On Restructuring Alliance Ground Forces and Adapting Deployment Policies for the New Mission Environment

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ABSTRACT

This investigation reviews research on the relative level of military personnel capability as a function of conscription level and investment expenditure per soldier. It categorizes NATO Alliance forces, country by country, on these dimensions and provides seasoned judgments as to the appropriate and likely future behavior of the Allies on these dimensions. This analysis focuses on Out of Area Operations like those encountered recently in Bosnia and post-war Kosovo. It makes the point that future forces should be composed predominantly of well-trained volunteers in smaller yet more effective numbers.

INTRODUCTION

The US Army's longstanding claim, that having a force structure designed to simultaneously conduct two major theater wars (MTW) provides sufficient capabilities for operations other than war or, in a more general sense, stability and support operations (SASO), is challenged by the growing worldwide demand for operations such as force projection, humanitarian intervention, peacekeeping and enforcement, and disaster relief.

This has not only caused a significant increase in both PERSTEMPO and OPTEMPO, but shifted the emphasis to combat service support and logistics which in MTW are provided to a large extent by the Army's reserve component. Therefore the respective units of the active component are being taxed to a disproportionate degree, in addition to reserves being called upon more frequently. In addition, support tasks for SASO are being complicated by the fact that, unlike in the most likely MTW contingencies, the deployed forces can rarely rely on mature and functional local infrastructures and host nation support.

European allies taking part in SFOR and KFOR are experiencing similar problems. To a large degree, their forces are still configured primarily for collective defense operations in Central Europe where the bulk of Soviet forces was deployed during the Cold War period. Most of NATO's active forces consist of combat forces. This is also true for the so-called crisis reaction forces established in compliance with the 1991 Strategic Concept of the Alliance. Active combat service support is sized to support peace time training and the exercise schedules of the combat forces.

Combat service support and logistics required for war time operations is organized in reserve forces or cadre units to be manned in a pre-war crisis by mobilizing reservists and assets from civilian economies. Moreover, a significant part of the military manpower of the European allies consists of conscripts which may not be assigned to operations outside the realm of article 5 of the NATO charter. For example, it is for these reasons that the Germany Army has severe problems in maintaining a ground force of some 8000 soldiers, out of a total of 230,000, deployed in the Balkans. Besides, like the forces of most other European allies, today's German forces lack the strategic mobility for timely response to demands not only for most cases of SASO, but also for collective defense at some distance from national borders, should massive threats to NATO territory reemerge in the future. In addition, the growing technological gap between the US and its European allies endangers the Alliance's potential for combined operations.

Thus, the question is what can be done to first avoid situations in which the US Army and its European NATO allies will be forced to turn down requests for conducting SASO because they cannot muster the required resources without seriously impairing the capability to conduct major theater war, and second, to maintain the interoperability essential for combined SASO and, it should be added, for collective defense as well.

Among the options that come to mind there are four major issues that need to be addressed by Alliance force planners and for which some exploratory analyses have been performed by these authors. They relate to the following:

- Increasing the size of active force components for non-article 5 operations;
- Maintaining interoperability of Alliance forces;
- Adapting the force mix and changing the use of reserve components;
- Redefining deployment and rotation policies.

STRUCTURAL CONSTRAINTS FOR NON-ARTICLE 5 OPERATIONS

In addition to size and unit mix of its active component as well as its personnel deployment and rotation policies, the number of troops that a military force may make available for SASO depends to a significant degree on its personnel structure, in particular with regard to the degree to which it consists of conscripts and their terms of service. This is not only because conscripted soldiers may not assigned to non-article 5 missions for constitutional or legal reasons, but also because in most cases the terms of service are too short to train them adequately for a subsequent deployment of worthwhile duration.

The degree to which deployment capability depends on conscription is illustrated by Figure 1 which applies to the German Army. The underlying mathematical model developed by Huber (Huber, 1998(a)) reflects the policy of the German Army of training recruits in the operational units and not assigning conscripts to units deployed out-of-area (OOA) unless they volunteer and extend their terms of service, currently 10 months, up to a maximum of 23 months. (Presently, about 17 percent of the conscripts extend their service to an average of 18 months.) Manning of OOA-units requires that regulars and volunteers be withdrawn from operational units not assigned to OOA-operations.

