Barrier Defense in Europe: An Option for the 1990s?

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Proposals for improving NATO's ability to defend itself by conventional means in central Europe frequently advocate an increase in antitank barriers as both an inexpensive and militarily effective option.[1] While German officials have repeatedly rejected this idea out of political considerations—and while such considerations have taken center stage with the recent political upheaval in Eastern Europe, including the rending of the Berlin Wall—many US defense experts regard the military usefulness of barriers as almost a truism.[2] Yet few published proposals go beyond a general endorsement of this option, occasionally supplemented by remarks on its political sensitivity.[3]

The main rationale for an increased use of barriers is military. However, barriers may also help NATO face the challenges posed by recent developments in conventional arms control, opened borders, shifts in public opinion, and demographic changes. Barriers are already part of NATO's defense plans, although under present arrangements NATO would lack both time and resources to implement them. Strengthening barrier options could contribute to NATO's conventional defense capability. Clearly, such a step would lead to political difficulties. Nevertheless, a number of recent trends have *strengthened* the constituency for barrier defenses, making it increasingly probable that NATO will place more reliance on them in the future.

The Military Need for Barriers

Although the threat may have been somewhat reduced by recent events, particularly by Soviet Secretary General Gorbachev's December 1988 announcement of unilateral troop reductions in Eastern Europe, one of the primary military concerns of Western analysts has been a short-warning, minimal-preparation ground attack by the Warsaw Pact that catches NATO off guard.[4] While Soviet implementation of the announced troop cuts would

indeed deprive the Warsaw Pact of a standing-start option in central Europe,[5] NATO still faces a number of problems in the areas of mobilization, deployment, and reinforcement. Furthermore, the alliance might not react to ambiguous warning out of fear of escalating an existing crisis.[6]

According to current NATO planning against a ground attack in central Europe, forward-deployed covering forces (together with those units that arrive first from their peacetime positions) would have to be stretched over the entire forward area until the rest of the assigned forces have arrived. Owing to peacetime maldeployment of some units and crowded roads, arrival might well be delayed. During this initial phase no coherent defensive line could be established, and breakthroughs would be very likely. In turn, these breakthroughs could result not only in early combat engagements of NATO units still on the move, but would also disrupt supply and communication lines and severely hinder NATO's ability to continue the mobilization process.

While previously prepared barriers would not permanently prevent a massive assault from breaking through—which most advocates concede—these structures would slow it down. Attacking troops would have to stop, clear mines, and bring forward earth-moving and bridging equipment. Depending on the type and depth of barrier, the delay could be measured in hours or in days.[7] If obstacles are emplaced properly, both attacking tanks and engineer equipment would be trapped for an extended period within firing range of those NATO forces already in place, resulting in significantly increased attrition. Even if the effected delay is short, the time gained could be crucial for the critical transition period, providing time for the movement of the bulk of NATO units from peacetime garrisons to assigned forward deployment areas and the initial deployment phase. The need to gain time can only be accentuated by the mutual reduction of forward-deployed forces as promised by the Bush-Gorbachev summit of December 1989, since in the event of hostilities an increased proportion of US reinforcements would have to be deployed from Stateside.

A second argument in favor of barriers concerns the availability of operational reserves. In order to defend a given front, the defending side needs operational reserves to commit to troubled sectors or to exploit enemy vulnerabilities. The ratio of frontline troops to operational reserves, according to

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NATO standards, should be roughly three to one. The minimum density of frontline troops—the force-to-space-ratio—on the other hand, is said to be 25 to 60 kilometers per US heavy division, depending on the terrain.[8] Under current conditions, NATO would be very short on operational reserves, especially during the first weeks after mobilization.

Barriers could effectively address this problem. Frontline sectors that have been prepared with barriers could be covered by fewer and less heavily equipped troops, decreasing the necessary force-to-space ratio and releasing heavy mobile troops for use as operational reserves. One defense analyst estimates the cumulative effect of various barrier measures in the NATO Central Region to be two divisions' worth of force savings.[9] This effect would be amplified if troops covering the obstacles are protected by hardened defensive positions.[10]

Factors Inhibiting Barriers

Despite these positive arguments, a broad constituency is opposed to barriers. The most popular argument against fixed defensive preparations in NATO's central region is not a military, but a political one: the symbolic impact of barriers in Germany. In this view, fortifications and trenches on the western side of the inter-German border would visibly (and psychologically) enhance the division of the country. Barriers would reinforce the notion that reunification is no longer possible. In view of the dramatic pace of recent political change in Europe, the construction of barriers would be criticized by many as a step backward. The political uproar that might follow installation of a barrier system, so the argument goes, could well be too costly for NATO or, in any case, costlier than the expected marginal advantage for NATO's defense.

This argument, while initially persuasive, might be more speculative than substantial. The division of Germany continues to be a very sensitive political issue. Nevertheless, public opinion on how barrier defenses affect the permanency of the German division has not been ascertained.[11] This is not surprising, since the concept of barrier defenses in the context of NATO's forward defense is a specialized military issue, attracting little public attention (despite a general increase of interest in defense matters in the aftermath of the INF deployment). Increased public interest in military affairs indeed led to a more active resistance against manifestations of military activity. Gorbachev and his dramatic arms-reduction announcements have created a markedly diminished threat perception.[12] Adding barriers to NATO's defense, as defensive and militarily useful as it might be, makes sense only if a certain degree of threat is perceived. Moreover, the environmental impact of the large-scale military presence in Germany generates concern. Nevertheless, resistance against barriers is likely weak compared to some other items on

NATO's agenda, notably the modernization of short-range nuclear missiles. In fact, barriers might be one of the few options left for NATO to improve its defense capability while upholding public support.

