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Center for Army Analysis

THE ARMY ROTATION RULE PROJECT

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13. ABSTRACT *(Maximum 200 Words)*

Since the fall of the Berlin Wall, Army participation in smaller-scale contingencies (SSC) has increased over 625 percent while Army force structure has decreased nearly 38 percent. These two factors have led to a substantial increase in the deployment tempo (DEPTEMPO) of units. Rotation rules provide a mechanism to manage DEPTEMPO by spreading the deployment load across the force. The project had four objectives: (1) determine the impact of alternative rotation rules on DEPTEMPO; (2) determine when current force structure fails to have sufficient forces to comply with alternative rotation rules; (3) determine the force structure requirements for alternative rotation rules; and (4) determine the impact of Reserve Component participation at alternative rotation rules. The project accomplished these objectives through the use of a discrete event simulation (Matching Army Requirements to Yearly Resources {MARTYR}) that applies Army force structure to a given force structure demand across time in accordance with stated rotation rules.

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THE ARMY ROTATION RULE PROJECT (TARRP)

SUMMARY

THE PROJECT PURPOSE was to provide analytical insight into what effect rotation rules have on force structure given operational requirements.

THE PROJECT SPONSORS were the Assistant Deputy Chief of Staff for Operations and Plans, Force Management Directorate (ADCSOPS, DAMO-FM), and the Assistant Deputy Chief of Staff for Operations and Plans, Operations Readiness and Mobilization Directorate (ADCSOPS, DAMO-OD).

THE PROJECT OBJECTIVES were to:

(1) Determine the impact of alternative rotation rules on unit deployment tempo (DEPTEMPO).

(2) Determine when current force structure fails to have sufficient forces to comply with alternative rotation rules.

(3) Determine the force structure requirements for alternative rotation rules.

(4) Determine the impact of Reserve Component (RC) participation at alternative rotation rules.

THE SCOPE OF THE PROJECT. TARRP measured the impact of various rotation rules across a 10-year period. Forces from all three components--the Active (AC), the National Guard (NG), and the US Army Reserve (USAR)--were available for deployment. Force structure was fixed over the 10-year period, utilizing the May 1999 Structure and Manpower Accounting System (SAMAS) database. Deterministic force structure demand came from the four recurring smaller-scale contingencies (SSCs) (Bosnia, Kosovo, Kuwait, and the Sinai), the three combined training centers (CTC), and the six major joint exercises (JEX) (RIMPAC, Balikatan, Cobra Gold, Foal Eagle, Roving Sands, and Bright Star). Stochastic force structure demand came from forecasts from the Stochastic Analysis of Deployment Excursions (SADE) model for nine SSC types (Domestic Support, Humanitarian Assistance, Intervention, Maritime, Noncombatant Evacuation Operations (NEO), No Fly Zone, Peace Operations, Show of Force, and Strike).

THE PRINCIPAL FINDINGS are that**:**

(1) The Army has insufficient force structure, as currently organized, to adhere to either the Rule of 3 or the Rule of 5 (rotation rules determine the rotation base required for an operation).

(2) Continuation of current practices in unit rotation will result in average deployment tempo (DEPTEMPO), measured in days away from home, levels ~ 41 percent for AC divisional units.

(3) Adherence to a Rule of 3 would reduce average AC divisional DEPTEMPO levels by ~ 12 percent, creating additional force structure requirements ranging from 98,000-120,000 soldiers.

(4) Adherence to a Rule of 5 would reduce average AC divisional DEPTEMPO levels by ~ 22 percent, creating additional force structure requirements ranging from 106,000-135,000 soldiers.

(5) The RC has insufficient force structure, as currently organized, to allow the AC to adhere to the Rule of 5 while maintaining current RC deployment policies.

THE PROJECT EFFORT was conducted by MAJ Robert Shearer, Force Strategy Division, and Mr. Barry Groves, Operations Support Division.

COMMENTS AND QUESTIONS may be sent to the Director, Center for Army Analysis, ATTN: CSCA-FS, 6001 Goethals Road, Suite 102, Fort Belvoir, VA 22060-5230.

CONTENTS

FIGURES

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1 METHODOLOGY

1.1 Background

In June 2000, the ADCSOPS (DAMO-FM) requested that the Center for Army Analysis (CAA) determine the impact of implementing rotation rules on the Army. He requested this work for the Army's Force Generation, Capability, and Structure (FGCS) Panel, in support of the 2001 Quadrennial Defense Review (QDR). Two motives existed behind the request. First, the request reflected a desire from the panel to determine ways to mitigate the high deployment tempo (DEPTEMPO) that many Army units were experiencing in the late 1990s and early 2000s. Second, as the United States Air Force had recently implemented a Rule of 5 policy, requiring a rotation base four times the size of the operating force, for their Air Expeditionary forces, the panel also desired a comparison between the Air Force's efforts and possible Army actions. The ADCSOPS (DAMO-OD) later requested excursions from the base work done for DAMO-FM to determine the impact of rotation rules on the Reserve Component. He requested this work for the Army's Readiness Panel, also in support of the 2001 Quadrennial Defense Review.

1.2 Timeline

MAJ Robert Shearer, Force Strategy Division, and Mr. Barry Groves, Operations Support Division, began work on TARRP I in June 2000 and completed the initial work in August 2000. The FGCS and Readiness Panels later requested several excursions from TARRP I. TARRP II began in September 2000 and ended in December 2000. TARRP III and TARRP IV both began in January 2001 and both ended in March 2001. The final excursion, TARRP V, began in March 2001 and ended in June 2001.

1.3 Purpose and Objectives

The purpose of the project was to provide analytical insight into what effect rotation rules have on current force structure given current operational requirements.

The study began with four broad objectives. These objectives were met with different approaches in accordance with the requirements of the different excursions. The four objectives included:

(1) Determine the impact of alternative rotation rules on DEPTEMPO (measured as the number of days a unit is away from home).

(2) Determine when the current force structure fails to have sufficient forces to comply with alternative rotation rules.

(3) Determine the force structure requirements for meeting alternative rotation rules.

(4) Determine the impact of Reserve Component participation in alternative rotation rules.

1.4 Key Definitions

Rule of X: a rotation rule that dictates that X units are committed to support a given operation (e.g., Rule of 3 dictates that three units are committed to each operation--one training for the operation, one deployed to the operation, and one recovering from the operation). Rule of X equates to a (X-1):1 ratio (e.g., Rule of 3 equates to a 2:1 ratio). Although this term is commonly used, it does not accurately describe how the Army rotates units through deployments.

Inter-rotation time (IRT): the minimum time a unit is fenced (made unavailable in order to provide time for recovery) from future deployments after returning from a deployment. This term describes how the application of a rotation rule would impact a unit. Inter-rotation times vary according to the rotation rule, rotation type (SSC, Combined Training Center (CTC), JEX), and component (COMPO). For AC units deployed to SSCs,

$$IRT = (X - 1) * (deployment\ length)$$

For example, a battalion returning from a 6-month deployment to the Sinai under a Rule of 5 would have a (5-1) x (180 day) = 2 year inter-rotation time, making it unavailable for deployment to any SSC for 2 years.

1.5 Approach

The concept for the project was to develop a simulation that would schedule the Army's forecasted SSCs and exercises out over a 10-year period to create demand for Army force structure (in terms of standard requirement code (SRC) required), and then allocate Army forces to fill this demand by unit identification code (UIC).

Mr. Barry Groves modified CAA's Matching Army Requirements to Yearly Resources (MARTYR) model for the simulation. Mr. Groves had originally created MARTYR to resource forces for multiple deployment schemes. MARTYR accomplishes this through a requirements determination process followed by a resourcing process. During the requirements determination process, MARTYR utilizes a force list (SRC), a substitute list, and a priority for unit fill list to determine the force requirements. The substitute list identifies which SRCs are considered interchangeable for that operation (e.g., a light infantry battalion, SRC 07015, might be an acceptable substitute for an airborne infantry battalion, SRC 07035, for certain operations). The priority fill list determines in which order the force list will be filled, allowing MARTYR to fill subordinate units under their actual commanding unit. During the resourcing process, MARTYR utilizes a Structure and Manpower Accounting System (SAMAS) database extract and a condition file to resource the force requirements. For each SRC identified in the requirements process, MARTYR identifies all available UICs, rank-orders these UICs based upon the condition file, and selects the one that ranks the highest to resource the requirement. The condition file provides guidance to MARTYR as to which unit characteristics are desirable and weights them accordingly. The SAMAS database provides an array for each UIC available in the force structure, to include SRC type and unit characteristics referenced in the condition file.