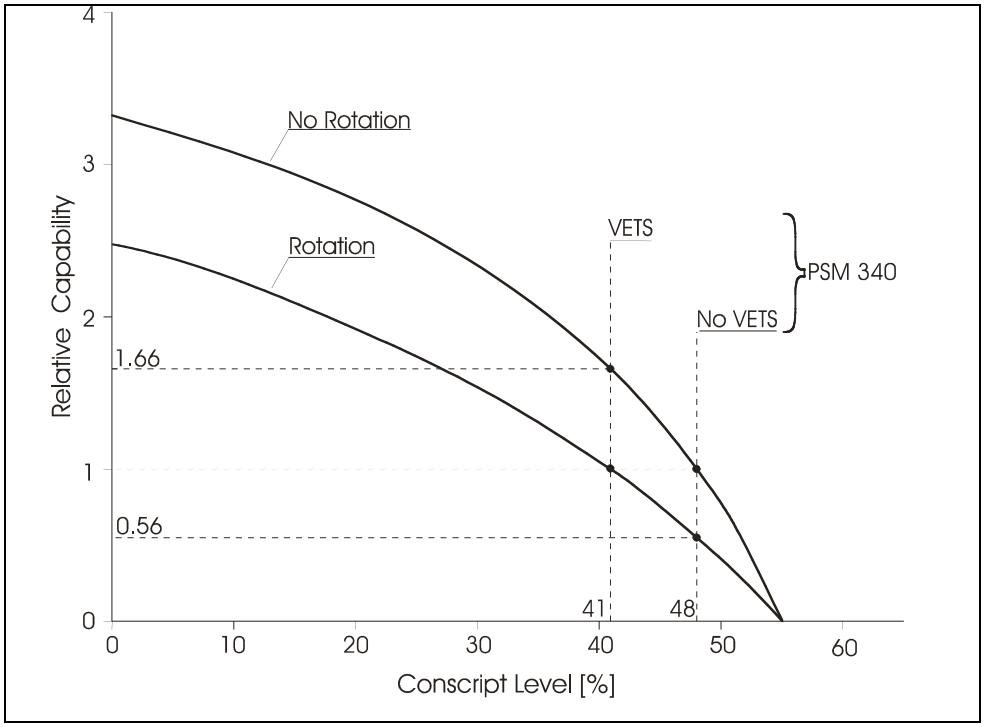

Figure 1: Relative Personnel Capabilities of the German Army for Out-of-Area-Operations as a function of the Conscript Level (VETS = Volunteers Extending Terms of Service).

The degree to which this can be done is limited by the maximum level of conscripts (assumed to be 55 percent) that operational units can tolerate without seriously jeopardizing training objectives. Thus, depending on whether deployed units need to be rotated or not, a range of operational units may be required for manning one OOA-unit earmarked for deployment. In addition, each deployed OOA-unit requires domestic back-up by a number of service support units that may, however, include conscripts. The relationships shown in Figure 1 are based on the assumption that the service support units are manned by twice the number of the deployed troops.

The reference value (one) holds for the capability of the current personnel model of the Bundeswehr (PSM 340) – which features a conscript level of 48 percent for the Army – if no conscripts were available to volunteer for extended terms of service (VETS). The availability of VETS to the degree mentioned above implies a reduction of the effective conscript level from 48 to 41 percent and, thus, an increase in the OOA-capability of 66 percent. It also compensates for the degrading effects of rotation[1] which otherwise would reduce the OOA-capability to 56 percent. There would be no OOA-capability if the conscript level were to approach the assumed training threshold value of 55 percent. On the other hand, depending on rotation, it would increase by factors of 2.5 and more than three if all of the conscripts in the German Army were replaced by volunteers. In other words, conscription limits today's deployment capability of German Army to less than 40 percent of the deployment capability of an all-volunteer force of equal size.

[1] It is assumed that 1) the duration of the OOA-operations exceeds the duration of one deployment cycle, being the sum of the training and preparation time (including transit), unit deployment time, and post-deployment regeneration time; 2) deployment time exceeds the times for training and preparation and regeneration taken together.

Of course, replacing conscripts by volunteers on a one-to-one basis is an unrealistic option because it would require a substantial increase in the Army's personnel budget. However, as the relationships shown in Figure 1 indicate that the OOA-capability of a given size ground force increases as the conscript level is decreased, it follows that a given OOA-capability can be preserved if force reductions are combined with an appropriate reduction of the conscription levels. For example, the German Army's theoretical personnel limit for simultaneous OOA-deployment is approximately 10,000-17,000 soldiers depending on whether or not they need to be rotated.[2] This theoretical limit could be maintained with about 70 percent of the German Army's current manpower of 231,000 if the conscript level were reduced to 38 percent, or at less than half of today's manpower if it were an all-volunteer force.

In order to characterize the deployment constraints of conscription forces, Huber and Schmidt (1999) have proposed a *conscription factor* in terms of the ratio of the number of troops that a given conscription force may deploy to those that an all-volunteer force of equal size may deploy. Based on this factor one may distinguish essentially four structural categories of conscript forces among the European allies as shown in Table 1. The values of the conscription factor have been estimated based on the assumption that forces of category I and II pursue a training philosophy similar to that of the German Army, training conscripts in the operational units, while those of categories III and IV have a dedicated organization for basic training. The number in parentheses pertain to the situation when 17 percent of the German and French[3] conscripts extend their service as described above for the German Army, or if conscripts with more than 12 months service in the Greek and Turkish forces are considered to be available for OOA-deployment.

The national manpower ceilings of NATO-European ground forces for OOA-deployment resulting from Huber's model using as a basis the 1998 IISS manpower data are compiled in Table 2.[4] The average personnel limits for simultaneous OOA-deployments of NATO-European ground forces taken together amount to between five and eight percent of their total ground force manpower of 1.6 million troops. This is considerably below the respective ceilings of 14-20 percent for the all-volunteer forces of the United Kingdom and, theoretically, the Netherlands and Belgium.

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[2] However, due to the levels of logistics, communications and medical units in the active force, the German Army is hard pressed to maintain its current deployment of 8,000 in Bosnia and Kosovo.

[3] It should be noted that the French conscription factors hold for the 1998 force structure. Since then, however, the percentage of conscripts in the French Army has decreased to about 30 percent and will continue to do so until 2015 when the French Army reform is scheduled to be completed, including the adoption of an all-volunteer force.

