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# The Evolution of Communications in the Military as it Relates to Leadership

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The Evolution of Communications in the Military  
as it Relates to Leadership

By  
Palmer Lipscomb

Project submitted in partial fulfillment of the  
Requirements for the  
Bachelor of Integrated Studies Degree

Regional Academic Outreach

Murray State University

August 30, 2017

### Historical Project Proposal

This project proposal will follow the “Design for a Historical Research Project” found in the BIS 437 Senior Project Guidelines.

1. This historical project will focus primarily on the United States military, but reserves the right to reference militaries of other nations throughout time.
2. The project will span a large amount of time in history. The intent is to show how military communications have evolved over time. To fully show the evolution of communications in the U.S military, this project will span from the inception of the U.S Army, as the oldest branch of the U.S military, in 1775 to present.
3. The most important questions that will be answered in the project are how communications have evolved over the history of the U.S military and what the relationship and effects communications have had on military leadership. The research will involve tactical communications as well as communications in leadership.
4. Primary sources will be from history books initially and as the project reaches into the modern era, i.e., the twentieth and twenty-first century, reference will come from peer-reviewed journals, writings from various U.S Army institutes of higher learning and military field manuals. The questions of how communications affect leadership in the military will be addressed.
5. Secondary sources will be individuals that have first-hand knowledge of communications in the military and have experienced the effects of leadership.
6. The sources will provide the necessary information to validate the evolution that has occurred in military communications since inception.

7. Due to the scope of time involved in the project, approximately five chapters will be needed. There will be four chapters dedicated to each century since the inception of the U.S military in 1775. There will also be a chapter dedicated to reflection and comparison of the evolution of communications and how effective or ineffective communications were in these different eras.

Notes: Project formatting will include a Table of Contents, a references page, and appendices as required.

MLA style was used for this proposal due to ease of format and space.

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Palmer Lipscomb  
Advisee

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Date

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Mrs. Regina Arnold  
Senior Project Adviser

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Date

### Abstract

The evolution of communications in the military as it relates to leadership will review the different means and methods of communications that have been used throughout U.S military history. This will be accomplished using a chronological format. Starting in the Revolutionary time when horseback riders and written communications were the primary means for commanders to relay orders to subordinates, through the invention of the telegraph, that was one of the most significant communications methods developed during the first one-hundred years of United States history. From the telegraph to wireless technology and finally to present day and the widespread use of satellite communications. A comparison of the effectiveness between interpersonal communications and technological methods for communicating will be made. Although it is hard to quantify, the effects on leadership will be discussed. This project is a learning experience in military history and technology. It will be interesting to see how communications within the military evolved.

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## Chapter 1

For as long as there have been militaries, communications have been key to the success and failures of these militaries. The earliest recorded war was in Mesopotamia between Sumer and Elam in 2700 BCE. Records of this war were discovered carved in stone, so this would be a very early example of communications (Gabriel & Metz, 1992). Verbal communications would have been employed as well, but this civilization had just learned to write. Communicating with hand and arm signals would also have been used to control formations.

To give a historical account of how militaries communicated back to ancient times would require much more time and space than is allotted. This chapter will focus on communications within the United States military from the time of inception in 1775, the beginning of the American Revolution, through the end of the century. The different means and methods of communications will be discussed and then determined if there was one method that was more effective than the other. The effect that different methods of communication had on leadership will be looked at also.

This time frame will encompass several wars that the United States participated in, including many wars with France and Britain. The Industrial Revolution occurred during this period also, from approximately 1760 to 1840. The telegraph was invented in the 1830's and 1840's by Samuel Morse (Staff, Morse Code & the Telegraph, 2009).

The span of time, the Industrial Revolution and experience in war contributed to the way communications in the military changed during this period.

As tensions intensified between the colonies in the Americas' and the British government abroad, the militias began to have clashes with the British soldiers. Eventually, this led to full-

scale war as the 13 colonies sought their independence from Britain (Staff, American Revolution History, 2009). General George Washington led the Continental Army against the British.

### **Means and Methods**

The industrial revolution greatly enhanced the colonist's ability to utilize resources that were abundant in North America. Coal was the fuel of choice and mining for coal started increasing dramatically. Coal use in 1700 was 2.7 million tons and by 1850 had increased to 50 million tons. Oil was being used for electricity while coal was used for heating and lighting. Once it was determined that oil could be extracted from the ground instead of from whales, oil production skyrocketed. Steel and iron were used to advance the capability of machinery which increased transportation, construction of bridges and better tools (Simmons, 2014). Better tools enabled craftsman to build items used in communications at a much greater pace.

The effect of the industrial revolution on communications will be discussed later in chapter two. Before many technological advances were developed, there were other means of communications that have been used to communicate in the military.

**Voice.** Voice communications have been and always will be the primary means to communicate with other military units. At a time when there were no telegraphs, telephones, computers, or satellites, people had to talk or write to relay information. Voice communications during the Revolutionary War may have appeared simple except for the fact that the colonies were being settled by not just the English, but also the French and Germans. The French fought primarily on the side of the colonist while the Germans were allied with the British. In one instance from the Battle of Brandywine, a German officer, Captain Johann Ewald wrote,

that in the army's advance, were sixty jaegers on foot, fifteen mounted jaegers, a company Highlanders, and a company of British light infantry. These units protected the army from

ambush and cleared the way for the advance. There was no explanation of how this could be effective despite the language barrier. (Dunkerly, 2016)

Societies have used hand gestures to communicate for thousands of years. Hand gestures are used to enhance or emphasize what is being communicated. Sign language was developed as a means to communicate with the deaf community in the 1500's.

