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Rethinking and Relearning Modern  
Warfare: The Influence of Geography  
and the Environment on the Process of  
Fighting World War II in the Pacific

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Rethinking and Relearning Modern Warfare:  
The Influence of Geography and the Environment on the Process of Fighting  
World War II in the Pacific

History 400B

By  
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**Introduction**

While the second World War is often seen as a singular, worldwide conflict, it is better viewed as two separate but simultaneous conflicts: the European Theater, encompassing the fighting in Europe and North Africa, and the Pacific Theater, encompassing the fighting across the Pacific Ocean region. This distinction must be made because the fighting was quite different in the two theaters, despite the common belligerents and the fact that both conflicts were taking place at the same time.

But why must the fighting in the Pacific and European theaters be considered separately? It is fundamentally an issue of geography. The character of the war in the two theaters was different because the divergent geography of the regions in which the war would be fought. **The geography of the Pacific Ocean region, and of the various islands in the Pacific region that would become the battlefields of the war in the Pacific, would each leave their own indelible mark on the fighting. Strategic and tactical doctrine would have to be adapted to the unique conditions found on many of the islands. Technological advances would have to be made in order to make the large scale amphibious landings feasible, and the environmental factors present on many islands necessitated massive scientific efforts.** Concepts of warfare rooted in hundreds of years of Western conflicts spanning Europe and the Americas would often be inapplicable in the Pacific. The geography of the Pacific would force the combatants to plan their moves, both offensively and defensively, around the terrain of the islands, and the vast expanses of the Pacific ocean.

In his magisterial work to catalogue the geographic and geologic

peculiarities of each island that played a part in the fighting in the Pacific Theater, Gordon L. Rottman observed that “The Pacific theater in World War II...  
...presented an extremely difficult strategic and tactical operating environment to all of the belligerents.”<sup>1</sup> Not only would the logistical challenges posed by the expanses of the Pacific prove daunting, but that “coupled with the vast distances, inhospitable climate, rugged terrain, the variables found on different islands, and the very nature of the reality of combat in the Pacific, it was one of the most difficult and challenging military theaters of operations experienced.”<sup>2</sup>

Each major war or conflict has been built upon lessons learned in the last war. The collective knowledge of war is continually added to, refined, and applied in the next conflict. The opening days of World War II in Europe saw a frightening display of the application of highly refined combined arms warfare strategy, in the form of the German *blitzkrieg*. The emergent concept of “combined arms” warfare was perhaps best defined in a modern sense in 1907 by British Maj. Gerald Gilbert, when he observed that “We have gotten into the fashion of talking of cavalry tactics, artillery tactics, and infantry tactics. This distinction is nothing but a mere abstraction. There is but one art, and that is of the combined arms.”<sup>3</sup> The German *blitzkrieg* doctrine was perhaps the most adept application of this theory of warfare at the time, and today is still cited as one of the most enduring lessons of the war. However, it was not the only lesson learned from the war, and the

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□ Gordon L. Rottman, *World War II Pacific Island Guide: A Geo-Military Study* (London, UK: Greenwood Press, 2002), 1.

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□ Rottman, *Pacific Island Guide*, 1.

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□ Gerald Gilbert, *The Evolution of Tactics* (London, 1907), 183-184.

lessons learned of the German model of combined arms warfare would have little to no bearing on the other side of the world, on the islands of the Pacific.

In his *magnum opus* on the topic of combined arms, Jonathan M. House wrote that “the mechanized combined arms force came of age in this war.”<sup>4</sup> While this is true of the war in Europe, the war in the Pacific was a very different matter. Rather than building off of the experiences and teachings of the previous war, the war in the Pacific forced those in command to rethink the lessons that they had learned from the previous wars, and even from the opening stages of the war in Europe. The Pacific would force those in command to relearn how to fight a war, and adapt their strategies and tactics to the geography of the Pacific.

This quandary that the officers would find themselves in is perhaps best exemplified in this passage from Josephine C. Bresnehan’s dissertation on the topic of combat fatigue in the Pacific:

As the old West Point adage had it, after all, getting an infantry division to carry out its first successful engagement was teaching a horse to waltz. At the start of the fighting, many military commanders may not have anticipated how difficult leading the dance might be in the Pacific theater. Neither their profession experience nor their experience in the last war could have prepared them for the conditions under which commanders had to map out ground strategy and show their line officers how to motivate and lead their troops in what were then called the Solomon Islands and New Guinea in 1942 and 1943.<sup>5</sup>

The geography of the Pacific seemingly took military planners by surprise:

despite the

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□ Jonathan M. House, *Toward Combined Arms Warfare: A Survey of 20th-Century Tactics, Doctrine, and Organization* (Fort Leavenworth, KS: US Army Command and General Staff College, 1984), 79.

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□ Josephine C. Bresnehan, *Dangers In Paradise: The Battle Against Combat Fatigue in the Pacific War*, Ph. D. dissertation, Harvard University, 1999 (Ann Arbor, MI: UMI, 2000), 95.

previous experiences of the United States fighting a relatively high intensity conflict in the Philippines at the turn of the 20th Century,<sup>6</sup> the United States seemed to come into the fighting in the Pacific as if it had never known combat in the region. The lessons that might have been learned during the Philippine-American War seem to have been almost entirely discarded in favor of the more recent lessons learned from the First World War, despite the massive geographic dissimilarities between the Pacific and Europe.

However, it would be remiss to say that the United States made no conscious effort to prepare for such a war. The American military establishment had actually spend much of the previous two decades preparing for a war with Japan, centered around a series of war plans labeled War Plan Orange.<sup>7</sup> While War Plan Orange proved to be instrumental in the actual strategic prosecution of the war, it was a document purely of strategy, and gave little thought to the geographic and environmental conditions that American forces would encounter in the Theater.