[4] In all cases it is assumed that the basic military organization (comprising administrative and managerial support functions as well as schools, training facilities, and practice ranges) accounts for 30 percent of the total manpower (military manpower overhead). Furthermore it is assumed that all recruits undergo an initial six-months basic training provided in training units of all-volunteer and conscription forces of categories III and IV, and in the operational units of conscription forces of categories I and II. Prior to qualifying for OOA-deployment, the volunteers of all force categories undergo additional training of at least six-months' duration provided by the personnel associated with the training facilities of the basic military organization. The ratio of recruits to training personnel is assumed to be 2:1 for volunteers and 3:1 for conscripts in case of basic training in all-volunteer and conscription forces of category III and IV, and 1.22:1 for basic training of all recruits, and subsequent training of conscripts in conscription forces of categories I and II. Also, it is assumed that there are no constraints in using conscripts in units providing domestic service support to troops of category I and II deployed out-of-area.

Structure Category	Nation	Percentage of Conscripts	Terms of Service (months)	Conscription Factor	
				No Rotation	Rotation
I	DK	30.1	4-12	0.78	0.66
	PO	36.0	4-8	0.64	0.52
II	FR	44.2 (40.4)	10	0.38 (0.52)	0.28 (0.40)
	GE	48.0 (43.9)	10	0.21 (0.40)	0.15 (0.30)
III	IT	59.8	10	0.21	0.21
	NO	65.8	12	0.11	0.11
	SP	61.4	9	0.18	0.18
IV	GR	76.3	18	0 (0.32)	0 (0.32)
	TR	88.0	18	0 (0.25)	0 (0.25)

Table 1: Conscription Factor and Personnel Structure Categories of NATO-European Ground Forces (1998).

The plausibility of the model and assumptions regarding personnel overhead and service support requirements for estimating the OOA-manpower limits of all-volunteer forces is underscored when the numbers resulting for the UK are compared to what the MOD's *Strategic Defense Review* of July 1998 states concerning the ground force component of Britain's Joint Rapid Reaction Force. It will comprise a total of six brigades of which the equivalent of two reinforced brigades will make up a first echelon spearhead battle group available at very high readiness (see Supporting Essay Eight, Joint Operations). Accounting for an average personnel absence rate[5] of about 30-40 percent, the 16,195 troops shown in Table 2 for the UK when rotation is required correspond well to the personnel requirements for manning two reinforced ready brigades.[6]

Comparing the ground force deployment ceilings of the European allies to those of the US forces, we note that the US ceilings are slightly higher even though the total manpower level of US Army and Marine Corps taken together is only about 40 percent of Europe's combined ground force manpower. An increase of European OOA-manpower ceilings by about 25 percent can be expected as soon as France, Spain, and Italy have completed their conversions to all-volunteer forces as currently planned.[7] However, that does not imply that Europe's combined operational capabilities will match those of the US in OOA-contingencies that demand more than a fairly modest level of force modernization.

[5] The absence rate accounts for recreational and sick leave, follow-up training, special details, and educational assignments to service schools and universities.

[6] In order to preclude any misunderstandings, it is pointed out that the accuracy to which the results of the model calculations are presented in this paper does not mean to imply that a high degree of precision may be attached to their interpretation. It only supports the reproducibility of the computational experiments and the avoidance of cumulative rounding errors.

[7] The total manpower level of the French ground forces will comprise 136,000 troops, or 60 percent of their 1998 level, once the conversion to all-volunteer forces is completed by 2015 (Clerc, 1996). Spain plans to reduce the 1997 manpower level of its ground forces by about 10 percent down to 115,000 volunteers by 2003 (Dean, 1997). However, a cursory calculation shows that the implementation of these plans would require Spain to increase the level of its (1998) defense budget by about fifty percent in order to maintain the current technical standard of its forces. Italy has only recently announced the conversion to an all-volunteer force. No details about its size are known at the time this paper is written.

Nation	Total Manpower (IISS MB 98/99)	OOA-Deployment Ceilings No Rotation	Rotation
BE	28,250	5,356	4,017
DK	22,900	3,392	2,152
FR	203,200	20,058	11,675
GE	230,600	17,444	9,779
GR	116,000	8,132	6,099
IT	165,500	6,433	4,825
NL	27,000	5,119	3,839
NO	15,200	326	244
PO	29,400	3,581	2,168
SP	127,000	4,344	3,258
TR	525,000	25,355	19,016
UK	113,900	21,594	16,195
NATO-Europe	1,603,950	121,134	83,267
US*	650,700	123,362	92,521

* US Army (479,400) and Marine Corps (171,300)

Table 2: Manpower Ceilings for Out-of-Area Deployment of NATO-European Ground Forces.

DIVERGING MODERNIZATION LEVELS: INTEROPERABILITY CONSTRAINTS

Combined operations may only be mounted by interoperable forces. In addition to compatible operational and tactical doctrines, interoperability requires that equipment and training standards be similar. Most of all, however, interoperability in an alliance can be maintained only if its members keep their forces on a similar technological level. The assessment of the modernization level of military forces in operationally meaningful terms is a difficult and time consuming task involving, amongst other things, more or less detailed analyses of age and state of current equipment, ongoing improvement programs and procurement schedules as well as research and development efforts. Besides, the modernization level may not be uniform throughout the forces. Procurement of new, modern systems may be limited to certain units such as those earmarked for immediate crisis reaction operations.