**Hand and arm signaling.** Hand and arm signaling are a means of communications that has been used since the beginning of warfare. Hand and arm signals can be used by themselves or in conjunction with voice communications. During the din of battle, soldiers cannot always hear commands from their leaders or between one another. In this instance, hand and arm signaling are used in concert with voice communications. When the need for stealth arose hand, and arm signaling would have been the preferred means to communicate between individuals and military units. This form of communications is especially effective when conducting reconnaissance missions or laying in ambush positions, and the need for silence is critical to the success of the mission. There are many military manuals dedicated to the use of hand and arm signaling. This form of communications in the military will be revisited throughout this project.



Figure 1

**Hand and Arm Signals**

**Flags and guidons.** The flag or guidon like hand and arm signaling are a visual means of communications. In the absence of verbal commands, soldiers would follow the unit's flag or guidon. Military flags are also referred to as standards or colors. So important are flags and

guidons to the military and the United States that an order was issued from Washington's headquarters on flags, as quoted, (Flags and Guidons of the U.S. Army, 2017):

“As it is necessary that every Regiment should be furnished Colours, and that those Colours should...bear some kind of similitude to the Uniform of the regiment to which they belong, the Colonels... may fix upon such as are proper, the standard (or Regiment Colours) and Colours for each Grand Division,...The number of the Regiment is to be mark'd on the Colours, and such a Motto, as the Colonel may choose, in fixing upon which, the General advises a Consultation amongst them. The Colonels are to delay no time, in getting this matter fix'd, that the Qr. Mr. Genl. May provide the Colours as soon as possible;...”

Flags and guidons provided identity to military units, this helped distinguish them from one another. The colors or standards were a source of morale for the unit. During combat, troops knew there was still a fighting chance as long as the colors were still flying. If the guidon bearer was struck down the soldier to the left, right, or rear would pick up the guidon and continue on, the unit would follow the colors. When troops saw the guidon go down this could be a sign that the commander was also down. This would cause the morale to drop. Also, command and control would deteriorate. Units were known to completely fall apart just because the colors were lost. As regiments maneuver, the regimental colors are carried and displayed near the commander. The same holds true for the battalions in the regiment, and the guidons for the companies within the battalions. An order would have been issued for the particular maneuver; this would dictate the order of battle and spacing between units. The colors will be posted wherever the commander of the unit is. When units were encamped, the guidon would be located at the headquarters when the commander is present. This practice holds true in today's military.

General Officers are referred to as “Flag Officers,” their flag will be posted where ever they are. An aide will transport the General Officer flag along with the general’s staff and ensure it is posted at the entrance of the general’s location.

Unit flags, colors, and guidons are not only used by ground forces, but naval forces have used flags to signal for centuries. The first known use of flags was from the ancient Athenians (McMillan, 2001).

In the 17<sup>th</sup>-century flag, usage became prevalent that a system was developed that became the standard for naval forces for close to a century. In 1738 a French officer created a flag system that could produce 336 number combinations, using only three flags each. Throughout the 18<sup>th</sup> and 19<sup>th</sup> centuries, the system for flag signal codes was revised and improved. In 1870 the International Code of Signals (ICS) became the standard for all maritime capable nations. In 1965 the ICS became regulated by the United Nations’ International Maritime Organization. Signaling at sea by the United States is now governed by a set of North Atlantic Treaty Organization (NATO) and U.S directives in conjunction with the ICS (McMillan, 2001).

**Print and written communications.** The printing press was invented in the Fifteenth Century by Johannes Gutenberg. Written accounts of war by militaries started as early as 2500 BCE during the Mesopotamian wars between Sumerians and the Elamites in what is current day Syria and Iraq. These accounts were carved into stone tablets, not only did the tablets depict battles but they also revealed that professional armies had been established (MilitaryHistoryNow.com, 2014). From the Revolutionary War period until present day written communications have been used as a way to distribute directives and battle orders. Before telegraph written communications were one of the primary means to deliver messages. In lower echelon units’ runners on foot would deliver communications between units. At the higher

echelons like regiments, divisions, and corps runners on horseback were used to distribute hand-written and printed messages throughout the battlefield. Written messages were used more for field orders, where flags would have been used for tactical maneuvering.

Newspapers were used extensively to communicate information from region to region. In many instances, secret messages would be hidden in newspapers. Intricate written codes have been employed during war for centuries. Written ciphers and codes are still used in modern war as a means to communicate secretly.

When the American Revolution began in April of 1775, Benjamin Franklin was the Postmaster-General and had established seventy-five post offices and over eighteen hundred miles of mail routes (Luhn, 1891). Written and printed text sent by post played a huge part in not just the American Revolution but military communications for decades to come. The telegraph would not be invented for another sixty years.

**Fife, drums, and bugles.** Music has been used as a means of signaling and communicating long before the Revolutionary War period. Horns and trumpets were used for military purposes since biblical times. In the seventeenth and eighteenth centuries, musical instruments were relied upon heavily to signal and communicate to units. Just as verbal commands and visual signals are used in combination, so are the fife, drums, and bugles employed. Drums are used for signaling because their beat could be heard for long distances.



**Figure 2**

**Fife and Drum**

Different beats are used during combat to direct units to conduct certain maneuvers. In camp or garrison drums can signal everything from wakeup times, when to eat, and conduct chores. Fifes and drums are used to build morale among troops. Fight

songs have been played by armies preparing for battle and while engaged in combat. Scottish armies have used the blaring sounds of bagpipes to shock their enemies during battles. The United States military has twenty-five different bugle calls that signal different tasks to be completed throughout the day. Bugles tended to be used by mounted cavalry because it was easier to play bugle on horseback than a drum.

Commanders communicated on the battlefield with visual signals and musical instruments before telegraphs and electricity. During this era flags, musical instruments, and hand and arm signals were quite effective for the period. Military commanders devised different ways to maintain the code of communications within the different armies. It was not difficult for armies to figure out how many beats of the drum were used to reload or fire the weapons. Commanders went to great lengths to ensure that other armies did not figure out the cadences.

