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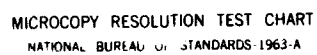
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ENHANCED ABILITIES OR LOST CHANCES?

An Examination of the Howitzer Improvement
Program's (HIP) Evolving Organization and
Doctrine.

By

Major Patrick C. Sweeney
Field Artillery

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School Of Advanced Military Studies
U.S. Army Command and General Staff College
Fort Leavenworth, Kansas

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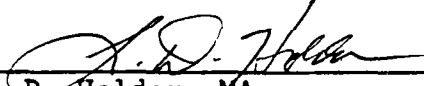
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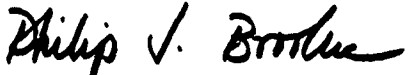
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ABSTRACT

Enhanced Abilities or Lost Chances? An Examination of the Howitzer Improvement Program's (HIP) Evolving Organization and Doctrine by Major Patrick C. Sweeney, USA, 50 pages.

This study analyzes the factors effecting the organization and employment of the U.S. Army's Howitzer Improvement Program (HIP). Since the semi-autonomous HIP evolved from the venerable M109 howitzer, the purpose of the study is to surface considerations that may otherwise be overlooked as a result of resistance to change.

The analysis begins with an examination of the Soviet counter-fire threat and its impact on the HIP's positioning. This initial data is further refined by including the HIP's technical considerations. The study continues with a consideration of the maneuver brigade's C³, in particular the impact of terrain management, and the constraints imposed by the Artillery's C³.

The study concludes that the optimum HIP battery should contain nine HIPs organized in three platoons of three HIPs each. Based on this recommended organization, the study projects both new and enhanced roles for the direct support artillery battalion. Some of the potential artillery support roles are so inconsistent with current fire support doctrine that resistance to change is anticipated. Accordingly, the study closes with a caution for the professional soldier to keep an open mind when considering new concepts.

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The better the infantry, the more it should be economized and supported by good batteries. Good infantry is without doubt the sinews of an army; but if it has to fight a long time against very superior artillery, it will become demoralized and will be destroyed.

Napoleon I: Maxims of War, 1831

SECTION I. INTRODUCTION

Colonel M. Avdeev, a Soviet artillery officer, asserted that:

"if the defender's artillery cannot be silenced during the attack and puts down effective fire on the attackers at critical moments, the attack will fail."¹

His statement is in keeping with the Soviet belief that they must achieve fire superiority over their enemy throughout the battle if they are to retain their tempo. Realization of this superiority arrives through a firepower advantage in quantity of systems, and a targeting priority on their enemy's artillery.²

This basic Soviet principle may become the root of their greatest vexation since the United States developed tactical nuclear weapons. While the U.S. Army has been ballyhooing the fielding of systems such as the M1 tank and the M2 Bradley Fighting Vehicle -- the Field Artillery has proceeded without fanfare on a new artillery weapon that may cause the Soviets more concern than either the M1 or M2. This exciting artillery weapon is called the Howitzer Improvement Program (HIP). This new semi-autonomous howitzer (see Appendix A for specifications) will provide the maneuver commander with enhanced indirect fire support that is practically invulnerable to counterfire!

The potential for this highly improved M109 howitzer is immense, and its probable impact upon Soviet planning is equally

staggering. Yet, will we exploit this system to its greatest extent? The purpose of this paper is to answer that question by examining the factors influencing the HIP's organizational structure and tactical employment.

Why is there any concern that the HIP's doctrine may fail to maximize the system's potential? A review of recent history provides us with mixed answers to that question.

The fielding of the Multiple Launched Rocket System (MLRS) in the early 1980's saw a completely new fire support weapon enter the inventory.³ Since the MLRS was unlike any other American artillery weapon, the tactics developed for the MLRS were unencumbered by existing tactics. It did not face entrenched beliefs centered on a basis of resistance to change. The doctrine developers started with a clean slate and produced a unit organization and tactical doctrine that took full advantage of the system's unique capabilities.

However, during the same time period, the artillery community began fielding another greatly improved system that did not fare as well. The PERSHING II (PII) missile was a replacement for the older PERSHING IA (PIA) missile, and though their names are similar, their capabilities are quite different.⁴ The PIA drew upon 1960 technology, with the resulting cumbersome equipment and restrictive positioning requirements. The PII brought state of the art technology which removed many of the previous equipment and position burdens. Yet, upon fielding, employment of the new tactical doctrine for the PII became almost indistinguishable from the older system.⁵ The new system's semi-autonomous capability was barely exploited, leaving the system as vulnerable as the one it

replaced. One of the culprits was a strong resistance to change within the small community of Pershing units; the other was a structure defect of the organization.⁶ The number of personnel authorized for the PII unit was insufficient to allow for extensive unit dispersal.

The nature of the HIP is perilously close to that of the PII in that it also is a dramatic upgrade of an existing system. And though a similar doctrinal fate for the HIP has yet to occur, the environment that the HIP faces is analogous to the PII. The circumstances are close enough that an examination of the HIP's evolving doctrine is worthy of our consideration.

The Field Artillery School is working diligently on the HIP concept as evidenced by the most recent draft Field Manual 6-50-HIP (1 September 1987). Many tentative organizational and doctrinal judgments are established in this document. Therefore, the focus of this paper must limit itself to an analysis of the factors most critical to the employment of the HIP.

Accordingly, the goal of this monograph is to determine the optimum battery and battalion organization for the HIP, and then examine the impact of the proposed organization on the maneuver brigade's fire support.

Before discussing the methodology applied in this analysis, it is important that the reader be aware of the assumptions that are used in this study:

- The design specifications of the HIP remain unchanged (see Appendix A).
- The U.S. Army continues to adhere to AirLand Battle doctrine.

- A J-series Armor Brigade in the defense employed in a European environment is used as the case study.
 - Only unclassified data can be considered in this report.
 - The existing HIP organization and doctrine can be modified.
 - The Advanced Field Artillery Tactical Data System (AFATDS) (see Appendix B) will reach the field.
 - Artillery mission accomplishment must suffer no degradation.
- The HIP must at a minimum be capable of satisfying the same requirements that the current 8-gun battery does.

A building block process will provide the vehicle for this study's HIP organizational conclusions. First it will be necessary to examine the survivability and technical influences on the HIP's need and ability to disperse on the battlefield. Second, that information will then be further refined by adding the maneuver brigade's C³ considerations. The final refinement of the HIP organization will come with an examination of the Artillery's C³ concerns. An analysis of the critical findings from each of these successive blocks will provide an optimum HIP organization. Beginning with the proposed HIP organization, the study will conclude with a probe of the HIP's impact on the fire support doctrine in support of the maneuver brigade.

With a clear understanding of the route to be taken during this inquiry of the HIP, one should realize that the most critical of the building blocks is also the most basic. How far apart should each HIP be from each other?

SECTION II. GUN DISPERSAL -- The Impact of Survivability and Technical Considerations on the Positioning of the HIP.

Survivability Considerations.

The driving purpose for the HIP's development was the need for a more survivable howitzer.⁷ The major threat to U.S. artillery is the Soviet's massive artillery counterfire capability. In view of their high targeting priority of nuclear delivery systems (which include all cannon artillery in the heavy divisions and corps), the likelihood of our artillery being capable of fulfilling the maneuver brigade's close support fires needs seems doubtful.⁸

The enemy's counterfire threat is blunted with the advent of the HIP. The HIP's ability to displace rapidly and initiate firing independently of any external assistance in laying for direction and technical computation provides the solution. The sheer mobility of the system outpaces the current and near term Soviet artillery indirect fire acquisition and attack capabilities.

Unlike current howitzers which are grouped in positions of four to eight weapons, the unique abilities of the HIP allow it to disperse from adjacent guns. This dispersal allows the HIPs to move outside of the Soviet's targeting threshold -- thus dramatically reducing the enemy's capability of striking more than one howitzer with a single counterfire mission. Yet how far apart should these guns be from each other? In view of the myriad of factors that this decision impacts, a close examination of the specific distance is worthwhile.