A second argument against barriers questions their effectiveness in modern warfare. France's Maginot Line in World War II is often evoked as the classic example of the limits of strategic barriers. While the Maginot Line's failure has taken on an almost mythlike quality, an increasing number of analysts argue that in fact it worked—that Germany bypassed it, and that France neglected to use its operational reserves properly. Later in the war, US and allied troops had serious and prolonged difficulties breaking through the same fortifications, combined with the West Wall on the other side of the border, when these fortifications were defended by German troops. Several accounts testify to the effectiveness of numerous other fixed defensive lines.[13]

However, the experience along the French-German border is not governing so far as the barrier issue in NATO is concerned. A strategic barrier of the scope of the Maginot Line would never receive serious consideration within NATO. Current proposals that do advocate such large systems, were they disseminated more broadly, would do a disservice to the cause of barriers. Claims that no single strategic barrier in recent history has worked, as well as assertions to the contrary, are therefore not really to the point. Unfortunately, such arguments often dominate the discussion.[14]

The lack of enthusiasm for barriers has to some extent infected even the military itself. Gregg F. Martin points to the low institutional prestige of combat engineers—the military branch responsible for the construction of barriers—within the Army. Their lack of bureaucratic clout makes it difficult to influence planning and funding priorities within the Army budget. A doctrinal preference both in the US and German armies for mobile, mechanized warfare also explains some of the skepticism among military officers toward fixed defensive preparations. This orientation has led combat engineers to prefer equipment that is best suited for counter-obstacle missions in concert with heavy armored formations rather than static defensive preparations.[15]

In addition, military officers often voice the concern that an extensive use of barriers would inhibit the flexibility of NATO's own troops. Fast movements for counterattacks or retreats to evade encirclement could become as difficult for the defender as for the attacker.[16] This fear may be justified for some of the more comprehensive barrier proposals but not for such flexible options as scatterable and switchable mines and explosive pipes, which will be discussed below. While the services increasingly appreciate these devices, a doctrinal integration that takes advantage of their potential is still missing.

Some observers are worried that NATO may perceive a strategic barrier to be "too effective." France's defeat in World War II is sometimes attributed to the false sense of security generated by the existence of the

Maginot Line. The barrier prevented France from paying enough attention to other, equally important components of a barrier defense strategy, such as sufficient mobile reserves. This "Maginot Line syndrome," it is argued, would also affect NATO were it to construct a barrier system.

Overselling barrier defenses could indeed create similar complacency. Should the public come to believe that barriers are in fact an extremely cost-effective and reliable way to strengthen NATO's conventional defense, it might begin to question whether large expenses for other existing and planned defense programs are justified. From a parochial point of view, a dilemma exists: Public resistance to barriers can be overcome only by pointing out the utility and low cost of the concept, yet this argument can be misinterpreted as a strong case against many of the armed services' current favorite projects.

A handicap for barrier advocates is the difficulty of measuring the effectiveness of obstacles in combat. While historical accounts and anecdotal evidence testify to the potential of barriers, the interaction of multiple barriers and defensive positions as well as their delaying effect are difficult to quantify. Combat simulations either rely on subjective assumptions about the effects of barriers on delay rates or enemy-to-friendly loss ratios, or they fail to include possible reactions and countermeasures by the attacker.[17] Problems in calculating the effects of obstacles thus tend to result in a certain bias against barrier arrangements in warfare computer models, whose outcomes often serve as the basis for defense planning.[18] However, barrier simulation problems could likely be solved if more resources were devoted to such analysis.

Existing Barrier Defenses in NATO

The concept of barrier defenses is not new to NATO. Indeed, current NATO defense plans include the use of natural obstacles as well as artificial barrier preparations.

Forests, rivers, swamps, and mountainous areas near the inter-German border would serve as a barrier for advancing enemy tanks. In addition, the extensive urban sprawl would slow down an armored attack and provide numerous defensive positions. However, the effectiveness of natural obstacles is dependent on the seasons, the weather, and other transient factors, and can be relied on only to some measure.[19] Moreover, significant areas do not feature natural or man-made obstacles.

All NATO combat units assigned for forward defense have barrier plans to implement after mobilization. As soon as they have reached their forward deployment areas, frontline units are supposed to begin construction of obstacles and fortifications, assisted by available combat engineer units. These activities are to continue as long as possible, i.e. until D-day and beyond. Thousands of roads, railways, and bridges in Germany have been built with prechambered demolition sites to prevent their use by advancing

enemy troops. NATO combat engineers are trained and equipped to emplace minefields in areas of expected attacks. The implementation of these barrier options—with the partial exception of charging prechambered demolition sites—will not start before a decision to mobilize.

Given a short-warning scenario, however, some experts are concerned that units will not have the time to prepare anything more than hasty defenses, should they be able to reach their forward deployment areas at all. Although advanced equipment is now being introduced, current mine-emplacement methods are time-consuming and manpower-intensive.[20] US Army engineer studies estimate that in order to reach the highest level of survivability for one heavy division, 21 engineer battalion-days of work on fortifications are needed.[21] In addition, combat engineers are at a premium and have to be allocated for the preparation of both obstacles and shelters. Recent analysis of Warsaw Pact artillery capability suggests that more priority will have to be given to the construction of shelters, resulting in even less barrier preparation.[22] Finally, US reliance on reserve components among combat support troops—including combat engineers—is very high. Sixty-seven percent of all US combat support units committed to NATO after mobilization would be drawn from the reserves, compared to 48 percent of combat units. Mobilization of these troops and their transport to the European theater will take several weeks.[23] All of this suggests that in the event of war, NATO's present plans for defensive preparations—however good they look on paper—will not be implemented.

