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MASTER OF MILITARY STUDIES

**GEORGE MEADE: GEOSPATIAL INTELLIGENCE PROVIDES DECISIVE
ADVANTAGE ON THE BATTLEFIELD**

SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF MILITARY STUDIES

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Executive Summary

Title: George Meade: Geospatial Intelligence Provides Decisive Advantage on the Battlefield

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Thesis: Because of General Meade's geospatial mindset from his training as a topographical engineer, and experience in battle during the Mexican-American War as a topographer on the staff of General Zachary Taylor, Meade approached his Commander-in-Chief's orders from a geospatial mindset. This geospatial mindset, and his familiarity with geospatial intelligence were key factors in Meade's success at Gettysburg.

Discussion: Geospatial Intelligence is defined by Title 10 US Code section 467, as "the exploitation and analysis of imagery and geospatial information to describe, assess, and visually depict physical features and geographically referenced activities on the earth."ⁱ Commanders that are able to effectively use the geography of the battlespace to their advantage are better able to achieve their objectives than those that do not. This paper examines the history of geospatial intelligence in the United States Army, General George Meade's history as a topographer in the Corps of Engineers, and how his training and experience in geospatial intelligence helped him to achieve success at Gettysburg. Finally, an examination of General Meade's application of geospatial intelligence is an example to geospatial analysts and decision-makers today. While methodology and technology have made geospatial intelligence more common, more precise, and more visually appealing, the principles of geospatial intelligence that General Meade used at Gettysburg can still be applied today.

Conclusion: Geospatial analysts convey much of the context to commanders and decision-makers. By producing visually appealing geospatial products like maps, story maps, dashboards, and web-based interactive products, geospatial analysts can quickly display the who, what, where, when, and how so that commanders can make decisions on the battlefield. By remembering the lessons of Meade, geospatial analysts can frame the area of operations, use the resources available to them to acquire the relevant data, analyze that data, communicate the information to commanders, and provide tactical advantage on the battlefield.

ⁱ Department of Defense. "Geospatial Intelligence" Title 10 *US Code*, 467, Definitions. Effective October 1996. Available: <https://uscode.house.gov/view.xhtml?req=granuleid:USC-prelim-title10-section467&num=0&edition=prelim>. Accessed October 26, 2019.

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List of Maps

Map 1: Gettysburg Movements and Positions of Armies to 4:00 PM, July 2

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Preface

Geography has become ubiquitous to most of us today. Maps are a part of our everyday environment, from phone-based GPS, to displaying data geospatially in dashboards, searching for a new restaurant, mapping runs and bike rides, and knowing what each state's favorite candy is at Halloween. But geography is much more than that. Geographers must be able to understand geology, climatology, hydrology, biology, anthropology, politics, history, and much more. Because of this, Geographers are proud to be a "jack-of-all-trades and master-of-none." We pride ourselves in having a broad knowledge of a variety of subjects because they are often interconnected, and with the right tools and talents, we can convey those connections on a map.

As a geospatial intelligence analyst, I love being able to provide the geospatial context to other intelligence analysts and decision-makers. When I begin working on a new map, I often ask, what is the story that you're trying to tell? Providing a map for context, or even better, gathering around a map to work through a problem is one of my great joys. Gathering around a map quickly orients an audience to a problem set. Whether it's a group of scouts going on a hike, decision-makers understanding the range of a new weapon system, or analysts discussing the effects of landcover, slope, and soil saturation on cross-country mobility, maps provide a focal point uniting the group to the problem.

While maps have become somewhat ordinary to a lot of people today, they haven't always been. I enjoyed researching General George Meade, an expert in topography, who rose to be the commander of the Union Army and deliver a blow to General Robert E. Lee, that turned the tide in the Civil War. Growing up in Virginia, I have had the opportunity to visit, hike, and even camp at many of the battlefields where Americans bled for the nation that we have today. Command and Staff College provided an opportunity to work with one of the nation's experts on George Meade, and I am truly grateful to Christopher Stowe, PhD for all of his guidance. I hope that the example of General Meade's use of geography can be a model for future leaders as well.

Introduction:

General George Gordon Meade awakened early on the morning of June 28th 1863 to find out that he was ordered to be the commander of the Army of the Potomac by President Abraham Lincoln. He would be the fourth person to fill this role since the beginning of the Civil War with all of his predecessors being replaced because of their inability to defeat Confederate forces in Virginia. Now the Confederacy had raided the North after General Joseph Hooker's loss at Chancellorsville. In the order, which was conveyed by General Henry Halleck, the General-in-Chief of all Union Armies, Meade was told that "the Army of the Potomac is the covering army of Washington, as well as the army of operation against the invading forces of the rebels. You will therefore maneuver and fight in such a manner as to cover the Capital (Washington DC) and also Baltimore, as far as circumstances will admit. Should General Lee move upon either of these places, it is expected that you will either anticipate him or arrive with him, so as to give him battle."¹ Meade's subsequent troop movements and orders, to include the Pipe Creek Circular on 1 July 1863, were a direct result of the orders that he received from Washington. Because of General Meade's geospatial mindset from his training as a topographical engineer, and experience in Battle during the Mexican-American War as a topographer on the staff of General Zachary Taylor, Meade approached his Commander-in-Chief's orders from a geospatial mindset. This geospatial mindset, and his familiarity with geospatial intelligence were key factors in Meade's success at Gettysburg.

To understand Meade's "geospatial mindset" at Gettysburg, it is important to: 1. Understand the history of Geospatial Intelligence in the United States Military, 2. Examine how Meade's training and experience in Geospatial Intelligence prior to the Battle of Gettysburg would shape his experience and lead to his success, and 3. how Meade's application of Geospatial Intelligence at Gettysburg applies to Geospatial Intelligence Analysis today.

Geospatial Intelligence techniques continue to improve with the advancement of technology, but having a geospatial mindset has led many generals to their success on the battlefield.

Geospatial Intelligence is not a new concept

First, while the term “geospatial intelligence” is fairly new, the concepts have existed from the time when humans depicted their surrounding environment on clay tablets, and later when they began to use maps to coordinate efforts on the battlefield. As defined by Title 10 US Code section 467, Geospatial Intelligence is “the exploitation and analysis of imagery and geospatial information to describe, assess, and visually depict physical features and geographically referenced activities on the earth.”² While advances in technology have improved the accuracy, depiction, and speed with which geospatial data can be created and disseminated, the concepts of geospatial intelligence are not new to the United States Military. Army topographers have existed in different forms since the formation of the U.S. During the Revolutionary War, Congress established a “geographer of the southern army”³ and “geographer of the main army”⁴. Later both positions received the title “Geographer of the United States”⁵. The next fifty years would witness the creation and dissolution of positions and the assignment of topographers to different organizations. Finally The Corps of Topographical Engineers of the Army would be established as its own Corps in 1838. John J. Abert was then made the commander of the Corps of Topographical Engineers and would remain in that position until 1861.

