFOR Data.

Year	Population	Area	Density	Risk	Calculated Troops	Actual Troops	Calculated BG	Actual BG
1	4099283	51129	80	High	31055	31000	21.1	21
3	4037275	51129	79	Med	23070	23000	16.5	16
5	4104444	51129	81	Low	11897	18500	12.9	14

Table 9: Model Fit to KFOR Data.

Of more interest is the application of the model to the Planning Situation data provided by NC3A. The NC3A provided worked scenarios for seven different Planning Situations/ countries covering Peace Enforcement (PE) and Peacekeeping Implementation (PK) Missions. The equivalent input data for these countries, including population and area data was taken from the CIA World Factbook. Several adjustments to these data needed to be made to align with NC3A assumptions used in their Planning Situations.

The predictive model based on the tables above was then applied to the NC3A Planning Situation data. Results are given below. The key comparison is between the numbers of BG calculated by the model, compared to the numbers of BG calculated by NC3A's Force Allocation Rules (FAR). The comparison is acceptably close in all scenarios, except for 'Island', which produces an anomaly. This is discussed further below. (Note country names have been generalised.)

Country	Mission	Pop Density	Assumed Risk	Calculated Troops	Calculated BG	NC3A BG
Africa 1	PE	Med	High	61808	40	55
Africa 2	PK	Low	Low	31090	34	31
Africa 3	PK	Low	Low	38005	41	32
Balkans 1	PE	Med	Med	34388	25	29
Caucasus	PE	Low	High	59234	40	39
Island	PK	Med	Low	110534	48**	16
Balkans 2	PE	Med	Med	30881	22	27

Table 10: Model Fit to NC3A Scenario Data.

The apparent anomaly of 'Island' illustrates the limit of our predictive model, which is based on data from two Balkans countries/operations. A contributing cause of the anomaly is the 'Medium' population density for 'Island' with the implied assumption that all of the population are 'involved'. This drives up the Calculated BG. The Planning Situation assumes that much of the population is quiescent, with a corresponding low rate of incidents. Therefore it could be argued that the appropriate population density parameter (for the purposes of the use of predictive model) should be 'Low' or 'Very Low.' This would reduce the anomaly but not eliminate it.

RESULTS DISCUSSION

The simple empirical model described above appears to be effective in predicting the number of manoeuvre BG required in a Peace Support Operation. Across the seven Planning Situations it produced broadly the same results as did the detailed FAR used by NC3A, with one notable exception. This result is important as it provides a level of assurance for the NC3A methodology.

As with the use of any norms, the model needs to be applied with care. Significant variations from the conditions that resulted in the development of this model could result in the predictions that are inappropriate. The anomalous 'Island' scenario illustrates this point.

CONCLUSIONS

This study undertook an historical analysis of SFOR and KFOR operations, covering input and output analysis. The input analysis derived and correlated actual force data with geographical data to give a near complete account of the grossed up force deployments for given periods. The output analysis focused on generating a classification of incident types and rates and correlating these with force type, size and deployment. (Quantitative data for ISAF operations were not obtainable in the timeframe of this study.)

Based on the input and output analysis, a simple predictive model was created, which effectively replicates the workings of NC3A's FAR, in generating the required number of BG for a particular Planning Situation. The historical analysis thus produced a level of assurance for the NC3A methodology.

Finally, the validated input and output data sets are a valuable resource in their own right. The input data set comprises 209 validated force/geographical records (80 for SFOR and 129 for KFOR). The output data set comprises 927 relevant incident reports for the period (400 for Bosnia and 527 for Kosovo). These initial data sets invite more detailed data gathering and exploitation, e.g. in relating the number, type and severity of incidents more closely to the unit and sub-unit (e.g. battalion, company) operational areas over time. More precision and detailed data analysis may reveal deeper insights from these operations. This is likely to be important to NATO, as lessons identified from these operations are key to future Alliance success.

In terms of actual force units, the emphasis of the study has been on infantry/manoeuvre units, rather than specialised units, such as engineers, civil affairs (CIMIC), etc. Yet these specialist units, employed tactically, may have desirable outcomes out of proportion to their size. This was a point stressed by a previous Commander of ISAF. With targeted further data collection, generation and correlation, a further study could examine empirically some strongly believed cause and effect relationships in these areas.