Mr. Groves rewrote the MARTYR source code to allow this matching process to function dynamically through time in accordance with a given rotation rule: allocating forces for deployment (to SSCs, JEXs, CTC rotations) by UIC to meet SRC demands, fencing deployed units from other operations while deployed, and fencing recently deployed units from further

deployments in accordance with the given rotation rule. Mr. Groves further modified MARTYR to provide as output a history of unit deployments, providing an array for each unit deployment including operation date, SRC requested, SRC deployed, UIC deployed, component (Active, National Guard, Reserve), operation start date, operation end date, and deployment length.

1.6 Scope

Forces utilized in TARRP included units from all three components--the Active, the National Guard, and the United States Army Reserve. Based upon the given excursion, certain units were "fenced" and other units were "favored." Fenced units were prevented from deploying to a given operation, e.g., fencing the 82d Airborne Division from attending SSCs in order to provide a rapid reaction force. Favored units were given higher consideration when selecting a unit for deployment to a given operation, e.g. favoring units from the 25th Infantry Division for joint exercises in the Pacific Command (PACOM) area of responsibility (AOR).

Operations utilized in TARRP included the four recurring SSCs (Bosnia {Operation Joint Guardian}, Kosovo {Operation Joint Forge}, the Sinai {the Multinational Forces and Observers mission}, and Kuwait {Operations Desert Spring and Southern Watch}); the nine types of non-recurring SSCs captured in CAA's Stochastic Analysis of Deployment Excursions (SADE) database (see CAA Study Report CAA-SR-98-6) (Domestic Support, Humanitarian Assistance, Intervention, Maritime, Non-combatant Evacuation Operation {NEO}, No Fly Zones, Peace Operations, Show of Force, and Strike); rotations through the three Combat Training Centers (CTC) (the National Training Center {NTC}, the Joint Readiness Training Center {JRTC}, and the Combined Maneuver Training Center {CMTC}); and the six largest JEXs (RIMPAC, Balikatan, Cobra Gold, Foal Eagle, Roving Sands, and Bright Star).

Analysis focused on the impact of implementing various rotation rules on the force structure while attempting to fill operational demands over a 10-year period. The SADE forecasting methodology was utilized to forecast the non-recurring SSCs by type, occurrence date, and duration.

1.7 Assumptions

Numerous assumptions were made to simplify the development of the simulation. The majority of the assumptions reflected desired Army positions. The remaining assumptions were modified during certain excursions to measure their impact on the model and the Army.

1. All units are candidates for future deployment despite current readiness rating.

(The operation types included in TARRP are scheduled years in advance; resources could shift to train units scheduled for deployment up to an acceptable level of readiness.)

2. Eighth United States Army (EUSA), CTC opposing forces (OPFOR), and C5 units, those undergoing transformation, are fenced from all operations.

(These units have not historically participated in the operations included in TARRP.)

3. Priority of deployment goes to the Active Component.

4. Favor units from same AOR as the JEX.

5. Recurring SSC characteristics.

a. Six-month rotation length.

b. Inter-rotation times (IRT).

i. Current "Most rested" approach (AC, NG, and USAR).

ii. Rule of 3 1 year (AC) / 4 years (NG and USAR).

iii. Rule of 5 2 years (AC) / 4 years (NG and USAR).

("Most rested" approach attempts to replicate how the Army currently selects units for multiple deployments: deploy units that have not recently deployed before deploying units that have recently deployed.)

6. Nonrecurring SSC characteristics.

a. SSC type, occurrence date, and duration accurately forecasted by SADE.

b. Inter-rotation time for AC = (X-1) * (deployment length).

c. The NG and USAR have the same inter-rotation times as recurring SSC rotations.

7. CTC rotations.

a. JRTC / NTC.

i. 10 rotations / year.

ii. 1 month rotation length.

iii. 2 years (AC) / 8 years (NG and USAR) IRT.

(The Army goal is to rotate AC units through either JRTC or NTC every 2 years, RC units every 8 years.)

iv. US Army Europe (USAREUR) units do not rotate through NTC / JRTC.

b. CMTC

i. 4 rotations / year.

ii. 1 month rotation length.

iii. 1 year inter-rotation time for AC units.

iv. Only AC units rotate through CMTC.

v. Only USAREUR units rotate through CMTC.

8. National Guard participation in operations will not increase above the 1996-2000 average participation.

9. 2^{d} Infantry Division (ID) (Korea) DEPTEMPO = 100 percent.

(2ID DEPTEMPO was not captured in the model. This percentage was utilized in post-run analysis to determine the divisional DEPTEMPO for all 10 divisions.)

10. Additional overnight training rate $\geq$ 16 percent.

(TARRP captures DEPTEMPO generated by SSCs, JEXs, and CTCs. Other significant sources of DEPTEMPO include home station and off-post training. DAMO-OD receives a Unit Status Report (USR) monthly from units providing the number of days per month that each unit spent in these training categories. Data collected from October 1998 to March 2000 showed AC divisions spending 16 percent of the time on average in home station and off-post training. This percentage was included in post-run analysis to determine the total amount of DEPTEMPO experienced.)

1.8 Input Data

Data for the model came from numerous sources. The US Army Europe (USAREUR) Current Operations Division provided the current and projected force lists for the operations in the Bosnia and Kosovo. The US Army Central Command (ARCENT) provided the current force lists for operations in Kuwait. Force lists for the forces in the Sinai and those participating in the JEXs were obtained from the force lists utilized by the Joint Staff J8 in the Dynamic Commitment 2000 wargames. The US Army Forces Command (FORSCOM) provided the force lists for rotations through the JRTC and NTC. The CMTC staff provided the force lists for their annual rotations.

ADCSOPS-FMF provided the rotation rules. ADCSOPS-ODR provided the data from which the additional overnight training rates were derived. National Guard usage rates from 1996-2000 were obtained from data provided by the DAMO-FM Sizing Task Force. CAA personnel developed the substitution lists.

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2 ANALYSIS

2.1 TARRP I

Overview. TARRP I consisted of the initial base case. All forces in the US Army were available for operations, except for the Eighth US Army in Korea, the CTC OPFOR, and C5 units, which were fenced. National Guard participation was capped at the mean 1996-2000 level. Recurring SSC operations modeled included Bosnia, Kosovo, Kuwait, and the Sinai. No nonrecurring SSCs were modeled. Joint exercises modeled included RIMPAC, Balikatan, Cobra Gold, Foal Eagle, Roving Sands, and Bright Star. CTC operations modeled included the JRTC, the NTC, and the CMTC. Runs were conducted for current practice, the Rule of 3, and the Rule of 5. For each run, the resulting average AC divisional DEPTEMPO level and additional force structure requirements were determined.

DEPTEMPO. AC divisional DEPTEMPO levels average 35 percent under current practice, 30 percent under the Rule of 3, and 25 percent for the Rule of 5. The ranges in DEPTEMPO decrease and weeks/year deployed shown in Figure 1 reflect the variability across combat, combat support, and combat service support units within the AC divisions.

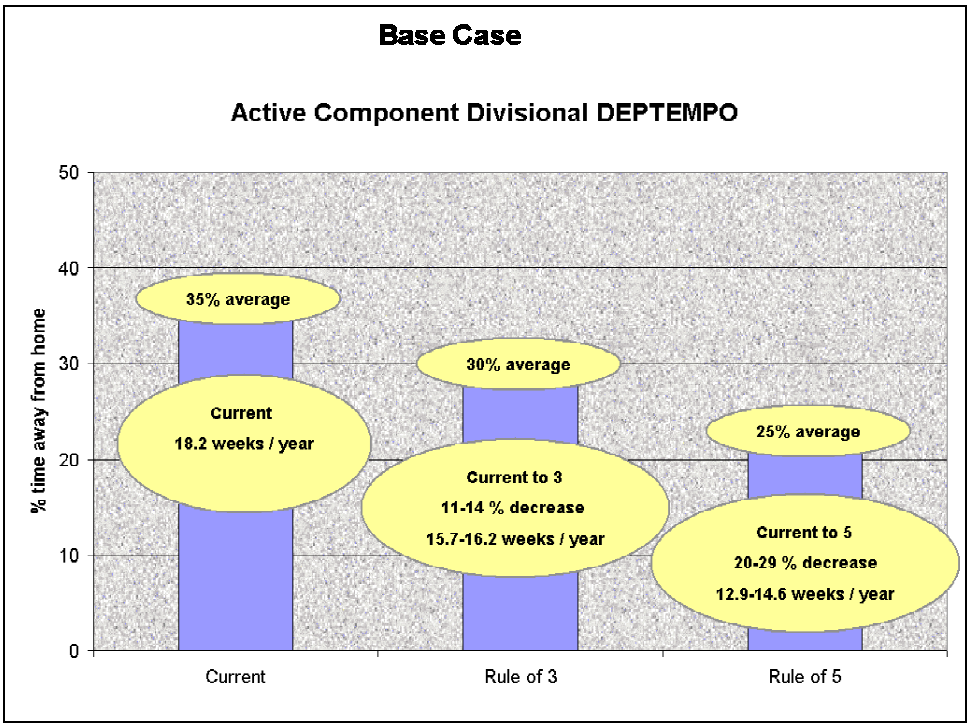

Figure 1. TARRP I DEPTEMPO

Force Structure. Results from the base case showed that the Army has insufficient force structure to adhere to either the Rule of 3 or the Rule of 5. The additional force structure required, by unit type (combat (CBT), combat support (CS), combat service support (CSS)), is shown in Figure 2.