Nevertheless, a first indication of the overall modernization levels of military forces should be revealed by comparing the level of defense investment spending for RDT&E and procurement over recent years to the levels required by a modern force of the size and service structure of the force under consideration. With the US forces being the technically most advanced in NATO, it seems reasonable to use the adjusted investment expenditure levels in the US defense budget as a basis for estimating the investment requirements of modern forces. Besides, the relative modernization levels thus established do provide a measure for the modernization gap between the US forces and their NATO allies given the current patterns of defense spending.

Table 3 presents the results of an analysis of investment spending patterns of NATO allies in the past decade from which the actual investment expenditures per soldier have been estimated based on 1998 defense budget levels. In order to arrive at the investment

expenditure levels that must be sustained in real terms by each respective country in order to eventually reach the modernization level of the US forces, the figure of the actual investment spending of the US is multiplied by the adjustment factor for each. The adjustment factors account for differences in the relative manpower levels of the three services in the forces of the European allies and the US as well as the relative per-capita investment spending requirements of air and naval forces on one hand and ground forces on the other.[8]

Nation	Actual Investment Expenditures [1000 US$]	Adjustment Factor	Required Investment Expenditures [1000 US$]	Modernization Level relative to US
BE	5.2	0.82	51.5	0.101
DK	10.1	0.79	49.4	0.204
FR	36.2	0.88	55.2	0.656
GE	16.2	0.80	50.6	0.320
GR	4.8	0.81	50.8	0.094
IT	8.1	0.84	52.7	0.154
NL	23.4	0.93	58.3	0.401
NO	29.6	0.92	57.9	0.511
PO	3.6	0.93	58.3	0.061
SP	5.7	0.84	52.6	0.109
TR	5.1	0.69	43.5	0.117
UK	57.4	0.93	58.8	0.976
US	62.9	1.00	62.9	1.000

Table 3: Required Investment Expenditure Levels per Soldier for matching US RDT&E and Procurement Spending in 1998.

The quotient of the actual modernization expenditures per soldier and the adjusted US spending level gives an indication of the modernization level of the forces of the respective country relative to that of the US forces.[9] There is a confounding factor. The differences relative to the US level (of 1.0) do provide an indication of the relative magnitude of the average modernization gaps between the forces of the US and of its NATO allies, but assume that the allies have not been given any sizeable equipment grants or financial assistance for the purchase of arms by third parties within the past ten years or so. Thus, the relative modernization levels (RML) for Greece, Portugal, Spain, and Turkey are likely to be higher than suggested by our estimates because equipment grants and financial assistance for

[8] Based on the evidence obtained from several US and UK defense budgets, it was assumed that about 75 percent of the investment expenditures for RDT&E and procurement per soldier go to air and naval forces and 25 percent to ground forces. Thus, since 0.691 of the German Bundeswehr's current manpower resides in the ground forces as opposed to 0.536 in the US forces, the share of investment spending for the German ground forces required for matching the US spending level results as 0.25(0.691:0.536) = 0.3, that of the air and naval force components as 0.75(0.309:0.464) = 0.5, adding up to an adjustment factor of 0.8.

[9] It has been pointed out that the comparatively high investment expenditure levels of the US and UK, and to a lesser degree France, might reflect the cost of their nuclear forces. If these were large enough to significantly affect the per capita expenditures underlying this analysis, the use of the US expenditures as a reference would result in an underestimation of the relative modernization level of the conventional forces of NATO-Europe. However, the respective margins of error should be minor. On the one hand, R&D and procurement of nuclear weapons is largely covered by the US Energy Department's budget. On the other hand, per capita expenditures for nuclear delivery platforms should not differ much from those for platforms of similar complexity used by conventional forces.

weapons procurement are equivalent to an increase of modernization investment spending by the recipients.

It must be pointed out that the RML estimates compiled in Table 3 imply that the respective NATO allies prefer a uniform equipment standard throughout their militaries rather than a mix of modern and less well equipped forces.[10] Bearing this in mind, the forces of European NATO allies may be grouped into five broad modernization categories:

1. A ($0.80 \leq$ RML): United Kingdom.
2. B ($0.60 \leq$ RML < 0.80): France.
3. C ($0.40 \leq$ RML < 0.60): Norway.[11]
4. D ($0.20 \leq$ RML < 0.40): Denmark, Germany, Netherlands.
5. E (RML < 0.20): Belgium, Greece, Italy, Portugal, Spain, Turkey.

From the manpower ceilings listed in Table 2 we conclude that about two thirds of NATO-Europe's current capability for OOA-operations on the ground consists of forces of categories D and E and only about one fifth of category A. The share of the OOA-capability at the lower end of the modernization spectrum would be even larger if we were to account for the new members of the Alliance because the forces of all three of them are likely to be located at the lower end in category E. Therefore, today sizeable European contributions to OOA ground operations of NATO can be expected only if the operational environment is rather permissive and does not require highly sophisticated military capabilities. In fact, largely unopposed peacekeeping operations like those in Bosnia and post-war Kosovo may mark the higher end of the operational spectrum across which Europeans and Americans may still be able to operate jointly and on a similar scale. Beyond that spectrum, if the trend revealed by Table 3 continues, even only small European contributions to US-led coalition operations other than mere peacekeeping and humanitarian assistance may become largely impossible because of operational incompatibility.