First, inasmuch as Soviet counterfire is the absolute influence on the HIP's position size, an investigation of their employment doctrine is in order. As stated earlier, the Soviets place top priority on the detection and attack of nuclear capable howitzers. Their detection means for this task are through "aerial reconnaissance (visual, photographic, and instrumental) and ground reconnaissance which includes visual, radar, sound-ranging, radio/radar intercept, and limited photographic means."⁹ Since they obviously have multiple means to detect a single gun position, how would they attack it?

Current Soviet doctrine indicates that target areas which exceed a dimension of 800 meters by 800 meters would be subdivided for separate artillery units to attack.¹⁰ Their doctrine further shows that they desire to attack artillery targets with battalion volleys rather than single batteries. This technique saves both ammunition expenditures and exposure time to our counterfire radars.¹¹ They developed their counterfire doctrine in view of our current battery positions, and it does not take widely dispersed HIP howitzers into account. In view of the enormous requirement of attacking single HIPs with battalion fires, it is reasonable to expect that the Soviets will attack each HIP individually with a battery's fire. They would use their point target engagement criteria, which is a single aim-point within one hectare (100 meter by 100 meter square).¹² Since the Soviets see the 152mm and 130mm howitzers/guns as their primary counterfire cannons, the 152mm's footprint of 300 meters by 300 meters is probably the best guide upon which the HIP should base its survivability moves.¹³

From this we can deduce the following:

1. Adjacent HIP howitzers should be at least 900 meters apart, placing them a minimum of 100 meters outside a single battalion's targeting criteria of 800 meters.
2. The Soviets will be unable to attack each individual HIP with a full battalion's fire -- a battery's fire is a reasonable expectation.
3. The immediate danger area after a HIP fires is a 300 meter circle centered on each of the howitzers that participated in the mission. These counterfires could come as soon as four minutes upon firing.¹⁴

How then does this information affect the HIP's positioning? The U.S. Army Field Artillery School used this data to develop a few basic parameters in the HIP's doctrinal manual, Field Manual 6-50- HIP.

Field Manual 6-50-HIP (Draft) Howitzer Improvement Program, states that each howitzer will occupy a position with a one kilometer separation from other howitzers and the platoon fire direction center (FDC).¹⁵ This distance is 100 meters greater than the 900 meter limit deduced above.

The Field Manual further directs that each howitzer will displace at least 315 meters -- outside the lethal effects of a single counterfire engagement -- within its one kilometer position after every 2-4 missions.¹⁶ Since these 315 meter survivability moves are made at the discretion of the individual howitzer section chief level, and the one kilometer separation must be maintained between adjacent weapons/platoon FDCs, the HIP platoon will be unable to occupy adjoining one kilometer positions.¹⁷

Simple mathematics shows us that adjoining positions of one kilometer in diameter would violate employment guidance if adjacent howitzers made survivability moves that gravitated toward the same location (Figure 1). To preclude such an occurrence, the HIP survivability moves must be controlled exclusively by the platoon FDC, or the individual one kilometer positions must be spread apart to such a distance that precludes the simultaneous counterfire engagement of two or more HIPs. As we will later see, terrain management concerns will most often preclude the luxury of the HIP expanding upon even more space in the maneuver brigade's area.

In summary and as a basis for our future development of the HIP's positioning on the battlefield, the following position survivability criteria will be used:

- one square kilometer position for each gun (though we must remember that the position is padded by a radius of 100 meters).
- survivability moves of 315 meters by each firing howitzer every 2-4 missions.
- the platoon FDC provides centralized control of the HIPs' survivability moves.

Equipped with HIP survivability data the next dimension to delve into is that of technical considerations.

Technical Considerations.

The survivability of the HIP means little to the fire support equation if the weapon cannot effectively mass on the target. The ability of the artillery to mass its fires on a single target is "a significant generator of immediate combat power."¹⁸ The

positioning of our artillery always attempts to exploit this combat multiplier. The question is, will the widely scattered HIPs

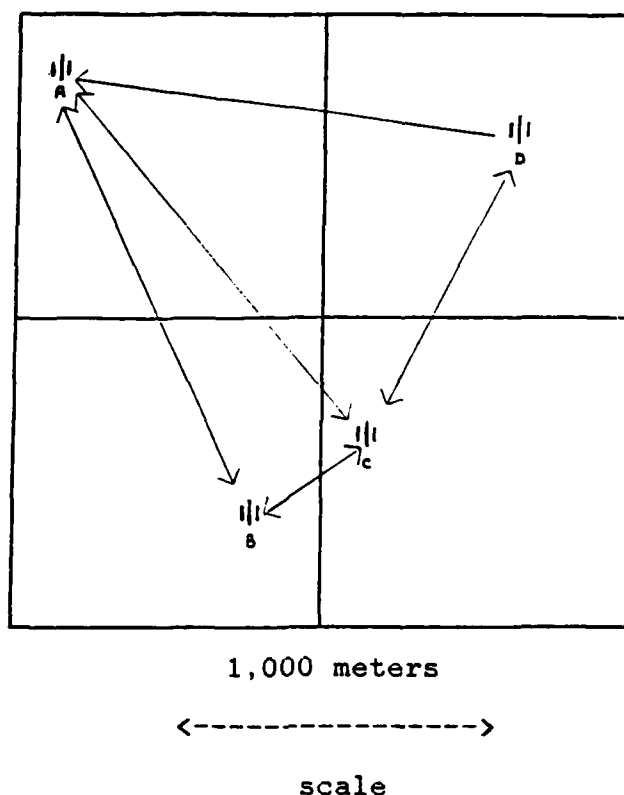


Figure 1. HIP Platoon Position.

A HIP platoon is shown with each HIP occupying a 1000 meter² position. In this situation, HIPs B and C have violated position guidance by locating their firing points only 400 meters from each other. All other position distances adhere to the 900 meter minimum distance.

be capable of achieving such a mass capability?

To answer this question, we will create a modest model to test the HIP's massing capabilities, constrained by our initial positioning findings. First, selection of a suitable target distance is in order.

Within an American defensive scenario, Field Manual 71-3 (Final Draft) The Armor and Mechanized Infantry Brigade sees a need for brigades to be capable of "directing battles against

enemy battalions and regiments up to 15 kilometers forward of the FLOT," and a need to focus on second echelon regiments of the Motorized Rifle and Tank Divisions before their closure on the defending brigade.¹⁹ An ability to strike a target 15 kilometers beyond the FLOT (Forward Line of Own Troops) includes the following targets: the entire first echelon regiments, the Divisional Artillery Group (DAG), the Army Artillery Group (AAG), Multiple Rocket Launchers (MRLs), and the Division Command Post.²⁰ This range appears to be a worthy goal for our massed fires using unassisted munitions, saving rocket assisted projectiles (RAP) for those high payoff second echelon targets as detected. In the offense, though not discussed further, an ability to mass 15 kilometers in front of the brigade's attacking formations encompasses the Soviet Division's entire forward security echelon -- further supporting 15 kilometers as a helpful measure of the HIP's massing capabilities.²¹

To illustrate the availability of HIP positions to mass on a single target, a mathematical model based upon the weapon's range capability will be employed. Using the initial positioning criteria discovered earlier in this section, the positioning of the HIPs in positions to mass on a single centrally located target 15 kilometers beyond the FLOT provides us with some revealing information (Figure 2). Assuming that the HIPs would begin positioning as far forward as 2 kilometers behind the FLOT, there are 135 conceivable locations that allow for massing on the single target. As one would expect, the preponderance of the positions are found nearest the FLOT on a 30 Km front. As a simple function of range, the number of available positions reduce the farther to

the rear that the HIP positions (ie, 10 positions at 7 Km). Obviously, these numbers will decrease dramatically with the addition of other factors such as unusable terrain, engagement of a non-centrally located target, and consideration of other units competing for the same terrain. Yet, the model depicted in Figure 2 is helpful in that it reveals to us the positioning requirement of two to seven kilometers for the majority of HIP units if they are to achieve the desired mass effect.