However, the importance of War Plan Orange should not be entirely discounted, as it was instrumental in preparing the armed forces of the United States for the war in the Pacific, regardless of its unanticipated shortcomings. War Plan Orange was a theoretical War Plan created in the interwar period to speculate as to what might happen in a war between the United States and

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□ David J. Silby, *A War of Frontier and Empire: The Philippine-American War, 1899-1902* (New York, NY: Hill and Wang, 2007), xiv-xv.

7

□ Donald L. Miller, *D-Days in the Pacific* (New York, NY: Simon & Schuster Paperbacks, 2005), 97.

Japan. As in all of the war plans of the period, the United States was the Blue country, and a country representing Japan was labeled as the Orange country, thus the designation War Plan Orange.<sup>8</sup> While various iterations of the plan were considered by military staff for some time, the first formalized plan to be signed off on by the Secretaries of War and the Navy were drafted in 1924.<sup>9</sup> The creation of War Plan Orange was motivated by two things: the ascension of Japan to relevance on the international stage,<sup>10</sup> and the desire of the Marine Corps to continue their existence as an independent branch.<sup>11</sup>

Following World War I, the Army claimed that the existence of the Marine Corps was redundant, citing the fact that the Marines had been used solely as land based infantry in France, and thus fulfilled a role no different than that of the Army.<sup>12</sup> But a conflict in which the war would be decided solely based on the success or failure of amphibious assaults against fortified beaches would necessitate the existence of a branch of the American armed forces that would be capable of such tasks, and as such, this new doctrine would not only be

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□ Edward S. Miller, *War Plan Orange: The U.S. Strategy to Defeat Japan, 1897-1945* (Annapolis, MD: Naval Institute Press, 1991), 1.

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□ E. S. Miller, *War Plan Orange*, 2.

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□ By the late 1930's, the theoretical war between Japan and the United States as projected in War Plan Orange bore a striking resemblance to the war that would eventually take place. American military planners projected a situation in which a war would erupt between the two nations despite historical friendliness, one in which neither would be able to rely on substantial help from allies, and that the root cause of the war would be increasing Japanese desire for regional domination and access to critical industrial resources.

□ E. S. Miller, *War Plan Orange*, 3-5.

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□ D. L. Miller, *D-Days in the Pacific*, 97.

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□ D. L. Miller, *D-Days in the Pacific*, 97.

central to War Plan Orange, but also to Marine Corps training.

While many of the big picture questions regarding how a war would be fought in the Pacific between the United States and Japan were answered before the war ever broke out, thanks in large part to the foresight of the various strategic planners of the Marine Corps, the Army, and the Navy, many more questions would arise due to the peculiar geography of the Pacific after the task of fighting and winning such a war was actually at hand. These questions would form many of the critical stumbling blocks encountered by the American forces early in the war, and the answers to these questions would each provide their own incremental, but ultimately instrumental step towards the ultimate victory of the United States.

While Jonathan M. House may have seen the innovations in army group level combined arms warfare as one of the most important concepts to be taken away from the fighting in World War II, the fighting in the Pacific yielded a great number of innovations, ranging from strategic and tactical doctrinal innovations, to technological and medical innovations. The one thing that ties these various innovations together is that they were born out of necessity, as the US military found itself fighting not only a hostile and incredibly determined enemy, but also against unforgiving geographic conditions.

### **The Geography of the Theater, and the Question of Logistics**

In the beginning of his analysis of War Plan Orange, Edward S. Miller

observed that “geography is the bones of strategy.”<sup>13</sup> This is true on both the strategic and tactical level, and has been true throughout history. From the tactical level, many of the most memorable battles throughout history are as memorable as they are because of the ability of one side to adapt to the geography. The battle of Thermopylae might have been lost to history had the Greek forces not made their stand at a narrow bottleneck, and in doing so negated much of the numerical advantage that the Persian army possessed. Waterloo may have proceeded very differently had the Duke of Wellington not deployed his forces on the reverse slope of the raised road that ran through the battlefield, effectively negating the terrifying effect of the massed barrage of Napoleon’s *grande batterie*. The effective use of terrain, and the consideration of geography has always been a critical factor in the success or failure of an army in the field.

On the strategic level, this concept was perhaps never more true than in the Pacific. In order to successfully fight and win a war in the Pacific, the primary consideration of the planners had to be the Pacific Ocean itself, as “the war theater would extend across five thousand miles of the north Pacific from Hawaii to the Asian coast, a region of much water and little land.”<sup>14</sup> The war in the Pacific would not be one of grand land battles, battalion and brigade level maneuvers, and the highly advanced German style of combined arms warfare. Instead, it

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□ E. S. Miller, *War Plan Orange*, 4.

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□ E. S. Miller, *War Plan Orange*, 4.

would primarily be a maritime war,<sup>15</sup> punctuated by fierce battles over the tiny scraps of land dotting the vast expanses of the Pacific Ocean.

To understand why the Pacific Ocean itself was such an important strategic consideration, one must first understand the immense size of it. The Pacific Ocean covers some seventy million square miles (approximately one third of the total surface area of the earth), and is up to fifteen thousand miles across at its widest point, approximately 8° North, from Panama to the Malay peninsula.<sup>16</sup> In comparison, the entirety of Europe, from the Iberian peninsula to the Ural mountains, is only some four million square miles. The expanded European theater, including all of North Africa, would come in at just under twelve million square miles.

