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The Utilization of Artillery and Mortars as Infantry Support Weapons in the Chaco War

Charles John Goodall
Western Michigan University

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THE UTILIZATION OF ARTILLERY AND MORTARS AS INFANTRY SUPPORT WEAPONS IN THE CHACO WAR

by

Charles John Goodall

A thesis presented to the Faculty of the School of Graduate Studies in partial fulfillment of the Degree of Master of Arts

Western Michigan University
Kalamazoo, Michigan
June, 1965
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Charles J. Goodall
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MAP I: MODERN PARAGUAY AND SURROUNDING NATIONAL STATES
I. THE BACKGROUND OF THE CONFLICT

In the summer of 1932, while the world's attention was focused upon Japanese aggression in Manchuria, a border skirmish in the upper reaches of the Plata Valley ignited a conflict which could not be extinguished by the good offices of the Pan-American Union or the peace-making machinery of the League of Nations. The prize in question, nearly one hundred and fifty thousand square miles of savanna and swamp, would be minuscule in comparison with the territorial acquisitions of the dictators of that era, but to the two politically unstable and highly nationalistic nations contesting possession, it represented strategic or economic advantages well worth gaining. The Chaco War of 1932-1935, pitting the predominantly Indiana republics of Paraguay and Bolivia, was the first international conflict in the Latin American region since the War of the Pacific (1879-1884), and the only one to utilize relatively modern systems of weapons and tactics. In some respects, it represented a "transplanting" of the trench-and-bunker warfare of the Western Front of World War I into a tropical environment, but with a few basic changes.

The primacy of the infantryman in what came to be a conflict of defensive positioning and withdrawal was firmly established by
1935, despite conditions preventing fluidity of troop movement.

Heavy artillery, the ruler of the battlefield during World War I, was conspicuous by its absence. Hand-to-hand combat with basic infantry weapons without artillery support for the possession of vital strong points became the order of the day in many tactical situations. Thus, the exploitation of numerical weaknesses in such situations was made impossible because neither belligerent could concentrate enough supporting fire upon any defensive position to create a breach in the opponent's lines for infantry assaults. It should not be deduced that artillery and mortars fell into complete disuse in the course of the war, even though the weapons employed were a far cry from the mammoth siege artillery that battered Liege or Verdun. For the most part, the guns of the Chaco were light in weight and caliber, operated by untutored personnel, and limited in effectiveness by European standards. The part played by such weapons was overshadowed by the dominance of the rifle and bayonet in the ground conflict, but the success or failure of both armies in reducing fortified positions depended to a large extent on the effectiveness of their artillery and mortar units. It is the present intention to examine the variety of factors bearing upon the origin, training, reliability, and strategic use of field artillery, mortars, and their personnel, and to show how these affected both the course and outcome of the Chaco War.
As a matter of historical record, a brief examination of the reasons for the Paraguayan-Bolivian rivalry over the Chaco is in order. Since the crippling defeat inflicted upon Paraguay by Argentina, Brazil, and Uruguay in the War of The Triple Alliance (1865-1871), Bolivian ambitions concerning the creation of a sphere of influence in the Chaco Boreal (see frontispiece map) for economic purposes were accelerated by Paraguayan weakness at this point. In 1855 the Bolivian Congress had proposed a port development scheme on the upper reaches of the Paraguay River, and had passed a legislative act to that effect in the same year, offering cash awards and land grants to prospective settlers.\textsuperscript{1} Paraguayan protests were verbose but ineffectual, as the dictatorial regime of Carlos Antonio López was preoccupied with domestic revolts at that juncture, but few Bolivian settlers braved the fever-ridden swamplands of the upper Paraguay and the project died from lack of interest. The momentary tensions created by the Bolivian attempts at settlement, and her diplomatic intransigence following the War of the Triple Alliance left many Paraguayans with lingering doubts about the intentions of the Altiplano republic.

Bolivian interest in the Chaco lay dormant for a quarter of a century, until the disastrous War of the Pacific which resulted in

the loss of Bolivia's sole link with the Pacific, the Atacama strip, to the victorious Chileans.

Figuratively and literally cut off from the outside world, and stung by the humiliation of diplomatic and military reversal, Bolivian national policy turned to the one slender straw of hope remaining, a series of river ports on the Paraguay and Pilcomayo, capable of replacing Atacama as a commercial outlet and lessening dependence upon the Chilean-owned La Paz-Atacama railway. To accomplish this end, territorial claims in the area, resurrected from ancient Spanish grants signed in 1627, were asserted by the Bolivian legislature in 1886, and were formally presented to the Paraguayan Congress in the fall of that year. In no position to confront the Bolivians in the field after achieving a degree of recovery following the War of 1865-1871, the Paraguayan government indicated its willingness to negotiate concerning the matter. During the next twenty years, three separate treaties (1887, 1894, 1907) were negotiated but not ratified.

Neither of the national legislatures could agree upon common boundaries or zones of neutrality, due to the lack of maps of the Chaco and the absence of landmarks, and Paraguayan public opinion hardened against the granting of any favorable port concessions to

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1 Ibid.
2 Ibid.
1907 saw the last attempt at serious negotiation by either party with the Pinella-Soler protocol, which attempted to establish a neutral zone between the two contesting powers separating their Chaco holdings at that date. Although arbitration commissions composed of member states of the Pan-American Union met at Buenos Aires (1913) and Montevideo (1928) in attempts to mediate the dispute, peaceful settlement of the issue became a forlorn hope. Having recovered both economic and human strength, Paraguay no doubt felt justified in asserting her own claims to the Chaco, based on ancestral possession by the Guaraní Indians, and in developing the unlimited timber and grazing resources for her own benefit. By 1928, both nations began large-scale settlement programs in the Chaco Boreal, concentrating in the forested areas adjacent to the two major rivers and around the major water holes, or canadas. Each constructed an irregular line of mud-walled stockades astride the savanna ostensibly as defenses against banditry, but actually as outposts designed to keep close watch on one another. Parties of Paraguayan and Bolivian surveyors, traders, and military personnel pushed out into the bush, frequently clashing over water rights and boundary violations, although no official demarcation line existed. On December 5th, 1928, a battalion of Paraguayan infantry from the

\[1\text{Ibid.}\]
2nd Regiment garrisoning Bahia Negra stormed Bolivian-held Fortin Vanguardia and held it for two months in retaliation for the Bolivian execution of a Paraguayan trader convicted of murder by a military court. From that moment on, patrol skirmishes escalated into a full-scale border war, not yet formal, but just as deadly.

Strength of the Combatants

In comparing the warmaking potential of Bolivia and Paraguay, the obvious initial advantage would seem to lie with the Andean state. Armed with a large capital surplus derived from the tin-mining industry and accumulated during World War I, Bolivia successfully obtained arms from abroad over a five-year period (1926-1931), without disrupting the domestic sector of her economy. In addition, private native banking firms and several Chilean syndicates advanced liberal loans to the government of Dr. Daniel Salamanca for military purposes. The Bolivian armed forces possessed far more elaborate equipment, and outnumbered Paraguayan forces as of 1931 in terms of total mobilized manpower by some sixty thousand men or two hundred thousand for Bolivia to approximately one hundred forty thousand for Paraguay. In spite of these advantages, domestic instability

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1 Ibid.
2 Ibid., p. 231.
weakened the total Bolivian war effort. The Salamanca government, heir of the military revolution of 1930, was distinctly unpopular because of increased taxes, national conscription of manpower, and repression of interest groups opposing the war, such as the mining unions and the Cruceros, political separatists from the eastern province of Santa Cruz. Thus, segments of the population at crucial phases of the war swung away from unanimous support of governmental policy. As a result of this instability, the masses of Indian recruits inducted into the Bolivian ground forces were frequently deprived of logistical services in the form of adequate medical care and sanitary engineering. Ineptitude and profiteering at high military and civilian levels added to the distress of the Bolivian foot soldier. Fighting in an unfamiliar climate, and poorly lead by creole officers who treated them with contempt, it is surprising that the moral collapse of the armed forces which occurred in 1934 did not occur sooner.

At the outset, prominent political and military analysts gave odds on a Paraguayan victory which ran almost one thousand to one against it. These odds appear realistic in view of the fact that national economic potential, in this case, was dependent upon an agrarian, "two-crop" base consisting of cattle raising and the cutting of quebracho wood, a critical material in the manufacture of tannin
extract, worth approximately two million Paraguayan pesos per year in combined export valuation. ¹ Compared to the yearly revenue on exported tin assessed by the Bolivian Ministry of the Interior, this would constitute literally a drop in the financial bucket. Because of this limitation, equipment and supply purchases for the national armed forces were not as elaborate as those of free-spending Bolivia during the period 1926-1932, but were carefully laid out over a longer period to avoid heavy foreign debts and prevent wholesale bankruptcy. Some Paraguayan formations, therefore, went into battle lacking needed equipment, and the requisitioning of arms, improvisation by local industry, and replacement with captured stocks came to be accepted solutions for Paraguayan logistic problems. Irrespective of these handicaps, Paraguay did possess three attributes which outweighed many of its physical deficiencies. Ill-equipped as the Paraguayan army was, it had able leadership in the person of José Estigarribia, a thorough knowledge of the terrain which the Bolivians did not have, and a group sense of elán drawn from the fact that ninety per cent of its officers and men were Guarani, the predominant Indian stock in Paraguay, whose fighting ability in bush warfare dated back to the time of the Spanish conquest. In terms of lines of supply, Paraguay fought on its home ground close to major depots and supply points.

and linked to the front by river steamer and three hundred fifty-nine miles of narrow-gauge lumber railroad, mostly private-owned, but immediately commandeered by the government at the outbreak of hostilities.  

Bolivian supplies, on the other hand, had to be transported down from the Altiplano via the wide-gauge railroad from Sucre to Santa Cruz, unloaded, and moved south by motor truck, muleback, and porters over narrow, rutted, and frequently washed-out trails. As the battle lines shifted further north, this Paraguayan advantage gradually decreased, but during the early stages of the war, the fact that adequate ammunition, foodstuffs, and medical supplies were available in quantity to the Paraguayan forces made a significant difference in their defense of the fortín line against the first Bolivian offensive in 1932-1933. However, the most significant "hole card" in Paraguay's hand was the relative degree of political stability possessed by the nation itself. The government of Eusebio Ayala, in office since 1932, had removed the stigma of political corruption and party squabbles between Conservatives (Blancos) and Liberals (Colorados) which had tainted the domestic atmosphere since the early '20's. Ayala, an ex-soldier and graduate of the Colegio Nacional Militar, was far from being the epitome of an idealistic, disinterested

\[1\] Ibid.
executive (as his conduct towards General Estigarribía after the war would demonstrate), but his leadership in this time of crisis rallied national mobilization behind a common cause; something which Salamanca was totally unable to accomplish. In the long run, we can view the respective combatants in an entirely different light without recognition of basic strengths or weaknesses. Both, in the cold light of reality, were impoverished political entities fighting an equal combat with limited resources; a combat which could ultimately benefit neither and might easily ruin all parties concerned.

Pre-War Military Buildups

By 1928, the future belligerents had decisively committed themselves to a program of gradual armaments purchasing, either by contract as in the case of Bolivia, or by random selection from a number of foreign corporations as did the Paraguayan government. These contract purchases will be discussed in detail in Chapter II, in reference to the artillery developmental schemes used by both nations. Purchasing of foreign-made equipment was not confined to arms and ammunition. Quantities of uniforms, medical supplies, motor transport, and other items were purchased along with priority weapons, although most of these supplies were fabricated by local industry or donated by the civilian population. The Red Cross drives
in both nations, and the activities of the National Arsenal at Asuncion serve as cases in point.

Expenditures of federal funds in both instances were exceptionally heavy, and, for Paraguay, proved to be a sizeable drain on the national gold reserves. In addition, the balance of payments for both nations tipped from the credit side to the debit, causing cutbacks in consumer production and driving up the cost of living in both states. An instance of this is shown by the extent of purchases made by the belligerents from one nation, France, during the period 1932-1933. Bolivia received eight million francs worth of munitions during that time, and Paraguay three million;¹ a staggering amount of debt for even a solvent republic to incur. At an earlier date, Joseph Kreech, the U. S. Minister to Paraguay, reported to the State Department in a dispatch dated January 5th, 1929, that the Argentine Consul in Asunción had mentioned to Kreech that a large shipment of German-made munitions (including twenty-four thousand Mauser rifles), had arrived in Buenos Aires. This shipment was valued at over a quarter million German marks and was consigned to La Paz.² After the League of Nations Arms Embargo of 1933, many overseas munitions firms, including several United States corporations, resorted to

MAP II: ZONES OF INITIAL TROOP CONCENTRATIONS

Key:

- Fortines:
- Bolivian: ♦
- Paraguayan: ◇

Units:

- Paraguayan Corps: XXX I
- Bolivian Corps: XXX II

Paraguayan Division: ◆
Bolivian Division: ▶
Divisional Sectors: ◆◆
Special Detachments: ◆

Villages And Towns: ◆
Main Supply Roads: — — — —
Trails: — — — —
legal loopholes to fulfill previously signed contracts; actions which led to cargo seizures and court suits in many cases. One example of subterfuge occurred in the delivery of four Curtiss-Wright bombers purchased before the embargo took effect. After reconditioning, the company sold these aircraft to a firm of rather questionable reputation in 1933, Tampa-New Orleans-Tampico Airways Inc., which promptly re-sold them to Bolivia after transporting them outside the limits of American jurisdiction. It is not our intention here to point out the disadvantages of such arms traffic to the belligerents or to the vendor nations, but to indicate that such sales did exist and were the main source of the military equipment used, especially artillery and mortars, throughout the conflict.

Troop Deployment in the Chaco:
Lines of Communication and Retreat

The map on the preceding page indicates the major troop concentrations within the Chaco at the outbreak of hostilities, and examination of the key will provide a concise picture of relative unit strength at that time. However, it must not be assumed that these concentrations were of the overnight variety. While both parties had maintained token garrison forces in the various Chaco fortines since 1928, Bolivian concentrations had increased consistently since that date, to the extent that mobilization of an effective combat force for immediate action was relatively simple, due to the constant state of

1 Hubert Herring, "Chaco Deadlock," Current History, XLII (May, 1935), 189-91.
readiness of the Bolivian army and its supporting arms. This consistent "red alert" may be typified by a dispatch from the United States charge d'affairs, at La Paz, William Trueblood, to Secretary of State Stimson on June 27th, 1931, stating that the aircraft and ground crews of the Military Aviation School were being readied for service in the Chaco, even though hostilities were not imminent. Paraguayan mobilization was not quite as consistent, because of the smaller size of that nation's military and the necessity for strict economy in fund expenditures. Prior to the commencement of hostilities in 1931, she could afford to keep on active status only one regular infantry division (of four regiments), one cavalry regiment, and one artillery regiment, whereas Bolivia had fully mobilized six infantry divisions (of three regiments) with supporting arms; three of which, the 3rd, 4th, and 7th, were wholly or in part garrisoning fortines in the Chaco.  

"An Infantryman's War"

Even with the most modern equipment and thorough training, tropical warfare becomes a risky proposition when the terrain and climate are as obviously adverse as was true of the Chaco. Con-

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sequently, the conflict took on the complexion of an old-fashioned
defensive "battle for position", similar to the aforementioned War
of the Pacific, but employing modern weapons systems. Both armies
possessed these as well as the somewhat dubious benefit of European-
oriented training by way of advisory missions which by all rights
should have resulted in trench warfare on the model of the Western
Front. The effects of the unusual terrain, extremes of heat and
moisture, and the difficulty of cross-country movement completely
revamped the traditional doctrines of trench warfare, changing them
to fit the circumstances of the moment and the tactics used. The
frontispiece map shows the Chaco in relief, but no map and no
descriptive phrases can adequately convey the nature of the region
or the burdens it imposed upon men, animals, weapons, and motorized
equipment. As a "pure" jungle by a biological or literary definition,
it would be considered second-rate, as heavy forests occur only along
the riverbanks of the two primary northern branches of the Plata,
the Paraguay and the Pilcomayo. Rather, the Chaco, geographically
speaking, is a combination of grassy savanna, heavy brushlands, and
riverbottom swamp bounded on the north by the Andean foothills
and on the east and west respectively by the two previously mentioned
rivers. In spite of the presence of these major streams, it is a
region parched by continuous drought, relieved only briefly by the
torrential rains of the winter season which overflow the rivers, creeks,
and canadas (limestone depressions used as local waterholes) and blocking overland travel on the few accessible trails for several months out of the year. Apart from these narrow cart trails, river steamers, and the narrow-gauge logging railroads in the central portion, overland movement is hampered by an inadequate water supply and the impossibility of traversing the inpenetrable acacia, thorn, and palmetto scrub that line both trail and railbed. Where a few men might move with ease, a marching column of fully loaded infantry or mule-drawn 75's could not penetrate, on many occasions, these "living walls", although Paraguayan columns by traveling light could and did make long overland marches. The lack of potable drinking water, save for the few canadas which did not dry up in the summer months, slowed troop movements by both belligerents and contributed to lengthening lists of non-battle casualties from extreme thirst and sunstroke.

The high degree of humidity, with annual temperatures during the summer consistently over 100 degrees, sapped the energy of the combatants, lowered their resistance to disease, and quickly rusted exposed metal equipment, particularly fieldpiece sights, shells, and fuse caps. The primitive medical/sanitation battalions of the opposing armies found themselves hard put to cope with recurrent epidemics of malaria, scrub typhus, and dysentery which frequently left whole regiments incapacitated. Evacuation of wounded
or sick personnel could not be properly carried out due to the inability of military ambulances to cope with roads made impassable by trucks or marching feet. Air evacuation was used by both sides where landing strips could be cleared in the scrub or savanna, but a wounded man's chances of reaching a rear hospital alive were minimal to begin with. More than half of the casualties incurred by both belligerents were non-battle, and derivatives of the inhospitable landscape in which they fought. Lines of communication and retreat were limited to the few man-made trails previously referred to, and the dubious link of air supply, which was employed here for the first time in Latin American military history, although on a small scale. As a result, the possession of key positions along major supply routes and strategic waterholes, as exemplified by Arce and Cañada del Carmen, often became the focal point for full-scale tactical operations involving entire divisions or corps.

In retrospect, the greatest burden borne by the Bolivian ground forces in particular was not physical, but psychological. Confronted with an alien, forbidding landscape, and bewildered by a type of warfare wholly unfamiliar to them, most Bolivian soldiers from the private in the front rank to the corps commander in the rear felt the tension and uncertainty common to conventional forces fighting in a strange environment, and expressed it through irrational operational orders, trigger-happiness in the frontline trenches, which
accounted for a sizeable proportion of total Bolivian casualties, and panic in times of encirclement or retreat. Their Paraguayan opposite numbers had to cope with similar difficulties, but to a lesser degree. Having an intimate knowledge of the terrain, and combining said factor with the Guarani propensity for bush warfare, Estigarribia and his subordinates could afford to let the Chaco be their temporary "ally", and not to regard it as an object of fear or scorn, as was the fashionable custom at Bolivian Expeditionary HQ at Santa Cruz. As a matter of record, let us make it quite clear that neither belligerent found the Gran Chaco an easy battleground, and the difficulties posed by nature which we have alluded to cancelled out many of the material or psychological advantages possessed by each. There is no question that the conflict was a grueling one, and tested the national strength of both parties to the breaking point. An English journalist, visiting the front lines in the summer of 1932, just after the outbreak of the war, summed it up exceedingly well when he said "...when our ancestors invented Hell, they had no knowledge of the Chaco."¹

¹"Verdun Over Again in El Gran Chaco," Literary Digest, CXV (February 18, 1933), 12-13.
II. THE STRATEGIC APPLICATIONS OF FIELD ARTILLERY AND MORTARS

Pre-War Influences

Probably the first shots fired by either antagonist in the Chaco came from field artillery, belying the implications that the conflict would be fought and won with infantry alone. A report dated 19 July 1932, from the commander of the Bolivian 4th Infantry division, garrisoning Fortín Mariscal Santa Cruz, stated that the stockade had been surrounded by three hundred Paraguayan troops on July 15, 1932, and that the garrison was receiving consistent artillery and mortar fire. Now that the cannon muzzles had been warmed, they would not be cold again for three long years. Before investigation of the direct role that infantry support arms played in a tactical sense, attention must be turned to other considerations of a strategic, long-range nature. Among these will be included military doctrines introduced by foreign advisors to both belligerents, pre-war field training, developmental planning prior to the conflict, the role of logistics and reconnaissance in weapons effectiveness, and most important of all, the integration of artillery and mortar units within the separate organizational tables of the two field armies.

1U. S., Department of State, Foreign Relations: Documents, 1932, V, 33.
The utilization of artillery and mortar in both armies came directly under the influence of two diametrically opposed systems that had once before clashed on a broader field of battle --- the Western Front in World War I. To a great degree, the belligerents had relied upon the assistance of advisory teams or individuals from other nations to direct re-organization and troop training since the early 1920's, and accordingly these brought the weight of their professional and personal influence to bear upon infantry support doctrine. Because of the variety of such influences, either voluntary or contractual in character, basic doctrine in both field armies was a conglomeration of many strategic theories. Two paramount examples, one individual and the other centered around a group, stand out above the rest as guideposts and tradition builders for two armed services relatively untutored in heavy weapons theory and practice.