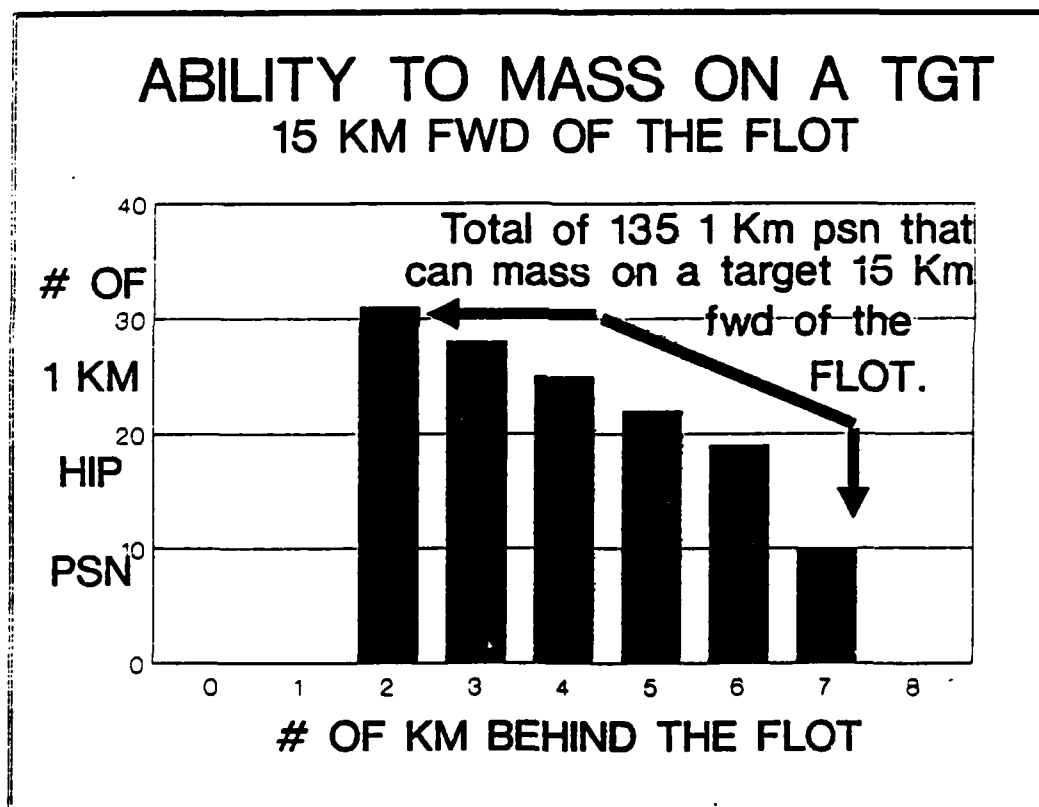


Figure 2.
Positions available to the HIP 2-7 Km behind the FLOT while massing on a single target 15 Km beyond the FLOT.

We now know that the HIP can physically achieve the necessary mass on enemy targets while dispersed in positions as far as 30 kilometers from each other. However, mass is not simply a function of the ability of the weapon to range a given target. The artillery commander must be able to focus the weapons with his automated fire direction system. The Advanced Field Artillery Tactical Data System (AFATDS) that will provide the artillery's automated fire control in the 1990's furnishes the HIP with that very control (see Appendix B for the capabilities of the AFATDS). The AFATDS, coupled with the HIP's SINCGARS AN/VRC 89 radio, provides the force artillery commander with all the tools to deal with the HIP's unique capabilities.

Summary. In this section some basic HIP operating parameters have been determined for employment during optimum conditions. These parameters are:

1. Each HIP will occupy a position with a diameter of 900 to 1000 square meters.
2. Each HIP will displace to new firing points no closer than 315 meters from its previous point, under the control of the platoon FDC.
3. The majority of the HIP positions will occupy the area of two to seven kilometers behind the FLOT.

The next section will address how the maneuver brigade's C³ considerations will influence these parameters.

SECTION III. MANEUVER BRIGADE C3-- The Impact of the Brigade's Terrain Management Considerations on the positioning of the HIP.

If the artillery operated independently of other units, its positioning on the battlefield would be a simple operation. Of course, reality dictates that positioning of the artillery must be in concert both with the maneuver commander's concept of the operation and the positioning of other supporting units. The significance of the latter artillery responsibility -- positioning among the many supporting units in the brigade rear -- presents the HIP with one of the management concerns with the greatest potential for problems. What is the HIP's impact on the brigade's terrain management operation, and how might the impact be reduced?

To understand the brigade's terrain management concerns, one must first understand its current responsibilities and capabilities to manage terrain.

Current Terrain Management Operations.

Terrain management falls within the brigade S-3's area of responsibility. Field Circular 71-3 (Coordinating Draft), The Armor and Mechanized Infantry Brigade, lists among functions of the brigade tactical operations center (TOC) the need for the TOC to "acquire and coordinate combat support assets ... (and) provide real estate management."²² This is only one of several responsibilities of the brigade S-3, and he receives no additional assets -- neither personnel nor communications equipment -- to assist him in accomplishing this task. Yet, is the HIP the only burr in what is otherwise a smoothly running operation? Or, is the

HIP only the most visible among many elements that add confusion to the terrain management system?

Within the artillery community alone, more widely dispersed and frequently moving units have been the trend for most new equipment. Systems such as the MLRS and the Q-36/Q-37 radars are in the brigade rear area now. They are making the same kinds of demands on the terrain management system as the HIP. Probably the increased numbers -- in the form of the HIP -- of such terrain demanding systems has finally caused great concern in the maneuver circles. This concern has been expressed by many to include the service school commanders and must become a significant consideration in the structure and employment of the HIP.²³

Terrain Management and the HIP.

Using the HIP positioning criteria discussed in the previous sections, a model can be created to determine the extent of the terrain demands that the HIP will make upon the maneuver brigade.

The model used for this terrain projection will be an Armor Brigade defending in Europe, deployed with three battalions forward and one battalion in reserve.²⁴ Though there is no doctrinal brigade position, this model will be satisfactory as a framework for our terrain management observations.

In view of our earlier findings, the examination will focus on the area 2-7 kilometers behind the FLOT for the preponderance of the HIP's impact upon terrain management (Figure 3). Within this belt of terrain, there are 125 km²s that may serve as potential positions for the HIP battalion. Of these, 24 km²s are occupied by battle positions plus a requirement of 7.25 km²s for other supporting units leaving 93.75 km²s for the HIP's potential use.²⁵