Formation of the Corps of Topographical Engineers

Abert had pushed for the separation of the Bureau of Topographical Engineers into its own corps, and was finally successful in 1838. He worked to further the science of topography and professionalism within the corps. “Most of the topographical engineers appointed after 1838 were members of high standing in the current graduating class at the United States Military Academy whom the Academic Board at the school had adjudged competent to perform

topographical duties and who had indicated a preference for service with the corps. Abert, who rarely asked for more than two or three graduates a year, rejected any candidate who made the corps his second choice, deeming such a choice a reluctant alternative.”⁶ Part of this reasoning was that “the corps of topographical engineers did not have a service school to provide further training to its officers. The topogs obtained their expertise in mapping and construction by on-the-job training, by travel, and by association with the scientists and engineers of the day.”⁷ Abert needed competent men that could learn the trade through experience. Under Abert’s leadership, he ensured the Topographical Engineers would be the top students in their class after the Engineers, and only issued four exceptions to that requirement in his career. Three transferred from other corps, and in doing so “waived his rank and came in at the very foot of the corps”⁸ which was certainly a major deterrent for existing army officers to transfer. “The fourth exception was a civilian who had graduated from West Point in 1835 and who had resigned his commission in the following year because of ill health and the prospect of employment in civil life. Of the many thousands of official letters Abert wrote as bureau chief, few if any better deserve the epithet ‘fateful’ than does the one dated April 30, 1842, which contains his eloquent and successful plea for the restoration of George G. Meade to the United States Army as a topographical engineer.”⁹

From 1838 to 1863, there were two separate corps in the US Army performing very similar functions, the Corps of Topographical Engineers and the Army Corps of Engineers. “The Topographic Engineers performed reconnaissance and produced maps. In practice, however, engineer officers performed the full range of engineering functions, including mapping and reconnaissance.”¹⁰ Topographers would have their own corps in the Army for 25 years, but would dissolve into the Army Corps of Engineers in 1863, where geographers continue to provide maps for the Army and to decision makers today. Both the “topogs” and the engineers served similar functions and were familiar with the other’s tradecraft. The Army Corps of Engineers focused primarily on surveying and constructing railroad bridges, forts, and roads.

Under the General Survey Act, the topographical engineers were authorized to survey roads and canals across the country, and to also perform boundary surveys. As the country continued to expand westward, this was an area in which the Corps of Topographical Engineers continued to use their skills. During times of war, topographers would be assigned in the field to assist commanders to make maps directed by the commander, to include: 1. Military positions and the area around them, 2. Key terrain to include “various roads, rivers, creeks, ravines, hills, woods, and villages to be found therein”¹¹ 3. Acquire intelligence by accompanying reconnoitering parties, 4. Sketch out their route and make a written description of their march, 5. keep a journal of every day’s movements to include “the varieties of ground, of buildings of culture, and the distances and state of the road between given points throughout the march of the day”¹² and 6. Map the “positions of contending armies on fields of battle, and disposition made, whether for attack or defense.”¹³ Meade, for his part, took these duties seriously throughout his career, and was well evidenced in his experience in war, (both during the Mexican-American War, and the Civil War) and in peace (U.S. Border surveys, lighthouse surveys and construction, and the Great Lakes Surveys). Meade’s meticulous note taking, letters, and journal writing, all reinforced by Topographical Engineer directives, also came to his rescue in the investigation of the Battle of Gettysburg.

There had been some friction between the Corps of Engineers and the Corps of Topographical Engineers as they performed similar functions, and different commanders would often prefer one over the other. In the Mexican American War, Colonel Joseph Totten, Chief of the Army Corps of Engineers, was on General Winfield Scott’s staff at the landing of Vera Cruz in March of 1847. Colonel Totten had both Engineers and Topogs under his command, serving in very similar functions, but made sure that “the role of his own engineers dominated the scene.”¹⁴ During the campaign for Mexico City, Meade wrote of his frustrations to his wife, “I have been pretty much a spectator for a week, the Corps of Engineers having performed all the engineering that has to be done. This is attributable to the presence of Colonel Totten, who

wishes to make as much capital for his own corps and give us (topographers) as little as possible.”¹⁵ General Zachary Taylor, on the other hand, “did not overlook his topogs, and they obtained due recognition throughout the campaign.”¹⁶ Engineers during the Mexican American War included Robert E. Lee, Pierre G.T. Beuregard, and George B. McClellan. Topographers during the Mexican American war included Joseph Johnston and John Pope, in addition to George Gordon Meade.

Meade is Trained, and Fights in Mexico

General Meade’s career in the Army began in 1835 as a graduate of the U.S. Military Academy at West Point. He resigned his commission by 1836, after which he worked as a civil engineer, but would return to the US Army to be recommissioned as a second lieutenant in the Corps of Topographical Engineers in 1842. While in the Corps, General Taylor called Meade from his home and principal duty station in Philadelphia to Texas to join him where the Mexican war was on the horizon.¹⁷ Upon his arrival, Lieutenant Meade felt that his presence (and the other Topographic Engineers – Captain Thomas J Cram and Brevet Second Lieutenant Thomas J. Wood) was unwanted by General Taylor.¹⁸ Second Lieutenant George Meade quickly found out that he was wrong, and that General Taylor had plans for the topographers, sending them out to “reconnoitre the region...in the direction of the contested river border.”¹⁹ General Taylor requested geospatial intelligence from the topographers to prepare for the eventuality of war with Mexico, and reporting that information back to Washington.²⁰

Tensions continued to rise along the Mexican Border, and the topographers faced their own challenges with health. Cram and Wood both became so ill that almost immediately, Meade was the only functioning topographer. In a fairly short time, Meade would be promoted to Chief Topographer for Gen. Taylor. In December of 1845, Meade himself became very ill with jaundice but refused to return home on sick leave.²¹ He recovered by the end of the month, and in February President James Polk directed Gen. Taylor to move to the disputed boundary with

Mexico. Meade was now General Taylor's Chief Topographer, and was sent ahead of the column to gather intelligence, surveying the bays and towns. In March, First Lt. Jacob E. Blake came to assist Gen. Taylor and was given orders to acquire and report geospatial intelligence ahead of the advancing party. While First Lt. Blake outranked Meade, Meade retained the office of Chief Topographer to Gen. Taylor²². First Lt. Blake reported back to Colonel Abert of the Topographical Bureau that he had received combat duties of a Topographical Engineer: "A subaltern and fifteen men of Dragoons will be kept about a mile in advance of the columns to communicate, at least hourly, intelligence of the enemy and of any obstructions to the march. The Topographical Engineer attached to the cavalry will accompany this advance. Following these orders, Blake recorded information on locations; the distances from Corpus Christi to Matamoros; the intermediate distances; appropriate information on the availability of water, wood, and grass; road conditions; and a geographic description of the rout of the advance."²³

Meade, in his role as Chief Topographer remained with General Taylor, and had his first experience with combat and battlefield command at Palo Alto and Resaca de la Palma. In a letter to his wife, Meade described his experience. "I was in the action during the whole time, at the side of General Taylor, and communicating his orders, and I assure you I may justly say I have had my *'batême de feu'* (baptism of fire). An officer of the General's staff had his horse shot under him...and some five horses and men were killed at various times right close to me."²⁴ In his letters to his wife, Meade expressed his pride in the role he played in this and subsequent actions under Taylor. General Taylor respected and utilized not only Meade but other Topographic Engineers as well and gained Meade's respect as a commander. Taylor in turn "commended Blake and Meade for conveying his orders to every part of the field."²⁵ Meade continued to fight alongside General Taylor, and due to unfortunate circumstances, Meade found himself the chief topographer for the majority of his time in Mexico. Lieutenant Blake, the other topographic engineer with Meade at Palo Alto and Resaca de la Palma, accidentally shot and killed himself, temporarily leaving Meade as the only Topographical Engineer.