Bolivian artillery and mortar technique in the Chaco were dominated from 1921 onward by the autocratic figure of an ex-Prussian aristocrat and Grenadier officer, Hans Kundt. A veteran of the Eastern Front who had risen from captain to brigadier general in the course of World War I, Kundt had originally come to Bolivia in 1910 as a member of an advisory team to serve as an instructor at the National War College in La Paz. After Versailles, he returned to his "adopted" fatherland and filed naturalization papers to escape
the Treaty clause forbidding German officers to act as military advisors overseas.¹ A thorough-going militarist of the pre-World War I school, Kundt can be considered responsible for the remodeling of the Bolivian armed forces along German lines, especially in the areas of tactical maneuver and infantry support. His command experiences in East Prussia and Poland, fighting an "open" type of warfare against enormous masses of Russians, had firmly convinced him that weight of fire, not accuracy, was the predominant factor in artillery/mortar support of assaulting infantry. Accordingly, he expounded the idea of the erosion of a weak point in an opposing defensive line by massive concentrations of carefully observed artillery and mortar fire, to destroy enemy resistance at that point and permit assaulting infantry to exploit the breach and "fan out" from that point. A descendant of the old Napoleonic concept of le _grande batterie_, literally, "the great battery", this tactic was effective enough in blasting a hole in an opposing defensive line situated on open ground with limited entrenchments, as was the case on the Eastern Front during World War I.² However, Kundt's proposed doctrine was extremely inflexible to the extent that it took no account of defense lines in depth and in its emphasis on weight

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¹ Henry Grattan Doyle, "Crisis In Bolivia," _Current History_, XXXIII (August, 1930), 990.

rather than accurate fire directed against frontal and flanking positions. The German artillery strategy employed on the Western Front adopted these factors into its overall doctrine, but little apparent attention was paid to its success by Kundt. The price paid by the Bolivian foot soldiers at Toledo and Nanawa was a result of this oversight, and will be considered in detail in Chapter IV.

Kundt's contributions were not, however, entirely negative. On the contrary, his administrative ability gave Bolivian field artillery and mortar units a proper place in the tables of organization and a definite mission to fulfill, rather than being the step-child and whipping boys of logistics or executive authority. In doing so, however, battery commanders and rear-rank gunners alike were penalized by the removal of initiative and their subordination to higher authority through a complicated chain of command. To make any weapon effective, particularly field artillery or mortars, a degree of personal choice must be left to those who operate and control it, for instance, in the sighting of the piece for effective fire. In his passion for total discipline, Kundt did not completely destroy freedom of action in Bolivian artillery/mortar theory, but watered it down by tying it to a command hierarchy which could not respond quickly enough to requests from the lower echelons under battlefield conditions.

1 Ibid.
Thus, fire support often came too little or much too late, and the embattled artillery received an unjust share of the criticism for subsequent defeats. In sum, Bolivian infantry support doctrine as it stood in 1932 is analogous to a man possessing only limited control of the vital parts of his body. The head worked well, as did the arms, legs, and feet, but they did not work in co-ordination with one another.

The prime influence upon Paraguayan artillery and mortar doctrine came from a different source, and it found fertile ground in which to plant theoretical seeds. Lacking excessive numbers of fieldpieces, mortars, and related weapons, the Paraguayan forces naturally fell back upon rapidity of movement and accuracy of fire rather than weight, and correlated these factors with the handicaps imposed by the Chaco terrain and climate upon an elaborate, "big-gun" establishment. As a result, the training systems advocated by a French military mission resident in Asunción from 1926 to 1929 became logical adjuncts to native "common sense" doctrines. Composed of five officers, the advisory team concerned itself with officer and enlisted instruction in basic arms specialties, prominent among them field artillery and mortar employment in infantry support. Other missions were present at the same time, but did

1 Ibid., II, 31-32.
not take such a prominent role as the French. Major Gustave Langlois was head of the artillery/mortar training section established at the Colegio Militar and the National Arsenal.  

Another veteran of World War I who had worked his way up through the ranks, Langlois saw in the untrained personnel under his instruction an opportunity to vindicate artillery/mortar mobility under battlefield conditions. Previously, French artillery doctrine had been built around the concept of the primacy of field batteries in direct support of the infantry, reserving heavy artillery for siege warfare or special operations. The famous French "75" was the prototype fieldpiece developed for such a strategy, which, however, called for conditions of "open" warfare. The stagnation of the conflict on the Western Front into trench war by 1916 killed off by degrees the necessity for artillery mobility, and by the time of the armistice weight rather than speed dominated the battlefields on both sides of the line. Langlois, having the opportunity to travel extensively throughout Paraguay, realized that an impending conflict with Bolivia would be fought along the lines of a defensive, positional conflict similar to the model of the Western Front. Without alluding directly to the subject, he asserted that the absence of a road

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1 Ibid.
2 Ibid.
or rail net in the Chaco and the unsuitability of the terrain would preclude the use of heavy artillery in the conventional pattern. Accordingly, he placed emphasis upon the direct support of Paraguayan infantry by attached pieces either in battery, section, or single gun; able to move in pace with the foot soldier and provide support where it was needed. In addition, Langlois did not overlook the possibilities offered by the trench mortar as an infantry support weapon complementing field artillery, as did his opposite number Kundt. Here was a simple device packing the relative power of an artillery piece, but inexpensive and easily operated by untrained personnel. Both belligerents used mortars extensively during the course of the conflict, thus proving the contention that equipment need not be elaborate to perform the desired battlefield task. Mass fire against fortified positions was not neglected by any means, although the primary emphasis here fell upon direct, accurate delivery of bombardment against a variety of specific objectives across open sights rather than indirect "destruction by weight of metal".

Herein lies the only weakness in Paraguayan artillery/mortar

\footnote{1}{Ibid.}
\footnote{2}{Ibid.}
\footnote{3}{Ibid.}
doctrine; namely, the exposure of gun crews to battlefield hazards. Open-sight firing certainly possesses the benefits of accuracy and clear observation of one's target, but if a gun crew is made a target in return, the value of the fire is diminished or totally lost. This is not to imply that Paraguayan artillerists and mortarmen were incapable of indirect fire against unobserved targets. The inadequacy of observation and reconnaissance facilities as will be indicated in Chapter IV forced the expedient of direct, exposed fire in many instances with high personnel casualties as the result.\textsuperscript{1} Disadvantageous as this method was, it did make for keen accuracy on the part of Paraguayan gunners and may have prevented major military catastrophes during the course of the conflict. At first, Bolivian artillery crews tended to emulate their Paraguayan counterparts in direct movement firing, but gradually lost their enthusiasm for the practice after the disaster at Nanawa.\textsuperscript{2} As a more concrete step, Langlois left behind him in 1929, among other things, a simplified range table (printed in Spanish and Guarani) which could be calculated by any literate common soldier.\textsuperscript{3} Thus, in an emergency, even regular infantrymen untrained in handling and firing an artillery piece could operate it with a reasonable degree of efficiency.

\begin{footnotes}
\item[1] Ibd.
\item[2] Ibd.
\item[3] Ibd.
\end{footnotes}
It might appear to the casual observer that the use of artillery and mortars in the Chaco War was dictated by traditional policies advocated by old military rivals. To a certain extent, this assertion holds true. We must recognize, however, that the field of battle in question was completely opposite from the flat fields of Picardy or the hills surrounding Verdun where the Franco-German contest of big gun versus big gun swayed back and forth. The doctrine might have been the same but the men who loaded and fired the guns in the bush turned it in many different directions; directions not dreamed of by the artillerists of World War I.

Field Training and Instruction

Having discussed the strategic influences imparted to infantry support doctrine by Kundt and the French mission attention can now be focused on the systems of pre-war field training used by the belligerents, and the operation manuals used in such training. Neither armed service possessed a hardened cadre of regular officers and enlisted men adequately skilled in operating artillery and mortars in the field, with the result that gun crews frequently went into battle with limited firing experience and were forced to learn the hard way. This technical deficiency can be traced directly to the insufficiency of pre-war instruction, and the presence or absence of illustrated texts or manuals as instructional guides. The lack of such essentials
on the part of the Paraguayan army, due to economy measures, proved to be a definite handicap to the corps and divisional staffs in the early stages of the conflict, not to mention the difficulties imposed upon Paraguayan artillery and mortar crews during this period. On the other side of the coin, Bolivian training and field manuals, while not up to present-day standards, sufficed to provide an initial advantage command-wise through the first offensive of 1932-33, until defensive measures not covered by orthodox considerations were encountered at Toledo and Nanawa.

After returning to formal military life in 1922, Kundt proceeded to translate the old Imperial field artillery manual into Spanish as the basic document for Bolivian infantry support doctrine. Consequently, the strategic doctrines previously mentioned received written expression, and became standard operating procedure for Bolivian artillery units in the field. The manual covered logistical situations, reconnaissance, maintenance procedures in the field and in garrison, as well as a mass of technical material on weapons operation, ballistics, and allied ordnance concerns. In 1934, a companion manual covering operations and training of mortar crews appeared, but no pre-war manual on this particular subject had

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2 Ibid. p. 163
existed. The 1934 manual was produced as a compendium of field experiences designed to demonstrate the value of the mortar as an infantry support weapon, and was published after the ouster of Kundt as Chief of Staff. ¹

In the re-organized tables of organization for the field artillery, Kundt adopted the traditional pattern of a hierarchical chain of command with operational responsibility vested in the corps or divisional commander according to the tactical situation being faced, and trailing downward through the divisional and regimental artillery organizations to the individual battery and piece commanders. ² This military "division of labor" possessed certain advantages in that it allowed the commander of a corps or division, as the case might be, to shift his artillery/mortar components where their weight would be most readily felt, and permitted co-ordination of unit support fires by a single officer. Objections to such a system are infinite in variety, and we shall mention only a few prominent ones in passing. A hierarchy of this order stifles, not encourages, individual initiative in unit commanders further down on the ladder or responsibility whose needs for fire support are immediate in nature, and may be

¹Ibid. An excellent summary of these manuals and how they influenced artillery doctrine in the Chaco can be found in Humberto Torres Ortiz, *La Artille∞ En El Bosque*, (La Paz, Bolivia: Escuela Tipografica Salesiana, 1936).

²Vidaurre, op. cit., p. 163.
inadequately fulfilled by waiting for orders from higher authority. In addition, an excellent system of communication is necessary between the command center and front-line units; a system in continuous working order and relatively foolproof. In field training such a communications net was simple to maintain, but in the brush and swamps of the Chaco, it became a Herculean task to keep lines of communication open within single regiments, much less whole corps. In spite of the obvious fact that Kundt's command system was overly rigid and slow in its response to requests from lower echelons, it gave Bolivian field artillery and mortars a conceptual framework within which to expand, although it came to be greatly altered under field conditions. Operational experience was to be the ultimate test of the Kundt system, as pre-war maneuvers had placed consistent emphasis on the role of artillery in support of attacks on fortified positions. After 1928 the artillery and mortar components of the six Bolivian divisions gained practical experience in war games held yearly or by consistent rotation assignment unit by unit to the Chaco fortines. This rotation, however, was not for the purpose of direct on-the-scene training, but for acclimatization purposes and to provide relief drafts for garrisons riddled by fevers and dysentery. These rotational drafts gave Bolivian artillery and

1 Ibid.
2 Ibid., p. 164
3 Ibid.
mortar units a taste of the terrain they would eventually be fighting in, and provided some opportunities for live firing practice. An abundant supply of practice ammunition allowed the majority of such units to use their weapons without going through the fruitless procedure of "dry-run" firing and the consistencty of the practice mobilizations ordered by Kundt kept both artillery and mortar units relatively battle-ready and prepared to depart for the front on a moment's notice.  

In terms of formal instruction manuals and extensive pre-war training, the Paraguayan field forces were less adequately prepared than their Bolivian counterparts, and were forced to acquire practical training through the hard medium of battlefield experience. The reason for the absence of an elaborate training scheme and its accompanying manuals was financial, in that the national pre-war budget for the military services had alloted only limited funds for an artillery/mortar training program in favor of equipment purchases. Major Langlois's translated range tables, plus his unpublished notes from the classes he had conducted at the Colegio Militar, constituted the entire range of printed instruction material available, and were reprinted extensively for staff and officer consumption, but no formalized artillery or mortar manuals were compiled until 1935

1 Ibid.
at Marshal Estigarribia's behest. This lack of educational materials curtailed the number of trained effectives for headquarters personnel, battery staffs, and gun crews, thus making it necessary to conduct behind-the-line seminars in artillery and mortar operations during lulls in the fighting. After the Bolivian failure in 1933 and national financial mobilization had assured adequate funds, training establishments for that specific purpose as well as for all service branches were established to insure adequate training of recruits before their dispatch to front-line batteries and mortar platoons.

In one sense, Paraguayan training problems in this respect resembled those faced by the United States in the course of Federal mobilization in 1940-1941: a plethora of manpower, but an absence of vital equipment and trained personnel for instructional purposes.

The structure of command used by the Paraguayan General Staff to integrate artillery and mortar units into co-ordinated efforts with other arms was essentially the traditional model advocated by Kundt. It was inspired by the French system laid down by the Coulet Mission, and supported by the military training of Estigarribia, who was a graduate of the French Ecole Militaire and a veteran of the

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1 Gonzalez, op. cit., I, 238-39.
2 Ibid.
3 Ibid.
Western Front trench fighting in 1916-1917. A hierarchical "chain" of command was established between corps commanders down through subordinate units to the specific unit officers, but with certain changes not apparent in the Kundt system. Ultimate tactical responsibility still was vested in the corps or division chiefs, but tactical control could be assumed by a lower echelon officer provided the existing situation warranted him doing so. For example, if a regimental commander desired heavy artillery concentrations from divisional artillery, he could request them directly without going through channels to the divisional or corps commander. In this fashion precious time was saved in field situations where immediate action was necessary, and the burden of responsibility was equally distributed among subordinate officers and in some cases, non-commissioned officers, where it rightfully belonged. Although this systematic alteration tended to oversimplify the chain of command and frequently tempted front-line officers to assert their authority unnecessarily, it prevented the Paraguayan field forces from being bound to a rigid command system lacking an adequate communications net.

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2 Gonzalez, op. cit., 240.
3 Ibid.
and made it possible to use artillery and mortars at the right place and right moment.

Pre-war maneuvers and practical field experience was limited by the lack of sufficient funds, as mentioned earlier. What little mortar and artillery field training took place was confined to dummy firing drills and occasional field problems, some of them on the fringes of the Paraguayan Chaco and away from the sensitive frontier zone. The main obstacle encountered was the obsolete nature of the equipment being used and the lack of adequate practice ammunition, either blank or live rounds. Newly-acquired weapons and ammunition were immediately stored in the military arsenals in Asunción, Villa Hayes, and Concepción, and were not issued to combat units until the frontier crisis became critical in 1931. Thus, battery and section practice was dependent upon old, outworn fieldpieces dating back to the War of The Triple Alliance and fit only for scrap. Plagued with these inadequate guns, Paraguayan artillerymen wrung their hands in anguish, and strove to do their best without telescopic sights, and with faulty breech mechanisms, pitted barrels, and old-fashioned instantaneous fuses. The training report of the regimental artillery company of the 4th Infantry regiment stated in 1928 that

\[1\] Ibid.
\[2\] Ibid.
the aged fuses of the model 1889 Vickers-Armstrong 75 mm howitzers with which the company was equipped had to be loosened before firing with mallets and wrenches, and frequently failed to burst upon impact because of pitted fuse points.\(^1\) Practice ammunition reserves were almost non-existent, making "dry-run" the order of the day.\(^2\) Though beset by mechanical deficiencies in training material and lacking instructional materials, the Paraguayan mortar and artillery units possessed a high esprit because of a competent, toughened core of officers and NCO's, graduates of the classes taught by Langlois and other French instructors, and the inherent technical bent plus diligence of the Guarani artillerymen and mortar crews when given wise leadership and an opportunity to learn the tools of their trade.

Developmental Schemes

To secure the necessary arms and equipment for strengthening their respective military establishments, Bolivia and Paraguay each evolved a systematic program based on foreign purchases and programmed to run for a definite period of time. The Bolivian plan consisted of a four-year munitions contract signed in 1927 with Vickers-Armstrong Ltd. of Great Britain, worth over three

\(^1\)Ibid., p. 241.

\(^2\)Ibid.
hundred Bolivianos or five hundred thousand dollars by the 1927 rate of exchange. Contracts were signed with other munitions firms for the supply of small arms, ammunition, automatic weapons, and aviation materials, but the bulk of Bolivian field-pieces and supporting equipment were derived from Vickers.

Arms purchase planning on the part of the Paraguayan General Staff began at an earlier date, before friction between the two powers had reached the danger point. The military reorganization scheme of 1924, called the Schevoni Plan after its author, Colonel Augusto Schevoni then Chief of the General Staff, proposed the formation of four new infantry regiments with attached supporting arms to be eventually formed into two new divisions. To meet the equipment needs of these new formations, a seven-year program of gradual equipment purchases from European contractors was suggested, with no single firm predominating. Two companies stood out, however, in the delivery of fieldpieces, ammunition, communications equipment for artillery and mortar spotting, and allied gear. These were Vickers-Armstrong and the Schneider-Creusot works of France, long-time rivals in the international

1 William T. Stone, "International Traffic In Arms and Ammunition," Foreign Policy Reports, IX (August 16, 1933), 131-32.

2 González, op. cit., I, 204-205.

3 Ibid.
munitions trade, but acting in accord in this instance to supply the Paraguayan armed forces. Economics, in this case, did make for strange bedfellows. Paraguayan purchases during this seven-year period were not exclusively confined to the aforementioned firms, but the greater quantity of the modern field artillery and ammunition used in the Chaco was derived from Franco-British factories, thus bringing an aspect of international economic conflict onto a far-removed battlefield.

Artillery And Mortar Unit Organization

The basic structure for the artillery units of both belligerents was the three-battalion regiment with headquarters battery and signal detail, totaling in numbers of personnel one hundred officers and enlisted men per regiment in the Paraguayan tables of organization, and one hundred seventy-five in the Bolivian tables. It must be remembered that in European terms these would be considered understrength regiments, but we are dealing here with infinitely smaller armies and limited manpower resources. In both cases, standard Bolivian and Paraguayan infantry divisions had one artillery regiment attached, out of which separate batteries could be told off for specific missions, as we shall illustrate in Chapter IV. All divisional artillery units could be integrated at

\[1\text{Ibid., I, 73-74}\]
the corps level to form corps artillery, but neither corps organization possessed organic artillery battalions or regiments, as would be the case for both the Allies and the Axis powers in World War II. In regimental terms, the formations consisted of one battalion of 105 mm fieldpieces, and two battalions of 75 mm howitzers. In Bolivian artillery regiments, a battalion consisted of three batteries of four guns apiece, totaling thirty-six pieces. Paraguayan regiments, on the other hand, made up battalion components of three batteries of two guns apiece, totaling eighteen pieces. Accordingly, Paraguayan regiments possessed fewer cannon than their Bolivian opposites, and sacrificed gunpower for the sake of mobility, due to lack of material resources. Furthermore, Paraguayan and Bolivian infantry regiments each had an organic artillery company, generally consisting of four pieces for direct support purposes, utilizing specially-made infantry howitzers or obsolete fieldpieces such as the model 1898 Krupp 75 mm used by Paraguay.

The mortar, being a relatively new weapon to both bellig-

1 Ibid.

2 Ibid., II, 35.

3 Ibid., p. 42.

4 Ibid.
erents, was integrated into their respective tables of organization differently in each case. Each Bolivian regiment of infantry included in its components a twelve-tube mortar platoon consisting of two officers and up to twenty enlisted men to provide support at the regimental level in co-operation with the regimental gun company.\(^1\) The platoon could also be broken up into two-tube sections (under the command of an NCO) to support line battalions or companies, with fire to be controlled in both cases by field telephone. Paraguayan regiments, although possessing an organic cannon company, had no such counterpart unit in their tables of organization for mortar units. Lacking sufficient numbers of these weapons to constitute such organic components, Paraguayan mortar crews and their tubes were parceled out to line regiments in two to three-tube sections. Crew numbers were small (only 4 or 5 men to a tube), and command responsibility was more often than not vested in an experienced non-commissioned officer who took his orders directly from regimental headquarters.\(^2\) Out of necessity, mortars in this particular instance would not be formed into formal platoons, because such concentrations would inevitably leave some regiments without any mortars at all. As the front shifted northward, and Bolivian mortars and ammunition fell into Paraguayan hands, scratch

\(^1\) Vidaurre, _op. cit._, pp. 163-67

\(^2\) Ibid.
mortar platoons were built from the ground up, but no pre-war unit of this nature existed in the General Staff T/O.

A word must be said here concerning the apportionment of artillery and mortars in relation to troop strength. Because of obvious material superiority, Bolivian apportionment of these heavy weapons was extremely high in relation to the relative size of the respective combat units, though not as high as in comparable European or United States formations. In Paraguayan regiments, however, fieldpieces and mortars were stretched thin to assure that each unit received a proportionate share. In terms of a conflict of the nature of Korea or South Vietnam, such elasticity would be considered suicidal. For example, artillery pieces were allotted on the basis of one to every four hundred eighty men in an infantry regiment, and mortars one to every seven hundred men. Cavalry regiments averaged one fieldpiece to every two hundred men, and one mortar to every two squadrons. Material shortages forced Estigarrixa and his staff to adopt this dangerous expedient during the first twelve months of the war, until additional purchases could bring the artillery and mortar units up to normal complement equipment-wise. Though tactically a calculated risk, the General

\[1\] Gonzalez, op. cit., II, 40.

\[2\] Ibid.
banked on the bushfighting ability of his soldiers and the bewilderment of his opponents by the irregularity and harshness of the terrain to balance these deficiencies, and won his gamble by a narrow margin.

Logistical Aspects

To keep a modernized military ground force in operation for sustained periods of time, the development of accessible elastic lines of supply is an absolute prerequisite for success in warfare. Not only must the front-line infantryman be fed, clothed, and supplied with ammunition, medical care, and other necessities, but his supporting arms must be given the same degree of attention lest they become inefficient in backing him up. This maxim is especially true concerning field artillery and mortar units, whose logistical needs are exceptionally heavy in the areas of ammunition, and field transport. In the Chaco, the maintenance of general supply links for both armies was sufficient to challenge the patience and ingenuity of any logistical organization. For the artillery and mortar units, it became a contest of endurance, and an unending war against the pervasive bush.