Once the industrial revolution began musical instruments like the fife, drum, and bugle could be produced much quicker and in larger numbers than ever before.

### **Key People During This Period**

- Johannes Gutenberg invented the printing press in Fifteenth Century, long before this time period, but it was key to communications during the revolutionary period. Commanders used printed messages to send orders and directives to commanders. It was also used as a means to spread propaganda through newspapers. It took months for news to go from England to the colonies. When it reached the colonies, it was old news, but it was the only news the colonist received. With that in mind, this population was easily influenced.

- Historically speaking, Paul Revere made the significant ride that spread the word of the coming of the British. Runners were a primary means to disseminate information over long distances.
- George Washington as the commander of the Continental Army utilized runners as a means to distribute orders. His leadership was instrumental in defeating the British. He would eventually become the first President of the United States and one of the founding fathers.

### **Impact of Communications on Leadership**

The methods to communicate during the revolutionary period were basic, to say the least. Effective in the simplicity but easy to misinterpret for many reasons. Hand and arm signal, flags and other visual means could be hard to understand during limited visibility and inclement weather. Flags were ineffective at night, for hand and arm signals to be effective distances needed to be short. Written messages sent by runners took time with no assurance that the message would even reach the intended recipient. On the battlefield, the din of battle would have been a challenge to communications, voice commands would be hard to hear. Fife and drums would have been muffled, leading to misinterpretation of signals, which in turn would've led to unfortunate consequences in combat. One possible cause for the Revolutionary War could be contributed to communication or the lack of. If the colonist and the British in England would have been able to communicate on a real-time basis they may have been able to discuss and come to solutions to issues facing the colonist. War may have been avoided through good up to date



**Figure 3**

**George Washington**

communications and diplomacy. News and information were old by the time it took correspondence to cross the Atlantic Ocean. Passage across the Atlantic could take upwards of two months. A modern-day infantry platoon has more capability to communicate than George Washington did as the Commander-in-Chief of the Continental Army in 1776.

## **Chapter 2**

With the advent of the industrial revolution and the invention of the telegraph in 1844 (Staff, Morse Code & the Telegraph, 2009), communications in the military would change dramatically. All conventional means discussed earlier will still be employed. However, the quality and quantity will increase. Once battlefield commanders could transmit messages through telegraph, they could communicate over much greater distances and speeds never seen before. A runner on horseback could not out run a telegraph.

As part of globalization came the need for better ships for transatlantic voyages and intercontinental transportation in the form of trains. As technology increased the need for some methods of communications were becoming legacy. Runners on horseback were not needed for long distance messaging, and the telegraph would fill that requirement.

### **Means and Methods**

Once America won its independence in 1776, there was a great deal of technical knowledge that was inherited from England. As machinery was built in America, one invention had a significant impact on American society. That was the invention of the cotton gin by Eli Whitney in 1794. The cotton gin increased the production of cotton exponentially. Cotton became America's leading export by the mid-19th century. This was good for southern states because seventy-five percent of Britain's cotton came from America. However, it was a contributing factor to America's civil war in that it increased the need for labor and that labor

came in the form of slavery. Exporting so much cotton also necessitated conveyance systems that allowed for the effective transport of materials to cotton factories and of completed products to England. No such system existed in the United States in the early 1800's (Staff, Cotton Gin and Eli Whitney, 2010).

The invention of the steam engine in the late 1600's was another development that would prove invaluable to opening lines of communications across America and the Atlantic Ocean (Lira, 2013).

**Stagecoaches and the Pony Express.** Until the invention of the telegraph and trains, stagecoaches were one of the primary means to deliver mail, cargo, and messages throughout America. Steamboats were active on the waterways in the early 1800's, but all overland cargo was carried out by stagecoaches. Stagecoaches were slow, and there was no guarantee of delivery. Travel times from the east to west coast could take weeks, sometimes months. These were dangerous times, and stagecoaches had a tendency to be attacked and ambushed. During the mid-1800's, the Post Office Department contracted mail transport to California and the military was also delivering mail to the west and southwest regions of America.

In 1860 William Russell established the Pony Express to carry mail between Missouri and California. The Pony Express was the fastest means to get mail from Missouri to California. Stations were established every five to twenty miles to change out horses. There were about 150 to 190 relay stations. On average a rider could cover one hundred miles in a day, less in the winter months. It would take about ten days to cover the nearly 2000-mile trip. President Abraham Lincoln's inaugural speech was delivered to California in seven days and seventeen hours, at the time that was the fastest delivery of mail in history. In October of 1861 telegraph lines had been run coast to coast and the Pony Express became history (Longfellow, 2017).

**Steamboats.** When people think of steamboats, they do not think of ships of war.

Adventures and settlers moving across a new country are what is envisioned. America has thousands of miles of navigable waterways in the interior. With the invention of steamboats, lines of communications and commerce expanded. Travel over long distances was not limited to walking or horse-drawn wagons.



Figure 4

Old Ironsides

While not being a method of communication the steamboat did provide a means to deliver military messages and orders. Steamboats were used extensively during the Civil War by the Union and Confederate armies. For the Union army steamboats gave them a route directly into the heart of the Confederacy via the Tennessee and Cumberland rivers. Summarizing the efficiency of steamboats (The American Civil War (1861-1865), 2017):

The cargo capacity of the western steamboats varied all the way from under 100 tons to the 1,700 tons of the chartered side-wheel steamer, the SULTANA. An Army supply officer calculated that an ordinary Ohio River steamboat of 500 tons would carry enough supplies on one trip to subsist an army of 40,000 men and 18,000 horses for nearly two days. This was the equivalent of five 10-car freight trains.