Meanwhile in May of 1846, President Polk received reporting from Gen. Taylor that fighting had broken out at Palo Alto and Resaca de la Palma. Polk relayed that report to Congress, and they approved a declaration of war, along with a bill appropriating funds and authority to raise 50,000 volunteers.²⁶ President Polk established a “three-pronged strategy to defeat the enemy and acquire territory.”²⁷ Three armies led by Gen Taylor, Brig Gen. John E. Wool, and Colonel Stephen Kearny acquired key objectives, with Gen. Taylor advancing on the northern Mexican city of Monterrey. Brig Gen Wool would march from San Antonio to Chihuahua, and Col. Kearney went from Fort Leavenworth to San Diego, occupying Santa Fe and New Mexico along the way. Meade was eventually joined by another topographical engineer, also senior to him, Captain W. G. Williams. Because of Williams’ presence within the staff, Meade hoped to join Brig Gen Wool as the latter’s chief topographer, but stayed with Gen Taylor, reconnoitering the area and gathering intelligence for his commander as army approached the well defended Mexican City of Monterrey. Taylor ordered a double envelopment of the city and his men got a little too close for comfort when they began receiving cannon fire from Monterrey. He ordered his men to return to camp out of the range of the enemy. Meade and the other topographical and regular engineers reconnoitered the town to discover that the enemy positions were formidable. The Citadel or Black Fort was in front, with Forts Ténier and Diablo to the left. Independence hill was across the town on the other side, “guarded by a strong redoubt overlooking the heavily-walled Bishop’s Palace.”²⁸ Other key information that Meade was able to gather was that the forts were “ringed with earthworks...sandbags fringed the housetops for protection of sharpshooters...loopholes were drilled into houses and walls, and...every principal street had been barricaded...Meade drew a field map to give General Taylor an idea of the prospects.”²⁹ The geospatial intelligence that Meade provided to General Taylor was key in his decision to split his forces, attacking the two forts to the left and Independence Hill to his right. Meade went along with General William Worth’s flanking column to capture Independence Hill while General Taylor attacked the two other forts in front of the town.

Because Meade had studied Independencia Hill's slopes, he was in charge of guiding the attacking party in the dark and rain at 3:00AM up the hill. While Worth's efforts were not without resistance, General Taylor's attack resulted in the majority of the casualties.³⁰ Eventually, the town was taken, with Meade providing Worth exceptional reconnaissance of Monterrey's urban terrain. The Mexican Army had surrendered and retreated, and General Taylor's gamble to split his forces paid off. When the Mexicans surrendered to General Taylor, he allowed them seven days to retreat from the town, an eight week armistice, and they were allowed to keep their arms. While many in the U.S. Army argued against this decision, Meade approved. Their army had fought hard for four days, they were far away from their base, 450 men had been killed, and they had come out victorious. Meade appreciated the political implications of the surrender, and thought that General Taylor had made the right decision.³¹

For his efforts, "Meade was brevetted a first lieutenant for his gallantry in reconnoitering the enemy positions and leading General Worth's Second Division storming party at its position at Monterrey."³² Meade had seen the geospatial intelligence that he gathered playing into General Taylor's decision-making, and the benefit it provided on the battlefield.

After the Mexican War, Lt. Meade returned home to Philadelphia where he was honored by his friends and family for his efforts in the war. He continued on with topographic duties planning and erecting lighthouses and mapping waterways. Meade "would come to regard that portion of his career as of considerable importance."³³ While in Florida, he took on the task of establishing lighthouses along the rocky Florida Keys, where "dangerous hidden rocks had taken their fair share of seafarers."³⁴ He continued to plan and construct lighthouses, and in August of 1851, he was promoted to first lieutenant.

Meade would lead lighthouse construction along the entire east coast, and some of the lighthouses that he directed still stand today. In 1856, he was ordered to "report as assistant to the officer in charge of the survey of the lakes"³⁵. As the West was expanding, the demand for

updated maps was increasing, especially as new settlers were arriving and accidents were happening because of the lack of good maps. Meade reported to the Great Lakes surveying and mapping them, finally being promoted to Captain on 17 May, 1857. While surveying the Great Lakes, Meade demonstrated his mastery of topography and hydrography. "The nature of the field operations required a combination of triangulation and astronomical work for the determination of the positions of points on the shores of Lake Huron, and made some change necessary in the method of executing the off-shore hydrography...the introduction of more accurate methods in obtaining longitudes, and the commencement of a series of magnetic, water-level, and meteorological observations at many points on the lakes."³⁶ Meade would use telegraphs to assist in determining the longitude more accurately than had previously been done. He demonstrated during this time not only an expertise at using current topographic mapping methods, but also a willingness to utilize new technology to increase the accuracy of the maps that he was making. He coordinated his efforts with an expert in telegraphy at the time, C.A. Young, professor of Western Reserve College in Hudson Ohio.³⁷ Meade continued to survey the Great Lakes, and wrapped up the survey of Lake superior in August of 1861, which allowed him to finish his responsibilities, and transition to support the Union Army to end the rebellion of the Confederacy.

Meade in the Civil War

When the Civil War started, there was high demand for trained professional officers for the mass mobilization of the Union Army. Because of Meade's expertise as a soldier and his experience in the Mexican American War, he was promoted to brigadier general of volunteers, and assigned to the Pennsylvania Reserves division as commander of its Second Brigade. With this promotion, he was no longer a Topographical Engineer but now placed in line command. It was in part due to Meade's promotion and the promotion of 23 other Topogs to general officer rank, seven defecting to the Confederacy and four losing their lives in the war, that the Corps of

Topographic Engineers was diminished in size and strength, leading to its dissolution into the Corps of Engineers.³⁸ In addition to the attrition of the Topographic Corps, the high demand for both topographers and engineers, and similarities in their disciplines and capabilities blended the responsibilities of the two specialties. Despite the structural changes and challenges of the war, topographers continued to advance their technical skills through advancements in technology. “Before 1861, the Topographical Bureau at the War Department possessed no presses of its own and was compelled to use commercial printers. This practice continued during the war. During 1864, for example, 20,938 commercial maps sheets were issued to the armies. The printing presses of the Coast Survey were also used to supply 42,000 sheets in 1862 alone. In the field, armies organized their own lithographic press operations to publish maps. Photography was also applied to map reproduction with excellent results.”³⁹

Meade’s lessons learned as a Topographical Engineer would certainly be important to him as he led and made decisions on the battlefield. Meade served in several battles leading up to the Pennsylvania campaign, and earned a reputation as a competent and skillful officer. He was wounded severely at the Battle of Glendale on 30 June 1862, but he returned to the fight. Among his peers, he was generally respected and admired for his professionalism and work ethic. He was a tough taskmaster and did not have the same political motivations and bravado as General Hooker. Colonel Theodore Lyman, a member of Meade’s personal staff from 1863-1865, “called Meade a thorough soldier, and a mighty clear-headed man; and one who does not move unless he knows where and how many his men are; where and how many his enemy are; and what sort of country he has to go through. I never saw a man who in my life who was so characterized by straightforward truthfulness as he is.”⁴⁰ Gen. Hooker’s relationship with General Halleck and President Lincoln was very strained whereas Meade had been able to avoid the politics of the time.