INCREASING THE SIZE OF INTEROPERABLE ACTIVE FORCE COMPONENTS

In order to illustrate the principal issues at stake with regard to increasing the size of active forces for non-article 5 operations and maintaining Alliance interoperability, the reader is referred to the matrix in Figure 2 which captures, in a simplified manner, the present state of NATO's military forces in terms of the categories defined above: personnel structure and conscript level respectively (see Table 1) on one hand and the modernization level on the other. In order to improve NATO-Europe's OOA-capability, the European allies would have

[10] The principal preference for maintaining uniformly modernized forces is often defeated by budget realities. If investment spending levels are low, it is not uncommon for certain (elite) parts of a force to receive preferential treatment. For example, the German Army is currently concentrating its modernization efforts on the crisis reaction forces of which one reinforced mechanized division is considered modern by today's international standards (Interview with The German Army's Chief of Staff, LtGen Willmann in the daily *DIE WELT* of 4 February 2000).

[11] Norway's allocation to category C is debatable because the per-capita expenditure levels underlying Figure 2 refer to the number of soldiers on active duty, a number that is usually quite small in militia-type forces like Norway's. In fact, when the modernization investments were related to the sum of active soldiers and reservists, Norway would presumably have to be positioned in category D.

to pursue a long-term force planning strategy that, figuratively speaking, would move their forces to the left and upward in this matrix.

Moving left implies lowering conscript levels in order to maintain or increase the OOA deployment capability as manpower levels are reduced freeing funds and thus permitting moving up to higher levels of modernization. Therefore, depending on the present state of its forces, a country's improvement process might consist of a series of consecutive steps, of left and/or upward movements, that might take decades to complete in some cases. Based on the data underlying this analysis we conclude that, by the time all countries arrived in the upper left hand corner of the matrix – an admittedly somewhat theoretical notion, at least at this time – NATO-Europe's OOA-deployment capability of category A forces would have increased by more than five times, while its total military manpower would comprise only about 40 percent of its current level, given that defense budgets would be kept at the 1998 level in real terms.[12]

[12] However, it is questionable whether each one of the NATO-European forces should proceed that far on the road to modernization and restructuring unless they can increase their defense budgets. A case in point is Turkey. The high conscription level of its ground forces (88 percent) notwithstanding, because of the long mandatory service (18 months) and the high manpower level (525,000), it currently does have the capability of providing some 20,000-25,000 troops for OOA-operations, albeit of the comparatively low modernization category E. In order to modernize its forces to eventually reach the standards of modernization category A and adopt an all-volunteer force posture, Turkey would have to reduce its forces to a level that would leave it with only about one third of its current deployable manpower for OOA-operations. In other words, while Turkey today may contribute more than 20 percent to the maximum level of 80,000-120,000 troops that NATO-Europe may be able to muster according to Table 4 for OOA-operations that can be handled well by ground forces at a low modernization level, its eventual contribution to highly modernized forces would be not more than 6-7 percent at the price of practically having to demolish its current system of military service. Since some, if not the majority, of the OOA-operations to be expected for the near and mid-term might be manpower-intensive rather than requiring highly modernized forces, and considering its economic situation, it might be in the interest not only of Turkey but the Alliance as well that Turkey keep its modernization efforts at a more modest level.

Conscription Level [%] / Category of Modernization	0 (zero)	I (low)	II (medium)	III (medium-high)	IV (high)
A	US, UK				
B			FR 36.0		
C				NO 57.1	
D	NL	DK 24.6	GE 41.2		
E	BE	PO 21.5	IT 44.9	SP 51.4, GR 66.9	TR 82.6

Figure 2: Modernization Trends and Conscript Levels of NATO-Forces (1998).

Thus, with a view to NATO's new mission environment, and assuming that all members of the Alliance spend a fair share of their national resources on defense, the countries of NATO-Europe might share a common guideline for the evolution of their military forces in the 21st century:

> *Stepwise reduction of manpower and conscript levels in a manner that the highest possible level of modernization, readiness, and sustainability can be attained without having to increase the defense budget in real terms and subject to the constraints that 1) the existing manpower capability for OOA-deployments is not decreased and 2) active manpower levels must not decline below a level that is required for maintaining a sufficient pool of reservists for replacement and build-up at least as long as the resurgence of a massive ground force threat against NATO-territory may not be dismissed altogether.*[13]

There are several options that the European allies may consider for the long-term evolution of their military forces based on this guideline. For example, Germany may choose a two step strategy. In the first step, the manpower levels of the German Forces might be reduced along with the conscription level in order to permit returning to an investment level that would be sufficient to arrive at the modernization level B within a decade or so. In the second step, to be taken as soon as conscripts no longer have to be considered the principal

[13] If not for political reasons, the second constraint may be dropped if the operational effectiveness expected from new technologies (involving modernization well beyond the level A of today's US-forces) indeed renders massed armored attacks counter-productive (Johnson, 1999 and Davis, 1999). However, in order to free funds for developing these technologies sooner rather than later, an evolution in steps may hardly be feasible without increasing defense budgets, at least temporarily.

source of recruiting volunteers, conscription would be suspended altogether in favor of an all-volunteer force of about 200,000 to 250,000 troops thus freeing further funds for further modernization.[14] However, category A may be reached only if the defense budget were increased or, contrary to proposed guideline, the requirement for maintaining the current OOA manpower capability were relaxed.[15] Moreover, there is the question whether Germany's defense spending level satisfies the common guideline's precondition that all members of the alliance pay a fair share of their resources on defense.