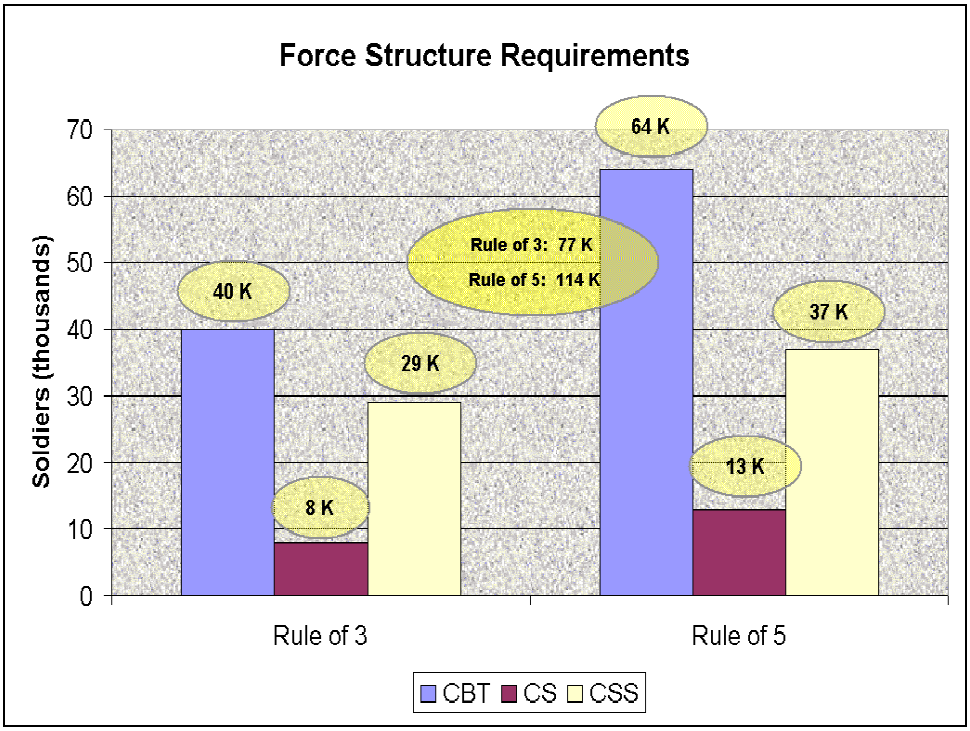

Figure 2. TARRP I Force Structure Requirements

2.2 TARRP II

Overview. TARRP II consisted of two excursion sets from the TARRP I base case. Excursion set 1 consisted of three excursions (A, B, and C), each with an increased number of fenced units. Excursion set 2 consisted of three additional excursions (D, E, and F), allowing increased National Guard participation but with varying rotation rules for the National Guard. Demand for forces remained constant from TARRP I. The TARRP I substitution list was modified to more accurately reflect equivalent units for substitution. For each run, the resulting average AC divisional DEPTEMPO level and additional force structure requirements were collected.

Excursion A. Same parameters as the Base Case, but further fenced the 82^{d} Airborne Division and all PACOM forces from SSCs (except the Sinai) and fenced the 3^{d} Mechanized Division from all SSCs. This excursion captured the impact of fencing one heavy and one airborne division from SSCs in order to provide a rapid response capability. It also captured the impact of the Commander in Chief, PACOM (CINCPACOM) preventing the use of his units

outside of the PACOM AOR. These fenced units were made available for participation in CTC rotations and JEXs, as these deployments improve combat readiness.

DEPTEMPO. AC divisional DEPTEMPO levels averaged 35 percent under current practice, 30 percent under the Rule of 3, and 25 percent for the Rule of 5. Fenced units (82^{d}, 3^{d}, and PACOM forces), experienced 30 percent DEPTEMPO under current practice, 30 percent under the Rule of 3, and 25 percent under the Rule of 5. Nonfenced units experienced 38 percent DEPTEMPO under current practice, 30 percent under the Rule of 3, and 25 percent under the Rule of 5. The +1 percent above Rule of 3 and the +3 percent above the Rule of 5 reflect the effect of including 2ID's 100 percent DEPTEMPO level on the 10 divisional average.

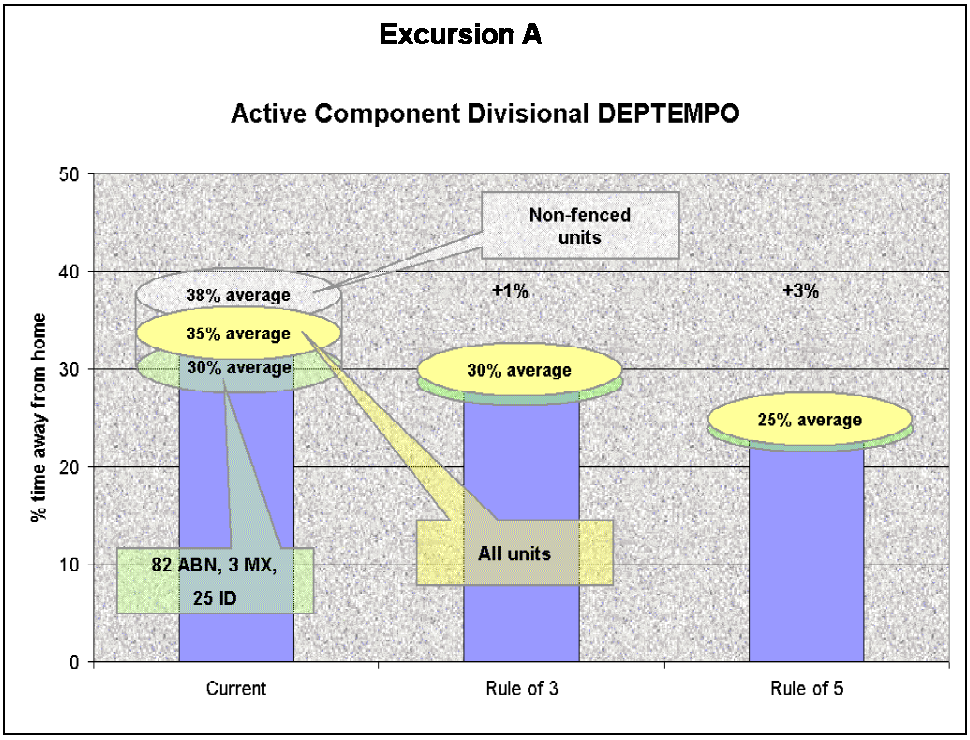

Figure 3. TARRP II (A) DEPTEMPO

Excursion B. Same parameters as Excursion A, but further fenced the 4th Mechanized Division from SSCs and JEXs. This excursion further captured the impact of fencing one heavy division for Force XXI Digitization (assuming at least one heavy division would be unavailable for SSCs and JEXs due to digitization over the 10-year period). The unit would participate in CTC rotations, as the 4th Mechanized Division did during its digitization in the late 1990s.

DEPTEMPO. AC divisional DEPTEMPO levels averaged 35 percent under current practice, 29 percent under the Rule of 3, and 24 percent for the Rule of 5. SSC fenced units, the 82^{d}, the 3^{d}, and PACOM forces, experienced 30 percent DEPTEMPO under current practice, 30 percent under the Rule of 3, and 25 percent under the Rule of 5. The Force XXI unit, the 4th, experienced 21 percent DEPTEMPO under current practice, 21 percent under the Rule of 3, and

21 percent under the Rule of 5. Nonfenced units experienced 41 percent DEPTEMPO under current practice, 30 percent under the Rule of 3, and 25 percent under the Rule of 5.