At this point in the Civil War, the civil-military relationship had been severely strained by “shifting war aims, compounded by twin defeats along the Rappahannock”⁴¹, yet Meade had avoided the politically-motivated and ambitious decisions that other generals had made. Meade’s ascension had come from his decades of Army service and his alacrity on the battlefield. Meade believed that his lack of political connections would prevent him from assuming command. He wrote to his wife, “I have no friends, political or others, who press or advance my claims or pretensions, and there are so many others who are pressed by influential politicians that it is folly to think I stand any chance upon mere merit alone.”⁴² This lack of political ambition, willingness to follow his Commander in Chief, and Commanding Officer were precisely what Lincoln was looking for in a new Commander of the Army. “Meade’s silence spoke volumes to a Washington wearied by the political schemes and unbidden sophistries of overtly ambitious Generals.”⁴³ . “His very reluctance to engage publicly in partisan intrigue (itself a hallmark of military culture that subordinated outward self-promotion and political displays in favor of the national interest) made him as much a viable contender for the command as did his battlefield performance.”⁴⁴

Meade Takes Command

Early in the morning of June 28th, General in Chief Halleck ordered Meade to take command of the Army of the Potomac. Meade dutifully accepted his orders and began his transition. It is important to note that Meade’s first actions were to assess his enemy’s strength and location, and to assess his own army’s strength and locations. Prior to taking command, one of Meade’s complaints about General Hooker was that he left his field commanders in the dark regarding their relative positions to each other, and what the plan was. Hooker was cautious as he pursued Lee north into Maryland, and not acting quickly enough for President Lincoln and General Halleck. Hooker had been devising a plan to cut off Lee’s supply lines, supported by a garrison from Maryland Heights who were protecting Harper’s Ferry. This was a major point of

contention between Hooker and Halleck, who was demanding a more aggressive approach to Lee, and Hooker had not been communicating this to his commanders. Meade on the other hand was quick to devise a plan on how to fulfil the President's orders.

At 7AM on the 28th, the first indications of Meade's plan were delivered to General Halleck, when he stated, "...in ignorance of the exact position of the troops and position of the enemy, I can only now say that it appears to me I must move towards the Susquehanna, keeping Washington and Baltimore well covered, and if the enemy is checked in his attempt to cross the Susquehanna, or if he turns towards Baltimore, to give him battle."⁴⁵ Meade used the current disposition of his forces, largely concentrated around Frederick, Maryland, knowing that Lee was to his north, and that he needed to protect Washington to his south and Baltimore to his east. He defined his area of responsibility based on the information that he had available to him after just taking command of the Army of the Potomac. Meade received a briefing from General Hooker on the current disposition of the Army of the Potomac, and began examining his maps, looking for a location that he could clearly define and communicate to his field commanders. His maps were lacking so he sent his engineers north to reconnoiter the area, and bring back better information for him to make a decision.⁴⁶ When the area had been reconnoitered, Meade examined the maps, and realized that "Westminster, Maryland, was the key location for carrying out his instructions"⁴⁷ Westminster provided several advantages, to include road and rail connections to both Washington and Baltimore, which he had been commanded to protect, and he could also use to resupply his own army.⁴⁸ With Westminster being the location of his headquarters, Big Pipe Creek provided an excellent natural barrier, "a well-defined landmark that the troops could easily identify, seems to run in the right direction and to be appropriately located to meet all the requirements of a defensive line."⁴⁹ It was just north of Westminster, south of the Confederate forces, and with plenty of existing impediments to Lee's movement, with deep ravines, forcing any reasonable attack to be funneled to the west of Meade.

It's also important to note that Meade did not make this plan in a vacuum; he had input from several of his experts to include Gouverneur K Warren, chief engineer of the Army of the Potomac, and Brigadier General Henry Hunt, the Army of the Potomac's chief of artillery, who thought it was a good position as well. "Hunt thought that the true strength of the position lay in the fact that Lee could not attempt to turn the position without leaving the Union army intact and in his rear."⁵⁰ Without knowing the exact location of Lee, Meade decided late on 30 June, that Pipe Creek is a good defensive line, and communicates this to his field commanders in what is known as the Pipe Creek Circular on 1 July. A plan is beginning to develop, and he is consolidating his forces that had previously been spread out by General Hooker. The Pipe Creek Circular has been used by critics after the battle and also by subsequent students of the Civil War to show that Meade was timid, or taking a conservative approach. Instead of going on the offensive, and bringing the fight to Lee they argue that he was planning for a defensive battle. Based on the information that Meade had at the time, the input from his staff, and the orders received from Washington, it was a perfectly reasonable approach to facing Lee. Meade also showed his flexibility with the plan when he states: "The time for falling back can only be developed by circumstances. Whenever such circumstances arise as would seem to indicate the necessity for falling back and assuming the general line indicated, notice of such movement will be at once communicated to these headquarters and to all adjoining corps commanders."⁵¹ Meade also continued to gather intelligence and use that to shape his decisions.

The Confederacy Struggles with Geospatial Intelligence in Enemy Territory

At the same time, General Lee is also finding out that the Union Army is consolidating forces to his south, and that contact is imminent. In previous battles, General Lee had relied on Stonewall Jackson who had in turn relied on Jedediah Hotchkiss to provide geospatial intelligence and awareness to the commanders. After Jackson's death at Chancellorsville, Hotchkiss would be attached to his replacement, General Richard Ewell. While both Meade and

Lee likely had access to the Adams County Map of 1858, it was not intended to be a planning tool for a battlefield commander. It was created by the GM Hopkins Map Company, and provided an excellent representation of Adams County Pennsylvania featuring roads, railroads, townships, and other key terrain features. Understanding lines of communication and waterways would have been pressing items for both commanders, but the Adams County map's intended audience did not require key terrain around Gettysburg, like Little Round Top, and Big Round Top.

In February of 1863, Lee and Jackson had already been considering a move north into Pennsylvania, and Jackson tasked Jedediah Hotchkiss maps to plan a movement north, out of the Confederacy. From Hotchkiss' record: "I got secret orders from the General to prepare a map of the Valley of Va. extended to Harrisburg, Pa., and then on to Philadelphia; - wishing the preparation to kept a profound secret. So I went to reducing a map of Cumberland Co. Pa."⁵² For Hotchkiss, the map would prove to be an incredible challenge for multiple reasons.