The immense scale of the Pacific caused logistical issues on a scale not before seen. The question of logistics, of how to supply a fighting army with all of the various forms of war materiel that it needs in order to fight, has long been one of the central concerns in warfare. From the baggage trains and camp followers of armies of antiquity, to the advances made in the Napoleonic wars, and subsequently studied by Carl von Clausewitz, the methods of supplying an army have always been important. Continental wars simplify the issue of logistics considerably: war materiel can be massed in the rear at supply depots, and distributed to the units on the front as needed. Just as the men on the front line are fed the supplies that they need by the supply depots in the rear, the supply

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□ E. S. Miller, *War Plan Orange*, 4.

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□ Rottman, *Pacific Island Guide*, 1.

depots are fed the supplies that they distribute from the industrial facilities of the country in question.

Unfortunately, this logistical model had to be heavily modified in order to fit in the Pacific. In the early stages of the fighting in the Pacific, a supply depot could be thousands of miles from a battle field. In *On War*, Carl von Clausewitz posed a question regarding whether war would dictate the system of subsistence, or whether the system of subsistence would instead dictate the course of the war.<sup>17</sup> Von Clausewitz determined that the system of subsistence would indeed dictate the course of the war, and perhaps never was this more true than in the Pacific. The Pacific was simply too vast for a traditional logistical model to work, and as such, the grand strategy of the war had to be molded around the logistical requirements of such a war. In the Pacific, it simply was not feasible to establish permanent and constant supply lines. Rather, as was the case on Guadalcanal,<sup>18</sup> the soldiers on the ground had to rely on that with which they came ashore, and on intermittent seaborne resupply convoys, which could

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□ Carl von Clausewitz, *On War*, trans. Col. J.J. Graham (Digireads.com Publishing, 2009), 227.

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□ At Guadalcanal, the American amphibious landing force was attacked by a naval task force led by Vice Admiral Gunichi Mikawa on the morning of 9 August, 1942. The American fleet was still in the process of offloading supplies, and had planned to withdraw some time that day after their air cover, headed by Vice Admiral Jack Fletcher's flagship USS *Saratoga* (CV-3), had withdrawn from the area late on 8 August. With part of the landing fleet sunk, and the rest withdrawing before having the chance to finish offloading supplies onto the beaches, the Marines on Guadalcanal were left perilously short of supplies, and would remain so until the US Navy could regain control of the sea in the Solomon Islands and around Guadalcanal. William Manchester characterized the predicament of the Marines at Guadalcanal as follows: "Bastogne was considered an epic in the [European Theater of Operations]. The 101st Airborne was surrounded there for eight days. But the Marines on Guadalcanal were isolated for over four months."

□ William Manchester, *Goodbye, Darkness: A Memoir of the Pacific War* (Boston: Little, Brown, 1987), 209.

□ D. L. Miller, *D-Days in the Pacific*, 49-52.

be intercepted and turned back or sunk.

Complicating matters was the fact that so little was known about the Pacific in comparison to Europe, which was thoroughly mapped, and had played host to an innumerable conflicts throughout human history. Rottman notes that what maps did exist often only detailed coastal terrain features, and had little to no information on the interiors of the islands.<sup>19</sup> As such, the forces involved in amphibious assaults at times had very little information regarding the actual sort of combat environment that they would be operating in after they made landfall. Furthermore, many of the available maps were outdated and inaccurate. Some of the naval charts used by the United States at the outbreak of the war dated as far back as the eighteenth century.<sup>20</sup> As such, American military forces would encounter situations such as a “ship, lying offshore of an island, reported she was one to one and one-half miles inland according to the chart,” and that “naval engagements were sometimes terminated for fear of running aground in uncharted waters.”<sup>21</sup>

What did this all mean? The war in the Pacific would have to proceed in a manner entirely unfamiliar to those planning the war. The grand battlefield that the Pacific ocean presented was as much of a mystery as the enemy. Unlike the familiar landscapes of Europe, the men fighting in the Pacific would be venturing into literally unknown territory. They would be relying on supply lines of

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□ Rottman, *Pacific Island Guide*, 5.

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□ Rottman, *Pacific Island Guide*, 5.

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□ Rottman, *Pacific Island Guide*, 5.

unprecedented lengths, and would be fighting across incomparable distances.

### **The Geography of the Islands, and the Implications on Combat**

For as expansive as the Pacific Ocean is, the vast majority of the islands of the Pacific that would play host to the land battles of the war were on the opposite end of the spectrum. While the theater was massive in overall size, the total amount of land that would end up being fought over was tiny, in comparison to the European theater. When you exclude Japan, Australia, New Zealand, New Guinea, the Philippines and the Dutch East Indies, the total land area of the remainder of the islands in the Pacific Ocean is just some 42,000 square miles: only slightly bigger than the state of Ohio.<sup>22 23</sup>

The relatively tiny amount of land present in the Pacific Ocean had a number of peculiar effects on the fighting that took place there. As outlined earlier, much of the doctrine of modern combined arms warfare had to be discarded: there simply was not room on many of the islands of the Pacific for the highly mobile tanks and other forms of modern armor to be particularly effective instruments of war. Even if there was room, many other conditions made armor a

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□ Rottman, *Pacific Island Guide*, 5.