Proposed Barrier Options

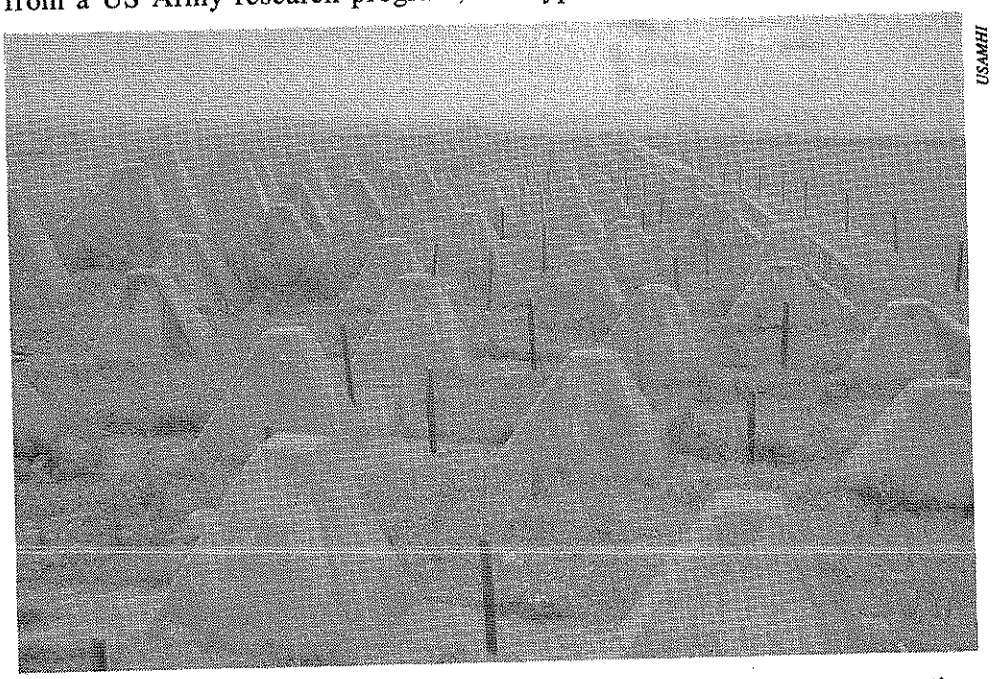
Over the course of the last few decades, several categories and specific types of barriers for NATO's central region have been proposed. To assess their political viability in Germany, let us consider their technical characteristics while addressing questions of obtrusiveness, land consumption, and the degree of peacetime preparation required.

Proposed obstacles include traditional measures, such as antitank ditches, dragon's teeth, and minefields, as well as walling of river or road embankments, forestation of open areas, planting of hedgerows, walled terracing of slopes, and adaptation of irrigation and recreation lakes. These types of barriers take considerable time to prepare and must be constructed in peacetime. Antitank ditches and certain concrete steps are easily recognizable as military construction, creating problems of obtrusiveness. Forestation and artificial lakes, while consuming considerable amounts of property, would allow recreational, ecological, and economic use of the areas. Modification of road and railway embankments would probably be obtrusive, although such modifications would not require additional land. More important, the construction would have to take place exclusively on publicly owned property, avoiding time-consuming and costly legal problems.

Partly in response to German domestic political concerns, recent proposals focus on more flexible, less visible, and less obtrusive options. New devices, which are already being procured and fielded in limited numbers, allow the rapid placement of scatterable antitank mines from aircraft, helicopters, multiple rocket launchers, tube artillery, and specialized mine-laying vehicles over wide areas, thus combining flexibility and surprise.[24] Even more significant from a tactical point of view is the development of switchable mines, permitting remote-controlled activation and deactivation of minefields after they have been emplaced. All of the scatterable mine types could be inserted rapidly, enabling NATO to withhold their deployment until the actual outbreak of hostilities.

While the military value of these systems is undoubtedly significant, their very flexibility underscores a feature that distinguishes peacetime fixed defensive preparations from other types of barriers. From a deterrence perspective, it may be desirable that the other side be aware of the presence of barriers so that it is deterred from initiating an attack in the first place.[25] In a crisis, where NATO would like to avoid measures that might escalate the risk of war, the mere act of emplacing minefields—as unprovocative as it might be—could be perceived as too risky.

Explosive pipes are offered as a compromise in this regard. Resulting from a US Army research program, this type of mine incited considerable



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Too obtrusive to construct in West Germany today, but an effective wartime obstacle fifty years ago, these concrete dragon's teeth formed part of the Siegfried Line. This photo was taken near Lammersdorf, Germany, on 25 September 1944.

controversy in Germany upon its first disclosure during the fall of 1984.[26] The mine consists of long, flexible plastic pipes which are buried in the ground and stay empty in peacetime but can quickly be filled with an explosive slurry in the event of a crisis. Should an obstacle be needed at the location of the pipe, its detonation would create an antitank ditch that modern tanks cannot cross. If tensions should decrease before detonation, the explosive can simply be pumped out, leaving the pipe available for future contingencies. While this system would probably have to be installed in peacetime, it would be virtually invisible, and harmless when empty. The property would continue to be agriculturally productive, reducing military land consumption to a minimum. The location of the pipes would probably be known to the adversary, however, leaving open the possibility of the preparation of countermeasures, circumvention, and sabotage.[27] While the German government has expressed its unwillingness to contemplate a large-scale peacetime installation of the explosive pipes, the US Army has proceeded with the development of the concept and is scheduled to field it with engineer units in Europe beginning this year.[28]

Barrier advocates point out that barriers have to be covered with direct-fire weapons in order to maximize their effect. For this purpose, but also for the defense of areas that are not protected by barriers, they recommend the construction of fortifications. These defensive positions are intended to enhance the survivability of direct-fire weapons. Some proposals include the prefabrication and storage of concrete shelters that could, on warning, be rapidly emplaced. While this concept would solve the problem of obtrusiveness and reduce the time needed for construction, it would probably not be sufficient to cope with a short-warning scenario. Depending on how effective these shelters are perceived by the other side, the delay between the decision to mobilize and the emplacement of the shelters might even invite preemption.