First, the area was in enemy territory. In Virginia, Jedediah Hotchkiss had been able to rely on sympathetic locals to provide geospatial intelligence as he created the maps. The people of Pennsylvania did not welcome their southern invaders by providing them insights into the topography previously enjoyed, that would be given to their Union protectors. Second, Jedediah Hotchkiss would not have been familiar with the geography of the area that he had with the Shenandoah Valley. Third, he would have to rely largely on existing maps intended for other audiences. Fourth, Lee did not go to Pennsylvania with the intention of fighting at Gettysburg, the location of the battle was a fluid decision made by both commanders. Finally, Lee's intent was never to have a large scale map of Gettysburg, but a small scale map of the region. Hotchkiss did his best, and provided what he could to Lee. "The map itself was a work of art. On cream-colored paper, red pencil lines identified roadways, blue marked rivers and streams, and black, in impeccable handwriting listed towns, mills, blacksmith shops, major topographical features,

and every rural resident's name."⁵³ The scale of the map that Hotchkiss had made was much too small (small scale maps have less detail, and cover a large area) for planning at a tactical level.

Lee's other source of Geospatial intelligence would have been reconnaissance from cavalry. General J.E.B. Stuart had received instructions from General Lee, unfortunately for Lee, Stuart decided to extend further than he should have, and was out of contact with Lee until July 2nd, well after the battle was underway. As the momentum towards battle began, Lee waited for Stuart to return, but had to prepare for battle without intelligence from him. "Lee kept asking the same questions over and over: Where was Stuart, and why had he not rejoined the army?"⁵⁴ Some have argued that Lee had access to other cavalry, which he could have sent to gather the intelligence that he was waiting on from Stuart, but it seemed that Lee expected Stuart to return at any moment, and provide the critical information he needed to prepare for the battle. Lee's access to incomplete maps and lack of geospatial intelligence from J.E.B Stuart were geospatial intelligence gaps that contributed to his loss to Meade at Gettysburg.

Meade Prepares for Battle

Meade, however, had no such deficiencies as he took command. His training and experience as a topographical engineer made it so that he knew that the geography of the area would be crucial wherever he ended up meeting with Lee. As he gathered information on where Lee was, he would personally reconnoiter the area with members of his army staff, Generals Gouverneur K. Warren (an engineer by trade), Henry Jackson Hunt (artillery chief), and Captain William H. Paine (the Army of the Potomac's chief topographer).⁵⁵ His experience in the Mexican-American War performing reconnaissance no doubt led him to look for the key features of the terrain that were important as the commanding general. In addition to the maps that they had available and the reconnaissance efforts they took, "his generals took information from loyal citizens and sometimes enlisted them as guides"⁵⁶ especially in finding "field roads." "Field roads were quite common in the 19th century and used often in Civil War battles. Such

concourses frequently incorporated farm lanes, wagon paths, and even walking trails. In the pre-automobile era, when travel was slow and arduous, straight lines of journey cut down on lost time. In part, that is why local guides were so important to Civil War units trying to find their way across country. One reads about it frequently from staff officers who were called to act in situations where haste was necessary, and when county maps did not show obscure routes.”⁵⁷ In addition to Meade having a personal geospatial understanding of the area of interest, on June 30th, he instructed his commanders to develop an understanding of the area as well, specifically on the locations of the other corps, and the lines of communication connecting them: “Corps commanders will avail themselves of all the time at their disposal to familiarize themselves with the roads communicating with the different corps. By command of Major General Meade.”⁵⁸ He was not going to have another Chancellorsville, where the corps commanders did not know the commander’s intent nor the locations of the other corps, being a key factor for the Union Army’s loss there.

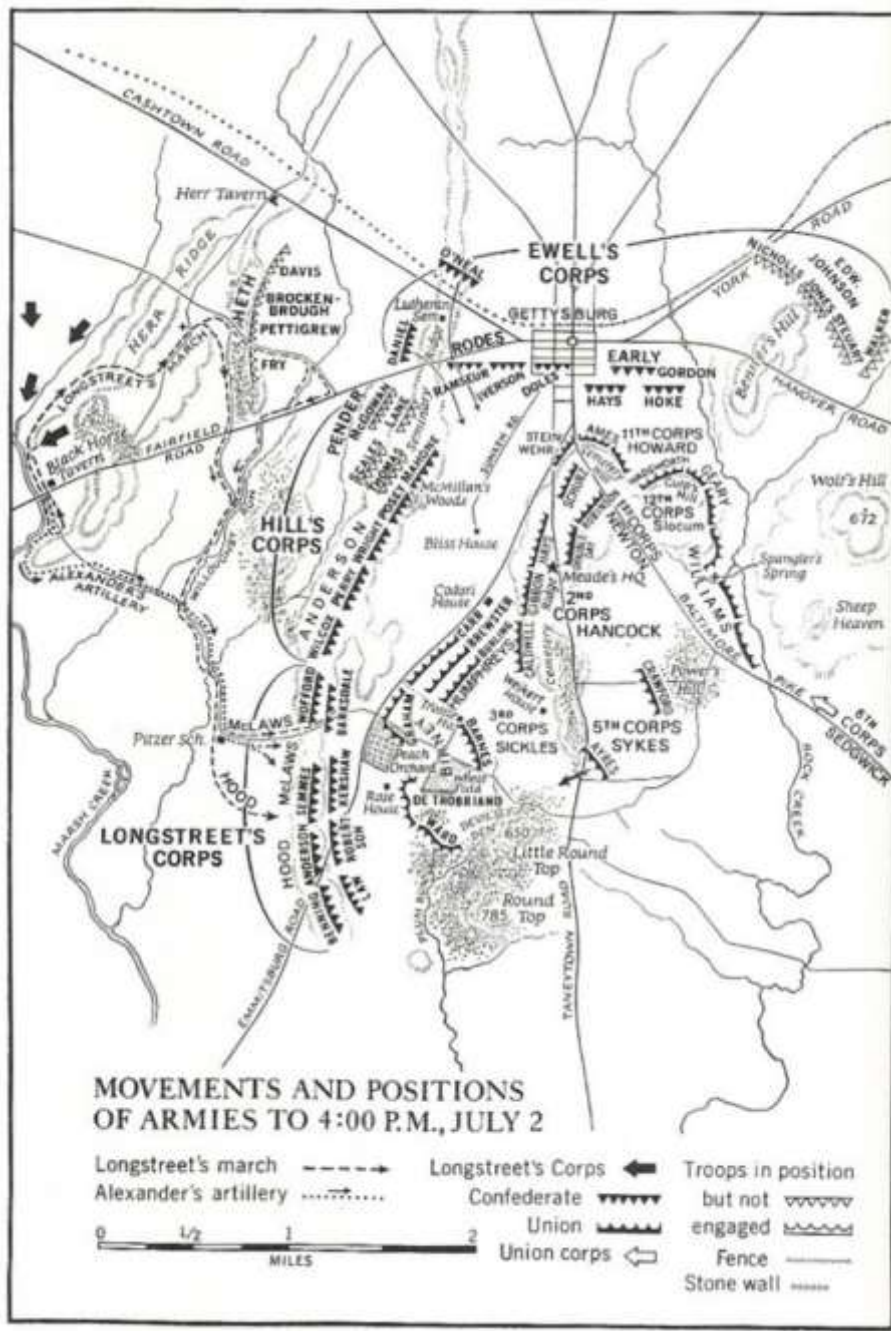
As he was instructing his commanders to become familiar with the geography of the area, both the First, Twelfth, and Fifth Corps and Brigadier General John Buford’s cavalry made their way into Pennsylvania. Meade’s movements from Frederick, Maryland north towards Gettysburg drew Lee’s attention. On the evening of June 30th, “Meade directed General Reynolds in command of the three-corps left wing (First, Third, and Eleventh Corps), to move his own First Corps to Gettysburg early next morning (July 1st) followed by Howard’s Eleventh with General Daniel Sickles Third to inch westward...to Emmitsburg.” In addition to Reynolds, Meade sent Warren with him to assist in surveying the ground for a potential battle. At the same time, Meade was still trying to understand exactly where Lee was, which was also difficult for him to conceptualize as Meade didn’t have a topographical map until the morning of July 1st.⁵⁹ As Reynolds was moving into his position, Major General Henry Heth went to Gettysburg to acquire supplies. While Heth had received reports that the Army of the Potomac had moved into Gettysburg, Heth was skeptical because of intelligence reports that the Army of the Potomac was