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□ It is worth noting that other than New Guinea and the Philippines, none of these major island groups played host to major ground combat. As such, I believe that Rottman was fair in eliminating them when discussing the relative amount of land area in the Pacific Ocean region. The vast majority of land engagements took place on the various smaller islands that remain in consideration in this comparative assessment. Additionally, the land based combat that took place on New Guinea and the Philippines was rather uncharacteristic of the combat that took place in the rest of the Pacific: while many of the same environmental factors were present on these larger islands and island groups, the vastly increased amount of land led to combat situations that much more closely resembled the sort of fighting that was taking place in the European Theater.

very unattractive option. Ranging from swamps, to fine volcanic sand and ash,<sup>24</sup> as well as steep terrain, the geography of the islands in the Pacific was not conducive to tanks and many other modern weapons of war. In many senses, the war in the Pacific was a war that was fought and won by the infantryman and his rifle. Hanson W. Baldwin perhaps best characterized the nature of the fighting in the Pacific when he claimed that “It is the man on two feet with hand grenades, rifle and bayonet - backed by all that modern science can devise - the man with fear in his stomach but a fighting heart, who must secure beachheads. He it is who wins the glory and pays the price, who changes the course of history. Man is still supreme in mechanistic war.”<sup>25</sup>

The nature of the fighting once on land was not the only concern in the Pacific. While the confines of the islands that served as the battlefields of the Pacific had their own effect on the fighting, the most unique aspect of the fighting was in fact how the soldiers got to the fight. In the Pacific, armies did not maneuver, feint, flank, withdraw, and regroup. The battlefields were not simply where two armies happened to meet on campaign. The battlefields were the beachheads, and often every last inch of the island past the beach. American commanders did not have the luxury of fielding the entirety of their forces before battle was joined. Rather, the first waves of soldiers to hit the beach found themselves under heavy fire. They were outnumbered, outgunned and pinned down on the beach, and would often remain so until they could build up the

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□ D. L. Miller, *D-Days in the Pacific*, 251-252.

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□ D. L. Miller, *D-Days in the Pacific*, xv.

critical mass of forces necessary to begin conducting effective offensive operations inland. While the defending force has always held an edge over the attacking force in warfare, this advantage was particularly pronounced in the Pacific, as the attacking forces were disadvantaged to a significant degree due to the constraints placed on the attack by the nature of amphibious landings.

However, the fact that the attacking American forces had to arrive piecemeal aboard waves of landing craft was not the only significant advantage afforded to the defenders in the Pacific. Due to geologic forces, the landing sites were incredibly predictable, and thus very easy to defend. Some islands would only have a few suitable beaches to put ashore landing craft, with the rest of the coast being dominated by rocky shores and cliffs.

One of the bigger impediments to the amphibious assault forces provided by the islands of the Pacific would prove to be the coral reefs found around many of the islands. At the outbreak of the war, very little was known about coral, and of how it would impact the fighting in the Pacific.<sup>26</sup> The coral reefs surrounding many of the islands in the Pacific proved to be extremely difficult obstacles when it came time to mount amphibious assaults upon them. On the windward side of islands, the coral reefs tended to be narrower, but were far less predictable, and tended to have a far greater density of potholes and coral heads. Additionally, there was significantly more wave action on the windward side of islands, which, when combined with the treacherous and unpredictable nature of the reefs,

served to make amphibious landings difficult.<sup>27</sup>

On the other hand, the leeward side of the islands was more sheltered and tended to have less wave action, but much wider coral reefs. Depending on tides, the reefs could be covered by as little as just a few inches of water at low tide, or by several feet of water at high tide.<sup>28</sup> While the leeward side of the island was often preferred due to more predictable nature of the reef, landings on the leeward side could often be disastrous, such as at Tarawa, where unexpectedly low tides forced many members of the assault force to disembark from their landing craft hundreds of yards from shore after the boats became stuck on the reef.<sup>29</sup>

Once ashore, further difficulties were encountered. The defenders could already prepare their defenses with a great bias towards the likely landing sites, and had ample time to prepare the rest of their defenses throughout the island. On Peleliu, the Japanese garrison had prepared a frightening series of defenses. To the left (north) of the landing beaches was a heavily fortified point that provided the defenders a well protected position from which to pour enfilade fire onto the landing beach. So impressive were the Japanese fortifications on the Point that the Marine Corps would go on to build a full scale mock up of it at Quantico as an example for officers in training of "how to assault a 'doomsday'

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□ Rottman, *Pacific Island Guide*, 9.

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□ Rottman, *Pacific Island Guide*, 9.

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□ Rottman, *Pacific Island Guide*, 9; "Secretary Knox Blames Wind for Tarawa Losses," *Los Angeles Times (1923-Current File)*, Dec 01, 1943, <http://ezproxy.ups.edu/login?url=http://search.proquest.com/docview/165498576?accountid=1627>

defense.”<sup>30</sup>

Once the beaches had been secured and the Point neutralized, the assault force came across the Umurbrogol: a series of coral<sup>31</sup> and stone ridges that housed an impressive set of fortifications. These defenses featured “Well dug in pillboxes and fortified cave positions [that] were developed in depth with interlocking fields of fire providing mutual support. The natural defenses were reinforced by elaborate tunnel systems...”<sup>32</sup> which were further augmented by defenses including armored steel doors which “covered the entrances to caves with the biggest guns... The largest of them held a thousand men and a number of the caves were five and six stories deep. The caves were ideally located for defense, in a 300-foot-high mountain of jagged coral, with sheer cliffs.”<sup>33</sup>

Peleliu was just one example of impressive defensive value afforded by the terrain of many of the islands in the Pacific. On Iwo Jima, Mount Suribachi was turned into a honeycomb of tunnels, pill boxes and fortified bunkers.<sup>34</sup> On Okinawa, General Mitsuru Ushijima concentrated almost the entirety of his forces in and around the cliffs and ridges around Shuri castle, on the south end of the

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□ D. L. Miller, *D-Days in the Pacific*, 171-172.

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□ The coral of Peleliu was noted for being particularly difficult. Not only did it tear through the boots of the soldiers fighting on the island at an impressive rate (Eugene B. Sledge, *With the Old Breed: At Okinawa and Peleliu* (New York, NY: Presidio Press, 2010), 155), and for its tendency to fragment.