Peacetime construction of fortifications alleviates this problem. Proposals range from elaborate "forts" equipped with high-tech weapons, to "strongholds" with trenches and bunkers, to simple two-person shelters. Some proposals include sizable peacetime detachments of personnel. All of these fortifications would be visible and obtrusive to some degree, while some of the more ambitious ones would be very much so. These types of proposals do evoke images of the infamous Maginot Line, and they can be considered generally unacceptable to the German government and public. Programs are under way now in Germany to modify selected farm buildings located in corridors of potential attack for use as military strongholds. The reinforced structures would be available for regular civilian use in peacetime.[29]

Most of the individual obstacles and fortifications outlined above are also part of more comprehensive proposals for barrier defenses. Their scope

ranges from very complex systems that are intended to fully replace NATO's current force posture to supplemental measures to decrease NATO's vulnerability against a short-warning attack. The extent and intensity of land consumption varies considerably.[30] Some advocates, acknowledging the political-military tradeoffs involved, offer a spectrum of options, mostly recommending a compromise between military usefulness and political feasibility.[31] Those few theorists who focus on *optimal* barrier defense, entailing great costs in terms of land, resources, and obtrusiveness, generally avoid the question of political feasibility altogether.[32]

Besides fixed peacetime preparations and new developments in barrier technology, a significant increase of combat engineer troops in NATO could improve barrier capabilities. This measure would not solve the problems of a short warning, but it could help NATO implement its existing barrier plans. Improving engineer capabilities has the principal advantage of being unspectacular enough not to arouse public or political controversy. It could be presented as part of a routine NATO improvement program. Given a fixed ceiling for the overall force structure, however, manpower and other resources would probably have to be drawn from other branches. Hence, it might be necessary for the political leadership either to overcome resistance from within the military or to initiate a special program with extra funding.[33] The troop drawdowns promised by the recent conversations between Presidents Bush and Gorbachev perhaps will offer an opportunity to increase the proportion of combat engineers in the remaining force structure.

NATO procedures prohibit any mobilization orders from NATO authorities until the member states have agreed on a decision. However, NATO members could grant limited pre-authorization of engineer troop deployment. During a growing crisis, NATO's engineer units could then start to prepare obstacles and fortifications before an actual mobilization takes place. This certainly would appear less threatening than the dispatch of combat troops.[34] While this option could significantly reduce the problems associated with a surprise attack, the inherent political problems are likely to be prohibitive. NATO member states have traditionally been very reluctant to predelegate command authority. The current perceived lessening of tensions will make them even less willing to do so.

The financial cost of barrier improvements depends largely on the scope of the proposed system. Some analysts see considerable improvements for NATO's conventional defense with an outlay of less than $100 million, while complex barrier systems might cost up to $100 *billion* dollars, including land purchases.[35] The low-technology character of most barrier construction permits competitive, local contracting. Some of the barriers that are based on modification of road or rail embankments could even be installed virtually cost-free, over the course of regular civilian infrastructure construction.

Countermeasures and Side Effects

If NATO were to install a system of barrier defenses, the Warsaw Pact would most likely respond with countermeasures, though such a response is perhaps rendered less likely by the Soviets' recent declared intention to switch to a "defensive" doctrine and force structure. What any countermeasures would look like depends on the kind and scope of the barrier. While countermeasures affect NATO military planning, they could also have serious political consequences involving the countries bordering on the NATO Central Region.

If obstacles were placed only in the expected avenues of approach, a Warsaw Pact planner could simply switch the main thrust of an attack to a less well suited, but also less expected, area. However, these areas would then feature natural obstacles such as forests, steep slopes, or rivers that make them less convenient for tank movements and more advantageous for the defender.

The attacker could procure more specialized engineer equipment to cross or destroy obstacles. But such operations would still require considerable time to effect, and this equipment would be at least as vulnerable to defensive covering fire as the tanks attempting to cross the obstacle. The Pact forces also could assume a less tank-heavy posture that would be less vulnerable to antitank barriers, foregoing the option of a quick and massive breakthrough. From a NATO point of view, of course, this response is desirable. Indeed, this is precisely why the Soviets' declared conversion to a "defensive" stance is being cheered in the West.

An alternative to an armored attack is the use of airborne and airmobile troops, which could simply avoid a barrier system by flying over the front line and conducting operations in NATO's rear area. While such operations are already part of Soviet planning, it is doubtful that they could have a decisive effect in an armed conflict in central Europe without a simultaneous armored attack.[36]

Intra-Alliance Issues

Aside from military considerations, a number of new intra-alliance issues would emerge with the advent of barriers. The most immediate would be the problem of financing. Existing barriers in Germany have been funded, constructed, and administered by the German army, more specifically the Territorial Army's *Wallmeister* organization. This arrangement was worked out between NATO force commanders and Germany under the Northern and Central Region Barrier Agreements.[37] A large-scale program, however, would require new, NATO-wide financing arrangements. A number of issues would have to be addressed, including the cost of land procurement, contract awarding policy, and how the overall cost would be fairly divided among the individual NATO countries.

The question of NATO participation becomes even more critical if the barrier system adopted involves routine peacetime staffing, perhaps by specialized troops that would be organized and trained for this purpose. One of the main rationales for NATO's "layer cake" scheme of wartime troop deployment along the inter-German border is political. This arrangement secures NATO commitment to the common defense of Germany by way of the immediate involvement of NATO troops. At least one of the barrier proposals, however, recommends that quickly mobilizable reserve units cover the barriers, while the bulk of active forces remains behind to serve as a mobile operational reserve. Despite the proponent's claims that "some active forces would remain to augment the fires of the mobilized reserves," the combination of quickly mobilizable reserves and deployment along the inter-German border obviously means that German reserves would bear the brunt of the attack. This arrangement in effect gives up the political advantages and deterrent effect of shared responsibility for the forward defense.[38]

Decisions on the location of barriers also could prove divisive within the alliance. Germany understandably insists that forward defense begin directly at the inter-German border. On the other hand, allied commanders might feel that, out of operational considerations, the forward line of defense should be moved a few miles westward to more advantageous terrain. These details are not widely discussed within the alliance now, since they would materialize only with the outbreak of actual hostilities. Peacetime-emplaced barriers, however, are readily visible indications of where the forward line of defense would be located at the outset of a war. Tradeoffs between operational usefulness and political considerations could thus incite a new area of intra-alliance disagreement.

Another question would be how local barrier preparation relates to existing national corps sectors. Official NATO doctrine for ground forces constitutes only a very general framework, with differing national operational doctrines. A survey of these doctrines in the Central Region suggests that in virtually all cases, defensive preparations and barriers do play an important role. The northern Belgian, British, and Dutch sectors each emphasize variations of area defense, with strong emphasis on defensive positions. The German and US armies both plan a mobile defense, also using barriers and defensive positions as cornerstones.[39] While this review of doctrines points to a general agreement on the need for barriers, a uniform barrier system along the inter-German border could well result in compatibility problems with individual national doctrines. An area-defense oriented doctrine, for example, would require preparation of barriers in greater depth and density than a maneuver-oriented doctrine.