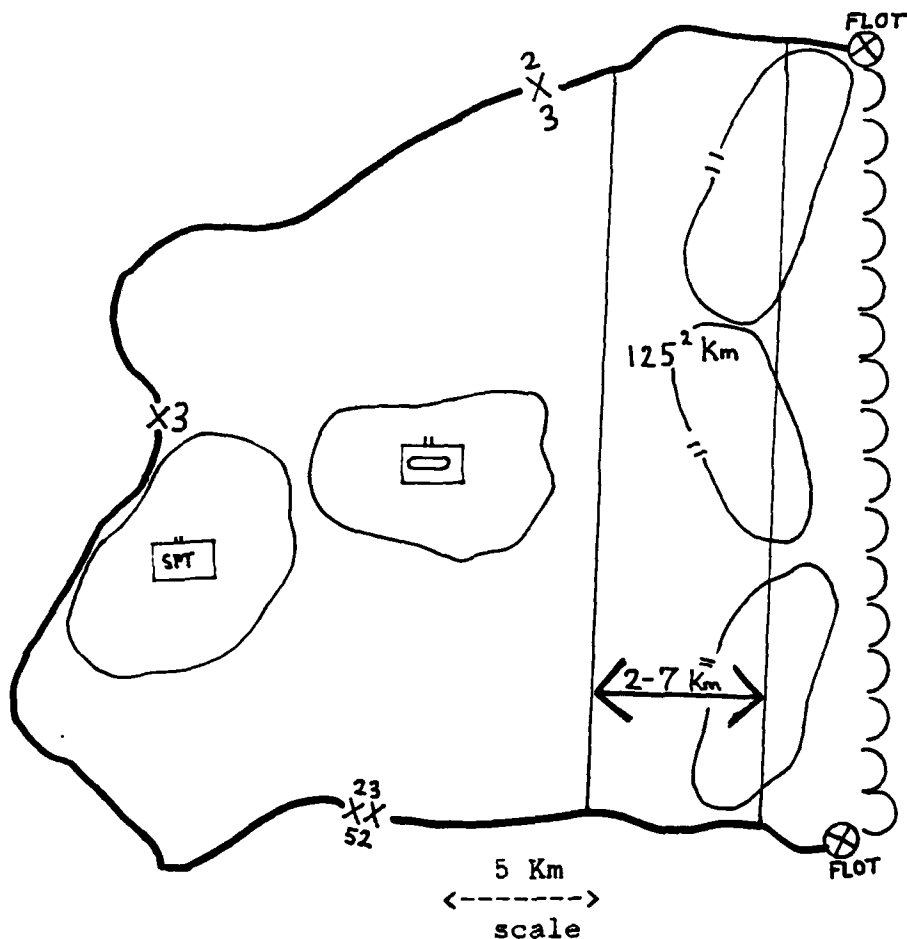


Figure 3. HIP positions in a brigade defense. There are 125 Km²s within the 2-7 Km area behind the FLOT that the HIP may occupy. That figure receives a 44% reduction after additional considerations.

Under the best of circumstances, it is reasonable to expect that at least 40% of the remaining positions would be unusable by the HIP battalion because of engineer emplaced obstacles, lack of road/trail networks, forests, chemical contamination, water obstacles, and some others. Such a further reduction of terrain would allow only 56 km²s to remain for HIP's initial employment in the brigade's sector. Many of these remaining positions would contain less than optimum firing positions, such as open fields, built up areas, etc.²⁶

Using our previously determined HIP positioning requirement data, we find that a HIP battalion requires 34.9 km²s within the two to seven km area behind the FLOT for its initial positions.²⁷ Though there appears to be sufficient space for the Direct Support HIP battalion, there is insufficient space in the event that the brigade receives the additional fires of another HIP battalion. Nor is there room remaining for the HIP battalion to make one to two tactical moves of seven km during a 24 hour period.²⁸ Additional battalions and displacing HIP units would invariably establish themselves near other supporting units, thus endangering those units by drawing counterfires in their shared area. The problem is not insurmountable at the present time, and the future holds even greater hope.

Terrain Management -- A Solution.

Currently the fire support coordinator (FSCoord) is responsible to the brigade commander for coordinating the supporting artillery's positions. This procedure should continue to be adequate for the HIP battalion. However, as we have seen, the artillery locations are only part of the riddle. The maneuver brigade must also establish a clearing house for the positions of all other units and resolve any discrepancies. This coordination must entail subsequent positions and displacement guidance. All this is accomplished as an additional duty of the brigade S-3 while he is trying to fight a battle. Two corrections to the brigade S-3's current terrain management dilemma seem readily apparent:

1. The brigade must dedicate an individual within the TOC to the mission of terrain manager. This soldier requires the support

of adequate dedicated communications equipment and needs the experience to understand the implications of a unit's position and its impact on the operation.

2. There is no way to create more terrain for the HIP to operate within. Instead, one must accept that some support units will share positions with the HIP and plan accordingly. To effect such an operation, consider the following:

a. HIPs should never fire from a position within 300 meters of any other friendly unit. This should avoid any unit from receiving the direct brunt of a counter-battery volley.

b. The maneuver brigade terrain manager should possess a predetermined list of specific units that cannot locate within the 1000 meter HIP position. These should be significantly vulnerable units like FARPs and ASPs or sensitive targets such as the Division TAC.

c. Both the artillery battery commander and his platoon leaders must assume a greater responsibility in terrain management. Face-to-face coordination with units positioned in the HIP's 1000 meter position must occur. Such coordination will serve as an assurance to the other unit's awareness of their potential danger and allows for mutually supporting position defenses.²⁹

In the near future, the fielding of the Army Command and Control System (ACCS) will measurably improve the brigade's capability to manage the units in its rear. The ACCS, which will interface with the new artillery computer system AFATDS (Appendix B), will provide the maneuver brigade TOC with greater control of the placement and subsequent movements of all units within the brigade area.³⁰ An inclusion in the ACCS's software of the HIP's

positioning requirements and those of other combat support units could reduce the brigade terrain manager's tasks markedly. A further upgrade of the software should include the minimum safe distances for different type units from one another. Such an addition would reduce unit and staff coordination requirements and decrease terrain management concerns.

Summary. For the HIP to exploit its semi-autonomous capabilities fully, its employment doctrine must be tempered by the terrain management realities of the maneuver brigade. There are some improvements that the maneuver brigade can institute to improve the situation. However, the artillery battalion must accept some modifications to their ideal employment doctrine. A summary of these improvements and modifications follows:

1. The maneuver brigade must dedicate both personnel and communications equipment to the mission of terrain management.
2. The software developed for the ACCS must include terrain management considerations.
3. The Artillery must plan to share positions with other units and become sensitive to their vulnerability to potential counter-battery fires.
4. Terrain limitations will cause semi-autonomous guns to fire from less than optimum positions (such as open fields).

The impact of the maneuver brigade's C³ concerns upon the HIP's ability to support and survive is indisputable. However, as will be seen in the next section, the inclusion of the artillery's C³ concerns provides even more decisive constraints.

Military history is filled with the record of military improvements that have been resisted by those who would have profited richly from them.

B.H. Liddell Hart: Thoughts on War, xi, 1944

SECTION IV. ARTILLERY C³ CONSTRAINTS

The effects of the Field Artillery are best maximized when its fires are massed rapidly and accurately upon a target. The very nature of the HIP's decentralized and semi-autonomous abilities pulls against this need for centralized control of subordinate firing units. The complications involved in displacing individual guns, platoons, batteries, and their Fire Direction Centers (FDCs) while still attempting to mass the fires of those units are legend within the artillery. To assure that the HIP does not overwhelm the Artillery's C³ capabilities, that concern will be our next focus of examination for influence upon the HIP's organization.

This analysis of the Artillery's C³ constraints will center on the ability of each level -- platoon, battery, and battalion -- to exercise the necessary span of control over its subordinate elements in order to accomplish the mission of rapid and accurate massing of fires.

Platoon Span of Control.

The current doctrine for non-HIP split battery operations provides for two, four gun platoons within a battery, with the platoon leader responsible for his four gun platoon. The platoon position is not large, normally within 200 to 400 meters, and it is usually only 400 to 1600 meters from the other platoon.³¹ So in reality, the current platoon structure is quite dissimilar to

the semi-independent platoons of the HIP organization, which occupy constantly changing positions that could be as large as 4,000 meters. Yet, the proposed structure for the HIP platoon reflects nearly the same platoon organization. The HIP platoon leader's span of control has increased ten times -- 4000 meter position versus 400 meter -- and the control of the constantly changing gun positions is also new. Can the platoon leader effectively control his four gun platoon? To answer that question, a review is in order of three elements that are critical to the HIP platoon leader's success in exerting adequate control over his cannons: communication capabilities, coordination tasks, and logistics.

Communications Capabilities.

The HIP platoon leader is capable of transmitting from 300 meters (low power) to 35 km (power amplifier) with the SINCGARS radio.³² The optimum setting would be the lowest possible to control the platoon and not broadcast far beyond the FLOT. This would most often be a setting of medium with a range of 4 km. This communication capability is more than sufficient to control the widely dispersed HIP platoon.

Coordination Tasks.

The HIP platoon leader will retain all of the earlier coordination requirements of the older cannon organization and several new "HIP peculiar" ones.

The largest new coordination task will be his responsibility to regulate the individual movements of the four howitzers within their firing positions to preclude violations of positioning guidance. This harmonizing of positions will occur at a rate of 80

individual HIP moves a day -- not including one to two larger platoon tactical moves a day!³³ In addition, as discussed in Section III, the platoon leader will coordinate with the units sharing portions of his platoon's position.