The carrying capacity of these ships and the ability to make them offensive weapons made steamboats indispensable for both sides. The ironclads so called because of the iron plating installed over conventional wooden ships played a significant role in the Civil War. As ironclads

continued to develop, they would be built of all iron. The battle between the CSS Virginia and the USS Monitor was the first face-to-face battle between ironclads. The Union would eventually build much more ironclads employed in combat on America's waterways (Arbuckle, 2016).

**The railroad.** Locomotives with steam engines were invented and first used in England in the early 1800's. The first railroad in the United States was put into service in 1827 in Baltimore. Initially, there were only thirteen miles of track. By 1852 the railway ran from Baltimore to the Ohio River, thus the B&O railroad. A line was eventually running to the Pacific establishing the Central Pacific and Union Pacific lines. Up until these lines were built, settlers heading west traveled by using horse and wagons (Congress, 1827).

During the Civil War, railroads were used to provide logistical support for the armies almost as much as steamboats. Railroads that supplied the units while engaged in combat were targeted

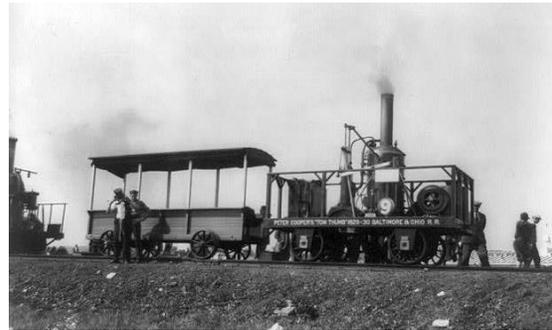


Figure 5

Steam Engine

by large enemy forces. Units could not fight long without the much-needed materials that were provided by the railroads. Therefore, it took large numbers of troops to secure railways. A technique used by both Union and Confederate Armies was to keep units within proximity to the lines of supply and communications. The rail systems at this time still carried much of the mail and military messages throughout areas of operations.

Railroads of the Civil War were typified by tactical and logistical support armies in combat. Americans set a standard for armored fighting vehicles of today's militaries, including a wide array of armored train configurations. The use of trains in the various armored compositions was the fore-bearer of modern armored forces (Koenig, 2006).

As reconstruction began after the Civil War, there were approximately 45,000 miles of railway in America. From 1871 to 1900 there were 170,000 additional miles of a rail system in America. In May of 1869, the first Transcontinental Railroad had linked California with Omaha, Nebraska, by 1900 four more transcontinental railroads ran from the Atlantic Coast of America to the Pacific Coast.

**Balloons.** The first use of the balloon in combat was by the French in June of 1794 (History&Headlines, 2017). Ever since the first use of balloons in 1794, militaries have used balloons during war. The first large-scale use of balloons by a country's military was during the American Civil War (1861-1865). Balloons were employed by many countries during both World War I and World War II. Balloons are still used today for reconnaissance and communications.

In the 1800's, the military used balloons for several reasons. Aerial reconnaissance was a primary use of balloons. Communications was another main use of balloons. The Austrians were the first to attempted aerial bombardment by balloon, but they were not successful. Successful aerial bombardment by balloon would not happen until World War II (Commission, 2017). Initially, balloons would ascend above the battlefield tethered to a line, so the balloon would not float away, the passenger would yell down to the ground crew and report what was seen. When the telegraph became the primary means of communications, a telegraph wire would go aloft with the balloon, and then the operator could send observation reports via telegraphs from the balloon.

One such observer dictated this message to a telegraph operator from a hot air balloon (Fanton, 2006):

‘This point of observation commands an extent of the country nearly 50 miles in diameter,’ he said, and the operator obligingly tapped out his words with the telegraph key. ‘The city with its girdle of encampments presents a superb scene. I have pleasure in sending you this first dispatch ever telegraphed from an aerial station, and in acknowledging indebtedness for your encouragement for the opportunity of demonstrating the availability of the science of aeronautics in the military service of the country.’

This message was sent by Thaddeus Lowe, who was an aeronaut for the Union Army, to President Abraham Lincoln in June of 1861. This is one of the first uses of air forces in America. The balloon would be employed by the Union Army and the Confederate forces throughout the Civil War.

**Telegraph.** Since the discovery of electricity by Benjamin Franklin in the late 1700’s and the invention of the battery by an Italian physicist Alessandro Volta in 1800, scientist began the quest to harness it for communications purposes.

When Samuel Morse and Alfred Vail first invented the telegraph, what occurred was an electric signal transmitted across a wire to a receiver at the other end. Needed was a means to transmit the signals in such a way that they could be deciphered. The ability to control when a signal was transmitted, and in what intervals was done through a key, however, there was not a way to decipher the signals. Samuel Morse and Vail



**Figure 6**

**Telegraph**

developed a code that assigned numbers and letters to signals based on the length and interval of the signal. Thus, Morse Code was developed. In 1844 a telegraph was successfully sent from Washington D.C. to Baltimore, MD. (Staff, Morse Code & the Telegraph, 2009). Before the Civil War began, the first attempts to run telegraph lines across the Atlantic Ocean. In 1866 a permanent telegraph line ran across the Atlantic Ocean. This feat would change the armies fought and communicated. To be able to communicate across an ocean in an instant compared to receiving messages by a ship that could take weeks was an advancement that changed society.

The invention of the telegraph had a substantial impact on how the Union army and Confederacy communicated. The speed at which tactical and strategic orders could be relayed to commanders throughout the theaters of operations changed the tempo of the war. A commander no longer had to send written or printed messages by runners on horseback, which could take hours and even days to reach the recipient. Trains and steamboats were slow compared to messages sent by telegraph.

When the Civil War started in 1861, the first telegraph line from Washington to California was completed, and thousands of miles of telegraph lines had now been installed in the north and south. The Union Army established the U.S. Military Telegraph Corps and started training telegraph operators and putting up telegraph lines at an alarming rate. President Lincoln's ability to communicate had no rivals. He could communicate with his field commanders in an instant utilizing telegraph stations that were strategically arrayed throughout the country (Staff, Civil War Technology, 2010).