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□ Rottman, *Pacific Island Guide*, 402.

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□ D. L. Miller, *D-Days in the Pacific*, 169.

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□ Rottman, *Pacific Island Guide*, 424.

island. Ushijima supervised the construction of an array of fortifications based around these natural defenses, in addition to converting the traditional Okinawan underground tombs into bomb shelters and fortified command posts.<sup>35</sup>

Finally, the small size of the islands, along with the relatively large garrisons of defenders and assault forces, led to some of the most cramped conditions in modern warfare. On Iwo Jima, the Japanese Garrison numbered some 21,000 defenders, and the American invasion force numbered some 70,000 men. Over 90,000 men would be fighting over an island that measured approximately eight square miles<sup>36</sup>--a human density that would put Iwo Jima on par with some of the more densely populated urban centers in 2013. With the sheer number of soldiers on both sides, and the limited land, the battles often devolved into something reminiscent of a scrum in rugby: two opposing forces grinding one another down at close range until one side is forced to cede. A Marine major observed that the fighting on Iwo Jima was similar to a football game, with one major caveat: you could not "run the ends up there... Every play is between the tackles."<sup>37</sup> The density of soldiers of Iwo Jima had another tragic effect: the effect of artillery was magnified to a frightening extent. With so many soldiers packed into such a small area, not only was artillery more likely to hit the men, but it often hit a far greater number of men than in other areas. This was part of the reason why 8% of American servicemen wounded on Iwo Jima would

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□ D. L. Miller, *D-Days in the Pacific*, 281.

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□ D. L. Miller, *D-Days in the Pacific*, 253-254.

37

□ D. L. Miller, *D-Days in the Pacific*, 247.

die of their wounds, almost triple the fatality rate for wounded American soldiers for the rest of World War II (3%).<sup>38</sup>

Near the end of the campaign on Okinawa in 1945, as American forces began to assault the Japanese fortifications on the Shuri Line, centered on Shuri Castle on the southern end of Okinawa, the density of combatants reached levels unseen at any other point in modern warfare. William Manchester described the scene along the Shuri line in a manner which cannot be equaled:

Counting both sides, the [Shuri Line] represented an extraordinary concentration of 300,000 fighting men and countless terrified civilians, on a battleground that was about as wide as the distance between Capitol Hill in Washington and Arlington National Cemetery. In the densest combat of World War I, battalion frontage<sup>39</sup> had been approximately eight hundred yards. Here it was less than six hundred yards. ...there was nothing green left; artillery had denuded and scarred every inch of ground."<sup>40</sup>

It is difficult to put into words what this meant. The trench warfare that characterized World War I is often remembered as some of the most densely packed, hellish fighting in modern times, and not unrightfully so. Yet, on Okinawa, the soldiers were packed in 25% more densely. Along the front line, on average, there was a man less than every two feet. These were the sort of combat conditions that the islands of the Pacific engendered.

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□ D. L. Miller, *D-Days in the Pacific*, 254-255.

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□ Battalion frontage is a metric with which to consider the density of soldiers on the main line of resistance, or the front line. Battalion frontage is defined as the linear area of the front line that is covered by one battalion (approximately 1000 men in this case).

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□ Manchester, *Goodbye, Darkness*, 411-412.

## Environmental Factors, Tropical Disease, and Medical Factors

The islands of the south and central Pacific regions were all tropical or sub-tropical; they tended to have high temperatures and high humidity-- conditions which are noted to produce enervating effects on individuals not accustomed to them.<sup>41</sup> These islands often played host to a great number of tropical diseases. While malaria was the most prevalent of the tropical diseases, and tends to get the most attention, the men fighting in the Pacific were exposed to a wide range of other diseases such as dysentery, beriberi, dengue fever, leprosy, and hookworm.<sup>42</sup> Gordon Rottman notes that “the horrid living conditions imposed by combat in such an environment only inflicted more suffering on combatants.”<sup>43</sup> The environmental conditions in the Pacific were extremely challenging: the issues of temperature and humidity contributed to exhaustion, fatigue, and sleep deprivation; the near constant rains and presence of swamps contributed to trench foot; the logistical challenges led to increased rates of dehydration<sup>44</sup> and malnutrition (which contributed to the contraction of beriberi); the constant mental stress of operating in such an environment led to a higher

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□ Rottman, *Pacific Island Guide*, 10.

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□ Rottman, *Pacific Island Guide*, 10.

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□ Rottman, *Pacific Island Guide*, 10.

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□ Eugene B. Sledge, in particular, notes the difficulties of obtaining water in the early stages of a campaign, in his case on Peleliu. He was forced to consume salt tablets to replace what was lost in his sweat, but only had one canteen full of water, and had no idea when they might get resupplied (Sledge, *With the Old Breed*, 67). When they were eventually resupplied, the water was transported and brought ashore in former oil drums. However, the drums had not been adequately cleaned, and the entire first shipment of water was contaminated by oil (Sledge, *With the Old Breed*, 76-77).

incidence of the psychological illness combat fatigue, as well as an increase in non-combat accidents and self-inflicted wounds.<sup>45</sup> These factors, combined with the ferocity of the combat experienced in the Pacific, resulted in a massive disparity in casualty rates in the Pacific and in the European theater: 2.16 casualties per 1000 soldiers per day in Europe, compared to a staggering 7.45 casualties per 1000 soldiers per day in the Pacific.<sup>46</sup>

One of the defining aspects of the war in the Pacific was the oppressive presence of the myriad of tropical diseases in the region. Early in the war, before effective prevention and treatment plans were in place, the rate of disease and illness related casualties far outstripped the rate of casualties caused directly by combat. This was perhaps most pronounced during the New Guinea campaign, where malaria was the worst offender: “Malaria struck down half a million American servicemen in the Pacific War. At the start of the New Guinea campaign [January 1942], malaria produced four times as many allied casualties as did Japanese weapons.”<sup>47</sup> Robert Leckie vividly describes the ravages that malaria visited upon so many American soldiers, recalling that he could neither eat nor drink, and had to be fed intravenously for approximately two weeks. Leckie described his fevers as leaving him to feel “baking... feeling the will to live shriveling within me, yearning only for a tiny trickle of sweat to burst from my

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□ Rottman, *Pacific Island Guide*, 10.