Figure 3 provides the results of calculations that indicate how the collective OOA-capability of the European allies would be enhanced in the long term, in comparison to the OOA-capabilities for ground operations of the US forces and the European allies in 1998, if all followed the common guideline proposed above while maintaining the relative manpower distribution among their service branches, and their real-term defense budgets in the years to come were either at the 1998 level in each case (option B98), or increased to 1.5 and 2.0 percent of the their 1998 GDP (options 1.5 GNP and 2.0 GNP) by those allies who had not reached these levels in that year. It should be pointed out that the allocation to categories now accounts for both RDT&E/procurement as well as O&M expenditures in order to capture the quality of OOA-forces in a wider sense of the modernization level of the equipment as well as the training and readiness status of the forces that is correlated to O&M spending.[16]

We note that NATO-Europe's collective OOA-capability could be increased by more than 40 percent, from 0.90 to 1.29 of the US level, without spending more on defense than in 1998 if, except for Greece and Turkey[17], all allies would adopt all-volunteer forces and reduce their collective active manpower from 2.4 to 1.5 million. In addition, the fraction of ground forces at modernization level A would increase to 53 percent of the US level compared to 20 percent in 1998, while those at the lowest modernization level E would

[14] In order to maintain its current level of 200,000 volunteers, the Bundeswehr needs about 24,000 new recruits every year. About half of them are recruited internally from the 135,000 conscripts who serve for 10 months. In contrast, an all-volunteer force of about 240,000 that Germany might afford at current budget levels would need an annual input of up to 50,000 recruits. Thus, external recruitment requirements of an all-volunteer force must be expected to be about four to five times that of today's conscript forces (Huber and Schmidt, 2000). For this reason, Huber has suggested that the terms of service be reduced to the minimum feasible for preserving the recruitment benefits of conscription. If that minimum were five months, the Bundeswehr could nearly double its current personnel level for OOA-operations while simultaneously reducing its total manpower level by about 20 percent (Huber, 1998(b)).

[15] Assuming that the relative manpower level of Navy and Air Force should not fall below 50 percent of the Bundeswehr's total manpower, modernization level A for the entire Bundeswehr may be reached within the 1998 budget level only if the Bundeswehr were reduced to a total of 170,000 troops. As a consequence, the Army's OOA manpower capability would be limited to about 85 percent of today's capability of category D. An increase of the defense budget by about 10 percent would be necessary for advancing the current OOA capability of the ground forces to modernization category A while maintaining level D for the main defense forces.

[16] Since data on the distribution of defense expenditures among the principal budget categories were available for the US, UK, and Germany only, the RDT&E/procurement and O&M expenditures have been estimated by subtracting personnel expenditures from the budget total. Personnel expenditures, in turn, have been estimated based on active manpower levels of the respective forces and personal expenditure levels per soldier that, using the US personnel expenditure level in 1998 as a reference, were assumed to be proportional to the per-capita GDP of the respective ally relative to the per-capita GDP of the US. In this manner, the personnel expenditures per German soldier are estimated at 37,990 US$. In contrast, at an average exchange ratio of 1.81 DM/US$ the actual personnel expenditures in that year amounted to 39,700 US$ suggesting that the GDP-based approach should be quite satisfactory for first-order estimates of personnel expenditures.

[17] However, the conscript levels are reduced to 50 percent of the manpower level for the Greek forces and to 60 percent for the Turkish forces (see also footnote 14).

decrease from 53,000 or more than 45 percent of the collective European OOA-capability in 1998 to 5,600 or less than four percent.[18]

The additional improvement resulting when the minimum budget levels are increased to 1.5 percent of the GDP is rather small because only four allies (Belgium, Germany, Portugal, and Spain) had defense budgets below that threshold in 1998.[19] However, a significant improvement would result if defense budgets were increased to 2.0 percent of the GDP by those allies who have spent less in 1998.[20] At a 30 percent reduction of the total active manpower level, from approximately 2.4 to 1.7 million, sufficient funds would become available to bring the European category A capability up to the US level. Europe's overall OOA-capability would increase by two thirds to almost 50 percent above the US level. In that case the forces of Denmark, France, Germany, Italy, and the UK would be in category A, Belgium and the Netherlands in B, Portugal and Spain in C, and Greece and Turkey in D.

SERVICEABILITY AND DEPLOYMENT POLICY CONSTRAINTS

During the Cold War period, NATO's mission environment was largely deterministic in the sense that the threat was well defined with respect to both its magnitude and geographic location. NATO's mission was to deter and, if deterrence failed, to defeat aggression by the Soviet Union and its Warsaw Pact allies. To this end, NATO allies had to train and build-up military forces sufficient for that purpose. In contrast, today's mission environment is highly stochastic in the sense that, in addition to being prepared for action in a major contingency such as collective defense should a massive threat against NATO territory. New requirements will reemerge in the long term, a variety of SASO requiring different numbers of troops for varying periods of time need to be mounted ad hoc on a more or less regular basis, however, at unpredictable dates in most cases.[21] In other words, while waiting and preparing for one or two large scale one-time events as in the past, today's NATO forces find themselves frequently engaged in a variety of different types of SASO events.