still in Middleburg. Heth moved towards Gettysburg early on July 1st, and attacked Buford's dismounted troopers just west of Gettysburg along the Chambersburg Pike. General Reynolds, upon learning of the attack quickly moved to support Buford's cavalry, and was subsequently killed. Once Meade learned of the attack, he quickly adjusted plans to the Pipe Creek orders, placed a map in General Hancock's hand, ordered him to proceed towards Gettysburg, and "assume command of all the troops assembled there"⁶⁰. Once there, Hancock was to "carefully examine the federal position. If it was found unfit, he was to seek out and report the nearest place where the army should concentrate. If that position happened to be good, then all the troops would be ordered up."⁶¹.

Initially, Meade waited for reports from Hancock on the suitability of the area for a battle, and Hancock's first message upon his arrival at Gettysburg only reported that he had arrived at the battlefield. The next message Meade received was from General Buford, via General Pleasonton, and was not any more helpful in deciding if the location was a good one, just a plea for assistance as they were being attacked from two sides that seemed to be reinforcing and joining forces⁶². Finally, that evening, Hancock's messages began to be delivered, first stating that he felt that they could hold the line until the dark so that Meade could make his own decision.⁶³ It may not have been the geospatial intelligence that Meade was hoping for, but Meade knew he needed to act. Either withdraw to Pipe Creek, or make their stance at Gettysburg. He chose the latter. "It seems to me that we have so concentrated, that a battle at Gettysburg is now forced on us, and that if we can get up to our people and attack with our whole force, to-morrow, we ought to defeat the force the enemy has."⁶⁴ While this message was being delivered, another was being sent from Hancock with the geospatial intelligence he had been waiting for. "The battle is quiet now...I think we will be alright until it can be told better what had best be done. I think we can retire; if not we can fight here, as the ground appears not unfavorable with good troops."⁶⁵ Knowing that Warren was with Hancock probably gave Meade some confidence about Hancock's assessment. Now Meade was faced with the

challenge of moving everyone up quickly as the battle would likely re-start the next day. As he was preparing to leave, Hancock and Warren surprised Meade by coming back to report on the day's battle. General Howard, who had also been fighting that first day, sent a message to Meade confirming what Hancock had reported about the suitability of the position for battle⁶⁶. Meade departed with Generals Hunt and Warren around 10pm, and arrived in Gettysburg shortly after midnight to receive a report on the day's battle, and advice from his commanders, Generals Howard, Slocum, and Sickles. "Later, before dawn, Meade undertook a reconnaissance of the area, accompanied by Generals Hunt and Howard and Captain Paine."⁶⁷ After examining the information available, Meade was able to decide on a line of battle, and convey that information to his corps commanders by having Capt. Paine make copies of a rough sketch map identifying where each corps was to go into position.⁶⁸ Meade's line of battle took advantage of the terrain, in the famous fish hook, marked by the Round Tops to the South, following along Cemetery Ridge from South to North, turning at Cemetery Hill in the North, and turning east and then quickly south along Culp's Hill (see map 1).

Meade had taken Taneytown Road to Gettysburg and arrived shortly after midnight. General Howard, when asked about their positions for battle said, "I am confident we can hold this position, General Meade." The other commanders concurred, and Meade replied, "I am glad to hear you say so, gentlemen, I have already ordered the other corps to concentrate here and it is too late to change."⁶⁹



Gettysburg is laid out like the spoke of a wheel with roads going in several different directions. Meade identified his lines of communication and the vital importance that they held. First was Taneytown Road, from the south, north into Gettysburg. To the east was Baltimore Pike, running southeast out of Gettysburg. Baltimore Pike, crucially, led to the supply base at Westminster, Maryland. West of Taneytown Road was Emmitsburg Pike, the third main road leading south, all held by the Federals.

Meade considered the topography that he had seen,

analyzed the maps that he had available, and relied on reconnaissance from Generals Warren and Slocum to decide if he should go on the offense, and bring the fight to Lee, or to take a defensive position. When initially faced with battle near Gettysburg, Meade had considered taking the defense at Pipe Creek, but events from the previous day had moved the Battle to Gettysburg. Meade's first orders were to launch a "strong and decisive attack"⁷⁰, but after their reconnaissance, Warren and Slocum returned with their analysis. The ground was "too rough

and too exposed to enemy guns...only good for defense”⁷¹. The federals would maintain the line, receiving reinforcements from the 6th Corps, and “strengthen its fortified works”⁷² to prepare for Lee’s attack. Meade’s focus would be on defending his primary supply line, Baltimore Pike.

Ideally, Meade would have preferred a straighter line that could not be turned by the advancing enemy, but he was limited with the geography available to him. The geography south of the town of Gettysburg and around Baltimore Pike included existing roads and elevated areas. Taneytown Road and Cemetery ridge were on the west with Culp’s Hill on the right. “Scattered hills and slopes that had been carved out by great glaciers made it a topographical patchwork. Whoever put this terrain to best use would win the upcoming battle,”⁷³ which is exactly what Meade planned to do. The next morning, Meade took a field map which had been drawn by Captain Paine, and “marked the positions for each army corps, and distributed (the) tracings”⁷⁴ to his commanders. The Army would be spread along a “fish hook” shaped line that from Round Top to Little Round Top, following Emmitsburg Road and along Cemetery Ridge, crossing both Taneytown Road and Baltimore Pike, utilizing Cemetery Hill and Culp’s hill to the north, turning south along Rock Creek until it intersects with Baltimore Pike.

The Battle Begins

Around 11:00 AM, Meade was still concerned with gathering and compiling geospatial intelligence to prepare for the battle. “He directed the corps commanders to send to headquarters without delay a ‘sketch of their positions with a view to the roads to the front and rear—with the position and apparent strength of the enemy in their front’...assign(ing) one general staff officer to each corps. Each officer was to learn the location of the corps headquarters and the positions of its artillery, infantry, and trains, particularly with respect to nearby roads which could be used for movements in any direction”⁷⁵ ensuring that his commanders were geospatially aware of their environment. General Butterfield, as chief of staff received this same order, in order to take charge in the event of any contingency. Butterfield

would later, when called upon by a congressional committee to examine Meade's Gettysburg performance, interpreted this as an "assignment for him to draw up formal orders for a retreat"⁷⁶. General Meade had no recollection of this "assignment" after the battle, and it was used by Butterfield and Sickles to accuse Meade of wanting to retreat from Gettysburg.⁷⁷ Butterfield, a friend of Hooker's, likely did not appreciate (as much as Meade, at the very least) the innate value of obtaining geospatial intelligence in the conduct of major military movements. This was an unfortunate misunderstanding that would be used months afterwards to accuse Meade of planning a retreat from Gettysburg.