The states that seceded from the Union captured telegraph systems installed by the North, or just simply forced the companies to favor with the Confederacy. All telegraph and postal services would be controlled by the Postal department.

Because of the importance of the telegraph, towns with telegraph offices and the lines connecting these towns were strategic targets for the armies. The Confederacy had a hard time sustaining these lines of communications due to the Union Army pressure and the inability of the south to maintain and repair damaged and broken lines. The industrial might of the Union was superior to the Confederates.

As reconstruction began after the Civil War, western expansion continued at a very fast pace. The United States continued to incorporate western territories into the nation. Native Americans were an obstacle to this expansionism. Military commanders mounted campaigns against the native tribes; again the telegraph would be key for commanders to communicate. This was a technology the Native Americans did not have. The telegraph would be used as a means to send messages to America for another one hundred and fifty years.

### **Key People During This Period**

- Eli Whitney and the invention of the cotton gin was significant to the history of America. The cotton gin was a contributing factor in America's economic success in the world. It also was a cause for increased demand for slave labor in the south.
- The Pony Express, established by William Russell contributed to communications to the likes of the telegraph. At the time it was the fastest means of delivering messages over a substantial distance. The ability to send a message across North America was significant to sending time-sensitive messages. The Pony express would finally be replaced by a faster means of communication, the telegraph.
- Thaddeus Lowe utilized the balloon not just for observation but coupled with the use of the telegraph as a long-distance communications technique established what would later be termed aerial reconnaissance.

- The biggest communications achievement the world was to see for almost two centuries would be the invention of the telegraph. The credit was given to Samuel Morse, although Alfred Vail contributed substantially to this development. It was Morse who created the code that would decipher and electronic signal, deemed Morse code. The military application of telegraph would be a decisive advantage to the commander that could maintain the lines of communications.
- President Abraham Lincoln was the Commander-in-Chief of the Union Army; he was the first commander to have communications capabilities that allowed him to communicate with field commanders instantly. Considerable time was spent by President Lincoln in the telegraph room of the war department. He was connected better than any commander or president of the time.

### **Impact of Communications on Leadership**

The means and methods discussed above are not communications techniques in the true sense, except for the telegraph. When military communications are considered it is hard to define it by a means that could take weeks to deliver. The use of stagecoach, steamboats, or railways was just a means to get the information from one point to another. They were just forms of transportation that were used to send correspondence, messages and combat orders. Commanders still had to construct a hand-written, printed, or voice message attached to the means, the other options were or face-to-face meetings. This form of delivering communications had a profound impact on how field commanders and the Commander-in-Chief communicated. Before being able to send a message via rail, or steamboat a commander had to send runners to deliver orders, Military units had to fight and maneuver in much closer proximity to one another to ensure good communications. Flags, hand and arm signals, and drums could not deliver an order or message

over a very long distance. Commanders held face-to-face meetings with their subordinates, which meant the commanders had to move to a designated location and congregate for a meeting. This was dangerous on two fronts; first, it was dangerous for commanders to moving to the rear of the front for meetings because the enemy would target the rear areas and set ambushes. Also, if word got to the enemy of the location of these meetings, they would attack the group of commanders. There are reports of units losing the entire chain-of-command because they were all killed during a raid on the meeting. By utilizing the different transportation means to deliver correspondence and orders commanders were not exposed to the dangers of moving around on the battlefield. The chance that messages sent by one of the means of transportation mentioned, being intercepted by the enemy did exist. Commanders devised ways to deceive the enemy by sending fake messages or writing messages in different codes. Until the invention of the telegraph the ability to send messages and orders took entirely too long, information was old by the time it was received. The flow of battle does not wait, and situations change rapidly.

The telegraph provided real-time communications between commanders and their subordinate units. Telegraph allowed units to maneuver over greater distances and maintain communications with adjacent units and their commanders. Thousands of miles of the telegraph had already been strung, but as the union pushed south along major avenues of approach, communications hubs were reestablished and reinforced. These communication hubs became strong points from which further operations could be planned and conducted from. Logistical points could also be established once the area was secured. The ability to maintain these lines of communications was paramount to the Union winning the war. This was the most significant innovation in communications in the history of the world. Telegraph not only contributed to the way commanders communicated but also the telegraph had an impact on society and Americas'

economy. The telegraph changed the course of the American Civil War and ultimately the way wars would be fought for the next century.

Because of the industrial might of the Union, its commanders had far better communications than the Confederate army. The north could establish more railways, build more steamboats, and string more telegraph lines than the south, thus giving the north a substantial tactical and strategic advantage during the war. Commanders of armies learned that to control major lines of communications, transportation and logistics was key to winning not just battles but wars as well.

### **Chapter 3**

The American military participates in five major wars and more than twenty minor wars, conflicts, or rebellions during the twentieth century. The cold war will end towards the end of the century. America goes through a second industrial revolution that saw an increase in steel production instead of iron, electricity was being made public, and liquid petroleum products were being made. Technological advances included many products and services that saw substantial improvements, but many new inventions came about also. This was an age that technology started moving faster than society could keep up with it.

#### **Means and Methods**

Before the turn of the century the telephone, wireless telegraph, and the radio had been invented. The telephone was invented in 1876 by Alexander Bell (Staff, Alexander Graham Bell patents the telephone, 2009) and the radio was invented by the Italian Guglielmo Marconi in 1897, with the first transatlantic transmission occurring in 1901 (Staff, Guglielmo Marconi, 2009). There will be a huge progression in communications methods between the first and

second halves of the century. This will occur when a man starts exploring space, and satellite communications become a reality.