Assessments of NATO's conventional defense capabilities often are optimistic about the situation in US and German corps sectors, but paint a gloomy picture for the Dutch and Belgian sectors. These latter countries'

forces have a high mobilization and reinforcement dependency, and are strongly affected by defense budget constraints. If barrier funding, construction, and management were tied to respective national corps sectors and therefore handled on a national basis, problems of uneven quality could continue. Moreover, problem sectors resulting from underfunding in the barrier system would then be similar to those already existing among assigned troops, canceling out the advantages barriers are supposed to offer. In deciding on priority locations for barriers, however, the Belgian and Dutch corps sectors would be prime candidates. Extended mobilization time is one of the main rationales for barriers, and this is a much more serious problem in these two sectors than in the US and German sectors.

Developments Favoring Barrier Defenses

Recent developments in the conventional arms control area may impair the chances for increased use of barriers—or it may enhance them.

NATO's negotiating position in the current Vienna talks on Conventional Forces in Europe (CFE) is frequently criticized as having little to offer in exchange for reductions in Warsaw Pact forces. This lack of flexibility stems from the so-called force-to-space-ratio problem. According to this concept, the number of troops necessary to coherently defend a given area is not merely contingent on the strength of the opposing force, but is dependent as well on the size and geography of the defended area. NATO troops are purportedly stretched so thin in the Central Region that it would be dangerous to reduce them at all, even with disproportionate reductions on the Warsaw Pact side. An influential RAND study suggests that anything below a 5:1 or 6:1 reduction rate in favor of the West will actually worsen NATO's position.[40] NATO's initial CFE offer reflected these calculations, creating possible problems of negotiability and public credibility. Economies of force created by an increased use of barriers could significantly improve NATO's perceived bargaining leeway in the CFE talks by adjusting the ratio deemed necessary for NATO's safety.

As we have noted, a consensus is emerging that negotiations on conventional arms control should not aim simply at lower levels of manpower and equipment but rather focus on the establishment of less destabilizing and more defensive force postures. Steps toward such a posture would include primary reductions in those weapon systems that are most suitable for mobile offensive warfare—tanks, artillery, and river-crossing equipment—and a mutual restructuring of forces which removes possible advantages for an aggressor. Barriers are part of several of these kinds of arms control proposals that feature concepts for a such a modified force structure.[41] Barriers could decrease the need for early mobilization and reduce the need for large mobile armored forces, while remaining unambiguously defensive.

Recent developments suggest that the Soviet Union has accepted the idea of barrier defenses. Soviet Defense Minister D. T. Yazov has announced plans to compensate for the unilateral cuts in Soviet armed forces by constructing permanent field fortifications in the western part of the Soviet Union as well as the conversion of motor rifle divisions into "machine gun/artillery divisions" to man these positions.[42]

Force structure changes that are driven by demography rather than by developments in arms control also might make barrier defenses look more attractive to NATO governments. Declining birth rates have diminished the available pool of conscripts, especially in West Germany. Force planners are scrambling for ways to compensate for the short-term projected shortfall of conscripts for the West German armed forces, which is expected to be as high as 100,000 by 1994.[43] An extension of draft service will not be sufficient to close the gap and, moreover, seems to be politically unworkable under current circumstances. Force economies resulting from increased reliance on barriers might solve this problem. Depending on the role that reserves play as part of a barrier defense, this option has even greater potential. Already, German army restructuring efforts emphasize reserve as opposed to active elements.[44]

The German Social Democratic Party (SPD) can be counted—at least implicitly—among the advocates of barrier defenses. In August 1986 the SPD adopted a new security policy platform oriented toward a more defensive force posture for the German army. A more recent SPD document, while refuting the idea of a Maginot-type line or "additional fortifications along the [inter-German and Czechoslovakian] borders," openly calls for "preparation of barriers, which can be activated in case of war . . . [and the] timely availability of earthworking machinery and explosives . . . for the reinforcement of natural obstacles and the creation of artificial ones" as part of defensively restructured land forces.[45] Even though a restructured alliance as envisaged by alternative defense advocates might not be wholeheartedly endorsed by all US advocates of barrier defenses, a common denominator—possibly a starting point for mustering public support—exists. It is not without irony, however, that some of the more prominent German alternative defense proposals would apply sophisticated technology to implement a barrier strategy.[46] This trend runs contrary to the low-tech, low-cost character of barriers when proposed as a supplement to NATO's current strategy and force posture.

US appeals to Germany to accept more peacetime preparation of barriers have long been unsuccessful. Now more serious pressure is building up. The rising costs of conventional weapon systems, concerns about military cost-effectiveness, and uneasiness about the consequences of the INF treaty for the military balance in central Europe have created a renewed interest in the idea of barrier defenses, particularly among members of the US Congress. Several have publicly voiced their impatience with German intransigence on

this issue. The Congressional Military Reform Caucus strongly endorses barriers.[47] It is conceivable that Congress might couple the question of barriers with the chronically divisive issue of burden sharing.[48] Congress could vote for a pull-out of US troops from Germany or demand German funding for the redeployment of US troops closer to the inter-German border if the German government fails to accept peacetime-installed barriers.

Yet, the burden-sharing lever is weakened by the fact that in recent years Germany has performed quite well in fulfilling its alliance obligations.[49] And it is Germany, after all, on whose territory barriers would be placed and whose government offers the most resistance. Also, increased visible pressure—and it can be assumed that any kind of significant pressure will become public sooner or later—might have a strongly negative effect on German public support for alliance matters. Finally, the degree of public resistance to new military construction in general—as opposed to the concept of barrier defenses in particular—should not be underestimated. The same dynamics that have led the West German government to cut NATO large-scale exercises by 50 percent, to reduce low-level training flights, and to reject extension of the conscription period to 18 months will also affect any decision on barrier defenses.[50] A unilateral decision by the German government in order to appease the US Congress will *not* be possible. NATO and its members will have to launch a campaign to explain the virtues of this concept to the public. A possible sweetener in this regard could be linking barrier construction with a significant reduction of training exercises in the affected areas.