Ammunition became the foremost logistical requirement of the Bolivian and Paraguayan artillery and mortar units, as it never seemed to exist in sufficient quantities to assure sustained fire in
support of the troops in the trenches. Both belligerents had ample reserve ammunition dumps, but these were located at extreme distances from the front, and could be reached only by torturous, heavily-rutted roads which, in most cases, were merely trails cut out of the scrub, and were consistently choked with two-way traffic. Stock-piling of shells, powder bags, and other vital equipment at locations close to the front was out of the question so long as the respective quartermaster and ordnance units lacked vehicular transport. Most ammunition and related supplies was moved to the battery sites by mule-driven carts or pack animals, which were more adapted to the climatic conditions, but whose movement under poor weather conditions or heat was equal to the proverbial snail's pace. As a result, batteries were kept out of action on both sides at critical junctures by ammunition shortages, or were forced to curtail support fires by rationing the number of shells used.¹

Battery dispersal in the brush and thick scrub made for other problems as well, forcing supply train personnel to muscle the heavy shells by hand through the thickets to the battery sites, which was a time-consuming and exhausting process for men who might have to march thirty miles or more to deliver the goods. Ortiz relates that on numerous occasions at Alihuata in November, 1932, several

¹Vidaurre, op. cit., p. 232.
batteries of Bolivian artillery with excellent firing positions were forced to displace closer to the Arce road to obtain more ammunition, and not by virtue of Paraguayan counter-fires. \(^1\) Heavy-duty trucks with light chassis and independent suspension systems to navigate the Chaco roads were the apparent solution to supply problems in general, and those of the heavy weapons units in particular. Neither army, however, had such vehicles in quantity, nor the funds to obtain them, or the means of maintenance for them. Most of the vehicles used by the Paraguayan or Bolivian quartermaster companies were comandeered civilian trucks, buses, or jitneys completely unfit for service over third-class roads.

In addition, the transportation units possessing such vehicles were so few in actual number that delivery of rations, water, small arms ammunition, and other items was given top priority over the logistical requirements of artillery and mortar units, who were considered fit to fend for themselves. Playing second fiddle to the infantry was far from pleasant for the gunners of both armies, although it is admissable that the needs of the respective infantry units (especially in terms of water and ammunition) were more pressing. For example, Paraguay had one thousand vehicles of all types and running conditions, but the General Staff saw fit only to allot five

\(^1\)Ibid.
trucks per artillery regiment to be used as ammunition and ration carriers, and not as prime movers.¹ It would be simple to lay charges of parsimony or ignorance against the planners responsible for such a decision, but these charges are unsubstantiated in view of the primacy attached to artillery and mortar units by the General Staff. The consensus of opinion was that vehicular transport was vital for logistical support of the infantry first, and all other arms in their proper turn. Bolivia's vehicular reserve was equally large, but was utilized in a like manner to the disadvantage of the heavy weapons units.

Both armed services faced even more critical problems in the area of weapons maintenance. Again, the problem was not a decided shortage of spare parts and trained artificers, but how to get them up to the front where they could do the most good. If a field-piece, for example, suffered a jammed breechblock, immobilization was the end result, unless available spares and ordnance personnel happened to be handy. It was impossible to maintain ordnance companies in the field per se, as their technical skills were needed behind the lines at rear-area supply dumps and government arsenals at Asuncion and Santa Cruz de la Sierra.² Consequently, the average Paraguayan or Bolivian artillerist or mortarman became his own

¹González, op. cit., I, 267.
²Ibid.
armorer, so to speak, and fell back upon improvisation to provide what field ordnance could not do. His task was complicated by the incessant heat, torrential rains in the fall which rusted elevating wheels, pitted barrels, and ruined optical sights, clouds of dust during the dry season which wore down breech linings by sand abrasion, and the attendant health hazards derivative from a hostile climate. There were no rear areas in the Gran Chaco, and the men of the artillery and mortar units suffered in equal proportion with their fellows in the trenches on both sides of the firing line.

Without trucks or equivalent vehicles as prime movers, field artillery and mortars moved by mule team, horses, or upon occasion, by shank's mare if the road was too narrow or muddy. Mortars were usually transported by hand in the line of march, but artillery was another matter entirely. Unless rapid cross-country movement was part of the tactical conditions called for, artillery regiments moved up or back from the front on the main roads, with six-mule hitches drawing the caissoned fieldpieces. Both belligerents made extensive use of draft animals for this purpose, in which Paraguayan artillerymen had a decided edge derived from their cattle-ranching experience. ¹ In several instances, however, draft mules, horses, or oxen were liabilities rather than assets in

¹ Ibid.
rapid transit of artillery. Skittishness under fire and the high costs of procuring animal forage, plus the necessity for veterinary services, could prevent a regiment from going into action just as surely as a lack of ammunition. Nevertheless, the majority of artillery units in both armies retained draft animals as prime movers to the conclusion of the war in 1935.\textsuperscript{1} Trucks or other vehicles were rarely used to draw artillery pieces, except in cases of unplanned withdrawal where speed was of the essence in removing valuable equipment.

Once off the main arteries of communication, artillery units were severely handicapped in their radius of movement. It is one thing to haul a fieldpiece with a team along an existing road, but quite another to move it cross-country through acacia and sawgrass. However, both parties attempted cross-country marches at various stages of the campaign with heavy weapons, with varying degrees of success. These efforts in their tactical perspective will be discussed in turn in Chapter IV. The Paraguayan forces, having an intimate knowledge of the terrain, took the lead in the use of "Backpacking" artillery in the Chaco bush; a factor which undoubtedly contributed to the high degree of mobility exercised by Paraguayan troops in pursuit and encirclement situations. Such mobility allowed

\textsuperscript{1} Ibid.
Paraguayan artillery units to move in step with advancing infantry columns and deliver needed fire support, and permitted quick withdrawal overland should the unit be surrounded as was the case at Picuña in October, 1934. The fieldpieces and mortars used by both armies lent themselves readily to such tactics, being primarily intended for mountain warfare, and easily dismantled, packed in to a battery site piece by piece on muleback, re-assembled, and readied for firing in a matter of hours. While fought in climate alien to orthodox pack artillery tactics, the use of knocked-down artillery and mortars by the belligerents is reminiscent of the "flying batteries" of the Civil War in their source of locomotion --- the strong, uncomplaining backs of horses, mules, and sometimes men.

Methods Of Observation And Fire Control

The difficulties encountered in positioning a fieldpiece or mortar, operating it effectively, and keeping it supplied with adequate ammunition and spare parts are compounded if the means of fire control prove to be ineffective, or the terrain hampers efficient observation of worthwhile targets. In bush fighting, such as in the Chaco, accuracy of support fires becomes a critical issue, and the army with the most efficient observation system possesses

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a definite edge in this department, tactically speaking. While both belligerents utilized methods of fire control that were particularly advantageous to their material circumstances, neither obtained a clear-cut superiority over the other, except in certain areas of specialization which will be considered in due course. The very ruggedness of the Chaco landscape limited the ground-level observation of artillery and mortar spotters, causing both sides to completely miss troop concentrations, gun emplacements, and the like which were masked by the impenetrable brush and second-growth timber in the Chaco Central. As a result, if fires were not carefully adjusted, one's shells might be landing in friendly trenches instead of hitting the opponent's positions. This, in part, was due to the interlocking nature of the ground fighting, where Paraguayan and Bolivian trenches often lay less than fifty feet apart, and mortars had to be raised to the full length of the elevation screw to be fired effectively.

As a consequence of the confusing nature of the terrain, delivery of fire concentrations using open sights became the most effective method of observation, albeit the most hazardous for gun crew and observer alike because of vulnerability to return fire. We have previously referred to the adoption of open-sight gunnery by the

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1 Ibid.
Paraguayan heavy weapons establishment as standard doctrine; a method which obviously benefits gun crews in ranging in upon stationary targets, such as a machine-gun nest. However, if the target is mobile, tracking and spotting fire to destroy same is difficult since it is impossible to aim a heavy fieldpiece as one would a rifle. In order to deal with this problem, and the handicaps imposed by vegetation, the Chaco belligerents developed a variety of methods for spotting and controlling artillery and mortar fire.

Securing a vantage point above the ground became the first essential to effective fire control in the Chaco, and so both armies naturally turned to the forest to provide perches for observation. The bulk of the existing timber was second-growth, but in some sections of the region, especially those close to the major rivers, virgin timber still towered above the surrounding scrub in small groves of quebracho, ceiba, tropical cedar, and other such varieties of the Latin American rain forest which grew in the river valleys. In the largest of these, crude platforms made of branches and logs carefully lashed with liana vines were erected in the highest solid limbs, and used as tree-top observation posts. Easily commanding a view of the surrounding countryside, they were generally manned by two or three signalers equipped with a rangefinder or fieldglasses, maps, and a field telephone or signal flags to communicate with their
parent batteries or regiments. They were used by both Bolivian and Paraguayan observation teams, although the latter possessed immediate advantages in knowledge of the terrain and in concealing their position through artful camouflage to such an extent that they could operate behind enemy lines without hinderance. An example of such a feat came in March of 1933, when a fire-control team from the 2nd Artillery Regiment of the Paraguayan 2nd Division remained behind Bolivian lines near Arce for a week, directing artillery fire by a concealed telephone line upon the Bolivian-held portion of the Arce-Alihuata road until they were discovered and driven out of their tree-top nest by Bolivian patrols. These tree platforms came into extensive use early in the conflict, when fighting was centered around Arce-Alihuata-Campo Via in the South-eastern Chaco, although their employment was general throughout the war wherever suitable trees large enough to support a man could be found. On occasion, bloody patrol actions would occur as both sides skirmished to gain possession of a tree platform commanding a wide vista of the surrounding bush. Harking back to the old Teutonic system of tree sentinels, these platforms, crude and ill-equipped as they were, were the prime observational stations throughout the Chaco campaigns.

1Vidaurre, op. cit., p. 244.
2Ibid.
3Ibid., p. 245.
In the front lines, where tree platforms made inviting targets for automatic weapons and sniper fire, the forward observer team assumed the burdens of fire control and observation. Anywhere from two to four artillery observers (either artillery personnel or infantry volunteers) commanded by an artillery officer or NCO trained in observational methods would be integrated into the respective battalion headquarters to call down preparatory or defensive fires, and to assist in spotting fire for regimental guns. As in the case of tree platforms, both artillery and mortar organizations used such teams. However, the superiority of Bolivian communications equipment and the predominance of the new battery-powered radio-telephone possessed by Bolivian signal companies gave an initial advantage to the Bolivian FOT's, in that constant communication could be maintained with parent batteries or mortar platoons without the attendant hazards of wiretapping or wire cutting by infiltrators or enemy shellfire. The Paraguayan signal establishment possessed few of these new signal devices forcing Paraguayan observation teams to rely upon old-style crank wirephones of French make, and, upon occasion, semaphore flags to direct supporting fires. Thus, communications efficiency was often impaired by mechanical breakdowns or

1 Ibid., pp. 246-47.
2 Ibid.
3 Ibid.
severing of the phone wires by shellfire, leading to a loss of "control" at critical junctures. Paraguayan signalers soon learned to bury their precious wires to avoid such happenings, and used another ancient method, the heliograph, to communicate with rear-area batteries when the weather permitted. In any case, forward observation teams in both armies, despite an equipment disparity, performed well under the adverse conditions of trench warfare, and suffered corresponding heavy casualties. An observer's morale was hardly improved when his aerial or phone line was made the object of a sustained mortar barrage, or when he was chosen as the object of attention by sharpshooters in the trenches opposite. Is it any wonder that under these circumstances, sustained accuracy from forward observers was, at best, inconsistent?

Aerial observation of gunfire might have proven to be the ultimate solution to the fire control problems of both belligerents, were it not for the absence of an effective air arm on the part of one of them. Paraguay's aerial potential had been neglected in favor of ground-unit development, whereas Bolivia possessed at the commencement of hostilities a small but well-trained air force with several multi-purpose squadrons versed in observation and fire control. We must consider, though, that such a disparity was

\[1\] Ibid.
balanced by the fact that aerial observation and close-support in
the Chaco were sometimes accurate and sometimes not by virtue
of the omnipresent variable of the terrain. To a pilot's eye, the
expanse of the Chaco appears as a slightly undulating brownish-
green blanket, broken only by canadas, scattered patches of forest,
and a few man-made clearings or roads. Prominent landmarks
are difficult to distinguish from the air, and low-level observation
useless in view of the density of the ground vegetation.¹ As a result,
fliers of both armies were often confused by the uniformity of the
landscape, and often erred in their selection of targets. Extensive
training is necessary for accurate interpretation and direction of
artillery fire by aerial observation, and this the Paraguayan Army's
Aviation Corps did not have. At the outbreak of the war, only five
Potez 25 reconnaissance bombers, purchased from Avion Marne-
et-Seine Ltd. in 1924, were available for service with trained
crews. On the twenty-first of September, 1933, the last of these
was shot down by Bolivian Focke-Wulf 310's over Algondon, depriv-
ing Paraguayan artillery regiments of effective air-spot throughout
the remainder of the conflict.² Paraguayan fighter pilots, untrained
in observational techniques, attempted to fill their places with
improvised spotting methods, but with few notable successes.

¹ González, op. cit., I, 203-204.
² Ibid.
Bolivia, on the other hand, had developed a highly-trained three-squadron reconnaissance group, trained by German and American contract pilots at the National Aviation School in La Paz, which could double in brass as a close-support group. Primarily, it was equipped with either the Focke-Wulf 310, a single-seat, all-metal biplane fighter manufactured in Germany by Focke-Wulf Ltd. of Bremen, or the Curtiss Falcon, a two-seat metal biplane designed by Curtiss-Wright Inc. of Buffalo, New York as a reconnaissance bomber. The aforementioned squadrons, together with other elements of the Bolivian Air Force, operated from landing fields at Vanguardia, Ballivián, and Villa Montes, plus smaller auxiliary dirt strips closer to the front lines, weather conditions pending.

While under administrative command of the Air Force, their tactical duties were dictated by the Army commander in the Chaco in accordance with the chain-of-command advocated by Kundt. In response to a request for aerial observation forwarded by a front-line commander, a two-to-three plane element would arrive on the scene, locate the target by low-level observation, and direct regimental, divisional, or corps fires upon it. Since two-way radio communication with ground units was impossible due to a lack of

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1 Vidaurre, *op. cit.*, pp. 247-49.
2 Ibid.
3 Ibid.
effective transmitters, a variety of methods were used, including the tried-and-true streamer drop used in World War I, the dropping of smoke bombs, combinations of Very flares and tracers fired over enemy positions, and dummy strafing runs. Aerial photography, which might have revealed camouflaged positions to both sides, was completely neglected because of a lack of aerial camera equipment and specialized training by both air establishments.\footnote{Ibid.}

Having considered the doctrinal background of artillery and mortar usage in the Chaco and the influences of training, developmental planning, administration, logistics, and observational method, we must now turn to the main characters, the weapons themselves, and consider their technical attributes in relation to the conflict and its outcome.
III. THE WEAPONS AND THEIR EMPLOYMENT

Mortars

The ideal infantry close-support weapon for brush fighting such as that experienced by Bolivia and Paraguay in the Chaco proved to be the trench mortar; one of the innovations in ordnance material developed during World War I. Inexpensive to manufacture, the mortar is capable of a high rate of sustained, rapid fire, even with inexperienced crews, and can be easily moved from position to position without any sacrifice of mobility, while field pieces or infantry cannon cannot be handled without difficulty. Furthermore, it can be effectively operated by the front-line soldier without prior instruction or formalized crews if need be, and can deliver a wide variety of shells besides high explosive and fragmentation, among them illumination, smoke, and chemical projectiles. In the see-saw defensive conflict that was the Chaco War, both belligerents made extensive use of mortars as basic weapons for close support, and, in some instances, a mortar section or platoon constituted the only available support unit for many line battalions or regiments. The tubes in question were both foreign in manufacture, although an improvised substitute was utilized by Paraguay at a later date, and will be considered in due course.
Initially, the Stokes-Brandt trench mortar had been designed as a device for breaching barbed-wire entanglements, and only in the latter stages of World War I had it been used for high-angle fire against entrenchments, machine-gun nests, and like targets. Developed by Browning Arms Ltd. of Belgium and named for two British Army officers who originated the design, the Stokes-Brandt was an 81 mm. (three inch) tube made of rust-proof chrome steel, with a light-weight supporting tripod and a reinforced baseplate. Possessing a high degree of elevation (better than 45 degrees vertical with the elevating screw at full), it had an effective range of over two thousand yards, and could deliver an estimated forty-five to fifty rounds per minute when handled by an expert crew. To the unskilled Guarani infantry, it was as good as an artillery piece, and accordingly took the place of artillery on several occasions where the terrain did not favor the use of fieldpieces, or in cross-country attacks where the batteries could not follow without a road being cut. The accuracy attained by Paraguayan mortar crews, despite the lack of aiming stakes and range tables, increased as the war moved further north, mainly because of the high-angle simplicity of the Stokes-Brandt itself and the hand-to-hand nature of the ground fighting. The Bolivian General Staff, on the other hand, had pur-

\[1\] Ibid., pp. 146-47.

\[2\] Enrique Vidaurre, El Material De Guerra En La Campaña Del Chaco, pp. 146-47.
chased a number of Stokes-Brandts prior to the outbreak of the war for experimental purposes, but made limited use of them in a combat role. This was primarily due to Kundt's insistence upon a heavier tube in weight and caliber, similar to the German minethrowers of 1914-1918. As a result of this decision, the Bolivian Stokes-Brandts went into battle with well-trained crews, but were consigned tactically to a military Limbo.

The mortar selected to supplant the Stokes-Brandt in the Bolivian Army was American in manufacture, and a literal giant in size and caliber. It had been developed by the American Armament Corporation of White Plains, New York for the export market, and the entire initial consignment, nearly one hundred tubes in all, was purchased by Bolivia in 1931. The AAC was equivalent in caliber to the modern 105 mm. howitzer in present use by the United States Army, and packed tremendous firing "punch" for a relatively lightweight weapon. Considering the caliber of shell fired, one might expect the AAC to be lacking in portability, but such was not the case. The designers at White Plains had copied the Stokes-Brandt tripod and suspension systems, and had attached them to the AAC, with a sturdier base plate to compensate for the heavy recoil. Its

\[1\] Ibid. pp. 159-62.

\[2\] Ibid.
rate of fire was equally as rapid as that of the Stokes-Brandt, and the approximate range of the shell was increased to almost twenty-five hundred yards by the use of super-charged Cortex shells. In overall performance, it frequently bested the Stockes-Brandt on the battlefield, but fell down in the matter of ease of operation. The attached range tables and elevating mechanisms of the AAC were excessively complicated, and could not be interpreted by illiterate Indians who could not read the English-Spanish dual markings. Consequently, Bolivian mortar crews spent valuable time puzzling over indecipherable instructions, while their Paraguayan counterparts, free of such encumberances, fired their tubes by rule of thumb and eyesight and more often than not hit their targets.

Mention should be made here of an ingenious mechanical improvisation concocted by the Paraguayan ordnance personnel at the National Arsenal in Asuncion to supplement the Stokes-Brandt 81's. To compensate for the fact that mortars were "spread thin" throughout the Paraguayan ranks because of numerical deficiencies, the ordnance crews, after lengthy experimentation and testing, devised and produced from seventy-five to one hundred "mortarettes" as substitutes. These were primitive weapons with two-and-one-half inch barrels mounted on a wooden base, which fired simple iron

\(^1\)Ibid.
shells of approximately 60 mm., loaded with black powder. Their effective range was a little less than one hundred fifty yards, making them something less than an accurate infantry support weapon. However, as scare devices, they were unparalleled, as they simulated the discharge of 75 mm fieldpieces, and their shells reproduced the sound of a "75" in flight. Many a Bolivian infantry unit received a severe case of battlefield jitters from these weapons, and some prematurely abandoned prepared positions in the war's early stages upon the firing of a few "mortarettes". In comparison with modern weapons, they faintly resembled the old grenade discharger used by the Japanese Imperial Army in the Pacific, at least in terms of overall accuracy of fire.

Infantry Cannon

We have previously mentioned in Chapter II that direct support of infantry in both armies was not limited to their respective mortar establishments. At the regimental level, Bolivian and Paraguayan infantry units possessed organic artillery units made up of light artillery designed to handle firing missions beyond the scope of mortar support, but not requiring the full weight of divisional or corps artillery. The primary role, in both cases, of

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1 Ibid., pp. 165-67.
2 Supra, p. 38.
infantry cannon came to be delivery of support fires in co-ordination with frontal attacks by the infantry upon fortified positions, defensive concentrations to repel similar attacks, and mass concentration of fires in co-operation with divisional and corps artillery units. These missions, in all circumstances, required fieldpieces which could conveniently be served by a small crew and which could advance along with the infantry over broken ground, giving supporting fire as they were moved. In this respect, Bolivian cannon companies rightfully outdid similar Paraguayan organizations, but only by virtue of material superiority. Both belligerents used their regimental gun components consistently in action, and used them with skill and flexibility.

Bolivian regiments generally utilized a British-made product as the backstop of their cannon companies; namely, the Vickers-Armstrong 65 mm. infantry howitzer, model 1926. Resembling in outward appearance a child's toy cannon, it was nevertheless a superlative infantry-support weapon, and one hundred ninety of them were employed by Bolivian line regiments during the war for this purpose. It hugged the ground with a low silhouette, forcing its four-man crew to operate from a crouching position, but had the advantages of a semi-hydraulic breechblock, hard steel wheels with rubber oversoles

Ibid., pp. 172-74
for ease of movement in rough terrain, and attached telescopic sights for direct fire. Originally designed as a mountain artillery piece, the Vickers 65 could be rapidly dismantled for overland movement, or transported complete (minus wheels) on muleback. A light steel trail with attached handles permitted the crew to easily push the piece over rough ground, or even lift it bodily should the need arise. Its range was better than two thousand yards, making it useful for the application of indirect, spotted fire if the situation warranted such measures. Operating in a four-gun section, the Vickers 65 could readily advance in pace with attacking infantry, laying fire on specific targets or a general blanketing fire, reminiscent of the tactics used by German infantry cannon companies in Poland, The Low Countries, and France in 1939-1940. The success of such tactics in the Chaco was demonstrated during the siege of Paraguayan-held Fortín Toledo (February 2nd—March 15th, 1933), where the cannon companies of the assaulting Bolivian 4th and 7th divisions effectively silenced the fire of Paraguayan machine guns and automatic weapons in the fortín's outer trench line, and opened gaps in the wire obstacles before the main fortifications. However, this maneuver was relatively inef-

1 Ibid.

2 Ibid., pp. 174-75.

3 Ibid.
fective due to the inadequate crew protection offered by the thin splinter shield from shrapnel and small arms fire, and similar use of the Vickers 65 at Nanawa resulted in heavy crew casualties as the alerted Paraguayan infantry concentrated well-aimed mortar and automatic fire on the unprotected guns and disabled them. 1 Although the Vickers infantry howitzer was unquestionably effective in its support role, the consistent repetition of the same set of tactics again and again by the Bolivian regimental and divisional commanders, on the basis of one success, soon negated its value and permitted the Paraguayans to create a defense against it.