**Wireless telegraph/radio.** In the early part of the 1900's dozens of telegraph lines had been strung across the Atlantic Ocean and would be used for decades to come. Orders could be sent across oceans in an instant; this changed the tempo of battles and campaigns. Wireless telegraph was developed by Guglielmo Marconi in 1895. When he first built the device to transmit Morse code through electromagnetic waves, Italy did not have faith in the technology, so Marconi took his invention to England (Staff, Guglielmo Marconi, 2009).

Wireless telegraphy became an essential part of warfare on the land, sea, and air by 1918. English armies were the first to employ wireless technology in battle. Once armies started using wireless telegraph as a primary means of communications, it would change the way wars were fought. One setback was the ease in which wireless telegraph could be intercepted. Navies' were more interested in wireless telegraph than ground forces. Land forces continued to try and figure out more secure means to communicate.

Though the English were the first to use wireless telegraph, it was the Germans who successfully employed during World War I while engaged in trench warfare along the Western Front. Germany maintained a tactical advantage during the initial year of WWI, and this allowed them to establish stations along the front. The necessity of wireless telegraph for the Germans was because Britain had cut most of the German underwater telegraph lines (Tworek, 2014). The British began to utilize wireless sets that could be moved in the trenches of the front. The use of wireless telegraph by both sides paid off here because of the large amounts of artillery fire that destroyed buried telegraph lines.

America did not enter WWI until 1917, but one of the first objectives against the Germans was a wireless station transmitting, oddly enough, from a village on the east coast of New York. Wireless technology would continue to be a key communications method for another century. Wireless telegraph and radio are the same things; they are just spelled differently. They are both the process of sending and receiving signals without wire. The only perceived difference would be that you can hear a voice through radio and only signals through telegraph (Hubert, 1925). Being able to hear a voice on a receiver was a breakthrough when wireless was offered to the public. The first transmission of long-range voice was accomplished by a Canadian inventor named Reginald Fessenden in 1900. The ability to transmit voice wirelessly was made possible by another inventor's invention, Ernst Alexanderson was a Swedish inventor that developed an alternator that allowed the transmission of voice (Radio A. S., 2004). As WWI came to an end the usage of radio by land forces was still limited. Radio equipment for land forces was limited in the distance, 2000 yards was about the maximum range of radio because the equipment needed to produce strong signals was large and heavy. As stated earlier naval and air forces employed radio technology much more successfully since they could transport the equipment needed to produce signals strong enough to travel long distances (Brady, 2014). Radio equipment was being installed in all trucks and tanks. The equipment used in wireless technology had improved immensely by the time the United States became involved World War II in 1941, from the equipment used a few decades earlier. As components for radios were made smaller and lighter, battery-powered radio sets were developed that could be hand-carried by soldiers with relative ease.

Radio technology continued to improve as the 1900's progressed. Distances were increasing, and the equipment was getting lighter and more portable. A two-way radio was

developed in 1924 by Bell Labs and is credited as the forefather of the cell phone (Cannell, 2015). This technology enabled Motorola to develop a radio that weighed only five pounds. This radio designated the SCR536 by the military was eventually fielded by the thousands to soldiers engaged in combat operations. The SCR536 was especially useful in the infantry and airborne infantry units because of the compact size of these radio sets (Radio H. T., 2017). This radio was affectionately referred to as the “Walkie Talkie” (Cannell, 2015).

Reliable two-way radio communication was now a standard consideration in all military operations. The walkie-talkie (SCR536) was the primary means of radio communications during WWII for small tactical units such as platoons and companies.



**Figure 7**  
**Walkie-Talkie**

During the middle of the century, America was involved in the war in Korea. Much of the communications equipment being used during the Korean War was the same used during WWII (Warfare, 2015). Commanders relied heavily on wired communications because the terrain and poor weather restricted radio communications. As the war wound down it became a war of attrition, both sides were dug in and just conducting defensive operations, this was very similar to WWI trench warfare. The tactical situations of these two wars required wired field phones as one of the prime communications methods; wireless was still the preferred method when terrain and weather allowed it to be used.

Communications equipment up until now used vacuum tubes to rectify signals and to amplify (Valve, 2017). Vacuum tubes were big and bulky and used a lot of power. Transistors developed in the late 1940's, transistors required less power, operated much cooler, and were much smaller and lighter than vacuum tubes (Begins, 2002). Transistors, some say was one of

the most important inventions of the 20<sup>th</sup> Century (Gaudin, 2007). The transistor would revolutionize communications, both civilian and military.

Transistors are used in medical equipment, vehicles of all types, ships, planes, tanks, and computers. They are components of virtually every type of electronics.

Enough cannot be said about the importance of wireless telegraphy and radio as it applies to military communications. Commanders rely on the capabilities radio provide for disseminating battlefield communications both tactical and strategic. Radio technology and the invention of the transistor will be the foundation for communications in the military right up to present time.

**Telephone.** The telephone was invented in 1876 by Alexander Bell. Initially, the telephone utilized wires to transmit signals just like the telegraph. The difference was telegraph sent signals in dots and dashes, whereas telephone sent signals of different pitches that allowed the person on the other end to hear the spoken voice. This approach developed by Alexander Graham Bell was known as “harmonic telegraph” (Staff, Alexander Graham Bell patents the telephone, 2009).

Telephones have been used by the military since early 1900’s. The United States coast had hundreds of miles of wire lines that were used to connect communications between key coastal sites. Telephones were used by commanders along the coast to coordinate shore battery fires. Commanders did not have much confidence in telephones due to a couple of reasons; one telephone s were susceptible to compromise, specially wired phones and telephone lines could be damaged by artillery barrages. Many commanders preferred to communicate by more legacy means, such as flags and signal flares (Sterling, 2008).