46

□ Rottman, *Pacific Island Guide*, 10.

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□ Mary Ellen Condon-Rall, “Malaria in the Southwest Pacific in World War II 1940-1944,” in *Science and the Pacific War*, ed. Roy M. MacLeod (Boston, MA: Kluwer Academic Publishers, 2000), 51.

desiccated flesh.”<sup>48</sup>

In addition to near catastrophic malaria rates early on in the Pacific, American forces also encountered another epidemic: psychiatric disability. As noted earlier, the conditions in the Pacific were sufficient to considerably exacerbate the ever present threat of psychiatric casualties presented by war, commonly lumped together into catch all terms such as “shell shock” (prevalent during World War I) and “combat fatigue,” or “Guadalcanal Neurosis.” Combat fatigue became the new catch-all term in World War II after it was discovered that the psychiatric issues encountered were not a direct result of the concussive effects of high explosive shelling. “Guadalcanal Neurosis” was an early diagnosis for combat fatigue after it reached near epidemic rates on Guadalcanal.<sup>49</sup>

Josephine Bresnehan notes that within six months of the outbreak of the fighting, “the difference between soldiers expectations and their experiences had generated more physical and psychological distress than their training taught them to handle and thus began to precipitate a morale meltdown in the Pacific theater.”<sup>50</sup> The psychiatric crisis in the Pacific only got worse: by October of 1943, more than 10,000 men were being discharged per month due to what was being labeled as psychiatric disabilities.<sup>51</sup> In some areas, these psychiatric casualties

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□ Robert Leckie, *Helmet for my Pillow: From Parris Island to the Pacific* (New York, NY: Bantam Books, 2010), 252.

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□ Bresnehan, *Dangers in Paradise*, 2.

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□ Bresnehan, *Dangers in Paradise*, 92.

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□ This number represents only those who were able to be removed from combat, diagnosed, and discharged. Many more men who suffered from mental breakdowns would die

made up more than half of all casualties,<sup>52</sup> with the balance of the casualties being made up of men stricken by disease, and those wounded by enemy fire.

### **Science in the Pacific: Overcoming the Geography, Overcoming the Environment**

It should be clear at this point that the military forces of the United States were effectively fighting two enemies in the Pacific theater: the military forces of Japan, and the Pacific region itself. In order to conquer both of these enemies, the Pacific became the grounds for the deployment of an unprecedented number of new technological and and medical advances:

“The list of new science-based innovations far outshone the list imagined by H.G. Wells on the eve of the Great War, or available to Field Marshal Douglas Haig at its end. Radar, rockets, improved systems of fire control; explosives, propellants, flame-throwers and napalm; advanced chemical weapons; and the applications of operational research emerged alongside penicillin and anti-malarial drugs, improved means of storing and shipping blood, and new and powerful insecticides.”<sup>53</sup>

By war’s end, the American military would find itself relying heavily on the achievements of scientists back home, and on new technology that had not existed at the beginning of the war.

At first, the high command in the American military attempted to simply

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before they were able to be removed from combat, either from enemy fire, or friendly. Sledge details an event where a man suffered a mental breakdown at night while on the front line, facing uncertain enemy dispositions in the area, and was bludgeoned to death with an entrenching tool by another Marine in an attempt to quiet him lest he alert the Japanese to their position.

□ Sledge, *With the Old Breed*, 101-102.

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□ Bresnehan, *Dangers in Paradise*, 3.

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□ Roy M. Macleod, *Science and the Pacific War* (Boston, MA: Kluwer Academic Publishers, 2000), 4.

push through the fighting conditions in the Pacific. At the outbreak of the war, the attitude of American officers towards the environmental factors in the Pacific was best summed up in this quote attributed to an anonymous high ranking officer: "We are here to kill Japs and to hell with mosquitoes."<sup>54</sup> There was effectively no effort by the officer corps to attempt to control malaria, and its prevention was seemingly the last thing on the minds of those in command.

However, as malaria and other tropical disease related casualty rates continued to spiral out of control, and reached the point that they were seriously compromising the American war effort,<sup>55</sup> the American high command began to take action. For the rest of the war, the military community would work hand in hand with the scientific community at an unprecedented level. It was because of the geographic and environmental factors present in the Pacific that the military was forced to "[mobilize] scientific knowledge on behalf of the fighting soldier."<sup>56</sup> World War II, and especially the campaign in the Pacific, represented the first time in history that a major war would be "affected decisively by weapons

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□ Robert J.T. Joy, "Malaria in American troops in the South and Southwest Pacific in World War II," *Medical History* 43: 199.

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□ Joy notes that by November of 1942 on Guadalcanal, as much as 12% of the total American force on the island was combat ineffective due to malaria. Casualty rates for malaria climbed to 1500 cases per 1000 soldiers per year. The malaria epidemic among American forces on Guadalcanal that Major General Vandegrift issued an informal order that a soldier could not be excused from line duty unless his fever measured over 103°F. Significantly more than 12% of American forces would have been ill with malaria at any given time, it was only that 12% that rated as being unfit for combat duty due to their illness.