Another uniquely HIP related coordination responsibility that the platoon leader may face will be that of a Fire Support Coordinator. As will be seen in Section VI, the new capabilities of the HIP provide the maneuver commander with some startling new capabilities. However, it is sufficient for now to say that the HIP platoon leader may find himself in such a role.

Logistics.

The HIP platoon leader will assume the responsibility of both an ammunition platoon leader and executive officer. His responsibility for sustaining sufficient ammunition stocks and maintaining a high level of mechanical readiness within his dispersed platoon will prove challenging. The combination of replenishing 254 rounds per tube each day and maintaining four constantly moving howitzers while still executing his other coordination duties may be asking too much.³⁴

Battery Span of Control.

The HIP battery commander faces some of the same problems that his platoon leaders do, but on a much larger scale. His battery may be as wide spread as 12 km, and his logistics concerns are triple that of a platoon leader. Additionally, the battery commander must solve various tactical dilemmas. How can the HIP battery maintain sufficient supporting fires during the following

events:

1. When a platoon needs to refuel, rearm, maintain equipment, and rest.
2. When a battery needs to decontaminate.
3. During tactical moves of the full battery.

An examination of these situations should provide an insight into the battery commander's span of control.

Refuel, Rearm, Maintain, and Rest.

Field Manual 6-50-HIP outlines ammunition resupply as a function of HIP platoon responsibility. Each gun sections' ammunition vehicle picks up grounded ammunition at central distribution points near the platoon position and then returns to its individual firing positions. When the full platoon is to displace on a tactical move, the battery coordinates with the battalion support element for a rearm, refuel, resupply, and survey update point (R³SP) on the platoon's route.³⁵

Crew rest, though identified as a point of concern in Field Manual 6-50-HIP, is largely unanswered.³⁶ The frequent movements of individual weapons and the increased ammunition consumption of the howitzers are bound to have a telling impact upon the crewmen. However, withdrawing a platoon (50% of the battery's firepower) out of action for crew rest -- leaving only four weapons "hot" -- would be an unreasonable luxury.

Decontamination.

How does a battery operating in a chemical environment rotate through decontamination and still maintain adequate fire support? By rotating a platoon at a time through a decontamination point, the battery commander is once again faced with the same problem of

drastically reduced fires. Yet no other reasonable choice is available for his selection. This is particularly bothersome since recent studies have shown there is a 200% increase in requests for indirect fire support while soldiers are under chemical attacks.³⁷

Tactical Moves.

Field Manual 6-50-HIP provides the commander with a variety of options for the displacement of his battery. The most decentralized method -- movement of individual guns -- provides the greatest retention of firepower, but also the least feasible for control and speed.³⁸ The other methods, platoon and battery movements, surrender available firepower for speed. None of the battery commander's choices allow for both speed of movement and readily available fires.

Battalion Span of Control.

The HIP battalion's physical area of control has expanded commensurate with the growth of the three firing batteries. The increasingly decentralized nature of the HIP platoon operations makes the HIP battalion much more reliant on the batteries for current weapon statuses than before.

Another increased concern for the battalion is the raised demand for ammunition, both in quantity and travel distances for the Ammunition Platoon.³⁹ Furthermore, as we will see in Section VI, there is a potential for greater requirements of logistic support for HIPs operating outside of the battalion's area.

Even with these considerations, the battalion's span of control is within manageable limits. As with the platoons and batteries, the SINCGARS radio gives the battalion a communication capability to control its batteries. And though the HIP's

logistics demands may at times become difficult, they certainly are adequate to support the unit.

Summary. The HIP battalion has the capability to control, support, and mass the fires of its widely dispersed subordinate elements. However, the projected HIP battery organization of two platoons with four guns each, may prevent the platoons and batteries from providing the most efficient ability to mass the battalion's fires.

The two platoons of four guns concept provides the platoon leader with a myriad of coordination tasks. This pressure to accomplish all coordination requirements without an adequate sleep plan could create some poor decisions. At worst, such a situation could result in casualties to the platoon leadership. Recent studies have shown that the junior officers and NCOs are the most likely to succumb to exhaustion under even less challenging circumstances.⁴⁰

The battery commander has an even greater problem than that of the platoon leaders. He is unable to displace his unit in echelon -- whether for R³SP, Decon, or tactical displacement -- without losing 50% of his fires (platoon movement). His only solution is to allow, when the situation permits, individual gun displacement; a long and risky venture by any measure.

The projected organizational ability to employ an adequate span of control over the HIP batteries and platoons may be flawed. In the next section, we will analyze the pieces to the HIP organization puzzle, and devise a possible solution to some of the questions raised.

Generally, management of the many is the same as management of the few. It is a matter of organization.
Sun Tzu, 400-320 B.C., The Art of War

SECTION V. ANALYSIS -- The Optimum HIP Organization.

In the previous sections, we examined several HIP employment and organizational considerations. For some of these considerations, ready solutions were available and selected. For others, the solutions begged for further analysis. In this section a blending of the HIP's employment and organizational attributes will occur, resulting in an optimum HIP organization. Before this blending can occur, a review of previous findings is in order.

Section II discovered that the individual HIP requires a position of 900 to 1000 square meters, and that the platoon FDC must manage the separate survivability moves of the HIPs within their positions. Also determined was that the HIP's range, especially in the defense, was optimized by locating in positions from two to seven kilometers behind the FLOT.

In Section III, the maneuver brigade's terrain management influences were addressed. The model used in this study revealed that though there is enough room for the HIP battalion, the artillery must accept lesser quality positions. Additionally, the individual platoons will have increased responsibilities for coordination with collocated support units. It also became evident that the amount of shared locations would increase dramatically when additional artillery battalions enter the brigade sector.

Section IV addressed concerns of the HIP battalion's capability to mass its fires. The investigation ascertained that the technical capability existed to accomplish this massing;

however, the battery organization of two platoons of four guns each seems to inhibit effective massing. The handicap of the structure is that the four gun platoon has the potential of overwhelming the platoon leader and it robs the battery commander of flexibility when he displaces a single platoon; thus reducing his immediately responsive fires by 50%.

In summary, it seems that the only consideration that remains unresolved is that of the HIP battery's structure. If the two platoons of four guns is not a satisfactory structure, then what organization is better suited for the HIP? To obtain an answer to that question, let's explore a possible solution at the platoon and battery level.

Platoon Organization.

The essence of the concern with the HIP platoon structure is the platoon leader's ability to control and supply four dispersed guns and accomplish the necessary position coordination and fire support coordination duties which he might have to execute. A viable option is the elimination of one HIP from the platoon.

By reducing the platoon to three HIPs, the platoon leader would receive immediate payoffs of the following:

1. A 25% reduction of firing positions required and resulting decrease in coordination with other units.
2. Total daily HIP survivability moves reduced from 80 to 60.
3. Daily ammunition resupply reduced by 254 rounds.

Obviously, the platoon leader's smaller span of control will ease his burdens. But is the cost of smaller platoons in line with the overall mission? Let's move up one level and review the

adjustments that the HIP battery must make in order to offset the platoon's loss of fires.

Battery Organization.

The root of the original HIP battery organization problem was its inability to echelon its platoons without suffering a drastic reduction of immediately available fires. The problem is compounded by the reduction of one gun from each platoon. However, both problems are eliminated by the addition of a third HIP platoon of three guns. The advantages of such an addition are evident:

1. The battery's firepower is increased to 9 guns, while the battalion's fires are increased to 27 guns. The increase of firepower would come at no extra cost in platoon C³ concerns.
2. The battery commander can move his platoons by echelon and still retain six HIPs (66% of the battery's fires) available for immediate support.
3. During lulls in the battle, the battalion commander can allow each battery to release a platoon to a "Cold" status.⁴¹ This could enable platoons the time for brief rests and battery maintenance sections more time for essential maintenance. All of these tasks are accomplished with minimal degradation to the artillery's fire support mission.

The proposed organization also has some disadvantages:

1. The battalion has a net terrain requirement increase of six more positions (three for the additional HIPs and three for the additional platoon headquarters). Though

not unmanageable, it further complicates the terrain management problem.