Telephone followed a similar path as the telegraph. As wireless technology progressed to the telephone, it became a viable means of communication for the military. When the radio became the primary means of tactical communications, commanders installed telephone stations to conduct everyday communication among commanders and staff. The telephone will continue to be utilized for the remainder of modern military history. As this project continues, the telephone will be a topic that will be discussed in depth.

**Field phones.** Despite the pace at which radio and telephone technology progressed, the military would continue to fall back on rudimentary systems. The Department of Defense (DOD) needed to maintain technological superiority over their adversaries. It continued to contract companies to develop new communications technology throughout this 20<sup>th</sup> Century.

During the 20<sup>th</sup> Century, most militaries utilized some form of wired communications. Radios in the early 1900's performed marginally at best, atmospheric conditions deteriorated radio signals, and radio was vulnerable to interception and jamming as technology advanced. Once wireless radio and telegraph were developed the militaries would use wired communications as a secondary means to communicate. This was of particular importance in defensive postures. Wired communications systems are not very effective when armies are engaged in offensive operations.

Trench warfare had become the tactic of choice during WWI. Radio communications in the trenches were minimal, and the importance of the field phone cannot be overlooked. The field phone is what allowed commanders to maintain contact with their subordinates in the trenches and the higher command in rear areas. Both sides fought to a stalemate and dug-in to the trenches. Huge volumes of field-artillery and mortar fire was being fired by these armies. The indirect fires hurt wired lines of communications. Wire for field phones needed to be re-strung or

spliced as it was severed by a shell burst. As time and resources permitted, the wire would be buried in communication trenches to better protect it. When the lines were maintained the field-phone provided the most reliable means of communication on the battlefield, the only comparison would be the runner.

The standard of use for wired field phones continued through WWII and the Korean War. During the Korean War, North Korea and the United States and their allies had again fought to a stalemate. Both sides dug-in along the demilitarized zone in trenches and series of interlocking fighting positions.

Radio technology was not much better than that during WWII. The mountainous terrain and harsh weather conditions of Korea had a detrimental effect on radio signals. Whenever units went into a defensive posture, wire for field phones would be emplaced as a priority of work.

Militaries started using airplanes during WWI, in Korea, the helicopter was first used for medical evacuation and observation. Radio had advanced considerably by the 1960's. Transistors made man-portable radios much more feasible, with more power and longer ranges. Airborne communications platforms increased this capability even more.

When the United States became involved in the Vietnam conflict, the terrain and weather again would not be favorable for radio communications. U.S. tactics would change from static defenses as seen in the trenches of Korea to a more mobile form of warfare. The United States and its allies would establish a series of interconnected "firebases" that could support each other with indirect fires. Infantry units would conduct operations out of these firebases. The firebases would utilize a radio to maintain communications between them. Communications on the bases would be with field-phones, and if the base were large enough a telephone system would be

established, but fighting positions on the perimeter and howitzer emplacements would be connected with wired field-phones.

There exist a family of field phones utilized from the battalion level down to squads. The TA-1 was carried by squad level units (9 to 12 personnel) to maintain communications to the platoon level (25 to 35 personnel). From the platoon to the company the TA-312 was the next level of field phone. The TA-312 would also connect companies to battalion headquarters when based together in static positions.

The standard deployment of field phones was if a unit were expected to halt for more than two hours the squads would string wire from the squad leader position to the platoon leader position. The platoon radio/telephone operator (RTO) would establish a radio and wired connection with the company headquarters using the TA-312 field phone. Each squad and platoon maintained a spool of wire, the wire was designated WD-1, and the spool was the DR-8. Each spool held approximately  $\frac{1}{4}$  of a mile of wire. This wired equipment gave a platoon the capability to extend wire communications via field phone up to a mile. Because it was wire, the terrain was not a factor as long as a soldier could traverse it. The weather did not affect wired communications.

Field phones would be used by ground forces into the 21<sup>st</sup> Century. As radio communications became more secure, the field phone would become obsolete.

**Satellites and space.** The concept of utilizing space to transmit signals began in earnest in the late 1800's. In 1946 the military "bounced" radio signals off the moon. In 1958 the U.S. Air Force put a satellite into orbit called for the U.S. Army called "Signal Communication by Orbiting Relay Equipment (SCORE). For the first time, a satellite transmitted stored voice data to ground receivers (Riccio, 2010).

(Riccio, 2010), comments on the feasibility and cost effectiveness of sending communications satellites into space versus maintaining communications cables.

One early communications pioneer, scaling from the first trans-Atlantic telephone cable, which carried 36 telephone calls at the cost of approximately \$40 million, estimated a satellite's capacity at 1000 calls and wondered if a satellite could be worth a billion dollars.

The military has been at the forefront of satellite communications and the use of satellites for navigation. In collaboration with civilian entities, the U.S. military continues to strive for satellites that provide more robust and faster communications. Satellite technology advanced at a rapid pace during the 1960's. The U.S. military recognized a need for a system that would integrate the research and the development of existing technology, and into the future. An agency was developed to oversee these requirements; this organization is now designated Defense Information Agency (DISA) (Riccio, 2010). At this time the military would primarily employ satellite communications strategically. The necessity for smaller, more portable communications systems was becoming apparent based on the United States involvement in Southeast Asia.

Special force's units needed satellite communications during the 1960's. Once the military provided systems that could be used in a jungle environment, Special Forces units had to direct the man-portable satellite dish to specific directions and height of angle or elevation just to get a few minutes of communications time before the satellite passed over the horizon. It could be hours before another satellite passed within range for the unit to establish communications again. This was satellite communications being employed on a relatively small scale.

Satellites dominate the way the world communicates now. Civilian communications companies along with the U.S. military, continue to develop better satellite communications. The focus going into the 21<sup>st</sup> century will be on making the means to communicate more mobile, whether that be man-packed or installed in combat vehicles and aircraft. These different means will be discussed in the next chapter.