Paraguayan infantry regiments were less fortunate in the fieldpieces selected to comprise their regimental artillery establishments. Instead of drawing modern infantry howitzers, as their Bolivian counterparts did, the regimental cannon companies in the Paraguayan Army received pieces that had plagued pre-war training exercises by their mechanical breakdowns and chronological age; namely, old-fashioned Krupp 75 mm. mountain howitzers of 1898 vintage. 2 These high-silhouetted, heavy cannon had lain untouched in arsenals and depots since the turn of the century, and were now distributed as infantry support weapons because of both the lack of

1 Ibid.
2 Ibid., p. 178
effective light artillery and of the funds for its purchase. Time and tropical climate had taken their toll, even with careful storage in cosmoline, resulting in a multitude of maintenance and reconditioning problems for the overworked arsenal staff at Asuncion and the gun crews in the field. When not disabled by faulty components or defective ammunition, the ancient Krupps could deliver a high rate of fire due to a completely hydraulic breech-block, and naturally fired a heavier shell than the Bolivian Vickers 65 mm.¹ Due to size and unwieldliness, their ability to be moved along with advancing infantry was limited, especially over broken ground, but in a stationary position, these old German howitzers could be devastating, as will be seen presently.

By 1931, the Paraguayan Ordnance Bureau had signed a contract with a Swiss branch of Browning Ltd. for the manufacture of a new, ultra-light fieldpiece to compliment the outmoded Krupp 75's. These pieces, called Semaks after the corporate name of the subsidy, were actually light machine-cannon, 28/20 mm. in caliber, designed as multi-purpose guns to be used by infantry.² In detail, the Semak was much smaller in wheelbase and total weight than the Vickers howitzer, fired a 2-1/2 pound shell via a six-shell clip.

¹Ibid.
²Ibid.
mounted atop the breech, had steel wheels with rubber treads and a light steel trail, and possessed an effective range of less than twelve hundred yards. ¹ In addition, elevating wedges could be inserted under the breech and carriage to convert it to an anti-aircraft gun, although the long trail and lack of telescopic sights hindered it in this capacity. ² A large consignment of Semaks were prepared for delivery, but only fifteen to twenty of these reached Paraguay in time for the commencement of hostilities, serving with the 1st and 2nd Infantry Divisions at Arce, Toledo, and Nanawa. ³ Had the entire shipment arrived, Paraguayan regimental gunners might have been able to compete on equal terms with their well-armed Bolivian counterparts. In spite of its ease of operation and the fact that it could be moved and fired by a two-man crew, the Semak did not possess sufficient muzzle velocity or a heavy enough shell to destroy a fortified pillbox, unless the shells pierced the firing slits. ⁴ Against uncovered targets, however, its performance was comparable to a similar weapon, the French-made Hotchkiss 25 mm. gun, as an anti-personnel vehicle or in destroying lightly-armored mechanized equipment. A consideration of the Semak's value as an anti-tank piece will be related in the section sub-titled "Special Artillery Types".

¹Ibid.
²Ibid.
³Ibid.
⁴Ibid.
Fieldpieces

To be successfully used in bush warfare, such as in the Chaco, the regular artillery establishments of the two belligerents had to be built around fieldpieces characterized by lightness of weight and a high degree of mobility. Consequently, ultra-heavy artillery of the conventional pattern, requiring uniformity of terrain and mechanized prime movers, was generally eschewed in favor of mountain-type pieces with the advantages previously referred to. Considering the contrary nature of the Chaco Boreal terrain as a whole, and the need for artillery which could move rapidly in pace with the infantry, the primacy of pack artillery in the conflict might well be justified. However, certain technical difficulties in the re-fitting of these mountain pieces for an entirely new tactical role arose and limited their total effectiveness in indirect fire support for both sides throughout the war. Being designed for the rigors of back-pack warfare in a mountainous region, the lightweight construction and carriages of the artillery used by the belligerents was often too fragile to stand the pounding of impassable roads and trails or rough handling by half-trained crews. Range tables and optical sights, in these cases, had been designed for a different purpose; namely, indirect fire support at high altitude, and were basically inaccurate for lowland, tropical warfare. When the period of trial-and-error adjustment necessary for the adoption of new weapons into a strange
climate had passed, Bolivian and Paraguayan artillerists both
managed to make effective use of their bastard equipment, but only
after prolonged experimentation and countless mistakes in the field.
Enrique Gonzalez neatly sums up the problem for both sides in his
comments on Paraguayan experiences with mountain artillery in a
conventional conflict:

"The cannons were thus converted into regular
field artillery under negative conditions, but con­
tinued with the range and the same inconveniences
suited to mountain pieces. The fact is that the only
non-mountainous nation in the Americas acquired,
not all at the same time, mountain artillery..."\(^1\)

By far the most durable fieldpiece of the mountain type
employed during the conflict was the Schneider-Creusot 75 mm.
howitzer, model 1927, which was used primarily by Paraguayan
batteries and which became the mainstay of the Paraguayan artillery
regiments. By its rugged construction and simplicity of operation,
the Schneider 75 gave the Paraguayan ranks a decided material
advantage over their opposite numbers, at least in the area of
field artillery. While light in total weight and possessing a light-
weight gun carriage, the 1927 "75" had the additional advantages of
tempered steel parts treated to prevent rusting, an hydraulic-slide
breech, telescopic sights, and range-finding equipment with simple
mathematical tables printed in Spanish and Guarani to allow rapid

\(^1\) Gonzalez, op. cit., I, 275.
calculation of firing data by inexperienced personnel. The cast aluminum fuses used by the 1927 model's ammunition were also rustproof, and adaptable to any recent-model 75 mm. shell, thus making them sought-after prizes by Bolivian gun crews, whose own cast-iron fuses often failed to detonate upon impact because of rust. The maximum range of the model 1927, firing indirect with observation, was approximately thirty-four hundred yards, making it a useful fieldpiece for high-angle as well as flat trajectory fires.

Bolivian artillery regiments possessed a number of Schneider fieldpieces interspersed with their modern equipment, but these were older, pre-World War models (the 1907 model 75 mm. howitzer, and the 1911 model 75 mm. pack howitzer) which were inferior to the model 1927 in construction, silhouette ease of handling, and condition of ammunition, especially in the matter of rust-proof fuses.

The primary fieldpiece utilized by the Bolivian artillery regiments was also of recent vintage, and was introduced at the same time as the Vickers 65 mm. infantry howitzer, resembling it closely in many aspects. Titled the model 1926 75 mm. mountain

\footnote{Vidaurre, op. cit., pp. 214-15.}
\footnote{Ibid.}
\footnote{Ibid.}
\footnote{Ibid.}
\footnote{Ibid.}
howitzer and distributed by Vickers-Armstrong Ltd., its major advantages lay in its light carriage and rust-proof construction of stainless steel and nickel. Its deficiencies far outweighed these factors, when we consider its mechanical breech and pneumatic recoil system, which markedly slowed down the rate of fire, and the absence of telescopic sights. Yet, the built-in range table and trajectory indicator did compensate for the lack of the latter in open-sight firing. Again, the old bugaboo of cast-iron fuses susceptible to rust cropped up once more, although the Vickers fuses were less liable to rust and moisture than the older Schneiders, due to a protective coating of cosmoline applied before storage. In competent hands, the Vickers 75 proved to be an adequate fieldpiece for close-range bush fighting, but in an artillery-versus-artillery duel, the advantage always went to the superior Schneider model 1927.

Heavy components in the artillery establishments of the belligerents were provided by fieldpieces of the classic pattern, at least in terms of caliber, as two of the pieces were originally designed as mountain howitzers. Let us first examine the Schneider-Creusot 105 mm. howitzer, model 1927, which resembled its "little brother 75" in construction, carriage, recoil mechanism, and fire

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1 Ibid.
2 Ibid.
control system. It weighed over two thousand pounds, however, in battery, and had a maximum range of forty-five hundred yards, making it the heaviest fieldpiece in the Chaco by virtue of weight and range. This enormous size provided an additional handicap in speed of movement, as the Schneider 105 could only be transported by a six-mule team, and could not be broken down for cross-country travel. As a means of indirect support fire at long range, it was unexcelled, and a few such pieces are still utilized for training purposes in the Paraguayan Army.

The Schneider's Bolivian counterparts were also products of the omnipresent Vickers-Armstrong combine, originally built as heavy mountain guns for overseas export, but purchased by the Bolivian General Staff in 1931 to fill the heavy artillery gap in their regimental tables of organization. Divided into models "B" and "C" by weight differential, the model 1931 V-A 105 mm. howitzers were identical in structure and fire control equipment to the Vickers 75, with effective ranges of one thousand twenty-one yards for the "B", and an increased range in the "C" of one thousand, three hundred fifty-four yards. As with other Vickers products, portability and

1 Ibid., pp. 219-23.
2 Ibid.
3 Ibid.
climate-proofing were the main advantages offered by the model 1931. Here, for an instant, Paraguayan superiority in field artillery material took a sudden reversal in the very area of strength that her general staff had relied upon -- superiority in mobility. Unquestionably, the Schneider 105 outdid the Vickers "B" and "C" in terms of range, but this deficiency was overshadowed by the lightness of the British-made howitzers and the fact they could be dismantled for cross-country movement; a technique which was impossible with the bulky Schneider.

Special Artillery Types

In discoursing upon the weapons used in the Chaco for infantry support purposes, little or no attention has been devoted to specialized types of artillery, such as anti-tank or anti-aircraft guns, as neither Bolivia nor Paraguay found it necessary to employ them in large quantities. Armored vehicles were handicapped in the brush, and exposed to heavy risk in attacks across open ground without infantry support. The Bolivian air force, on the other hand, remained quite active throughout the war, but could not indulge in long-range strategic bombing because of a lack of proper aircraft, while the Paraguayan aviation components were similarly restricted. Close-support missions and aerial reconnaissance became the sole preoccupations of both air arms, and these were limited in value
because of the terrain and the confused nature of the ground fighting. Consequently, elaborate anti-tank and anti-aircraft establishments would have been a financial and personnel drain on the two field armies. It is hardly accurate, however, to maintain that specialized weapons of these types did not exist, or that they did not come into play at various times during the conflict. Specialized artillery did have a definite role in the Chaco theatre, although an inherently subordinate one.

To offset the possibility of Paraguayan purchase of armored equipment, the Bolivian General Staff placed an order in 1930 with Skoda Ltd. of Czechoslovakia for twelve 37 mm. anti-tank cannon.¹ The purchase soon proved to be premature as Paraguayan tables of organization contained no blank spaces for tank units at that time or in the immediate future, and the guns were used to supplement regimental cannon companies in their assigned tactical missions. Although possessing no armor, the Paraguayan forces had an effective anti-tank piece in the previously mentioned Swiss-built Semak, which had its baptism of fire at Nanawa on July 4th, 1933. Three Semaks, concealed in the scrub on the fortified dry knoll that made up the keystone of the Nanawa defense complex, accurately crippled two Bolivian Renault medium tanks by destroying their front treads and

¹ González, op. cit., II, 32.
drivers, leaving them helpless in the face of heavier Paraguayan artillery fire which destroyed them both.¹ This constituted the only major battle during the course of the conflict in which anti-tank pieces were used in repelling an armored attack, and it proved to be the last time that Bolivia used her armor until the end of hostilities.

Defense against aerial attack was not a major object of concern to the Bolivian high command, as it knew full well the weakness of its opponent in this respect. As insurance against the possibility of Paraguay acquiring modern aircraft and trained pilots, an order was placed with Oerkilon Ltd. of Zurich, Switzerland in 1931 for the delivery of fifteen Oerkilon twin-mount 20 mm. automatic cannon, which were received by the Army Ordnance Sections in 1933. Broken into two seven-gun batteries apiece, these fine weapons served as static air-defense units throughout the conflict at the Expeditionary Force's major supply centers of Villa Montes and Santa Cruz without firing a single round at an enemy aircraft! At a later date, they were to become the favorite light anti-aircraft cannon of the Allied and Axis naval and land forces during World War II. The only effective aerial defenses possessed by Paraguayan ground units in the face of bombing and strafing was the enthusiastic, unpracticed hail of machine gun and rifle fire directed by the Guarani

¹ Vidaurre, op. cit., p. 178
² Ibid., p. 179
infantry, which undoubtedly did wonders for troop morale, but resulted in the destruction of very few Bolivian aircraft. In another aspect of aerial defense, Paraguay held full sway. On the two major rivers paralleling the Chaco Boreal, the Paraguayan river navy was in undisputed control of both water and sky, as no Bolivian surface craft had been built to challenge this supremacy. The main units, two six hundred thirty ton armored river gunboats named the Huimanta and the Paraguay, had been built abroad at the yards of Ansaldo Ltd. of Genoa in 1930, and were the most powerful craft on the rivers in terms of armament. Besides their main batteries of two six-inch guns apiece, each carried a heavy anti-aircraft battery made up of four four-inch dual-purpose guns, two 40 mm. automatic cannon, and six heavy machine guns. From 1932 onward, these ships convoyed Paraguayan supply steamers along the river routes, securing them from aerial attack or surprise assaults by Bolivian artillery on the shore, and provided anti-aircraft defense for ports up and down the Paraguay and Pilcomayo. In November of 1932, for example, the two gunboats broke up a Bolivian bombing raid on the docks of Puerto Casado by shooting down two Bolivian Junker 52's and damaging several others. In December of that same year, when Bolivian air attacks against the capital seemed imminent, one of these warships, on a rotating schedule, lay moored at the Naval Pier

\[^{1}\text{Gonzalez, op. cit., II, 9.}\]
at Asuncion to give what limited cover it could to the entire city.\(^1\) Naval considerations may lie outside the scope of the present study, but the activities of these craft in an air defense role are interesting and pertinent to the discussion. In 1964, thirty-four years after they slid down the ways at Genoa, both still ply the rivers as survey ships. In another connection, one wonders if their tremendous firepower potential was not wasted in the latter stages of the conflict, when accurate shore bombardment might have broken the Bolivian grip on Ballivan more quickly, and hastened the pursuit of the retreating Bolivian armies north towards the Parapiti.

It was not the intention of the author to go into great lengths concerning the technical details of the infantry support weapons used in the Chaco. To prevent confusion, and to provide details concerning ballistics and allied subjects, appendices containing this information plus a number of plates visually representing these weapons will be found in the appendix.\(^2\) Not all of the weapons referred to are illustrated, due to lack of adequate photographs, and the information in the appendices may not prove satisfactory to the student of military technology. These omissions were, in part, purposeful, so as to provide the reader with a generalized knowledge of the specific

\(^1\)Ibid.

\(^2\)Infra, pp. 160-66.
weaponry used by Bolivia and Paraguay in support of their infantry establishments, without overwhelming him with the finer points of detail. Having sketched in the actors and antecedents in the Chaco drama, we shall now turn our attention to the campaigns within the war itself, and determine how the artillery and mortars of both sides were used and misused.
IV. TACTICAL EMPLOYMENT
DURING THE COURSE OF THE CONFLICT

The Opening Round: Boqueron--Isla Poi
(September, 1931--July, 1932)

Basically, the Chaco War evolved out of patrol skirmishes, and retained this essential character until the Armistice of 1935. Out of these minor clashes often grew major battles for key fortified positions or water points, in which the field artillery and mortar establishments of the two armies played preponderant roles. A complete analysis of each action in which infantry support weapons aided in deciding the final issue would be unnecessarily elaborate, as such recorded instances run into the hundreds. Therefore, the focus of discussion has been confined to the four major campaigns of the conflict, and the tactical employment, successes, and failures of the weapons previously described and the men who handled them.

In considering the see-saw campaign for Fortin Boqueron, we must first consider that the actual fighting began well before the formal commencement of hostilities by both sides, and almost two years prior to the formal declarations of war in 1933. By examination of the troop concentration map, it is apparent that the Fortin was only one of several inconspicuous stockades making up the Para-
guayan defensive line in the southern half of the Chaco Boreal. Its strategic value lay in its position upon the main supply road from Puerto Casado on the Rio Paraguay through to Falcon and Nanawa, and its dominance of several local cañadas, thus controlling the local water supply. Due to these significant factors, and in response to so-called Paraguayan "provocations" in the form of patrol clashes, the commander of the Bolivian First Corps, Colonel David Toro, acted upon his own authority and ordered two battalions of the 4th Infantry regiment, 4th division, to seize and hold Boqueron. The fortin was promptly overrun on September 9, 1931, after a sharp battle with its garrison of some seventy-five defenders. Immediately, elements of the 2nd Paraguayan Infantry division under Lt. Colonel Rafael Franco marched from their depot at nearby Isla Poi, and commenced a counter-attack to retake the fortin and the Casado-Nanawa road. On September 13th, after completely encircling Boqueron, the assault battalions of the 2nd Infantry regiment attempted to storm the stockade without heavy preparatory fires from the divisional artillery, but were driven back with heavy casualties from intense small-arms fire. The Paraguayan infantry, eager to re-

1 David H. Zook, The Conduct of the Chaco War, p. 98.
2 Ibid., p99-100.
3 Gonzalez. op. cit., I, p. 100.
capture the stockade, had jumped off with only ten minutes of preparatory fires from the 2nd Artillery regiment, which had difficulty in adjusting its shelling due to lack of signal equipment, the erratic performance of the old French-style field phones used for spotting, and inadequacy of training in indirect fire support. The next day, having profited from their previous mistakes, two 75 mm. batteries of the 2nd moved to within two thousand yards of the stockade, and began a direct fire against the walls, supplemented by Stokes-Brandt mortars from the infantry. A chance hit destroyed the shallow well used by the garrison for water supply, and tormented by thirst, the Bolivian garrison (three companies of the 1st battalion, 4th Infantry) surrendered in the late afternoon. Boquerón was in Paraguayan hands once more, but the price had been extremely high.

In July of 1932, after the war had attained "hot" status, the Bolivian 4th Infantry division returned to besiege Boquerón, intending this time to make it the focal point of a Bolivian salient choking off the Paraguayan supply line in the Chaco Boreal (i.e. the Casado-Nanawa road) and using the fortín as the base for a major Bolivian offensive in the fall of 1932. The 4th Artillery regiment, taking advantage of superior fire control equipment and observation, laid

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1 Ibid., pp. 101-103.
2 Ibid.
down consistent harassing fire from July 8th onward, consisting of
daily concentrations of high explosive and shrapnel. It directly
supported the main assault of July 12th by breaching the adobe
walls of the stockade with 75 mm. fire over open sights, making
possible successful seizure of the position and one hundred Paraguay
1\footnote{Vidaurre, 
\textit{op. cit.}, pp. 228-30.} guayan prisoners. For one month, the new tenants of Boqueron
were unmolested, save by occasional sniper fire, and Bolivian
possession of the fortin seemed secure. However, on September 3rd,
the garrison, composed of two companies from the 8th Infantry
regiment totaling one hundred forty men, was greeted at dawn by
an overwhelming box-barrage of 75 mm. and 105 mm. shells from
the artillery of the Paraguayan 1st Division, which had moved in
overnight to re-occupy the stockade. 2 Mixing their fires well, the
1st Artillery regiment pounded the walls and outlying trenches for
days, with the only effective Bolivian response coming from a
lone Vickers 75 mm. howitzer within the walls which managed to
break up several probes against the outer trenches, but could not
reach the Paraguayan cannon for counter-battery fires. By the
afternoon of September 7th, Bolivian ammunition was exhausted,
and the Paraguayans stormed the breaches in the walls behind a

\footnote{\textit{Ibid.}}
creeping barrage. The much-battered stockade changed hands for the last time, and remained in Paraguayan possession for the duration of the war, effectively ending Bolivian attempts to dominate Paraguay's overland supply route and ensuring the safety of the 1st and 2nd Division depot areas and I Corps headquarters located at Isla Poi.

Some pertinent comments on the Boquerón campaign are in order at this point, especially in the matter of artillery employment. To that date, neither of the belligerents had used artillery or mortars to any extent in their skirmishing, and both were handicapped not so much by equipment deficiencies by lack of battle experience. In the second seizure of the fortín by Bolivian I Corps, we see an effective demonstration of superiority in fire direction and communications equipment, while Paraguayan measures in September of 1931 seem almost laughable by comparison. By the time of the second offensive in September of 1932, however, Paraguayan artillery and infantry alike had become aware of the value of skilled fire direction and coordination with infantry in the assault of fortified positions; a lesson which had been learned the hard way. The second-re-taking of the stockade is a case in point, and might seem to the observer to fall in line with the old proverb of "using a steamroller to crack a walnut".

1 Ibid.
Estigarribia was wise in utilizing such a heavy concentration of fire over a prolonged period, as he and the General Staff had no wish for a repetition of the near-disasterous first counter-attack, with its high casualties and deflated troop morale. This cautious substitution of firepower for men was materially assisted by the Bolivian garrison and its parent division through the ineffectiveness or absence of counter-battery fires. Had one battery been included in the garrison instead of a single howitzer, or had Toro chosen to throw the entire weight of I Corps artillery into the fray, Boquerón might have held out for a longer period of time, or could conceivably have been relieved.