Recommendations and Conclusions

Given the constraints outlined above, NATO will not easily gain acceptance for an increased use of barriers in the Central Region. However, under current circumstances, few defense improvement measures are uncontroversial within the alliance. Many of these proposals are more controversial than the use of barriers. If NATO is indeed serious about its conventional improvement efforts, there is ample reason to consider barrier options more seriously than in the past.

Developments in European threat perception do not appear favorable for barriers on first sight. Analyzed more carefully, however, these shifts in public opinion could provide a realistic chance to create support for barriers. In order to take advantage of this opportunity, NATO and its members should start an aggressive public relations effort to explain: (1) the defensive and stabilizing nature of barriers; (2) their potential non-intrusiveness; (3) their low cost; (4) their economy-of-force effect; and (5) most important, their complementarity with conventional arms control. NATO should under no circumstances attempt to implement the peacetime installation of barriers "under cover."

At the same time, NATO should avoid framing the promotion of barriers within a larger debate over strategy. Forward defense, along with its national doctrinal implementations, can accommodate—and even calls for—barriers. In the long run, a major change in strategy might be unavoidable. At this point, however, it will merely add to the already existing divisive issues within the alliance, thus impeding the implementation of the barrier option.

Installation of an uninterrupted barrier system from the Baltic Sea to Austria—while often suggested—is neither militarily necessary nor politically feasible. Yet, peacetime barrier preparation in only selected critical areas—such as the northern German plain and other expected avenues of approach—would be beneficial to NATO's conventional defense and would address many of its existing weaknesses. In addition, corps sectors with recognized mobilization and reinforcement problems should have a larger degree of barrier preparation. The types of barriers chosen should be as unobtrusive as possible, with explosive pipes, forestation, and landscaping the most desirable candidates.

Apart from the peacetime installation of barriers, NATO should improve its capability to implement existing barrier plans. Specifically, it should increase the number and the readiness of combat engineer troops. Establishing a special program with funding and political supervision, perhaps elevating it to a priority level comparable to the Long Term Defense Program, would serve to limit bureaucratic inertia and intraservice parochialism.

In addition, NATO and its members should develop a concept that integrates the potential of advanced scatterable mines and their delivery systems into ground and air combat doctrines. Procurement of these systems should also be accelerated. Finally, NATO should devote more resources to operational research on barriers. In particular, an effort should be made to learn more about the interaction of fixed defensive preparation and mobile warfare.

In the future, NATO may well give higher priority to barrier defenses, including some form of peacetime preparation. While military considerations may not be sufficient to convince European governments of the merits of barrier defenses, the realities of budget constraints, the need for force economies, and demographic developments may make NATO more receptive. The changing climate in East-West relations and recent movement in conventional arms control also may direct more interest to the defensive and stabilizing nature of barriers. Barriers may be one of the few options still capable of mustering public support in defense matters. This, however, crucially depends on NATO's ability to communicate the rationale and potential of barrier defense to its own public.

NOTES

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1. In this article I will use the term "barriers" to include both obstacles and fortifications. While these two concepts are different, in the public discussion they are often used interchangeably. Technically, barriers are combinations of man-made or enhanced natural obstacles whose primary purpose is to stop, delay, divert, or channel enemy (tank) movements. Fortifications or defensive positions are earth or concrete structures intended to enhance survivability of friendly troops and equipment and to increase the effectiveness of weapons.

2. Compare testimony given by Richard Kugler and Leonard Sullivan, Jr., in US Congress, Senate, *Alliance and Defense Capabilities in Europe, Hearings before the Subcommittee on Conventional Forces Alliance Defense of the Committee on Armed Services, U.S. Senate* (Senate Hearing 100-504), 4 August; 7, 20 October; 3, 17 November 1987 (Washington: GPO, 1988), pp. 209, 356-57; see also the yearly Brookings studies on the US defense budget, e.g. Joshua M. Epstein, *The 1988 Defense Budget*, Studies in Defense Policy (Washington: Brookings Institution, 1987), p. 39.

3. This generalization is not valid for the concept of alternative defense. The inherently defensive nature of barrier concepts has led to its adoption by a number of defense analysts who advocate defensive or non-provocative force postures. Looked at in more detail, however, these concepts are in some ways quite different from those developed to strengthen NATO's current posture.

4. Compare Carl Levin, *Beyond the Bean Count* (2d ed.; Washington: Senate Armed Services Subcommittee on Conventional Forces and Alliance Defense, July 1988), p. 14; Richard K. Betts, *Surprise Attack: Lessons for Defense Planning* (Washington: Brookings Institution, 1982); Philip A. Karber, "NATO Doctrine and National Operational Priorities: The Central Front and the Flanks: Part I," in *Doctrine, the Alliance, and Arms Control*, ed. Robert O'Neill (London: International Institute for Strategic Studies, 1986), pp. 177-78.

5. Phillip A. Karber, "The Military Impact of the Gorbachev Reductions," *Armed Forces Journal International*, 126 (January 1989), 54-64.

6. Compare the NATO reaction to the Warsaw Pact's invasion of Czechoslovakia in 1968. Even routine exercises near the border were canceled in order not to appear provocative. Discussed in Betts, pp. 81-86.

7. A 1988 Congressional Budget Office (CBO) study suggests that a rather elaborate system of barriers (20 km deep) could effect a delay of about three days, improving the force ratio significantly for the first few days after Pact mobilization. The same study concludes that barriers would reduce the amount of territory lost by NATO after an attack. This effect, however, appears to be much higher for the southern part of Germany, where the situation already is favorable. In the northern part, very high territory losses are to be expected even with the use of barriers. Unfortunately, the CBO study is based on a rather simplistic model, which reduces the value of its findings. US Congress, Congressional Budget Office, *U.S. Ground Forces and the Conventional Balance in Europe* (Washington: GPO, June 1988), pp. 38-43. Interview with Stephen D. Biddle, defense analyst in the Strategy, Forces, and Resources Division, Institute for Defense Analysis, Alexandria, Va., February 1989.