[18] The remaining category E capability is provided by Belgium. Belgium has already converted to an all-volunteer force and, therefore, has no room for savings through further reductions without violating the guiding principle.

[19] 1998 defense budgets of the European allies taken together amounted to 1.8 percent of their collective GDP.

[20] In addition to Greece and Turkey, only France, Norway, and the UK have spent more.

[21] The analysis of the data compiled by John Sherwood on operations-other-than-war of the US Army in the period 1984-1994 has shown that their inter-arrival times as well as their duration times follow negative-exponential density functions with constant arrival rates and average duration times, respectively.(Sherwood, 1995).

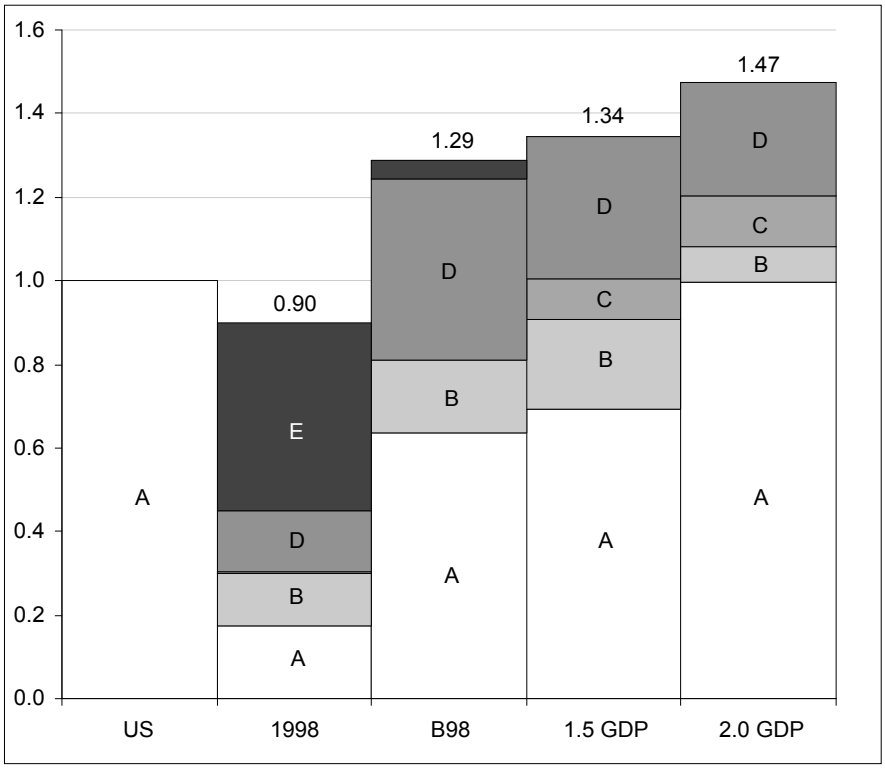

Figure 3: Implications of the Proposed Common Guideline for the OOA-Capability of European Allies relative to the US.

Thus, SASO military forces must be considered much like emergency service organizations such as, e.g., fire and police departments or medical rescue and disaster relief services, that respond on a first-come-first-served basis to a range of randomly-occurring emergency calls. Whether the Alliance can respond to a request for SASO depends, among other things, on the degree to which they have been committed to operations still going on as well as the deployment and rotation policies of their military forces.

It should be noted that the figures in Table 2 reflect the number of ground troops that the respective nations may deploy on a continuous basis given a troop rotation policy involving a five to six-month deployment and a two-year period between deployments. Whether these numbers are sufficient to respond to randomly-arising SASO events of different types is open to question. In order to investigate that issue, Cherry, Huber, and Hodgson (1998) have proposed a single server queuing model that has since been extended to accommodate several types of categories of stochastic events calling for SASO. Each event is characterized by an event-specific arrival rate and mean duration and a certain mix of military units or modules required for its handling. For each unit type, event-specific pre-deployment training and preparation times must be specified as well as post-deployment recovery times including eventual retraining times for their primary functions in contingency war operations and collective defense. Called the Stochastic Requirements Model (STORM), this model is an analytical tool for assessing, among others, the SASO capability of a given military force in terms of the degree to which it can handle randomly-occurring demands (SASO-

serviceability) given its unit mix and rotation policies in terms of duration of and minimum time span between individual deployments.[22]

Similar to the SADE approach developed by DuBois and Kastner (1998), STORM generates, via Monte Carlo simulation, an arrival stream of SASO events and their duration. The model then goes on and either determines the probability that SASO events arriving within a planning period can be handled by the assets available from a given force, or it estimates the number of elements or troops of the various categories that a force or its components need to have in order to guarantee that serviceability, i.e., the probability that arriving SASO events can be handled, does not fall below a desired value.