2. Assuming ammunition consumption rates remain the same as that of the 24 gun unit, the battalion will have a net increase of 762 rounds a day to provide the batteries. Through the use of "Cold" platoons that ammo resupply could occur at more centralized locations.
3. The increase in platoon positions will require additional survey support from the battalion.

Though these disadvantages cannot be ignored, they fail to outweigh the benefits derived from an organization that provides both a qualitative and quantitative increase in fire support for the maneuver brigade.

Summary. The HIP battalion should be organized with three batteries of three platoons each. Each platoon should control the fires of three HIP howitzers. The positioning management as outlined in Sections III and IV remain suitable for this slightly larger unit.

This recommended change in the HIP battalion structure may appear to be simply an artillery organizational detail, with little impact on the maneuver commander. In fact, this minor structure change opens up a broad range of fire support possibilities, many of which were unavailable under the earlier organization. In the next section, we will examine this enhanced fire support potential, and discover its implications to the maneuver commander.

Prejudice against innovation is a typical characteristic of an Officer Corps which has grown up in a well-tried and proven system

Erwin Rommel: Rommel Papers, ix,
1953

SECTION VI. NEW AND ENHANCED ROLES FOR THE HIP ARTILLERY AND IMPLICATIONS FOR THE MANEUVER COMMANDER

In previous sections we have indicated some of the basic changes that the HIP will provide to the maneuver brigade's fire support operation. Some of these changes were inherent with the semi-autonomous nature of the weapon and its increased survivability, while others were a result of our recommended organizational modifications. Yet, the bulk of these changes are simply the foundation for the real improvements to the fire support arena. The measure of HIP effectiveness is in its ability to support the maneuver forces. Using this category of measurement, the HIP provides the potential for a momentous increase in the Field Artillery's ability to support the maneuver commander. This section will probe the HIP's potential and determine if the proposed HIP organization and its tactical doctrine support the maneuver commander in the AirLand Battle.

These new and enhanced roles in support of the maneuver brigade are categorized into three areas: general, offense, and defense. The general category will concentrate on the fire support missions which are employed in multiple phases of tactical operations, while the offense and defense categories will limit themselves to roles which are characteristic with such operations.

General.

Counterfire.

The initial implication of the HIP's arrival was its ability to increase survivability from Soviet counterfire -- up to 200% more survivable than its less independent predecessor.⁴² However, the HIP's impact upon the counterfire battlefield may go much further. The Soviets would expose a full firing unit while attempting to engage a single HIP with counterfire. This action on the part of the Soviets would allow our counterfire to reply in mass upon their exposed unit -- a mission with a much higher probability of success than the Soviets'.⁴³ The inference that one might take from this is that: 1) The counterfire battle may be decided quickly in our favor. Or, 2) The Soviets won't expose their firing units for such a limited payoff as a single HIP.

Deception.

The HIP provides the capability of supporting a deception plan because of its unique abilities. Strength is depicted within a weak area by the frequent movement of a small number of HIPs inside a large area. Conversely, weakness can be feigned in an area of strength by massing individual HIPs from widely spread platoons on single targets, leaving the remainder of the platoons' guns silent; thus presenting the illusion of a widely dispersed unit.⁴⁴

Rear Area Operations.

The HIP battery provides the maneuver commander with increased flexibility in the support of rear area operations. A single HIP battery, augmented with some critical logistic and survey assets and assigned a tactical mission independent of its

parent battalion could support the rear area of the brigade. A widely dispersed HIP battery is capable of providing a limited degree of immediate indirect fire support against targets throughout the brigade rear. The battery could decentralize to the point of individual platoons supporting various rear area sectors. Such an arrangement would allow the platoon leader to perform as a FSCORD for his sector. The resulting direct coordination with the subordinate commanders or Rear Area Control Officers by the HIP platoon leader would provide an increased ability of the artillery to support rear operations in a safe and effective manner.

Economy of Force.

Just as the HIP can provide fires in the rear area, so can it support an economy of force mission. A single battery, outfitted with the SINCGARS radio, can support a brigade size area. Though some obvious logistical and other support augmentation are necessary, this economy of force measure allows the bulk of the artillery battalion's fires to support a more critical portion of the battlefield.

Special Missions.

The HIP provides the capability for greater responsiveness in the execution of priority targets during especially critical missions. Each HIP has the ability to communicate directly to a Forward Observer, consequently allowing the immediate firing of important targets. Examples of this concept might be key COPPERHEAD or FASCAM missions, the success of which are imperative to the maneuver unit's overall mission's success.

Offense.

Continuous Support.

As with the current 155mm SP, the HIP will still be unable to keep pace with the M1 and M2 as they advance at their top speeds. However, the danger of the maneuver forces outrunning their supporting artillery is reduced by a combination of the HIP's increased range, its ability to rapidly emplace, and by batteries echeloning their three platoons.⁴⁵

Dedicated Battery.

During special operations such as a movement to contact, the maneuver commander may decide to provide a single company with the dedicated fires of a HIP battery. In doing so, the HIP will be capable of providing a significant increase in responsiveness over the capabilities of other systems in this role. Since immediate suppressive fires are the most likely fires desired in such a mission, the company commander could opt to have a HIP platoon support each of his three platoons.⁴⁶ Another option that the commander may select is to have two of the HIP platoons prepared to fire suppressive missions, while the third prepares to fire COPPERHEAD. The company commander has a much larger fire support menu to choose from when he receives support from the HIP. The individual gun's communication and fire control abilities alone bring to mind an endless range of possibilities during a dedicated battery operation.

Defense.

Depth.

The HIP's increases in both range and number of platoons provide the brigade commander with the ability of placing his

artillery in depth.⁴⁷ By placing his units in depth he assures the continuity of fires throughout all phases of the battle, and, by default, he also eases some of the terrain management difficulties.

Priority Targets.

As pointed out earlier, the HIP has enhanced the artillery's responsiveness in attacking priority targets. In the defense, most direct support and reinforcing cannons should have a priority target that they are prepared to shoot on short notice. One example of a critical priority target is the Final Protective Fire (FPF). The three platoon HIP battery can provide the maneuver forces either more fires on the existing quantity of priority targets or a greater number of priority targets with slightly reduced fires.⁴⁸ No matter which option is selected, the HIP's communications and fire control capabilities will assure an increase in the responsiveness of fires.

Summary. The four basic tenets of the AirLand Battle -- initiative, agility, depth, and synchronization -- could easily be the tenets for the HIP. Field Manual 100-5 defines initiative as "decentralized decision authority,"⁴⁹ which is the essence of the HIP tactical doctrine. From the battery commander to the individual HIP Section Chief, the delegation of individual decision authority in various missions enhances the system's capabilities. The remaining tenets are equally upheld in the HIP doctrine.

Agility, defined as "the ability of friendly forces to act faster than the enemy,"⁵⁰ is the cornerstone of the HIP's ability

to survive on the battlefield. The HIP's agility allows it to sidestep the Soviet's devastating counterfire while setting up the Soviet firing units for its own counterfires.

Achievement of depth, the "extension of operations in space and time,"⁵¹ is a result of the HIP three platoon structure and its ability to echelon, its increased range and an ability to rapidly shift positions.

Synchronization is the goal of any fire support system and is defined as "the arrangement of battlefield activities in time, space, and purpose to produce maximum relative combat power at the decisive point."⁵² The HIP is only part of the synchronization equation. As seen by the variety of roles that the HIP can provide, the HIP battalion furnishes the brigade commander with the capability to achieve such a goal. However, with increased flexibility from the brigade's direct support artillery comes the increased responsibility of the brigade commander and his FSCOORD to effect the detailed planning that produces synchronization.

The only thing harder than getting a new idea
into the military mind is to get an old one out.
B.H. Liddell Hart: Thoughts on War, v, 1944

SECTION VII. -- CONCLUSIONS and RECOMMENDATIONS

This examination of the HIP has concentrated on how best to employ an evolutionary system with revolutionary capabilities. An inquiry into both the HIP's unique capabilities and the doctrine of its potential enemy yielded preliminary positioning requirements that might have surprised the uninitiated. When this basic data was combined with the realities of the maneuver brigade's C³ considerations, those that were surprised likely became stunned by the HIP's enormous appetite for terrain. The final consideration -- the Artillery's C³ constraints -- provided even more problems to consider. Nevertheless, solutions that overcame these problems were provided .