8. William P. Mako, *U.S. Ground Forces and the Defense of Central Europe* (Washington: Brookings Institution, 1983), pp. 36-38.

9. Interview with James A. Thomson, Vice President, RAND Corporation, Santa Monica, Calif., January 1989. The barriers assumed scatterable mines and explosive pipes in selected areas.

10. The availability of hardened defensive positions has been calculated to increase survivability of the defender by 54 to 77 percent in personnel casualties and 34 to 118 percent in tank losses. The effectiveness of direct-fire weapons may rise by five to ten times when barriers and fortifications are used. Quoted in John C. F. Tillson, "The Forward Defense of Europe," *Military Review*, 61 (May 1981), 69. A US Army engineer study concludes that obstacles could increase the effectiveness of the TOW antitank missile system by about 300 percent, and the US main battle tank by about 160 percent. US Department of the Army, *Obstacles*, Field Manual 90-7 (Washington: GPO, 1979), as quoted in Gregg F. Martin, "Another Maginot Line? Prepared Defense and NATO," unpublished paper, Cambridge, Mass., MIT, 1988, p. 42.

11. For possible social and psychological effects of barriers on Germany, see Robert L. Goldich, *NATO Conventional Force Structure and Doctrine: Possible Defensive Changes After an INF Treaty*, CRS Report 88-169 (Washington: Congressional Research Service, 26 February 1988), pp. 29-31. The outcry that followed the reports of US Army plans for an explosive pipe to be buried along the inter-German border is the only recent example of a public reaction to this issue. This incident should be seen as the combined result of a flawed public relations effort, press sensationalism, and misrepresentations, rather than a conscious manifestation of German public attitudes.

12. The German weekly *Welt am Sonntag* reported on a public opinion poll in December 1988 indicating that 75 percent of the West Germans no longer see a communist threat, compared to 47 percent

in 1984. Quoted in Rolf Soederlind, "West German Cut in Maneuvers Only Hints at Changes to Come," *Armed Forces Journal International*, 126 (January 1989), 33.

13. For a discussion of the effectiveness of the Maginot Line, the West Wall, and other fortified defensive lines, see Goldich, pp. 26-28; compare also Omar N. Bradley, *A Soldier's Story* (New York: Henry Holt, 1951), p. 243; and Chaim Herzog, *The War of Atonement* (Boston: Little, Brown, 1975), pp. 113-14.

14. For a Maginot Line-type proposal see esp. J.B.A. Bailey, "The Case for Pre-Placed Field Defenses," *International Defense Review*, 17 (No. 7, 1984), 887-92. For the criticism of strategic barriers see West German defense ministry spokesman referring to explosive pipes as quoted in Wayne Biddle, "U.S. Tests Explosive Pipeline To Thwart Advancing Tanks," *The New York Times*, 24 August 1984, p. A2. For a rehabilitation of the Maginot Line idea, see Jeffrey Record, "Maginot Lines and Misinterpreted Military Lessons," *Strategic Review*, 15 (Winter 1987), 75-77.

15. Martin, pp. 95-98.

16. Ibid., pp. 91-93.

17. Interview with Stephen D. Biddle, January 1989. It is, however, possible to simulate the effect of individual defensive positions on exchange rate (the ratio of enemy to friendly losses) and survivability, and recent US Army studies provide data for both. See US Army Engineer Studies Center, *Survivability—the Effort and the Payoff*, 1981; and US Department of the Army, Field Manual 90-7.

18. Interview with John C. F. Tillson, Staff of the House Armed Services Committee, Washington, November 1988.

19. Interview with Lieutenant Colonel John Fricas, US Army, National Security Fellow, Center for Science and International Affairs, John F. Kennedy School of Government, Harvard University, Cambridge, Mass., February 1989.

20. Hans-Henning von Sandrart, "Forward Defence—Mobility and the Use of Barriers," *NATO's Sixteen Nations*, 30 (Special Issue 1, 1985), 41.

21. US Army Engineer Studies Center, *Survivability*, p. 37.

22. Analysis conducted by the US Army, Europe, quoted by General Glenn K. Otis, Commander, USAREUR, in Charles D. Odorizzi and Benjamin F. Schemmer, "An exclusive AFJ Interview with General Glenn K. Otis," *Armed Forces Journal International*, 123 (January 1987), 46. A former senior engineer officer with USAREUR says that "the amount of critical work that is scheduled to be done in the plausible warning time 'will overload the engineers. . . . Anything we can do to pre-fabricate, pre-place, or pre-construct will be a great help.'" Major General Scott B. Smith, US Army, quoted in Martin, p. 31.

23. Compare Anthony H. Cordesman, "Fatal Flaws in Presenting the NATO/Warsaw Pact Balance," *Armed Forces Journal International*, 125 (July 1988), 62; Odorizzi and Schemmer, p. 48.

24. Von Sandrart, pp. 41-42; Price T. Bingham, "NATO Needs A New Air Interdiction Approach," *Armed Forces Journal International*, 123 (October 1986), 98; Stephen D. Biddle, "What Does Conventional Stability Mean, What Would a Stable Posture Look Like, and How Can Arms Control or Force Improvements Help Us Get There?" presentation for the US Congress, House Armed Services Committee, *Hearings on Conventional Stability in Europe*, 5 October 1988, pp. 14-15.

25. This argument is valid, however, only so long as the other side actually believes in the potential of barriers and has not succeeded in developing countermeasures. For evidence indicating such a perception on the Soviet side, see M. Bragin (Colonel, Soviet army), "Breaching Obstacles," *Soviet Military Review*, No. 7 (July 1979), 16-17.

26. William Drozdiak, "Bonn Rejects Using Border 'Pipe' Bomb," *The Washington Post*, 24 August 1984, p. A25.

27. Prechambered demolition sites, for example, have on occasion been the target of peace activists in Germany, who filled the chambers with concrete, thus rendering them ineffective. Owing to the immense number of sites which are by definition located at very accessible points, it is virtually impossible to prevent such tampering. The same would be the case for peacetime-installed explosive pipes. This points to the question of peacetime and premobilization security measures for the protection of barriers.