In order to illustrate how deployment policy affects force requirements for SASO, or how the SASO capability of a given force is constrained by its deployment policy, the reader is referred to Table 4 compiled from a series of exploratory simulation experiments each run for a period of 5,000 years with the first prototype of STORM. The numbers represent the so-called rotation multipliers, i.e., the total number of units required for assuring that the probability that a request for SASO of the indicated categories A, B, C, and D must not be rejected due to a shortage of forces does not exceed given values of 50 percent and five percent, respectively, assuming various deployment policies. The SASO events of categories A and B characterize lesser events such as, e.g., natural disasters, humanitarian relief, and hostage extraction operations, which have been assumed to arrive, on average, four and two times a year lasting for an average of 30 and 120 days and requiring no and 30 days pre-deployment training, respectively. C and D may be regarded as typical intra-state conflicts like those in Bosnia and Kosovo occurring, on average, every four years, requiring robust peacekeeping operations for periods of between 360 and 1000 days, and involving pre-deployment training of one or two months.

Deployment policies of most NATO ground forces today involve a rotation of 180 days and a minimum time of two years between consecutive deployments. Taking a look at the multipliers resulting in that case for a rejection probability of less than 50 percent, or serviceability of at least 50 percent, we note that their values reflect in all cases except C the assumptions underlying the factors of four to five used by most force planners for estimating force requirements for events the uncertain duration of which is to be counted in years rather than months. For event C the assumed average duration of one year is short enough in comparison to the average inter-arrival time of four years that there is a high likelihood that the time between arrival of consecutive events of that type is longer than two years in more than half of the cases, and is near zero for two arriving simultaneously. Thus, for events of type C two units would be sufficient to serve at least every other event of that type. If, however, the rejection rate must not exceed five percent, the multiplier increases to eight. For more restrictive rotation policies the multiplier may increase by up to ten times as in the case when the duration of an individual deployment must not exceed 60 days. However, shorter deployment duration times may be compensated for by permitting more frequent deployments like, for example, two per year rather than one every two years for events of type C.

[22] Both deployment duration (rotation) and deployment frequency determine what is being called PERSTEMPO, or intensity of personnel employment, which is indicative of the time that soldiers have to spend away from home. It is the high PERSTEMPO of the scaled-down post-Cold War militaries engaged in frequent SASO that has become a serious problem for retention of personnel.

The exploratory results presented in Table 4 suggest that more frequent deployments may be acceptable for "lesser" events such as of types A and B for which the likelihood of an operation lasting longer than the rotation time is rather low since the multipliers do not increase measurably, or not at all as rotation time is reduced, even if serviceability requirements are high. For example, it is easily seen that the expected inter-arrival time in case of event A is twice its mean duration. Thus, if units were dedicated to handling events of that kind, an average of two deployments per year would result in about the same relative PERSTEMPO as today's deployment policies for long lasting events of type D as in Kosovo. Therefore, in addition to efficiency in handling SASO events and reduced pre-deployment training requirements, maintaining equity in PERSTEMPO across the entire spectrum of different events may become an important consideration when deliberating the issue of dedicating parts of a force to specific events each rather than selecting ad hoc whatever troops may be available under a uniform deployment policy when an event occurs. Even if sufficient forces were available, it might still not be advisable to commit them if the level of troops remaining fell below the requirements for an event the handling of which should be of utmost priority in the light of national or Alliance interests, demanding therefore a high degree of serviceability. The results of the exploratory experiments illustrate that security policy objectives as reflected by serviceability requirements affect troop multipliers and, therefore, force requirements to a degree similar to that imposed by constraints of troop deployment frequency and duration.

event	**arrival rate per year**	**Mean duration [days]**	**pre-deployment training [days]**
A	4	30	0
B	2	120	30
C	0.25	360	30
D	0.25	1000	60

Table 4: Total number of units required for keeping one unit deployed throughout the indicated SASO event given different deployment policies (unit rotation R[days] and minimum time T_B[years] between consecutive deployments).

CONCLUSIONS

As during the Cold War period, defense spending and the number and type of available forces represent the principal constraints for planning operations in today's major theater war contingencies. Considering the spectrum of post-Cold War military operations subsumed under the term *stability and support operations*, however , personnel structure and deployment policies of military forces, as well as national and Alliance interests, have become important additional constraining factors that force and operations planners have to take into account.

Rejection Probability <0.05

SASO-Event	A			B			C			D		
R / T_B	180	90	60	180	90	60	180	90	60	180	90	60
0	2	2	2	4	5	6	4	4	4	6	6	6
0.5	6	6	7	7	10	12	5	8	10	9	12	15
1	8	9	10	9	13	17	6	10	14	12	18	24
2	13	14	15	12	18	24	8	12	20	16	27	39

Given that the general level of defense spending in NATO will not be increased significantly in the foreseeable future, the analysis presented above has illustrated that only by further cutting back on overall force size and de-emphasizing or eliminating conscription will the Atlantic Alliance be able to increase the quantity and quality of its military forces for non-article 5 operations and ensure that a level of interoperability is maintained that is indispensable for collective defense of the enlarged Alliance and other major theater war contingencies. In addition, it has been illustrated that an entirely different new force and operations planning approach may be required for the new mission environment in order to account for the priorities in military force employment demanded by national and Alliance interests while keeping PERSTEMPO and OPTEMPO at manageable levels.

Rejection Probability <0.50

SASO-Event	A			B			C			D		
R / T_B	180	90	60	180	90	60	180	90	60	180	90	60
0	1	1	1	1	2	2	2	2	2	2	3	3
0.5	2	2	2	2	3	3	2	3	5	3	5	6
1	3	3	4	3	4	4	2	4	6	4	7	9
2	5	6	6	4	5	6	2	4	6	5	10	13

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