The author has previously mentioned that the first formal shots fired by artillery on either side took place at the Paraguayan siege of Fortín Mariscal Santa Cruz in July, 1932. As the Boquerón campaign precedes this date, especially the action of September 9th-14th, the chronological honors should be vested herein for technical purposes. However, it must be remembered that the Boquerón campaign, for all practical purposes, originated as a minor skirmish over a single position, and escalated to a full-scale prolonged battle only after the war assumed a formal, though undeclared character after January of 1932. The significance here lies not with time, but in the content and effects of the battles fought.
Throughout the humid summer of 1932, the fighting in the Chaco Boreal sputtered and gradually degenerated into a series of patrol actions as both sides mustered their resources for the coming winter months and the re-commencement of the Bolivian offensive southward towards Villa Hayes, Concepción, and the junction of the rivers. In hopes of forstalling this thrust against their thinly spread-ground forces, the Paraguayan General Staff, under Estigarribia's direction, prepared plans for a late-winter holding attack against the Southwestern portion of the Bolivian fortín line in the vicinity of Arce and Alihuata, to be carried out after the end of the autumn rains. This attack was designed to throw the massing forces of the Bolivian I Corps off balance and to buy the Paraguayan Army time for re-organization, rather than as a concerted counter-offensive to recover lost ground. During the months of September and October, mounting Bolivian pressure against the sector held by the Paraguayan 1st Division from Falcon northward became heavier, taking the form of battalion-strength attacks against forward outposts supported by artillery. ¹ After nearly three months of waiting, until the point was reached where forbearance was impossible, the jump-off orders

were dispatched to 1st Division HQ on the 6th of December, 1932, and on the morning of December 8th, the division attacked eastward towards Arce. Neither of the previously mentioned fortines were captured by the Paraguayans, but the main Bolivian supply route was overran in several places, thus choking off any movement from Alihuata north and east toward Platanillos. Bolivian I Corps, its internal supply lines menaced and its offensive timetable derailed, responded by heavily reinforcing the two stockades in question and moving up both the 4th and 7th Divisions to push back the Paraguayans. By December 16th, the lines were again stabilized, but the Bolivians had lost the initiative and the opportunity for an easy breakthrough.

At many points along the front, elements of the Paraguayan 1st Division had not been forced back by the Bolivian straightening offensive, and had developed strongly-held salients dominating a portion of their opponent's forward lines. One of these satellite positions was directly in front of the Bolivian-held Fortín Saavedra, a key outpost along the Arce-Sopresa road, and had resulted from a Paraguayan assault during the first week of the holding attack. On the morning of December 8th, the 2nd Company of the 1st Battalion, 6th Infantry Regiment attempted to seize the outer trenches of Saavedra,

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1 Ibid.

2 Ibid.
preceded by indirect preparatory fires from 1st Divisional artillery from 5:30 a.m. onward, and a creeping barrage which was to be lifted when the Bolivian trenches were reached by the infantry. The purpose of this attack was to relieve Bolivian pressure on the 3rd Infantry regiment on their right flank, permitting its orderly withdrawal, and the establishment of a forward outpost to permit observation of the Bolivian positions. After jumping-off, however, the rolling barrage of artillery was suddenly lifted when the 2nd Company was two hundred yards from the Bolivian trenches, exposing it immediately to air-burst fire from a Bolivian battery in Saavedra and enfilading automatic weapons sited in a quebracho grove behind the trenches. This brought the attack to a halt, and forced the 2nd company to dig in amid a clump of brush where their advance had stalled.

Under constant attack by Bolivian artillery and two Junkers 52 bombers which saturated the open ground around their position with shrapnel and high explosive, the beleagured infantrymen of the 2nd Company established a perimeter, pushed out patrols to contact the 3rd Regiment with no success, and directed support fires upon

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1 Ibid.
2 Ibid.
3 Ibid.
the stockade and quebracho grove with signal flags and a buried telephone line to silence Bolivian counter-fires and thus continue the attack. ¹ The 1st Artillery regiment, suffering from ammunition shortages and relying upon the tenuous phone and flag links with the 2nd Company, temporarily neutralized the Bolivian automatics in the grove, but could not completely destroy them, whereas the two batteries of the Bolivian 4th Artillery at Saavedra had unlimited ammunition and superior communications at their disposal. ² By 7:50 of the evening of the 8th, the other two companies of the 1st Battalion had joined the 2nd Company in the perimeter, but could make no headway against the accurate Bolivian artillery and small-arms fire. For four days, they clung to their scooped-out trenches and weapons pits, calling down defensive concentrations of high explosive and air-burst when the 1st Artillery could spare scarce ammunition. ³ Under the cover of darkness on the evening of the 13th, the battalion returned to its parent regiment, and was replaced the following morning by the 2nd Infantry regiment, the victors of the first storming of Boquerón. ⁴ Throughout 1932 and well into 1933 the salient was continually garrisoned by Paraguayan troops, and

¹ Ibid.
² Ibid.
³ Ibid.
⁴ Ibid.
made a valuable observation post, although a hazardous one because of its vulnerability to indirect artillery fires controlled from the Bolivian trenches.

In lessening pressure against the 3rd Infantry as one of its primary objectives, the assault of the 1st Battalion, 6th Infantry on December 8th could be considered a tactical success. From an overall standpoint, however, Saavedra could have been readily taken and a breach opened in the Bolivian southeastern front if adequate artillery support had been available. Hesitancy on the part of the divisional staff probably led to the premature lifting of the rolling barrage, due to the fear of concentrations landing among friendly troops as well as in enemy positions. In addition to chronic ammunition shortages, no communications signals had been developed jointly by the Paraguayan infantry and artillery commanders for the dropping or raising of artillery concentrations, and forward observers, in this case, were forced to rely on intuition and a healthy dose of luck in calling down supporting fires. It can be said in the 1st Artillery's favor that throughout the occupation of the salient by the 1st Battalion, its defensive support excelled in keeping Bolivian automatic nests neutralized, thus giving the defenders much-needed respite from harassment and permitting an orderly withdrawal on the night of the 13th. As the conflict wore on, these defects in artillery-infantry co-ordination were gradually resolved by the Paraguayan
ground forces, to the extent that at Nanawa and later at El Carmen, real teamwork on the part of these arms became an actuality.

On the Bolivian side of the picture, we see asserted once again a definite superiority in communications, indirect fire support, and logistical resources. At the same time, a disquieting element was present in the failure of the 4th Artillery to eradicate or disperse the Paraguayan salient through weight of fire which was a tactic clearly suited to the pre-war "Kundt doctrine" by the exposed nature of the outpost itself. Observational accuracy was not at fault here, but simply the impatience of certain Bolivian regimental and battery commanders for quick results, which led to extremely rapid firing and few direct hits upon a closely-concentrated body of troops hemmed into a small perimeter. Little attention was paid to counter-battery fire upon the 1st Artillery or upon the 1st Division rear-areas to disrupt communications or prevent the reinforcing of the salient garrison. This obsession with spectacular fire concentrations, suitable for neutralization rather than destructive effects, would be the undoing of several Bolivian offensive efforts in the Spring of 1933, one of which we shall consider shortly. The action at Saavedra, by modern terms, would be considered a minor skirmish, but it proved indisputably to both belligerents that liason between arms was essential to win an engagement, and that sheer weight of fire alone was not enough to decide victory.
After the southwestern portion of the front had reverted to a state of quiescence, marked only by patrol clashes and raids, the attention of the two armies turned northward, where the fortín lines angled slightly southward for a distance of twelve or so miles, and then ran in an irregular line north and east across the savanna to the Río Paraguay. At the point where this bend in the lines occurred, almost like the joint in a man's elbow, stood two Paraguayan stockades named Corrales and Toledo. The former is unimportant to the present discussion, but the latter was the objective of a primary offensive effort by an entire Bolivian division. Fortín Toledo alone had no great strategic significance, but its successful capture by the Bolivian I Corps seemed relatively simple in view of the stockade's isolated position at the tip of a pocket virtually surrounded by Bolivian units, and its dependence upon a single-track trail running through Corrales to the main road as an avenue of supply. By cutting this trail, the position would easily fall into Bolivian hands after a brief siege, eliminating one link in the line of Paraguayan fortifications and giving the newly-arrived 3rd Infantry Division, transferred to the front in January of 1933 from Ingavi, an opportunity to blood itself in combat. Such were the optimistic plans laid by the I Corps staff.


2 Ibid.
Their fulfillment, however, was to be another matter entirely. A portion of the newly-raised Paraguayan 6th Infantry division moved into the elbow to garrison Toledo and Corrales at the same time the Bolivian 3rd Division had begun to concentrate at Fortín Bolívar. The divisional components making up the Toledo garrison consisted of the 12th Infantry regiment and the 1st Battalion of the 3rd Artillery Regiment; well-trained and with relatively modern equipment at their disposal.¹ This move was not due to any advance intelligence received by Estigarribía and Paraguayan I Corps staff, but simply a routine move to beef up a weak sector in their defensive lines.² Fortunately, it committed fresh troops and artillery where they were least expected, with damaging results to the unseasoned recruits of the 3rd in casualties and morale.

In the interim, Toro had been replaced as I Corps commander, and ordered back to Santa Cruz for re-assignment. His replacement was a Chilean field officer, Colonel Enrique Vergera Vicuna, who was on leave from the Chilean Army for the duration of the hostilities, and whose services were tendered to the Bolivian field forces for the twin purposes of combat experience and observation.³ Unlike Toro,

¹ Ibid.
² Ibid.
³ Ibid., p. 181.
whose bombast and overbearing attitude made him hated by I Corps officers and men alike, Vicuna was a quiet, thoughtful individual whose mildness of manner belied his talents as a soldier. With admirable efficiency, he whipped the 3rd division into fighting trim, bringing it out of the doldrums of the garrison life it had led for the past three years\(^1\) and preparing the entire corps for a proposed spring offensive to bring Paraguay to its knees. The first step on the I Corps itinerary would be Toledo, and from there "on to Asunción", but this grand march was fated never to take place.

By February 11th, the 3rd Division had moved from its original assembly area and had partially encircled Toledo on three sides, delaying the final assault until divisional artillery, composed of the 3rd regiment and organic regimental units, could be moved into firing position.\(^2\) Initial Paraguayan resistance had been light to moderate, and Vicuna, personally overseeing the operations, counted on an even greater slackening of the same once preparatory fires were laid down. The Paraguayan 12th regiment, however, had not been idle in the meantime, and had covered the terrain encircling the stockade with elaborate covered trenches and bunkers composed of earth and quebracho logs, and had sighted in their supporting artil-

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\(^1\)Ibid.

\(^2\)Ibid., pp. 182-83.
lery and mortars to cover gaps in the approaches and deliver counter-
fires. On the following morning, several Bolivian line companies
who launched a probing attack against the outer trenches received a
surprise in the form of an earthen emplacement containing two
antiquated Krupp 75's sited some four hundred yards from the Para-
guayan defenses which greeted them with a hail of high explosive and
shrapnel and, combined with small-arms fire from the entrenched
Paraguayan infantry, scattered the attackers within a few minutes.
This improvised battery was drawn from the 12th regiment's cannon
company, and was commanded by a young career officer, Lieutenant
Conrado Cecilio Baez. For the next sixteen days of the siege, the
lieutenant and his sweating gun crews fired continuously across open
sights, assisting the infantry in breaking up frontal assaults and
delivering harassing rounds against the Bolivian forward positions,
while being constantly exposed to artillery, mortar, and small-arms
fire which killed or wounded half of the original gunners. Throughout the siege, Baez's battery remained a thorn in the side of the 3rd
Division; one which they were unable to pluck out, try as they might.

During the week of February 12-16th, Bolivian artillery and

1 Ibid.
2 Ibid., p. 175
3 Ibid.
mortar units of the 3rd Division concentrated on indirect fires against the stockade's outworks, the previously-mentioned Baez battery, and the trail leading to Corrales (which had not yet been seized by the infantry). The garrison's artillery and mortars remained silent, and refused to challenge the Bolivian guns in counter-battery duels for reasons of economy in ammunition usage. \(^1\) Vicuna rapidly became distressed at the lack of progress made by the division in taking such an apparently weak fortification, and decided that one week of preparatory fires was a necessity to level the Paraguayan defenses. Beginning on the morning of February 22nd, the 3rd Artillery commenced a systematic, round-the-clock bombardment of Toledo and its environs. For an entire week, daily concentrations were fired against the Paraguayan trenches and bunkers, the stockade proper, a near-by canadita, and the Corrales trail. These consisted of box-barrages, long-range grazing fire with shrapnel, and night harassing concentrations using parachute flares for illumination of targets. \(^2\) In addition, the mortar platoons of the divisional infantry battalions were set to work at blasting holes in the Paraguayan wire entanglements directly in front of the fortin; a task for which the AAC 105 mm. was admirably suited. Bolivian aircraft joined in the pounding on February 25th, when ten Junkers 52 bombers dropped twenty-seven five hundred pound bombs

\(^1\) Ibid., pp. 183-84.

\(^2\) Ibid.
on the stockade and trenches in a horizontal attack at dawn in co-
ordination with an artillery barrage. 1 Vicuna, in a post-war inter-
view with Juan Ayala, stated that during the week prior to the major
attack of February 26th, 3rd Division artillery and mortars were
deriving two rounds per minute against the Toledo defenses. This
would be a feat of arms difficult even for a modern, mechanized
artillery unit, and, if true, probably placed an inordinate strain on
divisional and corps logistical systems, already pushed to the limit
by shortages of draft animals and vehicle breakdowns. 2 By his own
estimate, Vicuna felt that such consistent battering would eventually
wear down the Paraguayan garrison, thus making the 3rd's task on
the 26th appreciably less risky. Not all of the Bolivian officers
within the division were quite as optimistic. Colonel Jorge Quintela,
commander of the 3rd, commented to General Andres Osorio of the
General Staff, who was on an inspection tour of the front, that his
divisional artillery "would fire where the skirmish was most thick". 3
Such eagerness on the part of Bolivian battery commanders not only
posed hazards to their own troops, but tended to neglect obvious
priority targets in favor of sitting ducks. Other objections to the
rate and quality of the fire support were raised to no avail, and the
attack of the 26th was to go forward as planned.

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1 Ibid.
2 Ibid.
3 Ibid.
At 7:30 a.m. on the morning designated, the assault battalions left their own trenches and began to cross the shell-pitted strip of savanna separating the fortin and its besiegers. A rolling barrage from the divisional artillery, plus a glide-bombing attack by five Focke-Wulf 310's preceded the jump-off. Mixed in with the leading infantry companies were fifteen of the toy-like Vickers 65's pushed by their gun crews, and drawn from the various regimental cannon companies. As the smoke and dust of the preliminary bombardment cleared, these pieces opened fire at maximum range over open sights to silence Paraguayan automatic weapons in the outer trenches, which had begun to heckle the Bolivian advance. With their assistance, these positions were quickly destroyed, and the lead companies began to pour through the gaps in the wire. At 8:00 a.m. the Paraguayan artillery, which had rarely replied to the Bolivian shelling in the sixteen days of siege, opened a rapid counter-barrage which began to fall in the Bolivian trenches and artillery emplacements, cutting off communications from battery to battery, killing observers, and temporarily neutralizing the 3rd's artillery support. Without continuous covering fires, the Bolivian infantry, after crossing the first trench line, ran head on into accurate cross-fire from Paraguayan machine guns and automatic rifles situated in

1 Ibid.
2 Ibid.
bunkers constructed at ground level which could not be reached by indirect artillery fire, and supplemented by a barrage of shells from Paraguayan Stokes-Brandts plus Baez's two old Krupps. The infantry howitzers accompanying the assault units might have silenced these emplacements and permitted the advance to continue, but they were stalled on the opposite side of the outer trench line by the width of the trenches, and could not be muscled across in time to save the infantry's bacon. After an hour of futile attempts to penetrate the second line of Paraguayan defenses, the decimated assault battalions withdrew to their original jump-off positions under the protection of an artillery and mortar curtain, leaving behind nine officers and four hundred and fifty men dead or missing. Although the battle would drag on until the 12th of March, the 3rd Division tried no more frontal attacks against Toledo. The cost had become too great for an entire army corps to pick off a sitting duck, especially when the duck started shooting back and hitting.

Where had I Corps, and in particular, the 3rd Division gone wrong? Nearly two months of precious time, men, and material had

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1 Ibid.
2 Ibid.
3 Ibid.
4 Ibid., p. 185
been expended in a fruitless siege that had concluded in another stalemate. Part of the answer lies in the tenacity of the Paraguayan defense, and the well-trained state of the Toledo garrison, although to over-emphasize these points would be prejudicial to the equivalent fortitude and bravery of the men and officers of the 3rd, who might have been successful if the weight of supporting fires had been properly adjusted. The problem lay in Vicuna's reluctance to heed the advice of Quintela concerning the accuracy of the preliminary bombardments, and his timidity in asserting his own authority to halt indiscriminate firing at targets of opportunity. Vicuna surpassed Toro as an effective leadership figure, but in his desire not to offend national sensitivities within I Corps ranks, he made a fatal tactical blunder. If, during the week-long period of shelling and bombing, the network of Paraguayan bunkers and covered trenches had been adequately concentrated upon, the possibility exists that some of the emplacements would have been neutralized by direct hits or near-misses, leaving gaps in the defense system which might have been exploited by the Bolivian infantry. In other areas, divisional leadership was to blame. For example, the 3rd Artillery grew progressively careless during the siege in the matter of concealing battery sites and observation posts, making them easy marks for

\[^1\text{Ibid., p. 186.}\]
the Paraguayan counter-barrage. The infantry howitzers could have
crossed the outer trench to perform their assigned mission had the
divisional engineering units devised a method for bridging the trench;
namely, with planks or sandbags. However, we cannot burden either
corps or division with the stigma of failure for an unsuccessful
offensive operation. The bulk of the fault is vested in the overall
artillery and mortar doctrine used by the Bolivian Army, and in its
refutation of accuracy in favor of sheer weight. Already made
obsolete by the conditions of warfare in the Chaco, the Kundt system
survived only by virtue of indoctrination and the presence of its
originator. Their joint demise was not long in coming, however.
Toledo had been the first nail driven in the coffin of Kundt's mili-
tary predominance, and Nanawa would provide the impetus to slam
the lid shut forever.

Bolivia's Last Gasp: Nanawa
(May-July, 1933)

Enraged by the 3rd Division's failure to capture Toledo,
Kundt immediately departed for I Corps headquarters at Bolivar to
assume personal command. His immediate reaction was to order
the dismissal of Vicuna from his post as Corps Commander, but
cooler heads in the War Ministry at La Paz forstalled such an
action by re-calling the unfortunate Chilean on the 26th of March and

1 Ibid.
reassigning him to an administrative position at Santa Cruz on the grounds of ill health. 1 Obviously, this action was taken to prevent a breach of the intimate relationships, military and otherwise, existing with the Chilean government, which Bolivia could not afford to lose. Once on the scene, Kundt proceeded to ruthlessly reorganize both the corps and its component divisions for a master stroke of his own conception, to be carried out in the late spring of 1933. By opening a hole in the center of the Paraguayan lines through sheer weight of metal and manpower, he hoped for a successful conclusion of the conflict in Bolivia's favor and vindication of his own position as Chief of Staff, which had grown increasingly shaky since the disaster at Toledo. With such a triumph to his credit, the numerous critics of his military policy in the officer corps would be permanently silenced, or so he hoped, allowing a continued prosecution of the war by his designs to the exclusion of all others. The focal point of this new offensive was to be the Paraguayan stronghold of Nanawa, whose seizure would be the key to the two rivers and Asunción. Kundt, for all of his professional training and past experience, could not foresee the impending collapse of this grandiose scheme, nor did he take heed of the costly lessons learned by the 3rd Division at Toledo. Stubbornly clinging to the

outmoded tactics of World War I which called for attacks en masse upon fortified positions, Kundt could not perceive their obvious unsuitability in bush warfare, especially in situations where the enemy made advantageous use of the terrain. Nanawa became to him a personal grudge fight, and an objective to be attained at any price, just as Verdun did to Von Falkhayen in 1916. ¹

Situated in the center of the southwestern portion of the Paraguayan fortin line, Nanawa formed the nucleus of a defensive pocket covering the land approaches to Concepcion, Villa Hayes, and the capital, plus the vital supply road which led south to Fortin Delgado. Unlike other fortines, it possessed the initial advantage of a slight but commanding elevation (a little less than one hundred feet above sea level), as the stockade had been constructed on a scrub-covered mound overlooking a dry lake bed, with the road running behind the mound, ² giving the garrison a clear field of fire in all directions. Since July, 1932, the 4th Infantry regiment of the 2nd Paraguayan Division had occupied Nanawa, together with a composite artillery group made up of the regimental cannon company and the 2nd battalion of the 2nd Artillery. ³ By dint of hard labor

¹"Verdun Over Again In El Gran Chaco," Literary Digest, CXV (February 18, 1933), 12-13.
²Zook, op. cit., p. 195.
³Ibid., pp. 195-98
with hand tools, these units converted "the island", as Nanawa was nicknamed, into a formidable hedgehog. Concentric rings of trenches were dug around the hillock, as at Toledo, and the inner two rings converted into weapons pits and bunkers with ground-level firing slits, roofed over with shell-resistant quebracho wood and several feet of earth or sandbags. Concertina wire was stretched in front of the outer trenches where possible, and automatic weapons were situated to cover such gaps as existed in the wire. The regimental artillery and mortars were emplaced either behind the hillock, or by sections in the scrub which carpeted the sides and crest. A dirt airstrip was carved out of the brush on the other side of the Sopresa road to allow aerial supply and evacuation of wounded, and telephone lines were buried to prevent their being severed by shellfire, thus permitting constant communication between observers in the trenches and the battery switchboards. By New Year's day, 1933, the garrison was physically and mentally prepared for the inevitable assault by the Bolivian I Corps. Their mission? Hold Nanawa at all costs, and hold it they did through three and one-half months of constant bombardment and frontal attack that rivaled Verdun or even Ypres in its intensity and ferocity.