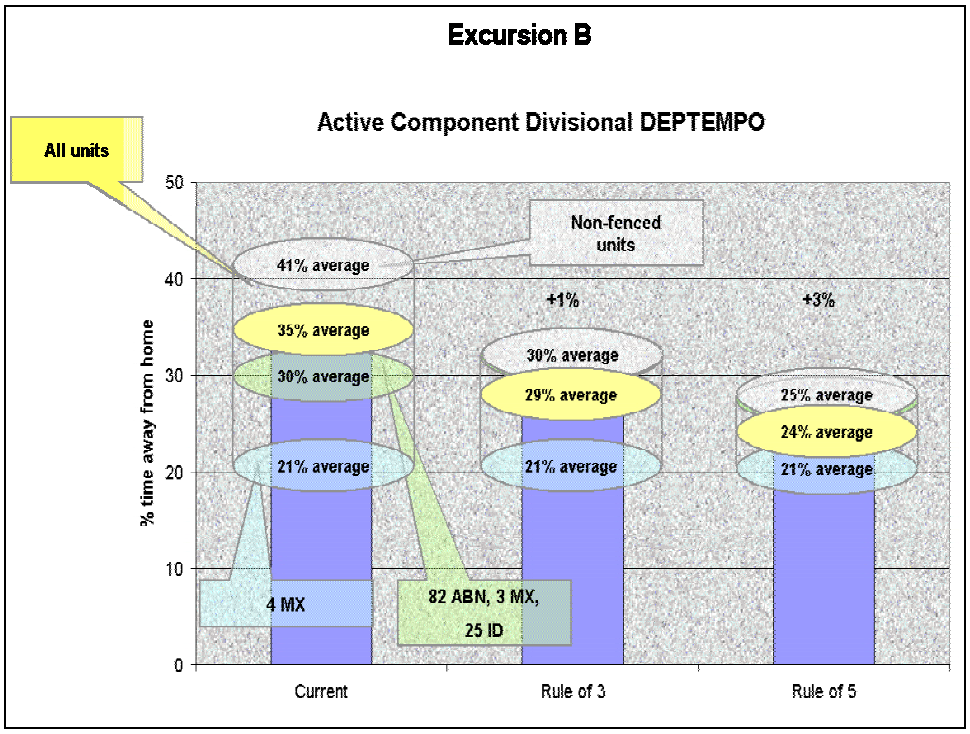

Figure 4. TARRP II (B) DEPTEMPO

Excursion C. Same parameters as Excursion B, but treated Korea as a 6-month SSC, freeing the EUSA force structure for deployment to all other operations. This excursion attempted to capture the tempo created by the 1-year individual rotation policy in Korea.

DEPTEMPO. AC divisional DEPTEMPO levels averaged 36 percent under current practice, 29 percent under the Rule of 3, and 24 percent for the Rule of 5. SSC fenced units, the 82^{d}, the 3^{d}, and PACOM forces, experienced 30 percent DEPTEMPO under current practice, 30 percent under the Rule of 3, and 25 percent under the Rule of 5. The Force XXI unit, the 4th, experienced 21 percent DEPTEMPO under current practice, 21 percent under the Rule of 3, and 21 percent under the Rule of 5. Nonfenced units experienced 43 percent DEPTEMPO under current practice, 30 percent under the Rule of 3, and 25 percent under the Rule of 5

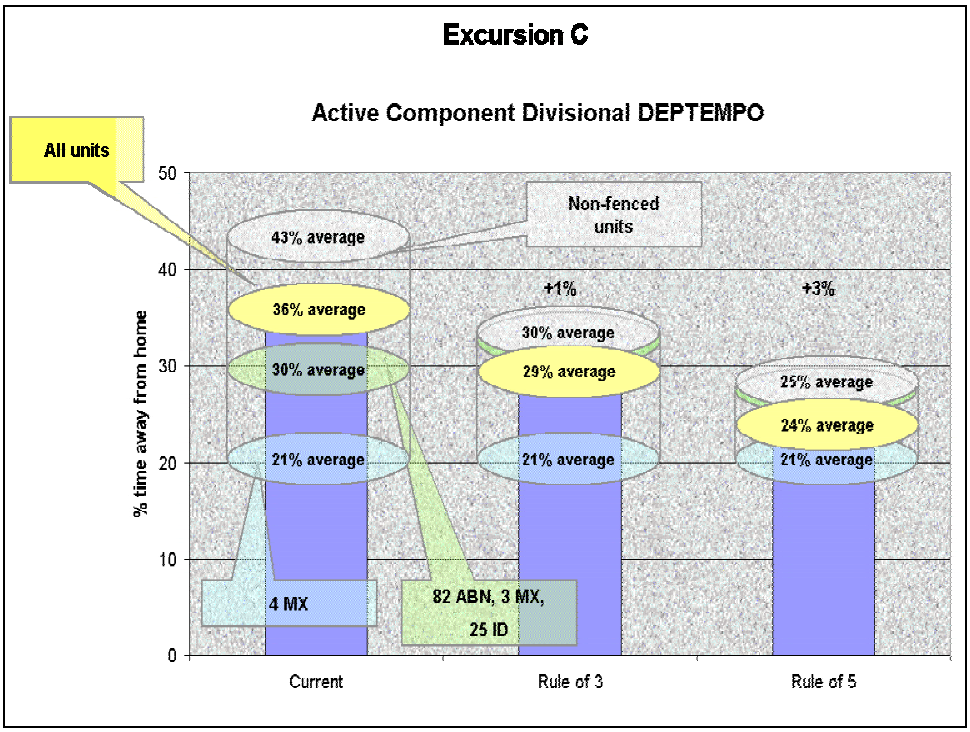

Figure 5. TARRP II (C) DEPTEMPO

Force Structure. Adhering to given rules and fencing certain units from operations for readiness and other reasons led to increased force structure requirements. The simulation creates force structure every time that an operation occurred and no units were available to deploy. These created units are eligible for reuse, after adhering to the given rotation rule's IRT. Initially, units were created for all shortages (Figure 6). (Base case values increased from TARRP I due to the modified substitution list.) Later, the MARTYR code was modified such that units were created only for SSCs and JEXs. This modification was made since the demand for Army units for these operations is generated external to the Army, in contrast to CTC rotations, which are internally generated (Figure 7). Figures 6 and 7 display these force structure requirements, with each excursion designated on the horizontal axes with the units fenced listed in the ovals above each column.

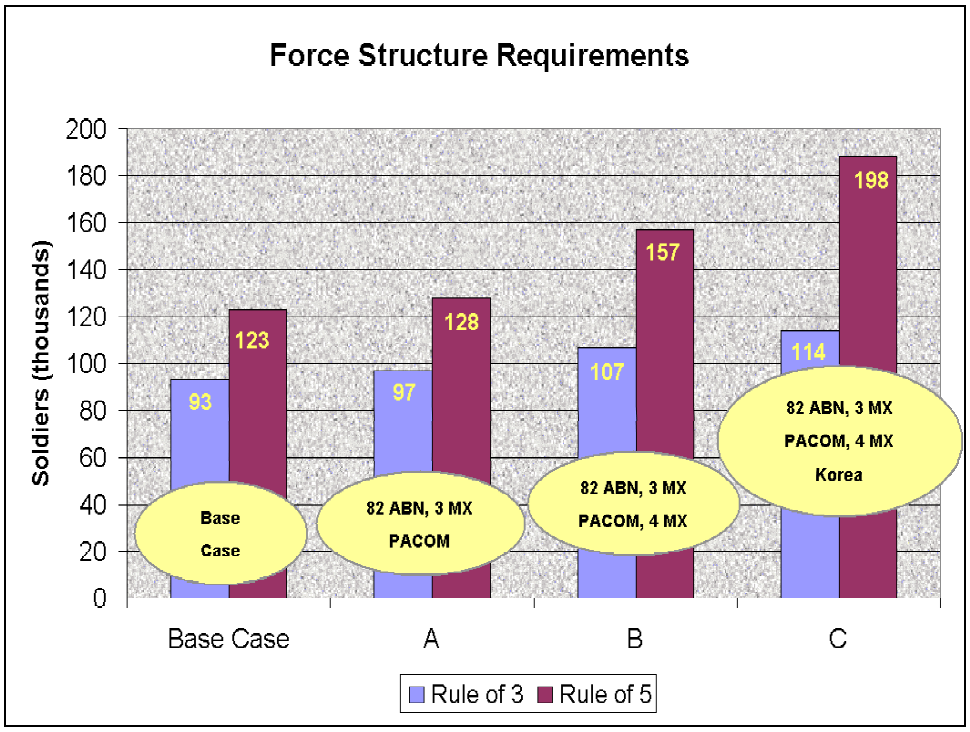

Figure 6. TARRP II (ABC) Force Structure Requirements (original)