□ Robert J.T. Joy, "Malaria in American troops in the South and Southwest Pacific in World War II," *Medical History* 43: 198.

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□ Condon-Rall, "Malaria in the Southwest Pacific in World War II 1940-1944," 51.

unknown at the outbreak of the war.”<sup>57</sup> It was not just newly developed weapons that would help win the war: it was also the technological and medical efforts of the scientists and doctors.

In November of 1942, just as the malaria epidemic on Guadalcanal was reaching its height, Admiral William “Bull” F. Halsey, Jr., the newly promoted commander of the South Pacific (SOPAC) region, authorized the creation of malaria control units, and ordered all officers in theater to comply with the control units. Officers were instructed to consult malaria control units before the establishment of any camps or airfields, so as to avoid placing areas of permanent or long term habitation near local hyper-endemic malaria zones.<sup>58</sup> Additionally, soldiers began to be issued quinine and mosquito nets as preventative measures.<sup>59</sup> Clothing began to be regulated after General George C. Kenney ran an experiment at the behest of medical officers. He had one group of men wear long sleeves and pants while on duty, and the other group wear short sleeves and pants. At the end of the month, there were a total of two cases of malaria in the former group, compared to a staggering 62 in the latter.<sup>60</sup>

While preventative measures were being instituted in theater, the

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□ Vannevar Bush, foreword to Irvin Stewart, *Organising Scientific Research for War: The Administrative History of the Office of Scientific Research and Development* (Boston 1948).

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□ Joy, “Malaria in American troops in the South and Southwest Pacific in World War II,” 199.

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□ Joy, “Malaria in American troops in the South and Southwest Pacific in World War II,” 200.

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□ Joy, “Malaria in American troops in the South and Southwest Pacific in World War II,” 200.

American medical and scientific community rallied around the threat posed by tropical illnesses. During the war, DEET, DDT, and insecticidal fumigation bombs<sup>61</sup> would be researched, developed, and deployed in the combat theater. In addition to the insecticides used to attack the source of malaria, new anti-malarial drugs would be synthesized and deployed during the war. Atabrine, which had been synthesized by German scientists in the early 1930s, entered trials in the US, and began to be mass produced during the war.<sup>62</sup> The effectiveness of atabrine, along with other preventative measures was demonstrated quickly after its initial deployment among Australian soldiers in New Guinea. The Australian soldiers, who were known to exhibit poor mosquito net discipline, suffered a peak of 4840 malaria related casualties per 1000<sup>63</sup> soldiers per year. After mosquito net discipline was enforced, and atabrine doses were doubled from .6 to 1.2 grams per week, the rate of malaria related casualties fell to 740 per 1000 soldiers per year in a period of just two months (between November 1942 and January 1943).<sup>64</sup>

Elsewhere in the Pacific, allied forces saw similar reductions. In the hyper-

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□ Joy, "Malaria in American troops in the South and Southwest Pacific in World War II," 202.

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□ Joy, "Malaria in American troops in the South and Southwest Pacific in World War II," 203-204.

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□ It may seem counterintuitive that there was over a 100% casualty rate. What these figures mean is that for every 1000 men, there were 4840 cases of malaria per year. This indicates that the average soldier would contract, and receive treatment for malaria to the point where he was deemed "cured" multiple times per year. While some soldiers may not have ever contracted malaria, the incidence rate was ~4.84 diagnoses per soldier per year, so one fighting in these conditions may expect to come down with malaria between four and five times in a given year.

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□ Condon-Rall, "Malaria in the Southwest Pacific in World War II 1940-1944," 64.

endemic malarial conditions in Milne Bay, New Guinea, allied forces suffered 3300 malaria related casualties per 1000 soldiers per year in January 1943. One year later, in January of 1944, the malaria casualty rate had fallen to 31/1000/year.<sup>65</sup> Across the Southwest Pacific Area of command, the malaria rate averaged 794/1000/year in February of 1943, and was reduced to 179/1000/year by February of 1944.<sup>66</sup> Eugene Sledge notes in his memoirs that by the time he first saw combat, during the campaign on Peleliu (September-November 1944), all soldiers began their Atabrine treatments during transit to the islands, before even being exposed to malaria.<sup>67</sup>

Psychiatric casualties saw similar reductions as new treatment techniques emerged. Prior to World War II, psychiatrists had thought that they had solved the mystery of shell shock: it was not, in fact, the result of the repeated concussive forces of artillery bombardments, but was rather childhood trauma being manifested as a psychiatric illness when the affected soldier was exposed to traumatic battlefield conditions.<sup>68</sup> As a result, soldiers were subjected to induction psychiatric screenings, as it would be impossible to “set off this disorder in anyone who was not already psychologically predisposed.”<sup>69</sup> However, as rates

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□ Joy, “Malaria in American troops in the South and Southwest Pacific in World War II,”

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□ Joy, “Malaria in American troops in the South and Southwest Pacific in World War II,”

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□ Sledge, *With the Old Breed*, 28.

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□ Bresnehan, *Dangers In Paradise*, 2.