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1 Ibid.
2 Ibid.
The Bolivian division slated by Kundt for the Nanawa operation was the 7th Infantry, which would be reinforced by two regiments drawn from the 4th Division and the 1st battalion of the 4th Artillery regiment. This latter unit, together with the 7th Artillery, provided a total of forty-eight fieldpieces for fire support, plus regimental cannon and mortars. With such overwhelming firepower superiority available to the assault units, a Bolivian victory seemed inevitable. Yet, in the preliminary probing attacks delivered in January of 1933, co-ordination and fire discipline problems almost negated the value of this concentration; the largest recorded composite of artillery formed for a single operation throughout the conflict. These difficulties arose as the result of disagreements between Kundt and Lieutenant Colonel Tomás Olmos, Chief of Staff of the 7th Division, who was responsible for the operational planning of the attack. The issue at stake centered around varying types of assault formation and how divisional and corps artillery and mortars could best support them. Kundt, naturally, opted for a continuous, heavy concentration upon a single point in the Nanawa defenses to be followed by a mass infantry attack after the lifting of fire. Olmos, who considered the Prussian system outmoded, proposed accurate battery fires against

1Villa, op. cit., p. 79
2Ibid.
3Ibid.
the fortifications in general and against specific targets which would impede the infantry advance. He also suggested the use of staggered assault waves covered by a rolling barrage to prevent bunching and reduce casualties. In spite of the feasibility of Olmos' suggestions, rank took precedence over reason; a decision which was eventually to cost I Corps the battle and Kundt his reputation.

While Kundt had refused to accede to all of Olmos' plans for the operation, assuming overall tactical command himself, he left the preliminaries to the harassed Chief of Staff as tactical "crumbs" unworthy of his own consideration but not that of a subordinate. Given an opportunity to vindicate his own suggestions, Olmos demonstrated during the first two months of the siege that co-operative effort by infantry and artillery could reduce fortified positions without heavy cost. After the 7th Division and attached elements had moved into position on January 18th and the Delgado road to the south was cut by roadblocks, the 7th, under Olmos' direction, set about a gradual reduction of the Paraguayan outer works, particularly the outer perimeter of trenches, which were manned by two companies of the 2nd Battalion, 4th Infantry spread around the fortín perimeter as an outpost line. Beginning on the morning of January 22nd, C

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1 Ibid.

2 Vidaurre, op. cit., pp. 242-43.

3 Ibid.
and T Batteries of the 3rd Battalion, 7th Artillery raked the frontal approaches of the "island" with shrapnel to neutralize Paraguayan automatic weapons and prevent reinforcements from reaching the outer trench, and continued this harassment for the next twenty-four hours, firing indirectly at a distance of thirty-five hundred yards. At 5:30 A.M. on the morning of the 23rd, the 1st Battalion, 7th Infantry advanced slowly toward the outer trench under the cover of a rolling barrage laid down by the 3rd Battalion, which ceased as the leading infantry platoons reached the trench.

The frontal portions of the trench were successfully seized by the Bolivians without a shot being fired in reply, as the Paraguayan infantry had vacated it several hours beforehand, leaving behind a few dead and some small arms. Few military textbooks could have furnished such an example of co-ordinated effort on the part of infantry and artillery which was ultimately successful in reducing a fortified position with little cost to the attacking elements. While the outer trench was being softened up and seized, divisional artillery concentrated on the destruction of the inner trench rings, the stockade proper, and the road, airstrip, and regimental supply dumps of the 4th Infantry on the reverse side of the hillock in

1 Ibid.
2 Villa, op. cit., pp. 80-81
preparation for a probing attack on January 24th. The assault would be delivered by the 41st Infantry of the 7th Division from the recently-captured outer trenches, supported directly by one battery of 75's from the 1st Battalion, 7th Artillery, commanded by Lieutenant Augustin López.

Unfortunately, Kundt superseded Olmos at this stage of the operation, and ordered the premature lifting of the preparatory fires on January 22nd, giving the Nanawa garrison a much-needed breathing spell to repair their battered emplacements and receive additional ammunition and rations from a pack train which arrived from Falcon on the 23rd. When the 41st Regiment began its attack on the morning of the 24th, it easily crossed the open ground between the second and third trench lines, but its advance was soon stalled by interlocking automatic fire from Paraguayan bunkers and covered trenches untouched by preparatory fires, and Stokes-Brandt mortars fired from pits along the crest of the hillock. Initially, casualties were relatively light as the Bolivian infantry took cover in old shell holes, but mounted as the Paraguayan mortars ranged in on the stalled line of troops. Battery López could not

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1 Ibid.  
2 Ibid.  
3 Ibid.  
4 Ibid.
effectively knock out either the bunkers or mortar emplacements for fear of hitting its own men, and a direct hit on a bunker firing slit was necessary to destroy it, as the Vickers 75 mm. shells with their instantaneous fuses would not penetrate the iron-hard quebracho logs. Clouds of powder smoke and dust screened the "island" from the view of 7th Artillery forward observers, making indirect fire against the fortifications impossible. Finally, at 11:35, the 41st withdrew slowly towards their jump-off position, covered by a box-barrage and chemical smoke. As a probe, the attack was successful, since it revealed to the 7th Division the approximate strength of the Paraguayan inner defenses and the fact that more preparatory fires were needed to destroy the system of interlocking bunkers that had impeded the advance. Olmos, recognizing the necessity of thorough artillery preparation, pressed for systematic reduction of the defences through timed fires on these grounds, but could make no impression upon the inflexible Kundt. In the end, Olmos found himself relegated to a subordinate position in the divisional hierarchy once again, and his brilliant preparatory labors were soon wasted by the ambition and bull-headedness of his superior officer.

1 Ibid.
2 Ibid.
3 Ibid.
Throughout February, March, and April of 1933, the 7th Division pounded away at Nanawa with infantry probes, consistent artillery and mortar barrages, and supplemental aerial attacks delivered by Bolivian bombers and fighters which systematically leveled the outer trench, blew large gaps in the concertina wire, and denuded the hillock of its scrub covering, but left the Paraguayan bunkers, built safely at ground level, intact and in firing order. As time wore on, Kundt's impatience grew, and the morale of the 7th plummeted to dead zero as a result of inactivity and boredom. The easy victory that would have touched off a triumphal march to Asuncion had degenerated into another wearisome siege, apparently without any end in sight.

Under other circumstances, the tremendous weight of preparatory fires would have rendered any fortifications impotent to resist a determined frontal assault, but weight alone was no longer a guarantee of success. Breaches in fire discipline, which had been evident at Arce and disastrous at Toledo, now became widespread within the ranks of the 7th Division and its support units as spring wore into summer. With the divisional artillery broken up into small firing packets to support line companies, and communications frequently breaking down between battery commanders and

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1 Ibid.
7th Artillery HQ, the rigid discipline proposed and enforced by Kundt was shattered time and again by eager piece or battery leaders who could not resist taking a crack at an especially tempting target.

Several examples illustrate this difficulty. For instance, in May of 1933, a Bolivian battery commander, observing by field-glasses that three Paraguayan Fiat observation planes had landed on the Nanawa airstrip, immediately opened fire upon the field with high explosive. None of the three aircraft were damaged by the shelling, and there was no aerial retaliation, since the aircraft were carrying no bombloads, but one of the three immediately took off again, spotted the smoke raised by the recoil of the Bolivian fieldpieces, and using a streamer drop and dummy strafing runs, directed counter-battery fire from Paraguayan artillery onto the interloping battery, forcing it to limber up and displace to the rear. Paraguayan gunners were no less prone to fire upon handy or obvious targets, but did so less frequently (at least at Nanawa) because of ammunition shortages. Kundt's ire was increased by these disciplinary breaches, not so much for the indiscriminate firing but because the responsibility for the decision to fire had not been transmitted by higher authority. Consequently, several drum-head

\footnote{Vidaurre, \textit{op. cit.}, p. 235.}
court-martials of intemperate Bolivian artillery officers took place during this period, stemming from these occurrences. ¹ Of more immediate importance, unimportant targets were worked over until leveled, while priority objectives, such as the Paraguayan bunkers, were given only cursory attention. The old mud-and-wattle settlement of Nanawa, for example, was gradually eradicated by the fires of an entire battalion during April and May of 1933, even though the village, located as it was at the edge of the dry lake bed, was unoccupied by Paraguayan troops.² Valuable time and ammunition were used in what amounted to target practice, leaving the Paraguayan interior fortifications relatively untouched. Here was not a question of wanton destruction, but one of wasted effort on the part of the artillery and mortars. Joint bombardment by Bolivian aircraft in conjunction with divisional artillery proved to be spectacular but something less than effective, as the bombs frequently fell wide of the hillock due to observational difficulties caused by dust and smoke raised by the shelling and did no damage to the well-entrenched Paraguayan infantry. Nanawa had become a stumbling block to Kundt and the entire I Corps; a block they were determined to surmount without thought of the costs.

¹Ibid.
²Ibid., p. 251.
From the Bolivian standpoint, time was rapidly running out in the Nanawa sector. Corps and divisional logistics had been stretched thin to maintain the 7th in its prolonged siege operations, especially in the matter of ammunition for its ever-hungry guns. With summer imminent, water for men and animals would soon be in short supply, and the hillock dominated the only canada in the vicinity. Therefore, the old Junker found himself under increasing pressure from the War Ministry and Dr. Salamanca to produce some tangible results in the campaign or be forcibly removed from his command. In desperation, Kundt began to prepare, in late May of 1933, for a large-scale attack designed to overwhelm the "island" by sheer force of numbers. ¹ By June 12th, a daily program of continuous harassing, time-on-target, and night fires was delivered against the hillock and its attendant trenches, in co-ordination with weekly bombing attacks by Bolivian Junkers and Focke-Wulfs. ² Through the month of June, these fires increased in their intensity, and Paraguayan intelligence reports noted the movement of new units into the Bolivian lines in front on Nanawa, including a tank company and engineer detachments. ³ Prompted by these estimates and the increased weight of the daily barrages, Rafael Franco, now

¹ Ibid., p. 237.
² Ibid.
³ Ibid., pp. 238-39.
a full colonel and commander of the Paraguayan I Corps, ordered
the construction of additional roofed weapons pits and the strength-
ening of existing positions with an extra nine feet of earth and logs.
Most of this work was done at night to avoid exposure to Bolivian
fire, and replacements as well as extra supplies of ammunition
arrived periodically during the hours of darkness.  

By July 2nd, the 7th Division was fully poised for the final
assault, but their Paraguayan counterparts were likewise well
prepared. At first light on July 4th, the fires of the 7th Artillery
slackened momentarily, then switched from the trenches and wire
obstacles to the stockade. This was supplemented at 8:10 A.M.
by a bombing and strafing attack carried out by twelve Bolivian
Junkers and Focke-Wulfs.  In the meantime, the regiments
selected for the assault (the 41st and 43rd Infantry of the 7th
Division, and the 8th Infantry of the 4th), moved up to the captured
outer trench. They were supported by five Renault tanks, three
mediums and two lights, twelve to fifteen Vickers infantry howitzers,
and a platoon of engineers equipped with flamethrowers.  To
further ease their task, the divisional engineer company had dug

1 Ibid.
2 Ibid.
3 Ibid.
a tunnel underneath the second Paraguayan trench and mined it with five hundred pounds of guncotton, to be exploded electrically at the moment of jump-off.  

1 At 11:00 A.M., a divisional engineer officer pushed the plunger, and a fountain of earth, sand and dust geysered up from the Paraguayan second trench. A rolling barrage of artillery and mortar fire opened from the Bolivian support units, and the assault infantry, led by the five tanks, slowly crossed the torn-up ground. At fifteen hundred yards, the barrage lifted, and the little Vickers 65's commenced direct fire against the Paraguayan bunkers and gun pits, silencing a few of them, but not all.  

2 As the leading infantry companies approached to within point-blank range of the second trench, the emplaced Paraguayan machine guns and automatic rifles cut loose with a devastating cross-fire, mowing down the front ranks like ripe corn. From the rear of the hillock, the 2nd Batallion's 75's and regimental Stokes-Brandts delivered a box-barrage of high explosive and air-bursts which raked the front slopes. The crater-pocked landscape bogged down the infantry howitzers, and accurate small arms fire killed or wounded most of the crews within a few minutes.  

3 Easily breasting the

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1 Ibid.
2 Ibid.
3 Ibid.
trench, the two Bolivian Renault mediums in the lead sprayed the Paraguayan pillboxes with machine-gun and cannon fire, which had little effect upon them, as the Hotchkiss 37 mm. shells simply bounced off the bunker roofs. Pressing forward, these two armored vehicles churned up the slight slope toward the inner trenches and stockade, and promptly had their front driver wheels and bogies blown away by several rounds from three Paraguayan Semak 28/20's concealed in a shrapnel-torn clump of brush about half-way up the hill. Both crews abandoned their tanks posthaste and fled downslope, as 75 mm. shells turned each tank into a flaming torch. The 41st Regiment, which had led the assault, had stalled at the second trench line around the mine crater, and the other two regiments, following in echelon, piled up behind and around them, leaving Paraguayan artillery, mortars, and automatic weapons with a massive, milling target. Bolivian artillery and mortar observers, fearful of hitting their own men, refused to call down covering fires, and could not properly direct the laying of a smoke screen because of the huge billows of dust and smoke which obscured the objective. At 1:35, with the three assault regiments almost decimated, Kundt ordered the withdrawal of the battered infantry to the captured trench. Some units, however, needed no orders, but started pulling back at 1:10 P.M. carrying their wounded and personal weapons and little else. Nearly

1 Ibid.
2 Ibid.
sixty-four hundred officers and men lay dead on the wire, in front of the bunkers, and around the crater, along with seven Vickers howitzers and the burned-out corpses of two Renault tanks. In less than two-and-one half hours, the "island" bastion had robbed a Bolivian division of over half of its strength, to no avail for the attacker.

For Hans Kundt, Nanawa was the last stop in a productive but checkered military career. Angered by the heavy casualty rates incurred by I Corps, the War Ministry, under Dr. Salamanca's orders, relieved the General of his post as Chief of Staff and ordered him to report to Santa Cruz, from whence he was taken to La Paz under "protective custody". There, he was found guilty of insubordination by a military tribunal, stripped of his permanent rank of Major General, and placed under house arrest in December of 1933. It is not difficult to speculate what his fate might have been had the assault on Nanawa continued. Unquestionably, Kundt was the progenitor of the modern Bolivian Army, and had contributed extensively to its administrative and technical development. As a field commander, he left a great deal to be desired, which unfortunately could only be proven the hard way. In the larger sense,

1 Ibid.
the 7th's failure at Nanawa was due to the shortcomings in the Prussian-style artillery and mortar doctrine that he had assiduously preached. Some of these deficiencies, such as the inadequacy of mass fire as opposed to accuracy, have been previously mentioned. Others are more painfully apparent. For instance, Kundt's refusal to use a timed-fire system in accordance with Olmos's suggestions smacks almost of professional jealousy; an unworthy trait for any officer in the field, and especially in one vested with a heavy tactical responsibility. Direct, open-sight fire with case shot and shrapnel might have eliminated the deadly Paraguayan bunkers, but in no case, either in the preliminary fires, probing attacks, or in the final assault, was this method used. Mortar sections in the forward trench might have been moved up with the first attack waves and fired in counter-battery against the stockade and its attendant weapons pits, but they remained in the rear firing haphazardly at unspecified targets with insufficient observation. When co-operation between infantry and artillery was needed, it was most conspicuously absent.

The defenders of Nanawa, on the other hand, possessed a smaller number of artillery and mortars, but made more skillful use of them in a defensive situation. Fourth Regiment mortar sections can be particularly cited in this regard, as the rapidity of their fire assisted materially in stopping the two frontal assaults previously described. Overall, the Paraguayan artillery components within
the garrison maintained excellent fire discipline, conserved their limited ammunition, and when the opportunity presented itself, backed up their infantry with previously-registered fires to plug gaps in the defensive perimeter. This refusal to engage in counter-battery duels with Bolivian artillery is feasible tactically, but why the 2nd Battalion did not oppose the seizure of the outer trench by the Bolivians on January 23rd is somewhat strange, in view of the exposed position of the attacking forces and their vulnerability to counter-fires. Part of this difficulty may be explained in the following comments by Vidaurre, which considered a problem faced by artillerists of both armies:

"In the initial phase of the war, when operations were begun against Nanawa to the South, and against Toledo in the North, the fire of the artillery lacked one element, the proper angle. The angle of fire had not been taken carefully for the reason that the uniformity of the terrain...is the same without presenting anywhere a depression or elevation from which it could fire."

With the collapse of the Bolivian offensive against Nanawa, the Chaco War entered into a new phase dependent upon fluid movement rather than static defense. The fortin lines, over which so much blood had flowed in the preceding two years, were soon to be abandoned as the conflict moved northward along the valley of the Pilcomayo towards the Andean foothills. The removal of Kundt at

\[1\text{Vidaurre, op. cit., p. 256.}\]
an earlier date might have salvaged part of what had been painfully
won from the jungle and the Paraguayans, but after July 4th, 1933,
dismissals were poor substitutes for victory. History has been
overly harsh with the old Junker, and blamed him disproportionately
for the Bolivian disintegration on the battlefield. It would be well
to remember that verdicts, at least in history, are never final ones.
Kundt fought the type of war that instinct and training had conditioned
him to do, and it was his misfortune that the system he created
was out of joint with both the times and circumstances. The initiative
had nonetheless changed hands, and would remain in Paraguay's
favor until the conflict's end, as the pursuer had suddenly become
the pursued.

Retreat And Advance To The Pilcomayo:
Ballivián-CañadaDelCarmen
(April-November, 1934)

Kundt's replacement, General Enrique Peñaranda, found him-
self confronted with a rapidly disintegrating tactical situation when
he arrived on the scene on August 15th. In terms of manpower, I
Corps had been sadly crippled at Nanawa, as the 7th Division was a
skeleton due to battle casualties and the 4th equally battered from
almost two years of continuous bush fighting. The 3rd Division was
still recuperating at Fortín Bolívar from the after-effects of the
Toledo Campaign, and would not be combat-ready for another month,
while the fresh but untried 5th Division was tied down far to the north-
east covering the Vanguardia-Puerto Suárez sector. At Villa Montes, Colonel Toro, arrogant and irascible as ever, was busily assembling II Corps from Reservist forces. This corps, composed of the 9th and 10th Infantry Divisions and the veteran 2nd Cavalry Division, would bear the brunt of the fighting around Ballivián in months to come. However, its infantry components were green, unseasoned troops, well-equipped but ill-trained. Their reliability as reinforcements to bolster the sagging southwestern front would be questionable under even favorable circumstances. Peñaranda, now wearing two hats as Acting Chief of Staff and I Corps commander, was forced to make do with what he had to face and repel the forthcoming Paraguayan counter-offensive. His lines of supply were still open to the north, but the autumn rains were fast approaching. Within a short time, the Villa Montes road would be an impassable quagmire, as would every road and trail in the Chaco. Thus, I Corps ran the risk of being cut off and left to wither on the vine by nature rather than Paraguayan encirclement. Peñaranda therefore decided to begin an orderly withdrawal in a northwesterly direction along the Pilcomayo and create a more stable defense line in the vicinity of Linares and Ballivián, two of the upriver fortines.

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1 Zook, _op. cit._, p. 204.
2 Ibid., _pp._ 205-206.
3 Ibid.
Before I Corps could carry out this maneuver, the Paraguayan offensive swung into high gear, and turned it into a disorganized retreat.

Estigarribia had managed to muster sufficient troop strength behind Franco's I Corps to permit the kick-off maneuver of the counter-offensive by the 28th of August. Realizing the weakened condition of his opponent's defensive lines, he ordered probing attacks along the southwestern front from Nanawa eastward. In the first week of September, elements of the 2nd Division located a momentary gap in the Bolivian lines between Platanillos and Bolivar, held by the 4th Bolivian Division. The place in question was an old ruined stockade dominating the road and a nearby canada called Campo Via. Moving across country without artillery support, the 2nd Division, with two regiments of the 6th as reinforcements, quickly severed the vital supply road and cut off the bulk of the 4th Division at Platanillos, where it surrendered after sporadic resistance on September 12th, with three thousand prisoners and some twenty fieldpieces falling into Paraguayan hands.

With a hole opened in the center of the fortin line, and Paraguayan infantry infiltrating into the soft, ungarrisoned rear, I Corp's

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1 Ibid., pp. 206-208

2 Ibid.
position was no longer tenable. On September 18th, the general
order for a retreat was given, and the remnants of the 7th and 4th
Divisions, plus the relatively intact 3rd, began to pull out and move
northward towards Linares. Paraguayan I Corps was not far behind,
although slowed down by rear-guard actions fought by the 3rd Divi­sion and occasional roadblocks. The toughened 1st Division, lead­
ing the pursuit, made frequent use of its mortar and regimental
cannon components to destroy these roadblocks and harass the
Bolivian rear echelons by marching cross-country parallel to the
main road and suddenly delivering point-blank fires into transport
columns, causing heavy damage and mass panic among the bewildered
masses of Bolivians fleeing for safety. 2 By December 1, 1933, I
Corps had seized Linares, its initial objective, and halted there
for re-grouping. 3 The long pursuit north had been no lark for the
weary Paraguayans, as Bolivian resistance grew stiffer as the
battle lines advanced closer to Ballivian. This was especially
noticable in the mounting number of air raids by the Bolivian Air
Force on Paraguayan columns and supply depots during this period,
and in the bloody repulse given to the Paraguayan 1st Division at
Cañada Strongest on February 24th, 1934, where an entire regiment

1 Ibid.
2 Ibid.
3 Ibid.
was surrounded and two of its battalions captured by the Bolivian 9th Division, part of Toro's newly arrived II Corps. ¹ Estigarribia's strategic planning called for the seizure of Villa Montes, and possibly the nearby Parapití oil fields in order to give Paraguay a better position at the conference table should an armistice be signed in the coming year. ² To accomplish these objectives, Ballivian and its attendant strongpoints had to be taken, and with a relatively fresh Bolivian Army Corps barring the way, this would not be a simple matter of head-on attacks. Subterfuge and envelopment were the weapons that he would use against Toro, with artillery and mortar support being relegated to a secondary role. This is not to imply that either belligerent stopped using their infantry support arms, but simply that orthodox technique, in this case, was abandoned by both sides for the sake of battlefield expediency.