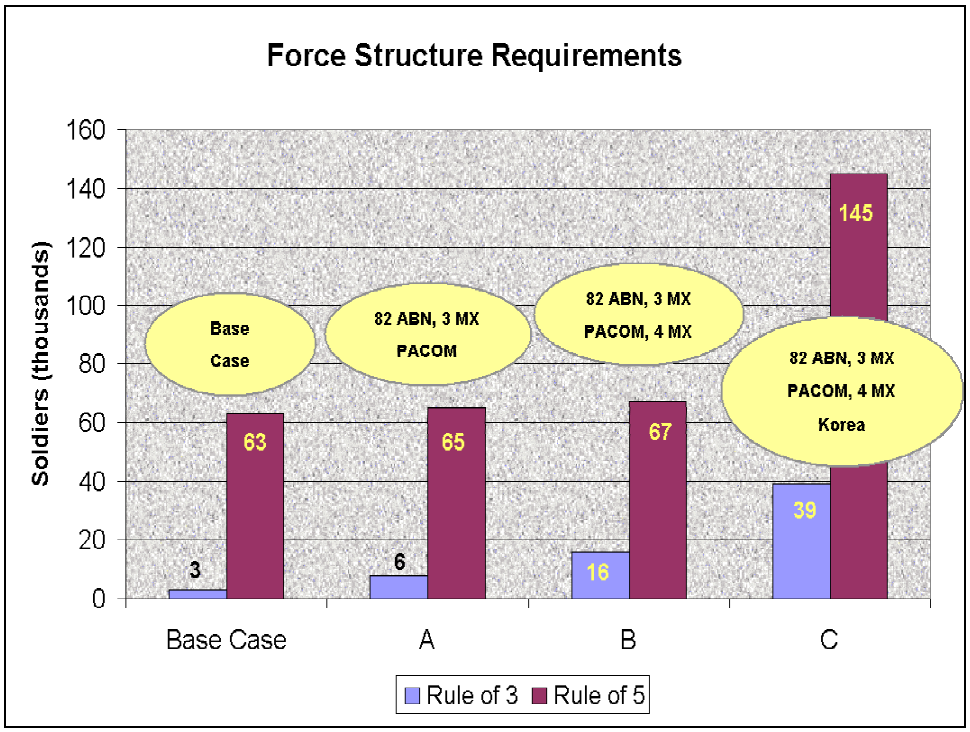

Figure 7. TARRP II (ABC) Force Structure Requirements (modified)

The last three excursions, D, E, and F, were run to determine the impact of allowing increased National Guard participation on the force structure requirements for the Rule of 3 and the Rule of 5. These excursions were conducted prior to the MARTYR change to creating force structure only for SSCs and JEXs. Accordingly, force structure was created for all operations, to include CTC rotations. Although this leads to additional force structure for internal demands, the impact of increased National Guard participation is still evident.

Excursion D. Same parameters as Excursion A, but allowed the National Guard participation in operations to increase as needed while adhering to a 4-year SSC IRT. This excursion captured the impact of allowing increased National Guard participation in SSCs.

Excursion E. Same parameters as Excursion A, but allowed the National Guard participation in operations to increase as needed while adhering to a 5-year SSC IRT. This excursion also captured the impact of allowing increased National Guard participation in SSCs, but with a longer IRT.

Excursion F. Same parameters as Excursion A, but allowed the National Guard participation in operations to increase as needed while adhering to a 6-year SSC IRT. This excursion captured the impact of allowing increased National Guard participation in SSCs, but with an even longer IRT.

Force Structure. Increased National Guard participation lowered the amount of active force structure needed to adhere to various rotation rules. The length of the National Guard units' IRT significantly affected this impact, with policies incorporating shorter IRTs having less impact on the force structure requirements than those with longer IRTs.

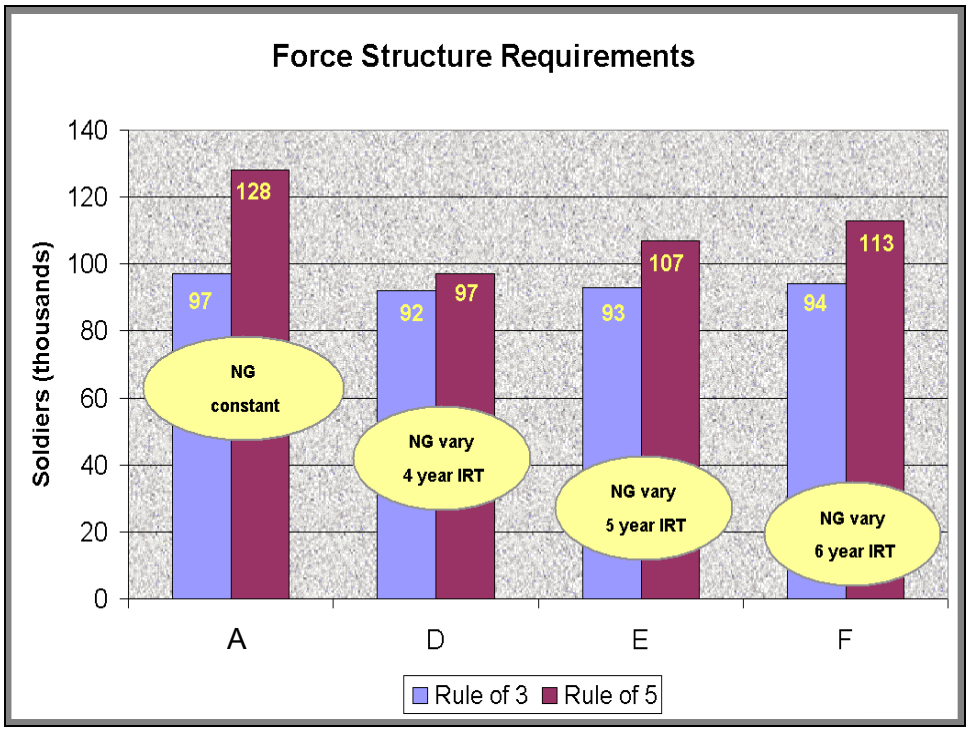

Figure 8. TARRP II (DEF) Force Structure Requirements

2.3 TARRP III

Overview. TARRP III consisted of one excursion from the TARRP II Excursion A run along with further analysis of TARRP II Excursion A. The excursion assigned the operation in Bosnia to the National Guard. The further analysis on TARRP II results consisted of identifying where the Reserve Component could provide relief to high DEPTEMPO AC SRCs. The TARRP III runs were deterministic; nonrecurring SSCs were not captured in the modeling. For each run, the resulting average AC divisional DEPTEMPO by various branches was determined.

DEPTEMPO. Turning the Stabilization Force (SFOR) mission in Bosnia over to the National Guard reduced AC divisional DEPTEMPO an average of 4.4 percent. Considerable variation in the DEPTEMPO existed across different unit types.

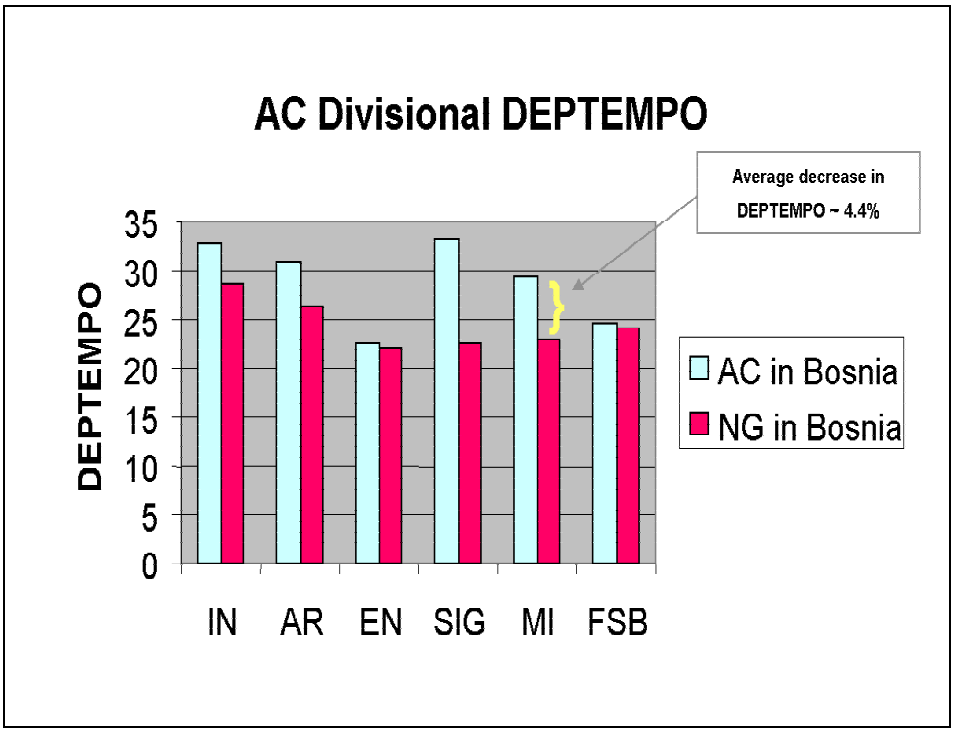

Figure 9. TARRP III DEPTEMPO

Name	*SRC*	*NG avail*	*USAR avail*	*180*	*150*	*120*	*90*
ATK HEL BN	01385A200	12	2	3	4	5	6
HVY HEL CO	01447A000	9	1	8	10	12	16
HVY EN BN	05335L000	32	0	7	8	11	14
	05337L000			2	2	3	4
155SP BN	06365A200	52	0	14	17	21	28
IN BN	07015L000	41	1	35	42	53	70
	07016L000			23	28	35	46
	07017L000			41	49	62	82
MX BN	07245L000	37	0	16	19	24	32
	07247L000			80	96	120	160
HVY MED CO (MSB)	08057L000	7	0	4	5	6	8
MSE SIG BN	11065L400	12	0	5	6	8	10
	11066L100			10	12	15	20
	11067L100			12	14	18	24
	11068L100			10	12	15	20
AR BN	17375L000	39	0	16	19	24	32
	17376L000			6	7	9	12
	17377L000			12	14	18	24
HVY MI BN	34395A000	7	0	5	6	8	10
PATRIOT MAINT CO	43607L000	2	0	1	1	2	2
AVENGER BTY	44178L400	7	0	5	6	8	10
MOBILE PA DET	45413L000	25	23	12	14	18	24
HVY FSB	63005L100	26	0	34	41	51	68
HHD CSB	63426L000	16	15	2	2	3	4
HVY ASB	63885A100	7	0	15	18	23	30