This study found that a nine gun HIP battery, consisting of three platoons of three guns each, would optimize the HIP's employment. In addition, it was concluded that though the HIP provides some new management concerns for both the maneuver units and the artillery, none of them are unmanageable. In fact, as modernized C³ equipment reaches the field the tasks will become easier.

Continued probing of the recommended organization's potential led us to consider a variety of new and exciting roles for HIP equipped artillery units. In order to maximize the HIP's full potential the proposed roles reflect a momentous increase in the responsibility of the individual HIP platoon leader and his

section chiefs. In conjunction with the increased responsibility for the junior leaders, the HIP shall require a dramatic departure from existing artillery doctrine. Individual batteries will receive their own support missions -- semi-independent from their parent battalion. A single artillery battalion can participate in the deep, close, and rear battles simultaneously. Forward observers will speak directly to a supporting gun during priority missions.

The organizational and doctrinal conclusions reached in this study and recommended to the Army for action might be considered by some as radical. Certainly, these recommendations require significant changes in the way the artillery does business. How will the system react to these proposals? Will the HIP encounter resistance to change and succumb to the same fate as the PERSHING II?

The United States Army has a long history of resistance to change. In Robert A. Doughty's analysis of the evolution of U.S. Army doctrine from 1946 - 1976 he concluded, "In each of the three periods of major change, one of the most difficult tasks has been the changing of the Army officers' and soldiers' thinking."⁵³ And though there are dedicated professionals working hard to maximize the HIP's employment, they will certainly face a similar challenge as discovered by Doughty.

We have studied the potential of the HIP, and its implications to the battlefield. At all costs we must avoid history finding our Army guilty of a charge similar to that of the French Army in 1940:

"The army viewed technological developments from the perspective of already accepted concepts and did not perceive new ideas or weapons overturning or forcing a fundamental transformation or revision of accepted doctrine."⁵⁴

The Seeds of Disaster

APPENDIX A - CAPABILITIES OF THE HIP

The Howitzer Improvement Program (HIP) weapon is a product improved version of the M109 155mm self-propelled howitzer. The essence of its improvements are found in its ability to operate in a semi-autonomous mode using its on board fire control equipment and self-locating/laying instruments. The howitzer is further enhanced by: an improved range, an ability to operate without the crew leaving the interior of the weapon, increased ballistic protection, and an NBC collective filtering system. One critical capability that has not seen significant improvement is in the M109's ability to keep pace with the mobility of the M1 and M2 systems. ⁵⁵

Basic Specifications⁵⁶

1. **Range** - rocket assisted 30 km, w/o assistance 22.8 km.
2. **Movement allowed before initialization of on board positioning system must occur** - 6.5 km.
3. **Time required to initialize** - 15 minutes if the 6.5 km limited was exceeded, 30 seconds if done before the limit is exceeded.
4. **Responsiveness** - responds to a fire mission in 60 seconds if moving, 30 seconds if stationary.
5. **Quantity of ammunition stored on HIP** - 42 rounds.
6. **Quantity of ammunition stored on accompanying Field Artillery Ammunition Supply Vehicle (FAASV)** - 90 rounds.
7. **Communication capabilities** - AN/VRC-89 SINCGARS, with maximum range of 35 km. (one digital and one voice channel).
8. **Self-protection armament** - one .50 cal. machine gun and one 40mm automatic grenade launcher.
9. **Number of crew members** - HIP and FAASV - 9 total.
10. **Redundancy of systems** - methods are available for one HIP, or the platoon fire direction center, to provide technical redundancy to another HIP for all fire control related malfunctions.
11. **Protection** - increased ballistic protection, NBC protection, and fire protection.
12. **Rate of fire** - 6 rounds per minute (burst).

APPENDIX B - ADVANCED FIELD ARTILLERY TACTICAL DATA SYSTEM (AFATDS)

AFATDS is the projected replacement for the U.S. Field Artillery's current tactical fire control (TACFIRE) system. Though the new system's software is not finalized, AFATDS is intended to provide a quantum leap in capabilities for automated fire control.

Unlike TACFIRE which is primarily a technical fire control device with some fire planning and execution enhancements, AFATDS is a complete fire support command and control mechanism. Though the new system has numerous capabilities found in the functional areas of fire support execution and fire support planning, this paper is primarily interested in the AFATDS' movement control capabilities.⁵⁷

AFATDS will interface with the future Army Command and Control System (ACCS)⁵⁸, providing the maneuver commander with a significant increase of control of the movement and status of his fire support systems. Between the AFATDS and the ACCS's subordinate Maneuver Control System (MCS), the Brigade Commander has the technical capability to see where all subscriber units are located in his area -- a tool for prevention of many terrain conflicts.⁵⁹

The automated system will also control the movements of subscriber units, thus providing continued control during the potentially confusing times of mass unit movements while the Brigade is in contact.⁶⁰

The projected fielding date for the AFATDS and the ACCS is the 1990 time frame.

END NOTES

- ¹ C.N. Donnelly, "The Wind of Change in Soviet Artillery." International Defense Review. No.6 (1982). p.738.
- ² Kerry Hines and John Hines, Soviet Front Fire Support. (Washington, DC: Defense Intelligence Agency, 1982): 3.
- ³ The MLRS is a self-propelled rocket launcher that operates in a semi-autonomous mode. The system has the ability to locate, lay, and compute firing data independent of any external support. The MLRS can deliver 12 rockets armed with DPICM bomblets to a range of 30 km. The MLRS is organized in batteries of nine launchers, of which one battery is found in the heavy division.
- ⁴ The PIA is an intermediate range nuclear missile with a range of 740 km. The PIA platoon contains three missiles, each of which must be on the azimuth of their targets, and connect to a single control vehicle. The PII has an increased range to 1000 miles with a significant increase in accuracy. The PII platoon also contains three missiles, however they have no requirement to be positioned on an azimuth, and each launcher can operate independently.
- ⁵ The PII tactical platoon positions still look quite similar to those of the older PIA. All of the platoon's missiles are grouped in a small area as if the older PIA position limitations still applied. The result of the positioning technique is that the missiles are easier to detect and vulnerable to a single attack.
- ⁶ This observation is based on the experience of the author, which entailed the command of a PERSHING IA battery that later transitioned to the PERSHING II system (September 1984 - June 1986). The resistance to change centered on the actions of officers (both commissioned and warrant) that had spent the bulk of their service with the PERSHING system. An attitude of "this is the way we've always done it" permeated the system. As more officers with cannon experience (no preconceived PERSHING tactical biases) began to arrive in the PERSHING organization, the resistance to change began to wane.
- ⁷ Rupert Pengelley, "Preparing the M109 for the 21st Century." International Defense Review. 20, No.2 (1987): 173.
- ⁸ William P. Baxter, Soviet Airland Battle Tactics. (Novato, CA: Presidio Press, 1986): 190. "TRADOC Systems Manager Briefing Slides." Undated briefing slides for the HIP system: The briefing slides reflect a 3.2 : 1 artillery advantage of Warsaw Pact over Nato. This threat translates to a greater than 75% requirement of all available NATO artillery required for counterfires at D-Day. These fires will be at the expense of close support and BAI/SEAD fires. The close support fire ratio becomes better as the projected war matures, but does not exceed 60% at during any period.