Toro's II Corps had begun to concentrate on Ballivian in December of 1934, and had developed the fortín and its outposts into a formidable defensive position equal in strength to Nanawa. Covered by the Pilcomayo and neutral Argentine territory directly to the west, the main stockade could only be reached by infantry assault by taking each one of its heavily fortified outworks, six

¹ Ibid., p. 214.
² Ibid., p. 216
in number, by storm. The divisional artillery of the 8th and 9th Divisions was grouped together in a two-regiment brigade adjacent to the main stockade, where it could fire concentrations in all directions.\(^1\) I Corps tasted the power of this grouping on July 10th, 1934, when the 3rd Battalion of the 4th Infantry Regiment occupied one of the outposts, El Condado, and drove its garrison back on Ballivián. Instantaneously, II Corps artillery dropped a box-barrage of high explosive and air-burst upon the Paraguayan troops, who had not enough time to dig in properly. On re-occupying the village after the two hour concentration, the Bolivian 12th Infantry regiment counted seventy-five Paraguayan dead and retrieved several stands of small arms from the shell-torn outpost.\(^2\) Episodes such as this made Franco, Estigarribia, and the I Corps staff a trifle wary of attempting frontal assaults against any of the Ballivián fortifications, and prompted the establishment of a holding perimeter facing the Bolivian defense complex in a rough half-circle. The worn-out veterans of the 1st Division who had lead the advance north from Campo Vía were pulled out of the line and sent into Corps reserve. Their place was taken by the newly-arrived 7th Division, which was sent into the middle of the holding line at Santa Rosa, while the 2nd

\(^1\) Vidaurre, _op. cit._, p. 248.  
\(^2\) Ibid., p. 253.
Division moved to the east of the Villa Montes road in the direction of Fortín Picuiba, and the 8th Division, another new formation covered the western sector reaching to the river. With its own lines thus strengthened, I Corps settled down to wait, conducting raids and patrol actions in the meantime to test Bolivian strength and throw them off balance.

The summer of 1934 wore on without any major clashes between the two belligerents, apart from a daily interchange of artillery and mortar shells, sniping, and occasional patrol actions. In one sense, this stage of the campaign resembled the opening rounds of a boxing match where each of the fighters sparred and jabbed, but refrained from landing decisive punches. The Paraguayan position, while firmly anchored to the river and Picuiba, was tenous in terms of manpower and ammunition reserves, neither of which did Estigarribia have to spare for offensive operations. The Bolivian II Corps, on the other hand, possessed the immediate advantage of the Expeditionary Force depots at Villa Montes as a source of reinforcements and supplies, although rain and constant use soon turned the road into a soupy morass which was impassable a good deal of the time. As a consequence of this material superiority, Toro contemplated a sweeping offensive in early November designed

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to envelop the Paraguayan I Corps, pin it against the Pilcomayo, and finish it off, thus leaving the road clear for the often-postponed march on Asunción. On paper, his offensive plans appeared promising enough, but in actuality, there was little substance or reality involved. To begin with, Toro's blunt dislike of Peñaranda prevented any effective liaison between Corps HQ and the Chief of Staff; a necessary condition for the success of a large-scale military operation of this type. He considered the new Staff head an incompetent blunderer, fit only to be replaced by a man of proven ability, and refused to reveal to him most of the operational details; a piece of rank insubordination which under ordinary circumstances might have cost him his commission. Peñaranda, unsure of his own position politically as well as militarily, could not arbitrarily remove Toro from his command, as governmental communiques and popular news media in La Paz had turned him into a national hero for his defense of Ballivian. Besides, he had no other seasoned field commanders on which he could rely. His only recourse was to send frequent written reprimands to the intransigent Corps commander, most of which were ignored, and to request that Dr. Salamanca support him in removing Toro from his post.  

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1 Zook, op. cit., p. 217.

2 Ibid.

3 Ibid., p. 228.
manca's temporizing on the subject would eventually lead to his own overthrow in the officer's coup of February 3rd, 1935, in which Toro had a prominent role, and contributed materially to a growing split in the Army high command at a time when unity was essential. ¹

Estigarribia's difficulties with other ranking officials were mainly of a personal nature, and did not involve deep-set political ambitions, as did his Bolivian counterparts. One of the least of Estigarribia's worries was a lack of concrete intelligence concerning his enemy's movements. Like an inept prizefighter, Toro telegraphed all of his forthcoming offensive punches without any attempts at concealment, mostly out of cocksureness at his own physical superiority and personal arrogance. No measures were taken to camouflage the shifting of units within the Ballivian perimeter to the obvious weak point in the Paraguayan lines, Fortín Picuiba; movements which were carried out throughout September and October of 1934 in broad daylight under constant surveillance by Paraguayan aircraft and ground patrols.² At the same time, a number of infantry probes were delivered against the Paraguayan holding line, always preceded by intense artillery and mortar

¹Ibid.
²Ibid., p. 220.
preparation. For example, on November 6th, a thirty-minute time-on-target concentration composed of 75 mm., 105 mm. and mortar fire struck the trenches held by the 3rd Infantry Regiment of the 7th Division in the Santa Rosa sector early in the morning. At 7:40 on the evening of the 6th, a similar concentration hit the neighboring 9th Infantry, and a patrol from the 17th Infantry captured a Bolivian straggler who revealed that the systematic barrages were to provide cover for ground reconnaissance of the Paraguayan defenses. The 4th Artillery Regiment of the 7th Division returned the compliment with a high-explosive concentration that raked the woods in front of the 7th's positions, foiling the probe.  

Toro's intentions were now crystal-clear to Estigarribía Franco, and their subordinates. A major counter-offensive was in the making, but where would the Bolivians strike first? I Corps had a fairly sizeable mobile reserve in the 1st Division, but it could not be parceled out in packets to reinforce the paper-thin holding line from the river eastward. Unless the Bolivians made the initial move, the waiting game would have to continue. However, Toro was not long in tipping his hand. On November 12th, the 8th Regiment of the Paraguayan 2nd Division, in garrison at Fortín Picuiba, found itself under heavy artillery and mortar fire from

\[1\text{Britos, op. cit., p. 68}\]
two regiments of the Bolivian 10th Division, supported by the 2nd Cavalry Division, as reported to I Corps HQ at 10 A.M. by telephone before the wires were cut. Estigarribia was in a desperate position, since releasing the 1st Division to break the siege of Picuiba would leave him without a reserve to meet a secondary assault by the bulk of II Corps. Yet, he could not leave the 8th Regiment to its fate, and transmitted an order for them to break out of the pocket at the earliest possible opportunity and rejoin their parent division. By 1:00 P.M., the infantry spearheads of the attacking Bolivian units had nearly surrounded the fortin, but a half-mile gap, heavily-forested and laced with trails, separated the two prongs of the converging pincers. Had Toro kept his composure and intrusted the closing of this gap to his subordinates, the 8th Regiment might have been captured intact with minimal resistance. However, he desired to claim sole credit for such a successful operation for himself, and the two attacking forces were halted in the late afternoon of the 12th to allow Toro to journey up from Ballivián to direct the closing of the trap in person. This hesitation by virtue of personal vanity was to have ironic and far-reaching effects for the personnel of II Corps and the fate of Ballivián.

1 Ibid., pp. 73-76
2 Ibid.
3 Ibid.
4 Ibid.
Toro arrived at the 2nd Cavalry field HQ in front of Picuiba at 7:45 on the morning of the 13th, after an all-night ride by command car from Ballivian. Immediately he ordered the two pincers to converge on the stockade, and at 8:15 A.M. the assault forces jumped off, preceded by a time-on-target artillery and mortar concentration laid on by the cannon companies of the 19th and 21st Infantry regiments of the 10th Division. When the two converging pincers met an hour later, they found only a ruined fortin, several burning ration dumps, and twelve broken-down Ford trucks left behind by the Paraguayans, who had seemingly vanished into thin air. During the night of the 12th, while Toro dreamed of an easy conquest, the 8th Infantry filtered out through the gap in Bolivian lines in small groups, carrying with them all their weapons, ammunition, wounded, and a few prisoners. Nothing had been left behind, not even the four Krupp 75's of the regimental howitzer company, which were dismantled and packed out on the backs of their crews. II Corps had been left holding the bag, and the Ballivian line was now appreciably weakened and ripe for infiltration.

While Toro raged and swore at the duplicity of a foe who

1 Ibid.
2 Ibid.
3 Ibid.
would not hold still long enough to be encircled, Estigarribia was already putting a counter-manuever in motion. The softest spot in the Bolivian defenses at the moment was the outwork named Cañada del Carmen, which jutted into the Paraguayan lines eastward in the 2nd Division's sector. The Bolivian 9th Division held this satellite in some strength, but their flanks were up in the air due to Toro's commitment of the bulk of the 10th Division at Picuiba. 1 Estigarribia and Franco, working jointly, conceived a double-envelopment pincers centered on Canadadel Carmen with the right wing composed of the 2nd Division and the left the 8th Division. The 7th Division would displace to the western sector of the holding line into the 8th's old positions, and prepare to support the attack if it was successful. 2 Field command of the operation was vested in Colonel Eugenio Garay, commander of the 8th Division, who was a veteran of Boquerón and Campo Vía and a specialist in bush warfare. Some commentators on the Chaco have referred to Garay as the Stonewall Jackson of Paraguay, by virtue of his skill in handling infantry as highly mobile assault units. 3 This description was not inaccurate, as the events of the next seventy-two hours will

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1 Ibid.
2 Ibid.
indicate. After the divisions had shifted to their pre-arranged positions on the afternoon of the 13th, the operational orders prepared by the I Corps staff were transmitted to the two divisional commanders. The jump-off time for both units was set at 7:00 P.M. after darkness had fallen. Only small arms and mortars would be carried, and of the utmost importance, there would be no preparatory fires above and beyond the normal harassing concentrations used nightly. Once in the Bolivian rear, mortar concentrations would be laid on all roads and trails, and roadblocks established to prevent the 9th Division's escape. Corps and divisional artillery, however, would hold their support fires until the two Paraguayan divisions had overrun their objective. This was done to prevent injury to friendly troops, and to insure that valuable ammunition would not be used in chewing up empty entrenchments. Like an unwary hunter, Toro and II Corps were about to fall into a trap of their own devising.

Concealed by ground-mist and an overcast sky, the 2nd and 8th Divisions moved out from their lines at exactly 7 P.M., crossed no man's land between the two defensive positions, and began to filter through the uncovered flanks of the 9th Bolivian Division six miles apart. Following old foot trails, or cutting new ones where

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1Ibid., p. 88
none previously existed, the Paraguayan infantry, with faces blackened by mud and equipment taped to prevent noise, passed in single file into the Bolivian perimeter, while scattered harassing and illumination fire from their divisional artillery struck the 9th Division in back of them. Due to the sudden pull-out of the bulk of the 10th and the 2nd Cavalry, this unit's flanks were not tied in with the 50th Regiment to the east and Corps troops in the western sector, and the gaps were not patrolled or even illuminated by parachute flares. II Corps headquarters possessed no specific instructions on how to deal with this problem, as Toro, in his haste to be victorious at Picuiba, had left none behind. No doubt, there was some bewilderment on their part at the scantiness of Paraguayan harassing fire that evening, but nothing to this effect was recorded officially or otherwise. In the meantime, Garay and his two divisions had reached their designated assembly point one mile from the fortín, and fanned out to block the trail leading from the stockade to Ballivian, thus sealing off the only escape route for the 9th Division. The mortar sections of each division assembled their tubes, sighted them in on the stockade, the trail,

1 Ibid., pp. 89-92.
2 Ibid., p. 93
3 Ibid.
and the numerous dumps and bivouacs around the cañada, and settled down to await the dawn and firing orders.

The Bolivian 9th Division received a rude reveille on the morning of November 14th. Divisional headquarters awoke to the tune of accurate 81 mm. fire which blanketed the stockade, set fire to tents and supply dumps, and panicked draft animals into a wild stampede for the woods. After the barrage had diminished, two converging columns of Paraguayan infantry appeared from out of nowhere, and overran the fortín after a brief skirmish, capturing the entire divisional administrative and line staff by 9:25 A.M.  

A few stragglers escaped down the trail to Ballivián to alert II Corps, but the warning came too late for the line regiments of the 9th. On hearing the sounds of mortar fire in the rear, fear swept through the Bolivian ranks, as officers and men alike realized that the Paraguayans had infiltrated behind them and had overrun Cañada del Carmen. Some of the officers attempted to turn their units about and attack westward to recover the stockade, but few succeeded in organizing any sort of effective opposition. The bulk of the 9th Division officers deserted their units, and struck out cross-country to Ballivián and safety, leaving the Indian draftees to their fate.  

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1 Ibid., pp. 94-96.

2 Ibid.
As units disintegrated, more and more thirsty, weaponless Bolivians trudged into Caña de Carmen to give themselves up. By noon of the 14th, the 2nd and 8th Divisions combined had taken over seven thousand prisoners, a complete divisional field hospital, several hundred head of draft animals, and two battalions of Indian labor troops imported from the Altiplano for roadbuilding. In addition, Lieutenant Colonel Estaban Ortellado, commander of the 2nd Division, reported to Estigarriba and Franco by field telephone that his 2nd regiment had overrun the divisional artillery park located near the stockade, seizing two Vickers 75's, fifteen head of draft oxen, and a large artillery ammunition dump, while the 2nd Battalion of the regiment had captured two more Vickers 75's, four Ford Model-A trucks, and twenty Bolivian artillerymen in an ambush of a transport column on the Seleck trail leading north to Caña Oruro. Having successfully closed the sack on Caña de Carmen, Garay released tactical command to Colonel Franco, who ordered both divisions to strike to the northwest and cut the Ballivian-Villa Montes road, thus trapping the remnants of II Corps against the river.

Word of the 9th Division's debacle at Caña de Carmen did

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1 Ibid.
2 Britos, op. cit., p. 133.
3 Ibid. pp. 134-35.
not reach Colonel Toro at Picuiba until 8 A.M. of the morning of the 15th. Reacting immediately, he dispatched the 2nd Cavalry north to Cana Oruro as a holding force, and dispatched the remaining two regiments of the 10th Division by motor truck to reinforce the eroded garrison of Ballivián hoping to stave off the fall of that key strongpoint. It is approximately thirty miles from Picuiba to Ballivián over a single-track, deeply-rutted trail which slowed the reinforcement convoy appreciably, preventing its arrival at the beleaguered fortín until 11:30 A.M. on the 16th. Hard on its heels came the advancing Paraguayans, racing by forced marches to cut the Villa Montes road and block the withdrawal of II Corps. Marching parallel to the Paraguayan line of attack was a composite Bolivian force racing to reach Cana Chile, a water hole on the Villa Montes road, before the 2nd Paraguayan Division arrived and blocked its access to safety. It consisted of the 50th Regiment of the 10th Division, the 2nd Battalion of the 16th Infantry Regiment (also of the 10th), and a battery of Schneider 75's drawn from the 7th Artillery Regiment, which had been in position at Huanci to the northeast and had withdrawn westwards toward the road on the 14th for fear of being outflanked. The 2nd Division attempted to block this group's

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1 Ibid.
2 Ibid.
3 Ibid., pp. 153-54.
line of march with mortar fire and ambushes, but was repulsed by heavy A. A. C. 105's and the Schneiders of the attached battery which fired point-blank against Paraguayan roadblocks, limbered up, and moved on. Aided by such close support, the 50th and its auxiliaries reached Cañada Chile at 2:40 on the afternoon of the 16th, where it was evacuated by motor transport north to Cañada Oruro. The 2nd had lost the footrace, and missed another golden opportunity by failing to bring the road at the bottleneck of Cañada Chile under artillery and mortar bombardment. Paraguayan aerial reconnaissance planes had reported that the macadam track and side trails at that point were jammed with trucks, carts, towed fieldpieces, and columns of men withdrawing from Ballivian, which were sitting ducks for the 2nd's artillery, now within firing range. Ortellado, however, decided that cutting the road was more important than bombarding it, as divisional ammunition reserves were beginning to run low, but had he chosen to do so, the majority of II Corps motor transport and field artillery would have not escaped across the Parapiti to fight another day. At any rate, the 2nd's infantry spearheads reached the road at 4:00 P.M. on the afternoon of the

1 Ibid.
2 Ibid.
3 Ibid.
16th, and closed it to traffic with flanking roadblocks. Ballivian was now totally encircled, without hope of relief, and the decimated garrison had little prospect of breaking out of the trap, unless they chose to cross the river and be interned in neutral Argentina. The cornered remnants of II Corps had only three days ammunition left, and the stockade's well was slowly running dry through constant usage by the excess of men and animals crowded into the narrow perimeter. Without munitions or water, a prolonged resistance was out of the question. On November 18th, the white flag was run up over the stockade's walls, and the instrument of surrender was signed by representatives from II Corps, Franco, and Garay. Forty-eight hundred Bolivian officers and men, including the entire Corps headquarters and staff, marched off to POW compounds, bringing the prisoner total for the campaign to over ten thousand. With the capitulation, I Corps took possession of thirty-six mortars, twenty-eight howitzers and fieldpieces of varying caliber, seven hundred forty rounds of mortar ammunition, one thousand, two hundred seventy-two rounds of artillery ammunition, and forty-four trucks. The path northwards was no longer obstructed.

1 Ibid.
2 Ibid.
3 Ibid., p. 162.
4 Ibid., p. 164.
Some of the elements of II Corps had escaped prior to the surrender, including most of its motor transport and artillery components, which had pulled out for Cañada Oruro on the 14th. One of these miscellaneous fragments drawn from the 9th Artillery regiment was a two-gun section of Vickers 75's from Battery F of the 1st Battalion, which had the unique distinction of being the last unit to depart from El Carmen before the 9th Division's capitulation.

Lt. Colonel Arturo Nataniel, commander of the Ninth Artillery, revealed to Britos in a post-war interview that the entire battery was ordered to pull up stakes on the morning of the 15th, when the word was received that the fortín had fallen the previous day. Loading the dismantled guns, ammunition, and personal gear on two divisional trucks, the battery departed for the north and Cañada Oruro via the Seleck trail. Upon arriving at this point, two of the four guns were dispatched south to Ballivian on the 16th, where they fell into Paraguayan hands two days later. The other two fieldpieces were transported to the southeast and emplaced at Picada Murillo to act as the nucleus of a rear-guard roadblock. This same depleted section, with varying changes of personnel, served as part of II Corps rear guard during the entire retreat north to the Parapiti, until the lines were stabilized in January of 1935.

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1 Ibid., pp. 137-38
2 Ibid.
3 Ibid.
Artillery usage in the Chaco War had come full cycle with this hasty employment of trained gunners as a last-ditch delaying force. The time they purchased for the Bolivian Expeditionary forces, together with terrain changes, slowed the rapid pace of the Paraguayan advance on Villa Montes to a crawl. By the end of November, the Parapiti had been crossed, and Paraguayan patrols skirmished with the 2nd Bolivian cavalry on the outskirts of Villa Montes, but national endurance on both sides had reached its limits, economically and physically. Men would still die, and battles would still be fought, although the object of conflict had long been bypassed.

Neither of the belligerents was in fit shape to carry the conflict over into the approaching new year of 1935. Paraguayan manpower reserves had been depleted by the strenuous campaign against Villa Montes, with nearly two thousand casualties piling up in a month's time (dated from February 18th, 1935). When the withdrawal had been completed, the conflict, for all practical purposes, ceased. Both armies stood poised on opposite sides of the river, exhausted by three years of continual warfare and a harsh, unrelenting climate which bred disease and starvation. Even after the toppling

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2 "Chaco War In Military Eyes," Literary Digest, CIX (March 2, 1935), 16.
of the Salamanca government in February of 1935,\textsuperscript{1} public opinion in Bolivia favored the continuance of the conflict, in spite of the opposition of General Peñaranda, who maintained his ground forces could no longer sustain offensive or defensive operations. The Paraguayan government, realizing the debilitated state of its own military establishment, was more willing to negotiate for an armistice until a permanent territorial settlement could be decided upon. Cajoled by a six-nation peace commission made up of Argentina, Brazil, Chile, Mexico, Peru, and the United States, the interim military regime in La Paz acceded after considerable procrastination, and signed the armistice agreement on April 5th, 1935.\textsuperscript{2} The front lines from the Pilcomayo to the upper Paraguay suddenly became strangely silent as the cough of the mortars was stilled, and the cannon's bark muzzled by tarpaulin and cosmoline. The verdant brush and savannas of the Chaco would bear the marks of their passing for many years to come, in shell-pitted fortines overgrown with acacia and thorn, in the rusty wire used by ranchers for penning their cattle, and in the rows of ill-tended wooden crosses at Nanawa and Ballivian where friend and foe lie side by side.

\textsuperscript{1}Ibid., p. 228.

\textsuperscript{2}Ibid., p. 238.
V. THE ROLE OF INFANTRY SUPPORT WEAPONS IN RETROSPECT

By present-day standards, the field artillery and mortars used by the Chaco belligerents were limited in technical efficiency, accuracy, and effectiveness of co-ordination with other service arms, particularly the respective infantry establishments. However, the conflict in which they were employed was hardly a textbook example of modern warfare. Both armies, on many occasions, discarded the principles of orthodox artillery and mortar tactics and fought literally by instinct, and in conformity to a hostile environment. It is well worth noting at this point that a similar situation confronts the United States in South Viet Nam at the time of this writing, only on a more expanded scale and of a more irregular character. Formal doctrine was not completely abandoned, but merely bent to adjust to the exigencies of the moment, as exemplified by the use of artillery in a rear-guard role during the Bolivian retreat from Ballivian. These factors, plus the obvious implications of training, terrain, and suitability of equipment, must be considered in analyzing the operations of Bolivian and Paraguayan infantry support weapons and their total bearing upon the outcome of the war.

Numerical superiority was the sole category in which one of
the two combatants completely outclassed the other. Assuredly, the Bolivian Expeditionary Forces were able to bring to bear a greater quantity of fieldpieces and mortar tubes for support purposes through extensive pre-war purchasing and an abundance of financial reserves, as previously stated. However, such a disparity in total weapon strength constituted a Bolivian advantage for only the first few months of active hostilities, as Paraguayan mobilization at that juncture was incomplete in regards to both men and equipment. A time allowance should be made for the mustering of artillery and mortar units and the issuance of basic weapons, ammunition, etc. within the Paraguayan field forces, thus accounting for this temporary numbers gap. By the spring of 1932, Paraguayan units had attained a partial parity with their Bolivian counterparts in terms of operational fieldpieces and tubes, increasing this parity further by the use of captured equipment as the conflict moved to the north.