Figure 10. TARRP III RC Utilization

Reserve Component. Numerous AC SRCs experiencing high levels of DEPTEMPO (>30 percent) have counterparts in the National Guard and the US Army Reserve. The first two columns of Figure 10 identify the more numerous of these unit types. The third and fourth columns identify the number of like units available in the National Guard and USAR. The last four columns represent the number of SSC deployments (given either a 180-, 150-, 120-, or 90-day deployment) that the Reserve Component would need to assume over the 10-year run period to reduce the corresponding AC SRC DEPTEMPO level to below 30 percent. Reserve units are assumed to be available once every 10 years for an SSC deployment. Darker cells identify where insufficient numbers of Reserve Component units exist to lower the AC SRCs to below 30 percent DEPTEMPO. Accordingly, the Reserve Component can help relieve high levels of DEPTEMPO for some AC units, but not all.

2.4 TARRP IV

Overview. TARRP IV consisted of two excursions, one each off TARRP II Excursion A and Excursion B. Both excursions fenced units 90 days prior to CTC rotations to allow for a train-up period. For each run, the resulting average AC divisional DEPTEMPO level and additional force structure requirements were collected. Neither excursion significantly altered DEPTEMPO levels nor altered force structure requirements.

2.5 TARRP V

Overview. TARRP V consisted of one excursion set off TARRP II Excursion A. The excursion set included the incorporation of nonrecurring SSCs forecasted from the SADE model. This change was made to better capture the full demand of SSCs. Three excursions were run, one at a low level of forecasted nonrecurring SSC activity (lower quartile), one at a medium level (median), and one at a high level (upper quartile). For each run, the resulting average AC divisional DEPTEMPO level and additional force structure requirements were collected.

DEPTEMPO. Under Excursion A, utilizing the medium level of forecasted non-recurring SSC activity, AC divisional DEPTEMPO levels averaged 41 percent under current practice, 36 percent under the Rule of 3, and 33 percent for the Rule of 5 (includes 2ID at 100 percent DEPTEMPO). Fenced units (82^{d}, 3^{d}, and PACOM forces), experienced 30 percent DEPTEMPO under current practice, 30 percent under the Rule of 3, and 28 percent under the Rule of 5. Nonfenced units experienced 40 percent DEPTEMPO under current practice, 32 percent under the Rule of 3, and 28 percent under the Rule of 5. Utilizing low level forecasts (lower quartile) of nonrecurring SSC activity decreased DEPTEMPO levels by 3 percentage points; utilizing high level forecasts (upper quartile) of nonrecurring SSC activity increased DEPTEMPO levels by 3 percentage points.

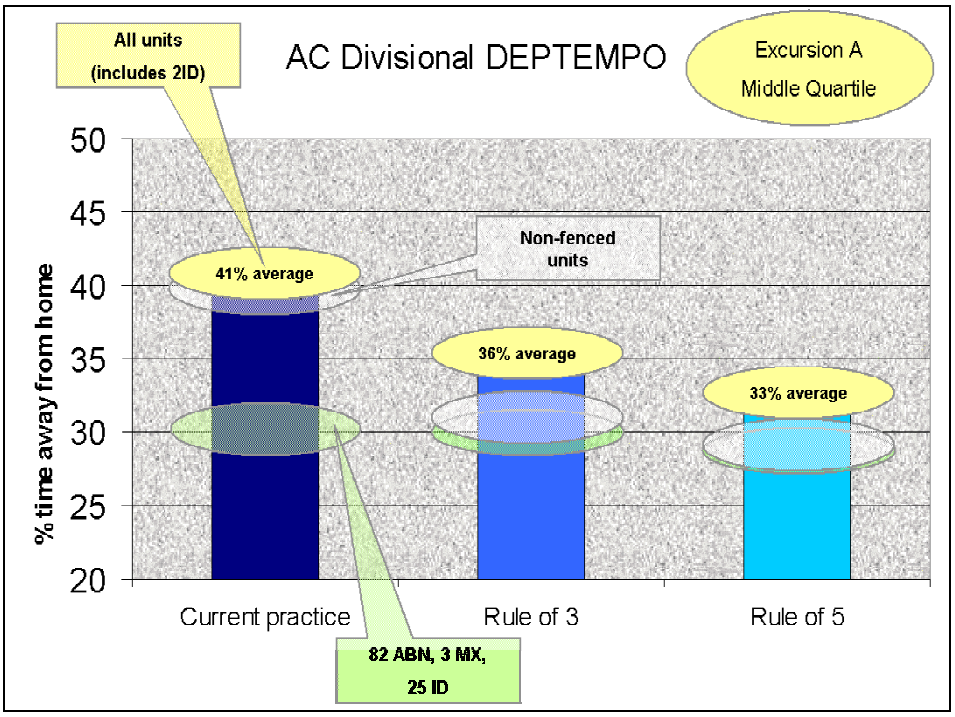

Figure 11. TARRP V DEPTEMPO

Force Structure. Force structure requirements varied based upon the level of forecasted nonrecurring SSC activity. Nonrecurring SSC activity level varied from run to run, generated stochastically from historical data. Assuming that force structure required for a given level of forecasted activity is a monotonic increasing function allows the creation of Figure 12 for the Rule of 3 and Figure 13 for the Rule of 5. The figures display the force structure required for the lower quartile, the median, and the upper quartile of expected level of activity. Force structure requirements for nonquartile values can be inferred from the curves.