At the same time that Meade requested information from his commanders, Sickles was confused about where he's supposed to go and when. Meade's son George, a Captain in the Union Army, was instructed check on Sickles, and to reiterate where he needed to be. By the time he arrived, Sickles was already moving forward with his troops. Instead of moving to where Meade had told him, Sickles took it upon himself to move forward to "higher ground", about 1500 meters west of the line Meade had intended, opening him to attack from both flanks⁷⁸. Meade sent General Henry Jackson Hunt with Sickles to examine the area, to see if the terrain provided an advantage without compromising the line. Hunt assessed that Sickles was too far forward, but Sickles was unconvinced, so Hunt suggested that Sickles send skirmishers to reconnoiter the area. Sickles was surprised to find Cadmus Wilcox's brigade of General A.P. Hill's Confederate corps. Luckily for Sickles, the column was coming at a right angle to them, and the volley of fire from the 100 sharpshooters supported by the 3rd Maine was so condensed that Longstreet was momentarily repulsed.⁷⁹ Meade understood the value of higher ground, but more importantly he understood that he needed to keep his line intact, and Sickles' decision to move forward had placed a weakness in the line.

As Sickles was withdrawing from his forward position, and Meade was trying to reinforce the line at Sickles' blunder, a messenger from Gen. Warren that Little Round Top had been

found naked. Meade immediately ordered the nearest Third Corps Division, but as they were moving another rider reported that Fifth Corps troops were moving to Little Round Top, and Meade moved the Third Corps Division back to where it was sorely needed. Just as Warren and the Fifth Corps were ascending Little Round Top, they directed fire at some of General John Bell Hood's (CSA) men who were coming up the other side of the hill, and repulsed the enemy.⁸⁰ Everywhere Meade looked, he found weaknesses in the line. Miraculously the Sixth Corps arrived just in time to strengthen the left flank against Longstreet's final push. Meade's fishhook worked, and the Army held its line. Warren's quick action saved Little Round Top, and the Sixth Corps marched through the night just in time to reinforce the line when it was needed most. Meade survived the second day of Battle at Gettysburg, despite Lee's best efforts and Sickles's seeming disobedience. That evening, Meade "summoned his corps commanders to meet in a council of war at the Widow Lydia Leister house".⁸¹

Around 9pm on the evening of July 2nd, Meade convened his meeting with General Butterfield, his chief of staff, General Warren, his chief engineer, two wing commanders, Generals Slocum and Hancock, and seven corps commanders, Generals Gibbon, Williams, Birney, Sykes, Howard, Sedgwick, and Newton, in the small bedroom in the house. General Warren was overcome by exhaustion, and slept through the meeting. The other Generals were too excited from the day's events, and "the satisfaction of having hurled back Lee's attempts to roll up their flanks and pierce the main line."⁸² Meade listened to their reports and excitement, but shared little himself. Besides regaling their successes and close calls, they also took to discussing the current situation. As each commander reported, Butterfield estimated their strength at 58,000 men ready to fight. Meade also ordered that wagons and baggage be left back at Westminster MD, as to not interfere with movements at Gettysburg, which left the remaining men with limited supplies of food and ammunition. General John Newton offered his opinion as an engineer that Gettysburg was a poor position and that Lee could turn their line if he chose.⁸³ Meade agreed that he didn't like the fishhook line, and would prefer something straighter to

avoid being turned by Lee, possibly stretching from Wolf's hill on the right down along the east bank of Rock Creek.⁸⁴

After the officers had regaled the day's successes and assessed the current situation and strength of their respective units, Butterfield made an effort to formalize the meeting and bring decisions to the group to be made. First they considered if they could and should remain in current positions, or if they should withdraw to a different location – the vote was to stay. Secondly, they debated if they should change their tactic and go on the offensive – the vote was to remain on the defense. Third, if they stayed on the defense, how long should they maintain a defensive posture, to which most agreed that they should not wait long. Maybe a day in defensive positions before Meade would reassess and take an offensive approach.⁸⁵ Meade would not have to wait long for the next day's battle to begin.

In the early hours of the morning on July 3rd, Gen Slocum discovered that the enemy was occupying a foothold on the lower spur of Culp's Hill, and Meade ordered him to attack at daybreak to regain the lost ground.⁸⁶ Meade rode with Warren and Hunt to Little Round Top to assess the situation and predict Lee's next moves. While the war council had decided to stay and fight, and remain defensive - but not for long, it was still Meade's decision on how to plan for the day's battle. Meade's decision was to "make no general attack, although should Lee be repulsed, the Fifth and Sixth Corps would be advanced against the Confederate right."⁸⁷

Slocum, reinforced by the Sixth Corps, and supported by Hunt's artillery, concentrated on the intruders, and in seven hours, the federals had regained the fieldworks close to the Baltimore Pike. The morning had started off with a victory, and Meade continued to direct his corps commanders. He anticipated an attack from Lee at the center, and advised Sedgwick to mass everything he had available to him in "a central position so it can be thrown in support as desired." Meade went about making sure that the men were ready for the attack, ate some breakfast, and encouraged Hunt to conserve his artillery's ammunition. He could see

confederate artillery pieces being moved and pointed towards the Federal center, and anticipated an artillery fight looming. Sure enough, Confederate cannon began firing at 1 o'clock in the afternoon. The Confederate artillery was inaccurate, overshooting the lines and landing in the rear. Meade's headquarters was in range and he eventually moved back to a barn near the Baltimore road. Meade continued to lead from there, reinforcing the center, but also making sure that "the flanks were well secured against any enemy turning movement."⁸⁸ After the barrage of artillery fire, Lee made his move. About 12,500 - 13,000 confederates were marching towards the Federal Line, and Meade hurried to evaluate his defenses. Damage had been done along the Ridge, but Meade assessed that it could still be held. Waves of Confederate troops attacked the federal line, successfully piercing in a few locations, but were eventually repulsed. Meade's superior positions and patience had brought him victory at Gettysburg. "On July 3, 1863, the Federals had faced the worst artillery blows yet delivered and had repelled a determined enemy charge on their center and right. No major counterstroke was believed possible under these circumstances."⁸⁹ Meade's initial plan was to pursue Lee if he withdrew, but after such a long day and arduous fight, Meade allowed his men to rest and relish in defeating Lee.

Meade's ability to secure key defensive positions based on geospatial intelligence acquired through reconnaissance and existing maps gave Meade an advantage in the battle. He was also able to quickly and accurately convey his intent to his subordinate commanders through maps created by Capt. Paine, assisting in major movements and accurate placement of defensive positions across the battlespace. After receiving command of the Army only six days prior to the Battle of Gettysburg, General Meade had beaten the Confederacy's most feared general. His experience as a Topographic Engineer, led to the decisions that he made on the battlefield, and win what is considered a major turning point in the Civil War. Geospatial Intelligence proved to be invaluable in the National Security of the United States by adopting new technology, and giving a better understanding to commanders, just as it does today. The

lesson to be learned is that if the nation is slow to adapt new technology that can assist in geospatial intelligence or fails to understand the geospatial context that intelligence can provide, the security of the United States will be put into danger.