Overall efficiency of Bolivian and Paraguayan artillery and mortar units left much to be desired when compared with the combined Allied and Axis effort from 1939 to 1945. Some of the reasons for this lack of aptitude have been mentioned in Chapter I, in the sections considering terrain handicaps and logistical problems, to which a few casual observations should be added here. Of primary importance,

1 Supra, pp. 14-17
neither army possessed adequate mechanical or animal transport designed to carry artillery and mortars, due to material shortages, the demands of front-line supply, and the poor quality of the Chaco road and trail network. Without prime movers, artillery mobility on both sides was limited by the slowness of mule or horse transport, thus entailing a loss of valuable time in concentrating divisional or regimental artillery at a certain point along the lines in readiness for firing. The lengthy buildup required by the Bolivian I Corps prior to the battles of Toledo and Nanawa was in part due to artillery and logistical re-concentration in preparation for the designated offensive. Paraguayan field forces encountered similar difficulties during the latter half of the northern campaigns, especially after the crossing of the Pilcomayo. Mortars presented little difficulty, as they could easily be dismantled and carried by hand, but transporting a fieldpiece under similar circumstances was a horse of another color. Many a gun crew during the course of the war had to resort to their own strength in hauling and emplacing their cannon, and in preventing its capture in time of retreat or withdrawal.

The iniquitous nature of the Chaco landscape and climate seemed to conspire against Bolivian and Paraguayan gunners without distinction of nationality. Guarani artillerymen and mortar crews, to be sure, had fewer difficulties in adapting to a familiar environment, but they suffered no less than their opposite numbers from
the incessant heat, dampness, torrential autumn rains, insects, and disease characteristic of the land between the rivers. Not only was the health of the respective artillery and mortar personnel affected by these factors; equipment took a beating as well from mud, dust, and corrosion, leaving whole batteries out of commission at critical moments. Main roads and trails frequently were blocked, even during dry weather, by their narrowness and the thickness of foot and cart traffic moving to and from the front lines. Ammunition, crews, and the guns themselves often arrived at battery sites several hours after fire missions were supposed to begin, leaving the infantry shorn of effective support when it was most needed. Logistical problems grew worse during the rainy season, as well-laid roads turned into impassable morasses, bogging down all vehicular traffic for weeks at a time. Even the sure-footed artillery mules were stymied by the mud as they towed pieces up to the front, forcing the use of shank's mare by the weary gun crews to merely insure forward progress. Aerial and ground observation was consistently hindered by clouds of dust and brush-fires caused by shells in the dry season, and torrential curtains of rain in the autumn, leaving artillery and mortar observers literally "blind" in directing fire concentrations; a condition which did not lend itself to overall accuracy by gunners of either side.
Quality of equipment and training seriously handicapped the belligerents in the area of infantry support. The bulk of the field-pieces and mortars on both sides were surplus discards from World War I, or relatively modern pieces such as the 1927 Schneider 75's which had not been especially fitted for tropical warfare either by weather-proofing or other necessary adaptations. Most of the guns involved would be classified as mountain artillery; excellent in weight and portability but deficient in range and operational simplicity. Complicated breech mechanisms and sighting equipment baffled artillerymen of both armies, and necessitated lengthy training to insure accurate usage. This involved the expenditure of precious time, which neither nation could afford to waste in the preliminary stages of the war. As far as durability under extreme battlefield conditions, the newer equipment purchased during the four years prior to the war stood the gaff well, but pieces of an older vintage, such as the 1898 Model Krupp 75, broke down frequently and occasionally caused operational accidents, such as breech explosions, by their very age.

At the outset of the conflict, each field army possessed a hard core of trained officers and non-commissioned officers as a leadership nucleus for their artillery and mortar units. Thorough-going professionals, these men soon found themselves swamped by a wave of untutored enlisted recruits, products of national conscription,
who had been arbitrarily selected to receive instruction in the intricacies of artillery and mortar operation. With time running short in 1931 and 1932, the best that such professional cadres could provide was an extremely sketchy course in the rudiments of how to fire and maintain a piece or tube before their units were thrust into combat. Half-trained soldiers and complicated equipment make a dangerous mixture in any circumstance, and operational accidents multiplied on both sides. As casualty figures among the regulars increased with the progress of the war, stopgap promotions from the ranks and inexperienced cadets from the national military academies filled their places, leading to a momentary decline in field efficiency and disciplinary lapses, such as the breaches in Bolivian firing discipline mentioned in Chapter IV.¹ Battlefield experience is a hard master, and by the time of the siege of Ballivian both infantry support establishments had been hammered into fairly efficient organizations by the elimination of inexperienced "deadwood" through casualty or transfer. This process, however successful, was no substitute for the thorough pre-war training and careful recruit indoctrination that might have saved time, material, and lives on both sides of the firing line.

Despite these overriding limitations, both belligerents

¹Supra., pp.107-109.
excelled at one or more specialties within the field of practical infantry support, and demonstrated a definite superiority (and preference) for them on the battlefield. Because of a shortage of trained personnel and technicians, Paraguayan support doctrine naturally favored economical, simple weapons which could be handled by the average infantryman in the forward trenches with a minimum of training. The Stokes-Brandt mortar provided the ultimate answer, and Paraguayan proficiency with "the two-legged stovepipe", as it was nicknamed, more than made up for the absence of artillery on several occasions. Stokes-Brandts gave the infantry their own private artillery with an equal amount of firing punch, and were the perfect weapons for infiltration tactics, such as those practiced by Colonel Garay at Cañada del Carmen. As far as the Paraguayan field artillery was concerned, the major effort was devoted to the perfection of open-sight firing tactics, which presented definite hazards to the relatively unprotected crews, but provided the advantages of point-blank accuracy and target visibility. In one sense, Lt. Baéz's handling of his guns at Toledo is an example of the preceding reference, and one reminiscent of the Union artillery at Malvern Hill during the Peninsular Campaign of 1862 in our own Civil War, in its use of open-sight concentrations against attacking infantry. From the standpoint of reconnaissance, Paraguayan

1 Supra., p. 92.
observers outclassed their opponents in the construction and concealment of tree platforms, daringly emplacing them within enemy lines and calling down fire seemingly from nowhere, as was successfully done at Arce in 1932. It is apparent from the total picture of Paraguayan artillery and mortar operations during the war that a premium was placed upon simplicity, mobility, and conformity to the demands of a known region, which was treated with respect as an informal ally. No attempt, formal or otherwise, was made by Estiggarribia and his associates to gain primacy in weight of metal or accuracy in indirect fire, as such advantages would be impossible in view of the existing financial and technological considerations.

Bolivian superiority rested in observational equipment and in the relative accuracy with which indirect, ranged fires could be delivered as a result. Modern communications equipment, in the form of the wireless radiotelephones used by Bolivian artillery spotters, plus the use of aircraft for directing the fall of shot, made it possible for Bolivian artillerymen to accurately hit a generalized target area and assure its partial destruction on nearly every occasion. The clearing of the outer trench at Nanawa and the box-barrage "trap" laid for part of the Paraguayan 2nd Division at El Condado are illustrative cases in point. ¹ In both of these instances, fire control was

¹ Supra., pp. 103-105, 121-22.
provided by radiotelephone observation on the ground, but aerial spotting assumed the burden of observational duties throughout the siege of Nanawa up to the fatal day of July 4th. As previously related, the system broke down when pin-point accuracy on single or moving targets was required, although this difficulty was common to each of the contending armies. Novel usage of weapons is evident in the attempts to utilize the Vickers 65 mm. howitzer in mobile support of advancing infantry at Toledo and Nanawa. Because of lack of co-ordination with the infantry and the absence of protective shielding to cover the gun crews, this promising effort, soon to be an integral part of Blitzkrieg tactics, died aborning. Adherence to the concept of accuracy by weight of fire and observational superiority were the cornerstones of Bolivian infantry support operations, but could not insure a final victory.

Outside the battle zone, a number of international organizations and states watched the conflict with interest for a variety of reasons, self-interested or altruistic. The attempts of the Pan-American Union and the League of Nations to bring about an arbitrated settlement of the dispute have been briefly referred to in the introduction, and will not be analyzed here, as they lie outside the context of the discussion. It is worthy of note, however, that the League's failure to effectively intervene and thus halt the hostilities permanently provided conclusive proof of its weakness as a peace-keeping organ.
The military aspects of the war, from 1932 onward, were carefully followed by a number of observation missions drawn from representatives of the United States, Germany, Italy, France, Czechoslovakia, and the Latin American republics of Argentina, Brazil, and Chile. For the European powers and the United States, the impact of the conflict was not as profound as might be expected, although some of the assimilated material probably found its way into the respective War Plans offices of these nations for instructional purposes or into specified archives as legitimate military history. No far-reaching changes in strategy or tactics were made as a result of these observations, although some of the techniques developed for the handling of artillery and mortars in a tropical climate would eventually come into play in the Southwest Pacific and Burma during World War II as an indirect result of their employment to the Chaco.

Latin American observation and direct participation in the conflict was more apparent and had more immediate consequences for the three nations previously designated. At the commencement of hostilities, Chile had dispatched a field mission of seventy-five commissioned officers to Santa Cruz to act as a training cadre and as volunteer replacements for Bolivian officers killed or wounded in battle. Colonel Vicuna, the unfortunate goat for the Bolivian

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defeat at Toledo, was the mission's commander. Idealism was hardly at the root of this gesture by the Chilean government. Battle experience and information on weapons and tactics were the primary objectives in this case. Brazil and Argentina did not dispatch contingents to either belligerent to take an active part in the fighting, choosing to maintain covert neutrality instead. However, the Argentine Defense Ministry deployed a large observation force near Yrendagüe in the Argentine Chaco from March of 1934 to the war's conclusion. Composed of five thousand infantry supported by cavalry, engineer, artillery, and air detachments, this group, equivalent to a corps in relative strength, was ostensibly present to prevent violation of Argentine territory by one or both of the belligerent armies crossing the Pilcomayo. Brazilian ground forces and naval patrols were also reinforced in the upper reaches of the Paraguay River, especially after several Bolivian aircraft mistook a Lloyd Brasilero steamer, the Paraguay, for a Paraguayan gunboat and heavily strafed her near Puerto Murtinho on November 29th, 1934. With grandstand seats for the action, these frontier

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1 Ibid., p. 43.
2 "Battle Of 100 Hours Ends," Literary Digest, CXVII (April 28, 1934), 15.
3 Ibid.
forces lost little time in grasping the significance of the Chaco fighting, particularly concerning the use and misuse of artillery and mortars. Their observations were no doubt supplemented by the reports of the official military missions present on either side of the front lines, and jointly filed with their respective defense ministries for future reference. There has been prior speculation that the presence of such large, well-equipped contingents on the neutral sides of the Paraguay and Pilcomayo indicated that armed intervention on the part of Brazil or Argentina would be forthcoming when an opportunity presented itself, such as the weakening of one of the warring nations. It is difficult to confirm or deny such speculation in view of the existing accounts, although Argentina's diplomatic attitude showed her to be plainly pro-Paraguayan and Brazil was at best lukewarm towards the Bolivian claims on the Chaco. Regardless of these considerations, neither nation made a hostile move, and the frontier forces contented themselves with watching the conflict roll northwards. At the domestic level, their recorded impressions produced significant results in financial allotments for military spending, purchase of arms overseas, and national planning for future military conflicts. For instance, the Brazilian military budget in 1934 was doubled from its previous figure of two hundred million cruzeiros, with a sizable portion of

\footnote{Ibid.}
the funds being alloted for the purchase of light artillery, communications equipment, mortars, and allied items.\(^1\) Within the respective armed forces establishments, standardization of fieldpieces and mortars was speeded up, and new training manuals covering operations in irregular terrain were hurriedly developed. Standardization became so much the order of the day that by 1935, all three nations had adopted the Stokes-Brandt mortar as their prime weapon for close support of the infantry.\(^2\) In comparison with current efforts to bridge certain technological gaps within a modernized army, this somewhat frantic re-tooling might seem wasteful in view of the support weapons the present-day infantryman has at his command. To the ABC powers, however, such re-emphasis was vital at that moment. They had no means of predicting if the war in the Chaco might spill over the natural barriers of the two rivers, and decided that a little preparation would go a long way towards preventing their unwitting entry into the conflict, or towards bringing it to a quick conclusion should they be forced to enter the arena.

The lessons learned in the Chaco, irrespective of the accen-
tuated primacy of the infantry in tropical warfare, still point to one indisputable fact; namely, that support fires of a heavier variety


\(^2\)González, op. cit., p. 34.
than carried by small arms are necessary even under adverse
conditions of terrain and climate. There is no refuting the obvious
contention that field artillery, mortars, and allied weapons played
a secondary role in a conflict undreamed of by theoreticians of the
stature of Clausewitz and Foch. Certainly, the standards of
murderous efficiency established in World War I were not met in
the Chaco, despite the high casualty rates suffered by both sides.
Arthur T. Watkins offers an explanation for this phenomena, when
he states that:

"The mortality per cent of the fighting troops
is considerably higher than in the Great War, being
about one in five as compared with one in eleven.
This is not caused by any superior engines of destruc-
tion that have been invented in the last decade of
progress, for no weapons of any importance are
employed in the Chaco which were not in use during
the Great War, while many, such as tanks, gas, and
heavy artillery, are impractical and seldom or
never used. It is the deadly climate, the mosquitoes,
and the bad water that send up the death toll, coupled
with the fact that primitive medical arrangements
and difficulty of transport made recovery from even
a slight wound an...event."\(^1\)

The see-saw nature of the conflict, with its emphasis upon
strategic position and limited freedom of troop movement, forced
planners and commanders of both armies to drastically alter the
traditional doctrines concerning artillery and mortar usage left

\(^{1}\text{Arthur T. Watkins, "The Chaco War," Contemporary}
\text{Review, CXLVII (May, 1934), 590.}\)
behind by the departed foreign advisory missions in order to meet the problems posed by a difficult environment and achieve their desired objectives. Immediate amendment of these principles by the Paraguayan armies did not insure immediate success in the field, but proved to be the first step in that direction. The unwillingness of Bolivian field commanders such as Toro and Peñaranda to scrap the outmoded German system, even after Kundt's demise, foretold the drawn-out, agonizing failure of their field forces to conquer the Chaco, or to even hold what had been seized and developed.

In a lecture to the Cadet Class of 1943 at the National Military School in May of 1939, Estigarribia, newly-made a Field Marshal, stated the reasons for the underdeveloped state of Paraguay's artillery at the beginning of the conflict as being ones of technical deficiency and high cost. In conclusion, however, he remarked:

"It is evident, nevertheless, that for the reason of the potency of its projectiles, the artillery ought not to be depreciated."\(^1\)

From a modern vantage point, these words appear slightly dated in the era of nuclear confrontation, where the modern artillery of the Marshal's day has been supplanted by a variety of missiles, ten times as destructive as a 75 mm. howitzer firing

\(^1\) Decoud, op. cit., p. 17.
point-blank over open sights. As in the Chaco, the military establishments of the entire world have encountered numerous situations in the past twenty years where unorthodox use of simple weapons was essential. A guided missile or jet bomber can be used against industrial complexes or large, unshielded troop concentrations, but what value does it have against strongpoints deep in a rain forest or scattered throughout a mountain chain? Conventional field artillery and mortars must still fulfill this mission in regular warfare, or in informal, guerilla-type situations. Past experience in China, Malaya, Algeria, Sinai, and now Viet Nam has demonstrated that even the most fanatically dedicated irregulars cannot hope for tactical success against regular troops without the assistance of portable, heavy-caliber artillery, mortars, or recoiless rifles in direct or indirect support. To reduce a complex of pillboxes, or destroy a supply column, simplicity is a basic requirement, not technical complication. Competently-handled, mobile artillery and mortars are capable of performing tasks such as these, without resorting to heavier forms of support. Considerations of cause and chronology aside, the rule of thumb illustrated by the infantry support units of Bolivia and Paraguay in the hell that was the Chaco are obvious. Infantry in any circumstance may take the high ground and hold it for an indefinite period, but the taking and holding must rely upon support from another source, whether it be mortars or missiles.
NOTE ON MAP, PHOTO, AND STATISTICAL SOURCES

The maps used within the text were derived from David H. Zook's volume on the military aspects of the Chaco War. Map I can be found in the frontispiece of this work, and Map II on Page 87.

Statistics and photographs of the primary infantry support weapons used by both armies were derived from Enrique Vidaurre's work on the munitions used in the Chaco. The statistical information may be found on pages 146, 147, 148, 152-62, 172-75, and 214-23. The photographs and two ink sketches were reproduced by Xerox copying, and are located on pages 144, 176, 178, 214, 216, and 220.
I. THE STOKES-BRANDT 81 MM. MORTAR:

Assembled Weight -- 64.0 kilograms
Weight of Tube -- 20 kilograms
Weight of Tripod -- 18 kilograms
Weight of Base Plate -- 22 kilograms
Accessory Weight -- 4 kilograms
Effective Trajectory -- 70.2 millimeters
Projectile Range (w/normal 3300 kg shells) -- 3,000 yards
(w/supercharged 6500 shells) -- 4,500 yards
Shell Velocity -- 30 revolutions per minute

II. THE A. A. C. 105 MM. MORTAR:

Assembled Weight -- 58.5 kilograms
Weight of Tube -- 29.5 kilograms
Weight of Base Plate and Tripod -- 24 kilograms
Accessory Weight -- 5 kilograms
Effective Trajectory -- 68.5 millimeters
 Projectile Range (w/ A. A. C. common) -- 1,500 yards
            (w/supercharged) -- 1,650 yards
Shell Velocity -- 20 revolutions per minute

III. THE VICKERS 65 MM. INFANTRY HOWITZER (MODEL 1926):

Weight of Cannon w/Breech and Carriage -- 84.4 kilograms
Weight of Breech Mechanism -- 17.2 kilograms
Weight of Carriage -- 27.2 kilograms
Weight of Barrel -- 39.9 kilograms
Length of Barrel -- 1128.9 inches
Carriage Wheelspan -- 221 inches
Caliber -- 65 mm.
Muzzle Velocity -- 18 r.p.m.
No. of Rotating Bands -- 20
Weight as Mountain Piece (minus louver) -- 204.1 kilograms
Weight (w/louver and heavy tires) -- 288.5 kilograms
Estimated Range -- 2,760 yards (at extreme elevation)
Approximate Elevation -- 35 to 40 degrees
IV. THE SCHNEIDER-CREUSOT 75 MM. MOUNTAIN HOWITZER (MODEL 1927):

Weight of Cann w/Breech and Carriage -- 1850 kilograms
Weight of Breech Mechanism -- 27.3 kilograms
Weight of Carriage -- 25.1 kilograms
Weight of Barrel -- 18.6 kilograms
Length of Barrel -- 1415 inches
Carriage Wheelspan -- 302 inches
Caliber -- 75 mm. (3 inch)
Muzzle Velocity -- 480 r.p.m.
No. of Rotating Bands -- 24
Recoil Length -- 1,070 mm.
Estimated Range -- 3,451 yards
Maximum Elevation in Train -- 880 mm.
Brake Fluid -- liquid glycerine and distilled water w/borax
Recoil Mechanism Fluid -- Liquid glycerine and distilled water w/caustic soda.

V. THE VICKERS 75 MM. MOUNTAIN HOWITZER (MODEL 1926):

Weight of Assembled Piece -- 3,937 kilograms
Length of Piece -- 241.6 inches
Carriage Wheelspan -- 540 inches
Caliber -- 75 mm. (3 inch)
Muzzle Velocity -- 475 r.p.m.
No. of Rotating Bands -- 24
Recoil Length -- 1,092 mm.
Estimated Range -- 4,021 yards
Maximum Elevation in Train -- 1,070.6 mm.
Brake Fluid Capacity -- 480 liters
Weight of Piece as Mountain Howitzer -- 876.3 kilograms
as Field Howitzer -- 1,335 kilograms

VI. THE KRUPP 75 MM. MOUNTAIN HOWITZER (MODEL 1898):

Weight of Assembled Piece -- 181.4 kilograms
Length of Piece -- 1,441.5 inches
Carriage Wheelspan -- 482 inches
Caliber -- 75 mm. (3 inch)
Muzzle Velocity -- 478 r.p.m.
No. of Rotating Bands -- 24
Recoil Length -- 1,231 mm.
Estimated Range -- 3,435 yards
Maximum Elevation in Train -- 841 mm.
VII. THE VICKERS 105 MM. HOWITZER (MODELS B AND C: 1926):

Series B:

Weight of Assembled Piece -- 590 kilograms
Length of Piece -- 2,352.3 inches
Carriage Wheelspan -- 473 inches
Caliber -- 105 mm.
Muzzle Velocity -- 490 r.p.m.
Recoil Length -- 1,118 mm.
No. of Rotating Bands -- 32
Estimated Range -- 1,021 yards
Maximum Elevation in Train -- 2,205 mm.

Series C:

Weight of Assembled Piece -- 264 kilograms
Length of Piece -- 1,302.3 inches
Carriage Wheelspan -- 473 inches
Caliber -- 105 mm.
Muzzle Velocity -- 483 r.p.m.
Recoil Length -- 1,155 mm.
No. of Rotating Bands -- 32
Estimated Range -- 1,354 yards
Maximum Elevation in Train -- 879 mm.
PLATE I: STOKES-BRANDT 81MM MORTAR
IN FIRING POSITION
PLATE II: AMERICAN ARMAMENT CORPORATION
105MM MORTAR IN FIRING POSITION
PLATE III: VICKERS 65MM INFANTRY HOWITZER
IN A TYPICAL BATTLEFIELD SETTING
PLATE IV: 28/20MM ANTI-TANK/ANTI-AIRCRAFT CANNON IN THE TRENCHES
PLATE VI: SCHNEIDER-CREUSOT 105MM HOWITZER
MODEL 1927
PLATE VII: VICKERS 105MM HOWITZER
MODEL 1926 B
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