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□ Bresnehan, *Dangers In Paradise*, 2.

of “war neurosis” and “combat fatigue” spiralled out of control in the early stages of the war in the Pacific, doctors began taking a very different approach. Morale programs were enacted to attempt to keep the spirits of the soldiers up, and troops were rotated off the front line with greater frequency. If soldiers showed signs of being on the verge of breaking down, rather than keeping them in the fight until a breakdown actually occurred, they would be pulled off the line for a minimum of 48 hours of “rapid return” therapy to determine if they were fit to return to duty after a small break from the horrors of combat, or if they needed a longer recuperation period.<sup>70</sup>

But what of the various other challenges that American forces encountered? Many of those would be solved as well. The question of logistics was solved, in part, through the strategy of island hopping. American commanders recognized that it would be far too costly to assault and seize every Japanese held island across the Pacific. Instead, they picked and chose which islands to take. In doing so, they not only avoided a great number of costly battles, but they were able to let the islands that were passed over “die on the vine” so to speak. By only taking strategically important islands, American forces were essentially able to build a bridge across the Pacific closer and closer to the home islands of Japan. There was still a great deal of distance between the origin of the war materiel required, and the men in combat who required the materiel, but as the bridge across the Pacific was slowly built on the back of the amphibious assaults, American forces gained valuable real estate upon which to

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□ Bresnehan, *Dangers In Paradise*, 3-4.

establish supply depots. While the distances between soldier and supply in the Pacific was never cut down to the level of the European theater, the distance was cut down significantly as more and more of the Pacific fell under Allied control.

In regards to the difficulties encountered in the battles themselves, those too were the subject of rapid scientific research and application. Many of the hardened Japanese bunkers that presented such difficult targets at the beginning of the war were soon rendered obsolete with the development of napalm at Harvard University.<sup>71</sup> In addition to general anti-personnel uses, napalm was used to great effect against these Japanese fortifications by simply burning the oxygen out of the air inside, asphyxiating those taking shelter within.<sup>72</sup>

At the outbreak of the war, the Marines and Army forces that would be tasked with the amphibious assaults were extremely fortunate in one regard: they already had shallow drafted landing craft in the form of the Higgins boat, which was developed from earlier shallow draft vessels designed by Andrew Jackson Higgins in the late 1930's through a series of military trials.<sup>73 74</sup> However, the Higgins boat (or the LCVP: Landing Craft Vehicle, Personnel) wasn't always able to clear the reefs surrounding some of the islands. The shortcomings of the

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- Robert M. Neer, *Napalm* (Cambridge, MA: Harvard University Press, 2013), 5.

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- D. L. Miller, *D-Days in the Pacific*, 113-114, 258, 308.

- Sidney Shallet, "Peleliu Clean-Up a Difficult Task," *New York Times (1923-Current File)*, Nov 26, 1944,  
<http://ezproxy.ups.edu/login?url=http://search.proquest.com/docview/106945179?accountid=1627>

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- Jerry E. Strahan, *Andrew Jackson Higgins and the Boats that Won World War II* (Baton Rouge, LA: Louisiana State University Press, 1994), 28-40.

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- D. L. Miller, *D-Days in the Pacific*, 98.

Higgins boats were supplemented by the LVT (Landing Vehicle, Tracked) and the DUKW<sup>75</sup>. Both of these were amphibious vehicles that could go from ship to shore, but also possessed tank tracks. Originally designed to be able to crawl up past the beach, deliver supplies to troops on the island, and then swim back out to supply ships, it was quickly discovered that they were invaluable for climbing over the reefs regardless of the tides.<sup>76</sup>

## Conclusions

Perhaps more so than any other theater of operations in modern warfare, the Pacific theater forced those fighting in it to adapt to its peculiarities. It was not a force that could be conquered and bent to the will of man. Rather, man had to submit to it, and rethink the conventions of warfare in order to fight, and win in the Pacific.

The war in the Pacific represented an amazing fusion of military ingenuity and scientific expertise. Without the innumerable contributions of scientists and doctors, the Allied victory in the Pacific simply would not have been possible. While the most obvious legacy of science in the Pacific theater is that of the atomic bomb, and the contributions of the physicists involved in the Manhattan Project, the United States may have never gotten within range of Japan to deliver

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□ Naming convention in which D represents the model year (1942), U represents the purpose (utility), K indicated driven front wheels, and W indicated that there were two powered rear axles.

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□ D. L. Miller, *D-Days in the Pacific*, 98, 104-105; Rottman, *Pacific Island Guide*, 9.

the bombs that would end the war, and begin the Atomic Age, without the myriad of other inventions and innovations that were developed and implemented in the Pacific.

The war in the Pacific may have been a war that was unwinnable with the technology possessed at the outbreak of the war. The Japanese strategy at the beginning of the war actually seems realistic in hindsight: after the surprise attack at Pearl Harbor, it would rapidly expand and fortify the islands of the Pacific. Japan hoped that the United States would not be prepared for, or have the stomach for, a brutal war of attrition in the Pacific, and hoped to force the United States to negotiate a peace in the Pacific, leaving Japan atop a new Eastern Pacific empire.<sup>77</sup> The Japanese were correct on one account: the United States was woefully unprepared for the war in the Pacific at the outbreak of the war. If not for the scientific innovations made during the war, and the willingness of the commanders to abandon traditional strategic and tactical doctrine in favor of new techniques that were more suited for the geography of the Pacific, the United States and its allies truly may not have been able to win the war, and may have been forced to sue for peace.

However, the military of the United States did adapt, and the technological and scientific advances necessary to win a total war in the Pacific were made. The unique character of the Pacific Ocean region necessitated an unprecedented level of adaptation and flexibility, and one of the key legacies of the Pacific was the ability of the American military to make the necessary changes to fight and

win in one of the most varied and unforgiving environments touched by modern warfare. From the jungles and swamps of Guadalcanal, to the atolls of the central Pacific, and from the coral hell that was the Umurbrogol on Peleliu, to the shell scarred moonscapes of Iwo Jima and Okinawa, the American military not only survived the tests of the Pacific, but thrived because of them.

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