28. Interview with John A. Reed, Defense Intelligence College, Washington, January 1989.

29. Raymond E. Bell, Jr., "Fighting from Fortified Battle Positions," *Army*, 29 (July 1979), 34-39; information from German defense analyst Lutz Unterseher, quoted in Mark Stout, "Defensive Barriers Along the Inner-German Border," unpublished paper, Cambridge, Mass., John F. Kennedy School of Government, April 1988, p. 12.

30. According to Tillson, effective land consumption for installations of a 40 km-deep barrier system would be 40 square kilometers, .02 percent of West German territory. The whole defensive zone would cover 32,000 square kilometers, 13 percent of West Germany.

31. Compare Martin, pp. 47-48.

32. See, for example, Bailey. He elaborates in great detail the features of a very deep and dense system of fortifications and trenches which would cover a sizable part of West German territory—a nightmare for every German politician. It must be granted, however, that he explicitly excludes political considerations from his proposal.

33. Interview with Paul K. Davis, Director, Strategy Assessment Center, RAND Corporation, Santa Monica, Calif., January 1989.

34. Interview with William Durch, Center for International Studies, MIT, Cambridge, Mass., January 1989.

35. William Kaufmann gives a figure of $1 billion over a period of six years for an unspecified belt of barriers along the inter-German border. William W. Kaufmann, "Nonnuclear Deterrence," in *Alliance Security: NATO and the No-First-Use Question*, ed. John D. Steinbrunner and Leon V. Sigal, Studies in Defense Policy (Washington: The Brookings Institution, 1983), p. 85. Tillson assesses the cost for a system 40 km deep, including prechambering, landscaping, explosive pipes, and fortifications, at $5 billion for construction and procurement. The $100 billion figure was suggested for a modern Maginot Line-type barrier system. Michael G. Sovereign, "Economic Implications, Cost and Manpower," in *Modeling and Analysis of Conventional Defense in Europe*, ed. Reiner K. Huber, German Strategy Forum Workshop on Long-Term Development of NATO's Forward Defense (New York: Plenum Press, 1986), pp. 201-04.

36. If NATO should decide to establish an extensive barrier system along the inter-German border, some strategic scenarios must be given increased attention. Foremost among them is the Warsaw Pact advancing west by way of Austria. Extending the barrier along the German-Austrian border, of course, would touch even more serious political sensitivities than those already apparent in Germany. Goldich, pp. 34-35.

37. Letter from Admiral William Crowe (then Chairman of the Joint Chiefs of Staff) to Senator Carl Levin, 24 November 1986, and interview with Lieutenant Colonel James P. O'Neal, both quoted in Stout, p. 6.

38. Tillson interview. An early German defense proposal including the use of barriers and blocking forces—the so-called "Bonin-Plan" from 1955—was rejected partly out of concern over the lack of involvement of non-German NATO troops. See Bogislaw von Bonin, *Opposition gegen Adenauers Sicherheitspolitik, Eine Dokumentation* (Hamburg: Verlag Neue Politik, 1976), pp. 21-26, 140-54. In fact, NATO still takes pains to ensure early international involvement in the case of its flank regions, namely with its Allied Command Europe Mobile Force.

39. James A. Blackwell, "Conventional Doctrine: Integrating Alliance Doctrines," in *Conventional Deterrence: Alternatives for European Defense*, ed. James R. Golden et al. (Lexington, Mass.: Lexington Books, 1984), pp. 137-48.

40. James A. Thomson and Nanette C. Gantz, *Conventional Arms Control Revisited: Objectives in the New Phase*, RAND Note N-2697-AF (Santa Monica, Calif.: RAND Corporation, December 1987).

41. See for example, Jonathan Dean, *Watershed in Europe*, Union of Concerned Scientists (Lexington, Mass.: Lexington Books, 1987), pp. 211-12.

42. Charles G. Pritchard, "Soviet Fortified Regions: A New 'Cult of the Defense'?" *International Defense Review*, 22 (July 1989), 895. Yazov's announcement came in February 1989.

43. Federal Minister of Defence (FRG), *White Paper 1985*, Bonn, June 1985.

44. *Report of the Commission on Long-Term Planning for the Federal Armed Forces*, Bonn, 1982.

45. *Peace and Security: Resolution Adopted by the Party Conference of the Social Democratic Party of Germany*, Nuremberg, 25-29 August 1986, rpt. in US Congress, House of Representatives, Subcommittee on Europe and the Middle East of the Committee on Foreign Affairs, *Challenges to NATO's Consensus: West European Attitudes and U.S. Policy* (Washington: GPO, May 1987); Sozialdemokratische Partei Deutschlands, *European Security 2000—A Comprehensive Concept for European Security from a Sozial-Demokratic Point of View* (Bonn: Presseservice der SPD, 6 July 1989), Annex VI.

46. The required technology includes sensors, rocket launchers, intelligent mines, and advanced antitank missiles. Compare Albrecht von Müller, "Technischer Fortschritt und Rüstungskontrolle," in *Sicherheitspolitik Kontrovers*, eds. Heisenberg/Lutz (Bonn: Bundeszentrale für Politische Bildung, 1987), p. 511; John Grin and Lutz Unterseher, "The Spiderweb Defense," *Bulletin of Atomic Scientists*, 44 (September 1988), 28-30. For a general review of these and other alternative defense proposals, see Jonathan Dean, "Alternative Defence: Answer to NATO's Central Front Problems?" *International Affairs*, 64 (Winter 1987-88), 61-82; and David Gates, "Area Defence Concepts: The West German Debate," *Survival*, 29 (July-August 1987), 301-17.

47. US Congress, The Chairmen of the Congressional Military Reform Caucus, *Budgets and Bullets: Improving Our Conventional Forces*, Washington, October 1988.

48. George C. Wilson, "Senator Pushes W. Germany To Erect Antitank Lines," *The Washington Post*, 25 July 1986, p. A23.

49. NATO Defense Planning Committee, *Enhancing Alliance Collective Security*, December 1988.

50. Soederlind.