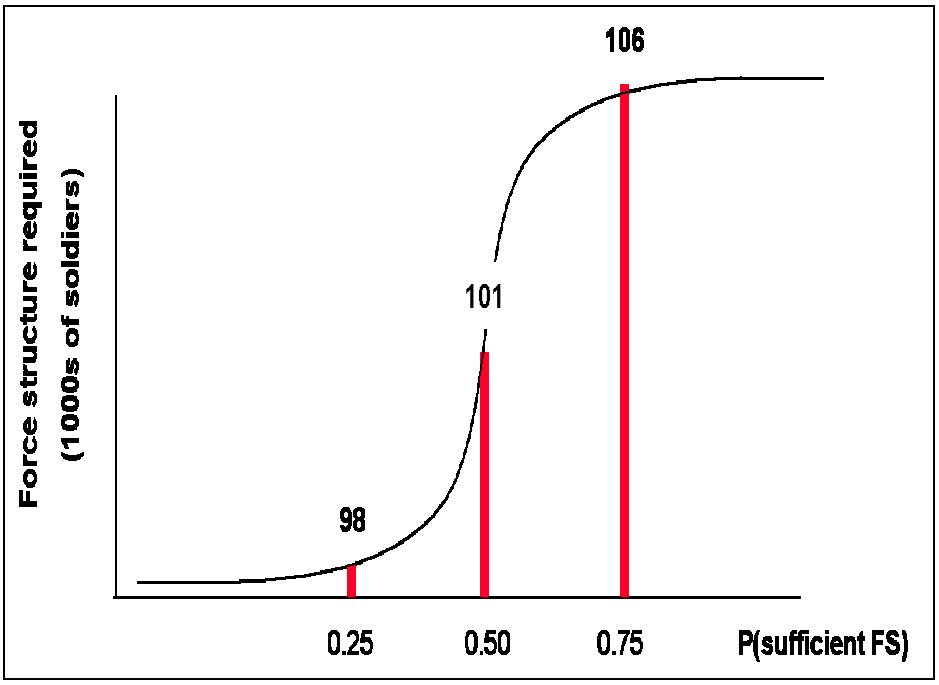

Figure 12. TARRP V (Rule of 3) Force Structure Requirements

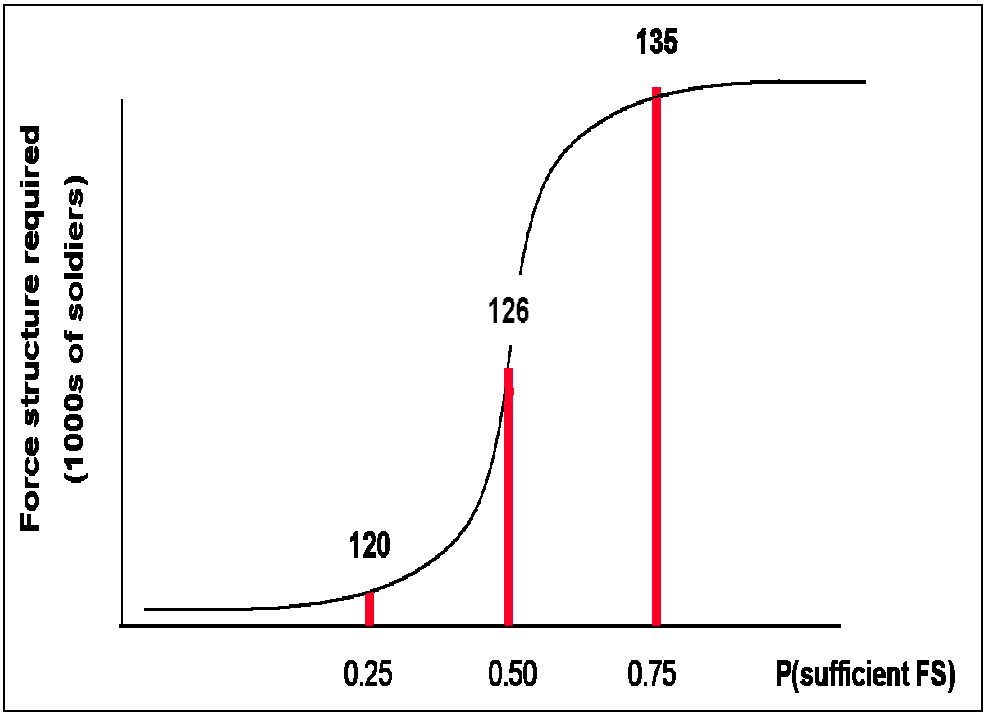

Figure 13. TARRP V (Rule of 5) Force Structure Requirements

SADE Run Selection. Ideally, one would conduct a large number of MARTYR runs with SADE forecasts of nonrecurring SSCs included in the demand. Unfortunately, MARTYR runs took in excess of 10 hours to finish. In an attempt to yet capture the stochastic nature of the nonrecurring SSCs, it was determined to select three SADE forecasts, representing the lower, middle, and upper quartiles of activity level, and incorporate these into MARTYR runs. The difficulty lay in determining which SADE forecasts to select. Two characteristics of each forecast are of interest when selecting forecasts from a sample to represent a given quartile of SSC activity level: the number of SSCs per month and the proportion of each SSC type. CAA developed the following selection process for determining which run to select to represent a given quartile:

- Conduct *N* SADE runs.
- Rank order the *N* runs by number of SSCs forecasted.
- Determine the mean number of SSCs per month for the given quartile, q,

$$\bar{y}_q$$

- Determine the mean number of SSCs per month for each run,

$$\bar{x}_i \quad where\ i = 1, ..., N$$

- Select the *n* SADE runs that minimize:

$$|\bar{y}_q - \bar{x}_i| \quad where\ i = 1, ..., N$$

- Determine the proportion of each of the *j* SSC types for the given quartile,

$$\bar{z}_j$$

- Determine the proportion of each of the *j* SSC types for each run,

$$\bar{w}_{i,j}$$

- From the *n* selected SADE runs, select the run that minimizes:

$$\sum_{k=1}^{j} (\bar{z}_k - \bar{w}_k)^2$$

The thought behind this approach was to imitate the statistical method for selecting a best unbiased estimator, where minimizing the selection of the *n* SADE runs attempted to produce an "unbiased" group of runs and minimizing the selection of the final run attempted to select a run with "minimum variance."

2.6 Summary

TARRP provides the capability to determine the impact of various deployment policies on the US Army. In support of the 2001 Quadrennial Defense Review, TARRP provided analytical insight for the Assistant Deputy Chief of Staff for Operations and Plans, Force Management Directorate, and the Assistant Deputy Chief of Staff for Operations and Plans, Operations Readiness and Mobilization Directorate. These insights included:

- **Rotation Rules.** The Army has insufficient force structure to adhere to either a Rule of 3 or a Rule of 5. This is due largely in part to the fact that the Army is structured to fight two major conflicts nearly simultaneously, with SSCs lesser included.

- **Force Structure**. Adhering to a Rule of 3 would require an additional 101,000 soldiers, 126,000 for a Rule of 5. Both of these values, however, are highly sensitive to the substitution list utilized for operations. All five TARRP studies utilized a narrow substitution list, requiring like units, where other units might have been able to perform the mission. Expanding the list of equivalent units greatly reduces the additional force structure requirements, as it widens the pool of available forces.

- **DEPTEMPO**. The Army's AC divisional units currently average 41 percent DEPTEMPO. Fencing units from SSCs significantly lowers the DEPTEMPO of the fenced units, while significantly raising the DEPTEMPO of the nonfenced units. Non-fenced units experience DEPTEMPO levels almost 10 percent higher than fenced units.

- **Reserve Component**. The Reserve Component can help reduce DEPTEMPO levels for some Active SRCs to manageable levels, but not all. Given the size of the Reserve Component, a commitment of only one long-term SSC deployment per decade for some units would keep over half of the AC SRC types currently experiencing high DEPTEMPO levels at manageable levels.

APPENDIX A PROJECT CONTRIBUTORS

1. PROJECT TEAM

a. Project Director

MAJ Robert Shearer, Force Strategy Division

b. Team Members

Mr. Barry Groves, Operations Support Division

2. PRODUCT REVIEWERS

Dr. Ralph E. Johnson, Quality Assurance
Ms. Nancy M. Lawrence, Publications Center

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APPENDIX B REQUEST FOR ANALYTICAL SUPPORT

PART 1

Performing Division: FS ***Account Number:*** **2000174**

Tasking: Verbal ***Mode (Contract-Yes/No):*** No

Acronym: **TARRP**

Title: The Army Rotation Rule Project

Start Date: 06-Jun-00 ***Estimated Completion Date:*** 31-Jul-00

Requestor/Sponsor (i.e., DCSOPS): VCSA ***Sponsor Division:*** QDR Panel

Resource Estimates: ***a. Estimated PSM:*** 2 ***b. Estimated Funds:*** $0.00

c. Models to be Used: **MARTYR**

Description/Abstract:

This study analyzes the force structure required to support the current rotation rule and several alternatives. The AOC will provide the current deployed force. The current SAMAS will provide the available force structure. The Matching Army Requirements to Yearly Resources (MARTYR) process will match forces to smaller-scale contingencies (SSC) and combat training center (CTC) rotations. End products will include the total force structure requirements for each given set of rotational rules and identification of when a given force structure fails to comply with a set of rotational rules.

Study Director/POC Signature: *Original Signed* ***Phone#:*** 703-806-5685

Study Director/POC: **MAJ Robert Shearer**

If this Request is for an External Project expected to consume 6 PSM or more, Part 2 Information is Not Required. See Chap 3 of the Project Directors' Guide for preparation of a Formal Project Directive.

PART 2

Background:

QDR panel 2, Force Generation, Capability, and Structure, requested analysis of the impact of various rotation rules for SSCs on force structure. Units rotate through SSCs according to rotation rules. Rotation rules vary by the length of time between rotations and the length of the rotation. Different rules have different effects on PERSTEMPO and OPTEMPO.

Scope:

This study will focus on the Rule of 3 and 5 rotation rules for all three COMPOs with current year forces. (The rule of X requires X units committed to the SSC, e.g., Rule of 3 would have one unit training to deploy, one unit deployed, and one unit recovering from deployment)

Issues:

What is the total force structure requirements for each of the rotation rules? When will the current force fail to comply with each of the rotation rules?