Meade's Geospatial Intelligence Applies Today

For Geospatial Analysts today, there are many lessons that can be learned and applied from General Meade's experience at Gettysburg, which make up the four steps of the Geospatial Intelligence Preparation of the Battlefield process. Step 1 – Define the environment. Joint Publication 2-03, Geospatial Intelligence in Joint Operations (JP 2-03) defines step 1: "Gather basic facts needed to outline the exact location of the mission or area of interest. Physical, political, and ethnic boundaries must be determined. The data might include grid coordinates, latitude and longitude, vectors, altitudes, natural boundaries (mountain ranges, rivers, shorelines), etc. This data serves as the foundation for the GEOINT product."⁹⁰ For Meade, understanding the terrain at a large scale was just as important as him having a broader picture of the area of responsibility. Meade had been ordered to protect Washington and Baltimore, and also find and destroy Lee's army. He knew that in general, Lee was to his north, Washington and Baltimore were to the south and east respectively, and this defined his area of operations. Meade had to make use of existing road networks, avoid major river crossings, and be aware of any other terrain features that would impede his movement. While there are mountains in Pennsylvania near Gettysburg, there are also hills and ridges, of smaller elevation that provided Meade with a tactical advantage.

Step 2 of the GIPOE is to describe influences on the environment. JP 02-3 defines Step 2 as: "Provide descriptive information about the area defined in Step 1. Identify existing natural conditions, infrastructure, and cultural factors. Consider all details that may affect a potential operation in the area: weather, vegetation, roads, facilities, population, languages, social, ethnic, religious, and political factors. Layer this information onto the foundation developed in Step

1.”⁹¹ Meade had access to local civilians on troop movements that could identify local roads that might not exist on published maps, and Army officers trained in reconnoitering the landscape. Today’s geospatial intelligence environment often relies on existing datasets and satellite imagery. It is important to remember that landscapes can change fairly quickly with new roads, buildings, towns, and facilities being built, along with impacts from weather and enemy movements. A dry road one day may quickly become a quagmire, or as General Longstreet learned too late, an unoccupied hill can become occupied quickly. Using the most current geospatial information can provide a commander information to help him in his decision making. Modern technology can assess the slope, soil composition, elevation, landcover, aspect, and susceptibility to saturation that could affect heavy machinery mobility. This can provide a commander ideal locations, least cost paths, helicopter landing zones, and landing beaches. Jedediah Hotchkiss’ maps contained elements of Human Geography with locations of farms and their owners. The indirect information that was given to Lee was where the population was, how densely populated they are, and some possible sources for food and other supplies. Today Human Geography can give commanders information about population density, the make-up of the population (religion, tribe, sect, friendly/unfriendly), significant events/actions, access to water, etc.

Step 3 of the GIPOE is to assess threats and hazards. JP 02-3 defines step 3 as: “Add intelligence and threat data, drawn from multiple intelligence disciplines, onto the foundation and descriptive information layers (the environment established in the first two steps). This information includes: order of battle; size and strength of enemy or threat; enemy doctrine; the nature, strength, capabilities, and intent of area insurgent groups...”⁹² For Meade assessing threats and hazards would be directed at his enemy, which was very similar to his in size, strength, and doctrine.

Finally, step 4 of the GIPOE is to develop analytic conclusions. “Integrate all information from Steps 1-3 to develop analytic conclusions. The emphasis is on developing anticipatory analysis. In Step 4, the analyst may create models to examine and assess the likely next actions of the threat, the impact of those actions, and the feasibility and impact of countermeasures to threat action.”⁹³ Meade certainly did this as he assessed Lee’s position and his own position to determine where Lee would attack and what advantages Meade could gain from the terrain.

In today’s environment, the commander would not be going through the steps to create a “geospatial intelligence preparation of the environment” product, but provided to him by his geospatial intelligence analysts. The final product should be a map that is clear for the commander to understand. In a modern context, that map may not be a printed sheet of paper, but a dashboard, web-map, story map, or other product that geographically displays relevant information to the commander. While most commanders today are not trained as topographers like General Meade, most have a decent geospatial mindset. In a world of GPS Maps, Mobile devices, and a global economy, many people are familiar thinking spatially, but it is important for the analyst to create products that tell a story quickly and clearly to the commander so that they can process the information being presented and make sound decisions. More often, commanders are looking for interactive products that they can choose layers to display, measure distances easily, and derive coordinates for actions on the battlefield. Geospatial Analysts need to remember the lessons of Meade, and how framing the area of operations geospatially, using the resources available to acquire relevant data, and communicating that information effectively to decision makers can provide tactical advantage on the battlefield.

¹ United States War Department, *The War of the Rebellion: A Compilation of the Official Records of the Union and Confederate Armies*, 70 vols. in 128 parts (Washington, D.C.: Government Printing Office, 1880-1901), series 1, vol. 27, pt. 1, p. 61.

² Department of Defense. "Geospatial Intelligence" Title 10 *US Code*, 467, Definitions. Effective October 1996. Available: <https://uscode.house.gov/view.xhtml?req=granuleid:USC-prelim-title10-section467&num=0&edition=prelim>. Accessed October 26, 2019.

³ Frank N. Schubert *The Nation Builders: A Sesquicentennial History of the Corps of Topographical Engineers, 1838-1863* (Fort Belvoir, Virginia: Office of History, United States Army Corps of Engineers. 1988), 3

⁴ Frank N. Schubert *The Nation Builders: A Sesquicentennial History of the Corps of Topographical Engineers, 1838-1863* (Fort Belvoir, Virginia: Office of History, United States Army Corps of Engineers. 1988), 3

⁵ Frank N. Schubert *The Nation Builders: A Sesquicentennial History of the Corps of Topographical Engineers, 1838-1863* (Fort Belvoir, Virginia: Office of History, United States Army Corps of Engineers. 1988), 3

⁶ Garry David Ryan, "War Department Bureau 1831-1863: An Administrative History" (Doctoral Thesis in History, American University, 1968), 204

⁷ Adrian G. Trass, *From the Golden Gate to Mexico City; The U.S. Army Topographical*

Engineers in the Mexican War, 1846-1848. (Washington, DC: Office of History, Corps of Engineers and Center of Military History. 1993), 9

⁸ Garry David Ryan, "War Department Bureau 1831-1863: An Administrative History" (Doctoral Thesis in History, American University, 1968), 206

⁹ Garry David Ryan, "War Department Bureau 1831-1863: An Administrative History" (Doctoral Thesis in History, American University, 1968), 206

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¹¹ Henry P. Beers, "A History of the U.S. Topographical Engineers, 1813-1863." *Military Engineer*, 34 (June 1942), 287

¹² Henry P. Beers, "A History of the U.S. Topographical Engineers, 1813-1863." *Military Engineer*, 34 (June 1942), 287

¹³ Henry P. Beers, "A History of the U.S. Topographical Engineers, 1813-1863." *Military Engineer*, 34 (June 1942), 287

¹⁴ Adrian G. Trass, *From the Golden Gate to Mexico City; The U.S. Army Topographical*

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