- 9 Hines, Soviet Front Fire Support, 7.
- 10 Field Manual 100-2-1, The Soviet Army Operations and Tactics. (Washington, DC: HQ Department of the Army, 1986): 9-13.
An investigation into the HIP's capabilities cannot be complete without consideration into the eventual counters to the HIP.
The HIP might maintain a limited window of advantage over the Soviet's counterfire capability, though this may be fleeting. We should not expect that the Soviets will allow the United States Army to retain such a firepower advantage over their ground forces. Some near term countermeasures they are likely to take might be:
1) Increased reliance on the role of air platforms to seek and destroy U.S. artillery.
2) Increased emphasis on the detection and destruction of U.S. artillery command centers and our counterfire radars. The destruction of the latter would offset much of our counterfire advantage, while the elimination of our Artillery C² would cripple our ability to mass. The increase in assets dedicated for this mission might come from the artillery diverted from the counterfire mission against the HIP.
3) A change in targeting techniques to adjust to the parameters of the HIP unit.
The longer term solution may very well be our forcing the Soviets to push through development of terminally guided "smart" munitions that will more efficiently detect and destroy single HIPs.
- 11 Ibid., 9-28.
- 12 Ibid., 9-24.
- 13 155mm Self-Propelled Howitzer Requirements Analysis (U). (Aberdeen Proving Grounds: U.S. Army Material Systems Analysis Activity, July 1984): 11. This was an unclassified assumption used in their study.
- 14 Hines, Soviet Front Fire Support, 88.
- 15 Field Manual 6-50-HIP (Draft), Howitzer Improvement Program (HIP) M109A3/E2, 155mm Howitzer Self-Propelled (SP). (Fort Sill, OK: U.S. Army Field Artillery School, 1 September 1987): 1-7.
- 16 Ibid.
- 17 Ibid., 2-1. The Field Manual reflects a recognition of this positioning incongruity by stating that the Platoon FDC may control the individual howitzer survivability movement under certain circumstances.
- 18 Field Manual 6-20, Fire Support in Combined Arms Operations. (Washington, DC: HQ, Department of the Army, 1984): 1-3.

- 19 Field Manual 71-3 (Final Draft), The Armor and Mechanized Infantry Brigade. (Washington, DC: HQ Department of the Army, April 1987): 1-5 -- 1-6.
- 20 Field Manual 100-2-1, 5-20 -- 5-21.
- 21 Ibid., 6-5.
- 22 Field Circular 71-3 (Coordinating Draft), The Armor and Mechanized Infantry Brigade. (Fort Leavenworth: Combined Arms Center, 1985): 2-26 -- 2-27.
- 23 Major General Eugene S. Korpai, "Semi-Autonomous Employment of the 155mm Howitzer Improvement Program (HIP) Howitzer." Message sent to Major General Tait, Commander of the U.S. Army Armor Center, in reference to the Armor Center's terrain management concerns, 072005Z May 1987.
- 24 Student Text 100-3, Battle Book. (Fort Leavenworth: U.S. Army Command and General Staff College, June 1987): Appendix B. The model is based on the sample unit (3d Bde 23d Armored Division) used in Appendix B of the text.
- 25 Calculations are based on the following:
- a. Battalion Battle Positions within the 2-7 km zone require 24km².
 - b. Engineer Company Headquarters requires 300² meters.
 - c. Six unit trains at @200² meters requires 1200² meters.
 - d. Maintenance collection point requires 200² meters.
 - e. Two Task Force Headquarters at @200² meters requires 400² meters.
 - f. One Mortar Platoon requires 200² meters.
- Units considered in addition to those shown in ST 100 - 3:
- g. One FARP requires 200² meters.
 - h. One Decontamination site of 300² meters. The actual site may be much larger, but the additional space would not be occupied unless it was in operation.
 - i. Six air defense weapons at @50² meters require 300 meters.
 - j. Three counterfire radars at @50² meters require 150² meters.
 - k. One MLRS platoon requires 4,000² meters.
- Total requirement = 31,250² meters.
- 26 Calculations are based on a map study of the area found in the 2-7 Km area used in the model (ST 100-3). Of the available terrain, 32% was deemed unusable for firing positions (primarily for dense forest). The remaining 8% was an estimation of the possible impact of NBC and engineer activities.

- 27 Calculations are based on the following requirements:
- a. Each HIP requires 1 km². x 24 = 24 kms².
 - b. Each Platoon Headquarters requires 1 km². x 6 = 6 kms².
 - c. Each Battery Headquarters requires 1 km². x 3 = 3 kms².
 - d. Each Battery Trains requires 300² meters. x 3 = .9 km².
 - e. The Battalion Headquarters requires 1 km². x 1 = 1 km².

HIP Battalion position requirement 2-7 kms behind FLOT- 34.9kms²

These calculations take into account that the Soviets would apply the same targeting criteria towards the HIP Platoon/ Battery/ Battalion Headquarters as the individual guns themselves. The Battalion Trains are omitted since they would normally be located further than 7 kms from the FLOT.

- 28 Field Manual 6-50-HIP, 1-7.
- 29 Ibid., 2-13.
- 30 Bruce A. Brant, "Command and Control of the American Fire Support System." (Fort Leavenworth: School of Advanced Military Studies. MMAS Monograph. 1986): 33, 36, 37.
Robert J. Reese, "Airland Battle and Tactical Command and Control Automation." (Fort Leavenworth: School of Advanced Military Studies. MMAS Monograph. 1987): 26, 34.
- 31 Field Manual 6-50 The Field Artillery Cannon Battery. (Washington, DC: HQ, Department of the Army, 1985): J-4.
- 32 Field Manual 6-50-HIP, 4-4.
- 33 Ibid., 2-1. Computed based on 20 moves a day made by each HIP in the platoon (20x4).
- 34 Ibid.
- 35 Ibid., 5-3, 5-4, 5-5.
- 36 Ibid., 2-20, Encl.#4 Test Issues.
- 37 TV Tape of Combined Arms in a Nuclear/Chemical Environment (CANE). The tape was shown to students of the School of Advanced Military Studies on 24 Sept. 1987. The tape (undated) presented an unclassified briefing of the results of the CANE tests which took place in the early 1980s.
- 38 Field Manual 6-50-HIP, 2-16.
- 39 Ibid., Enclosure 4 Test Issues, 5-6.
- 40 Doctor Frederick J. Manning and Doctor Larry H. Ingraham, "Who Melts, When, and Why?" The Field Artillery Journal. (May-June 1981): 15.

- 41 Cold status is envisioned to mean that the weapons would be in a hide position, available to fire, but not as responsive as the remainder of the battery.
- 42 Field Manual 6-50-HIP, 1-7.
- 43 LTC William W. Breen, "Survivable, Affordable, and Lonely." Field Artillery Journal. (November - December 1977): 23.
- 44 Ibid., 22-23.
- 45 This option assumes that the three platoon option recommended in Section V is adopted.
- 46 Ibid.
- 47 Ibid.
- 48 Ibid.
- 49 Field Manual 100-5, Operations. (Washington, DC: HQ, Department of the Army, 1986): 15.
- 50 Ibid., 16.
- 51 Ibid.
- 52 Ibid., 17.
- 53 Robert A. Doughty, "The Evolution of US Army Doctrine, 1946 - 1976." Leavenworth Papers No. 1. (Fort Leavenworth, KS: Combat Studies Institute, US Army Command and General Staff College. 1979): 47.
- 54 Robert A. Doughty, The Seeds of Disaster: The Development of French Army Doctrine 1919 - 1939. (Hamden, CN: The Shoe String Press, 1985): 182.
- 55 Field Manual 6-50- HIP (Draft), 1-1, 1-4--1-5; Robert M. Forrest, "Shooting From the HIP -- A change in concepts." Field Artillery Journal. (July-August 1986): 26; Rupert Pengelley, "HEL's New Howitzer Testbed." International Defense Review. 20, No.3 (1987): 345.
- 56 Field Manual 6-50 HIP (Draft), 1-3, 1-6, 2-20, 2-22; Fire Support Mission Area Analysis - Phase I Report (U). (Fort Sill, OK: U.S. Army Field Artillery School, 10 March 1980): (U) 8-III-9.
- 57 Suzann W. Voight, "Lightening Up On TACFIRE." Field Artillery Journal. (May-June 1987): 31-32, 34.
- 58 Bruce A. Brant, "Command and Control of the American Fire Support System." (Fort Leavenworth: School of Advanced Military Studies. MMAS Monograph. 1986): 36.

59 Ibid., 22,36.

60 Ibid., 33.

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