Milestones:

(1) 7 June - 7 July: data collection (2) 10 - 26 July: MARTYR process (allocates forces to SSCs by SRC) (3) 26-31 July: conduct analysis / prepare presentation

Signatures ***Division Chief Signature:*** *Original Signed and Dated* ***Date:***

Division Chief Concurrence:

Sponsor Signature: *Original Signed and Dated* ***Date:***

Sponsor Concurrence (COL/DA Div Chief/GO/SES) :

PART 1 2

Performing Division: FS ***Account Number:*** **2001059**

Tasking: Verbal ***Mode (Contract-Yes/No):*** No

Acronym: **TARRP II**

Title: The Army Rotation Rule Project II

Start Date: 01-Sep-00 ***Estimated Completion Date:*** 01-Dec-00

Requestor/Sponsor (i.e., DCSOPS): DCSOPS ***Sponsor Division:*** FDF

Resource Estimates: ***a. Estimated PSM:*** 0 ***b. Estimated Funds:*** $0.00

c. Models to be Used: **SMARTYR**

Description/Abstract:

This study continues the analysis of the impact of rotation rules upon Army force structure begun in TARRP. TARRP II will consist of two excursion sets from the TARRP base case. The first excursion set will determine the impact of fencing various units from certain operations on the force. The second excursion set will determine the impact of various rotation rules on the National Guard.

Study Director/POC Signature: ***Original Signed*** ***Phone#:*** 703-806-5685

Study Director/POC: **MAJ Robert Shearer**

If this Request is for an External Project expected to consume 6 PSM or more, Part 2 Information is Not Required. See Chap 3 of the Project Directors' Guide for preparation of a Formal Project Directive.

Background:

PART 2

QDR panel 2, Force Generation, Capability, and Structure, requested two excursion sets from the initial TARRP work done for the panel.

Scope:

The first excursion set will consist of three excursions, each with an increased number of units fenced from operations. During these excursions, the National Guard participation will remain constant at current usage rates. The second excursion set will also consist of three excursions, varying the time between National Guard rotations from 4-5-6 years. During these excursions, the National Guard participation will be allowed to vary.

Issues:

What are the force structure requirements for each excursion? What are the effects on DEPTEMPO for the excursions in the first excursion set?

Milestones:

Signatures ***Division Chief Signature:*** *Original Signed and Dated* ***Date:***

Division Chief Concurrence: COL Mark Hanson

Sponsor Signature: *Original Signed and Dated:*

Sponsor Concurrence (COL/DA Div Chief/GO/SES: COL Morris Young

PART 1

Performing Division: FS ***Account Number:*** **2001093**

Tasking: Verbal ***Mode (Contract-Yes/No):*** No

Acronym: **TARRP III**

Title: The Army Rotation Rule Project III

Start Date: 02-Jan-01 ***Estimated Completion Date:*** 01-Mar-01

Requestor/Sponsor (i.e., DCSOPS): DCSOPS ***Sponsor Division:*** ODR

Resource Estimates: ***a. Estimated PSM:*** 1 ***b. Estimated Funds:*** $0.00

c. Models to be Used: **SMARTYR**

Description/Abstract:

This study continues the analysis of the impact of rotation rules upon Army force structure done in TARRP and TARRP II. TARRP III will consist of one excursion set and further analysis of an excursion set from TARRP II. The excursion set will determine the impact of the National Guard assuming the Bosnia mission with varying rotation lengths on the Active force's DEPTEMPO. The further analysis will identify where National Guard units can help relieve high DEPTEMPO among Active units.

Study Director/POC Signature: *Original Signed* ***Phone#:*** 703-806-5685

Study Director/POC: **MAJ Robert Shearer**

If this Request is for an External Project expected to consume 6 PSM or more, Part 2 Information is Not Required. See Chap 3 of the Project Directors' Guide for preparation of a Formal Project Directive.

Background:

QDR panel 4, Readiness, requested an additional excursion set and further analysis from the TARRP and TARRP II work done for the QDR panel 2, Force Generation, Capability, and Structure.

PART 2

Scope:

The excursion set will consist of four excursions run off of TARRP excursion A. In these excursions, only the NG will fill the demand in Bosnia; the NG will not participate in any other SSCs; and the length of the NG rotations in SSCs will vary (90, 120, 150, 180 days). TARRP III will only create force structure for shortfalls in SSCs and JEXs. The further analysis will identify AC SRCs with excessive DEPTEMPO and the corresponding NG UICs that could provide relief.

Issues:

What impact does the National Guard picking up the Operation Joint Endeavor (Bosnia) have on AC DEPTEMPO and force structure shortfalls? How is this impact affected by varying National Guard rotation lengths? What AC SRCs are experiencing high levels of DEPTEMPO? What NG UICs share the same SRC? What impact could use of these NG units have on AC DEPTEMPO?

Milestones:

Signatures ***Division Chief Signature:*** *Original Signed and Dated* ***Date:***

Division Chief Concurrence: COL Mark Hanson

Sponsor Signature: *Original Signed and Dated* ***Date:***

Sponsor Concurrence (COL/DA Div Chief/GO/SES): COL Cox, Division Chief, DAMO-ODR

PART 1

Performing Division: FS ***Account Number:*** **2001098**

Tasking: Verbal ***Mode (Contract-Yes/No):*** No

Acronym: **TARRP IV**

Title: The Army Rotation Rule Project IV

Start Date: 29-Jan-01 ***Estimated Completion Date:*** 01-Mar-01

Requestor/Sponsor (i.e., DCSOPS): DCSOPS ***Sponsor Division:*** FMF (FDF)

Resource Estimates: ***a. Estimated PSM:*** 0.5 ***b. Estimated Funds:*** $0.00

c. Models to be Used: **SMARTYR**

Description/Abstract:

This study continues the analysis of the impact of rotation rules upon Army force structure done in TARRP I, II, and III. TARRP IV will consist of one excursion set from TARRP II. The excursion set will determine the impact of incorporating the time for which a unit is fenced prior to a CTC rotation into SMARTYR. This attempts to more accurately model reality.

Study Director/POC Signature: *Original Signed* ***Phone#:*** 703-806-5685

Study Director/POC: **MAJ Robert Shearer**

If this Request is for an External Project expected to consume 6 PSM or more, Part 2 Information is Not Required. See Chap 3 of the Project Directors' Guide for preparation of a Formal Project Directive.

PART 2

Background:

QDR panel 2, Force Generation, Capability, and Structure requested an additional excursion set from the TARRP II work done.

Scope:

The excursion set will consist of two excursions each off of TARRP II excursions A and B. The first two excursions will increase the time a unit is fenced for a CTC to 90 days. The second two excursions will increase the time to 120 days. The Rule of 5 will apply for all excursions..

Issues:

What impact does more accurately modeling the time in which a unit is fenced for a CTC rotation have on force structure requirements?

Milestones:

Signatures ***Division Chief Signature:*** *Original Signed and Dated* ***Date:***

Division Chief Concurrence: COL Mark Hanson

Sponsor Signature: *Original Signed and Dated* ***Date:***

Sponsor Concurrence (COL/DA Div Chief/GO/SES): COL Young, Division Chief, DAMO-FMF

PART 1

Performing Division: FS ***Account Number:*** **2001110**

Tasking: Verbal ***Mode (Contract-Yes/No):*** No

Acronym: **TARRP V**

Title: The Army Rotation Rule Project V

Start Date: 13-Mar-01 ***Estimated Completion Date:*** 15-May-01

Requestor/Sponsor (i.e., DCSOPS): DCSOPS ***Sponsor Division:*** FMF

Resource Estimates: ***a. Estimated PSM:*** 2.5 ***b. Estimated Funds:*** $0.00

c. Models to be Used: **SMARTYR, SADE**

Description/Abstract:

This study continues the analysis of the impact of rotation rules upon Army force structure done in TARRP I-IV. TARRP V will consist of incorporating SADE forecasted futures into the current TARRP process in order to capture the stochastic nature of short term SSCs.

Study Director/POC Signature: *Original Signed* ***Phone#:*** 703-806-5685

Study Director/POC: **MAJ Robert Shearer**

If this Request is for an External Project expected to consume 6 PSM or more, Part 2 Information is Not Required. See Chap 3 of the Project Directors' Guide for preparation of a Formal Project Directive.

Background:

PART 2

BG Odierno, DAMO-FM, requested that the impact of short-term SSCs be incorporated into the TARRP process. SADE provides the ability to forecast the occurrence and duration of such SSCs in the future.

Scope:

SADE will require modifications to generate futures that are in a format acceptable to TARRP. The new SSCs will require SRC substitution lists. The excursion set will consist of TARRP II Excursion A and B following the Rule of 3, 4, 5, and current practice. National Guard participation will be limited to an amount to be determined by the sponsor.

Issues:

What impact does incorporating short-term SSCs have on DEPTEMPO and force structure requirements? How does the stochastic nature of future short-term SSC forecasts impact these factors?

Milestones:

Signatures ***Division Chief Signature:*** *Original Signed and Dated* ***Date:***

Division Chief Concurrence: COL Mark Hanson

Sponsor Signature: *Original Signed and Dated* ***Date:***

Sponsor Concurrence (COL/DA Div Chief/GO/SES): DAMO-FMF

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