**Internet and cell phones.** Technology progressed through the latter half of the century. During this period researchers were perfecting different ways to send information from a computer to computer through a network. In 1991 the World Wide Web was developed by a Swiss computer programmer named Tim Berners-Lee (Staff, The Invention of the Internet, 2010).

Until the late 1990's communication in a garrison environment was done by telephones, radio, and even wired field phones. This was a time when leaders in the U.S. Army held an enormous number of meetings. There were meetings for everything. Army installations began to install intranets on the bases and internets that connected different installations. When commanders started utilizing e-mail to send messages, it began to change the way commanders communicated in the military. Mundane communications could be sent by e-mail instead of making a telephone call or holding a meeting, commanders and staffs could just blast out an e-mail to everyone involved.

Cell phones, though invented in the 1970's, did not become affordable to the public until the latter 1990's. The ability to send text messages was a capability that the military saw a use for. The BlackBerry was one of the



**Figure 8**  
**BlackBerry**

first devices that had e-mail and cellular phone capabilities. The U.S. government and the military chose the Blackberry phone because DISA deemed it more secure than other cellular phones (Hoffman, 2014). Commanders and key personnel were issued BlackBerrys, so they could be reached no matter where they were located.

E-mail and cell phones would become the way that people communicate in the military. These technologies will change how orders are disseminated and how superiors would communicate with subordinates. The face-to-face communication that was the norm would be a thing of the past.

### **Key Persons During This Period**

- Guglielmo Marconi discovered that radio wave could travel over a distance without wires he built a device to generate radio waves. When the Italian government showed no interest in his invention, he did not quit. Marconi persevered and moved to London to pursue his dream. Within three years of moving to London Marconi had sent radio signals across the English Channel. In 1901 he sent the first trans-Atlantic radio signal. In 1909 Marconi was honored with the Nobel Prize in Physics (Staff, Guglielmo Marconi, 2009).
- Although the telephone was invented in 1876, the widespread use of the phone occurred in the 1900's. Therefore Alexander Graham Bell was key in the communications field in the 20<sup>th</sup> Century.
- Tim Berners-Lee the Swiss computer programmer that developed the World Wide Web. The ability to access information across a network no matter where in the world is what society expects of today's internet (Staff, The Invention of the Internet, 2010).

### **Impact of Communications on Leadership**

When wireless technology was invented in the early part of the 21st Century communications equipment was heavy and bulky. Because of the size and weight of the equipment, it was not favorable for offensive operations. Large communication sets would be situated in rear areas with tactical operation centers (TOC). Field commanders during WWI would be limited to communications sent using Morse code. It must be noted that the difference in wireless telegraphy and radio is that radio had the capability to hear the spoken voice, were telegraphy was sent in code. This required skilled operators to interpret the code. This was at a time when literacy rates were quite low. This had an impact on commanders because of the lack of skilled operator. Once the radio was developed, and commanders could communicate with by voice miss communication would surely be reduced. Units would communicate much quicker and clearer than using code. The drawback to voice communications would be that it was easier to decipher if intercepted.

During WWII radio communications had improved drastically. Equipment was much smaller and lighter. This enabled radio capability down to squad and platoon levels. Orders and directives could be transmitted much quicker from the top levels of command, down to the troops in the field. Due to the improvement in communications equipment, the tempo was increased. Units received information quicker and therefore could execute tactical maneuvers quicker. In war, the army that can shoot, move, and communicate the quickest has a tactical advantage over their adversaries and normally will win the battle.

When the U.S. entered into conflicts in Southeast Asia, the world was developing the means to communicate via space. This was accomplished through satellites. Communication technology was thought to be unlimited as space was explored. However, many tactical commanders were skeptical of these capabilities and rightfully so. In the dense forests of Vietnam radio signals, no matter where they came from, had issues penetrating the triple canopy jungle. Because of this, military leaders would revert to methods that relied less on technology. Wired communications, hand and arm signals, flags and even musical instruments accomplished the communications task better in this environment. These are methods used over one hundred years ago.

Satellite communications were being used to the fullest potential when the U.S. military deployed to the deserts of Kuwait and Iraq. Aircraft had been fitted with the latest in global positioning systems (GPS). Communications technology was such that commanders could send messages and orders to scores of subordinate commanders on the move in seconds. Encryption equipment was so good that radio traffic could be sent without fear of it being intercepted. This made the job of the tactical leader much easier. Operations in the desert are more spread out. Distances between vehicles are such that radio communications were a necessity. Even in a defensive posture, the use of radios between defensive positions enables communications much more effectively. The ability to communicate so quickly and with minimal breakdown, allowed the U.S. coalition to adapt to a very fluid, fast-paced battlefield and this is why the first Gulf War was such an overwhelming victory against a substantial enemy force.

At the end of the 20<sup>th</sup> Century, tactical communication on the battlefield was as efficient as the military could hope for. Scientist and physicists had breached space, and that would give

the leadership of the U.S military the potential for advancements in communications technology that lasts into the 21<sup>st</sup> Century.

#### **Chapter 4**

In the short seventeen years since the 21<sup>st</sup> Century began, the United States has been at war for sixteen of them. With the terrorist attacks of September 11, 2001, the U.S. would be engaged in combat operations on five of the seven continents in the world. Alongside their allies, this effort to combat terrorism has been termed "The Global War on Terrorism (GWOT). Afghanistan and Iraq have been the primary theaters of operations. Two very different set of circumstances. The ideology is similar, but the culture is very different.

Afghanistan is considered a Third World Country with a Gross Domestic Product (GDP) per capita of \$956, and an unemployment rate of 35% (Countries, 2017). Afghanistan has been at war continuously since 1979. Afghanistan is a landlocked country with few exports, mainly fruits, and nuts. The U.S. military and the North Atlantic Treaty Organization (NATO) have been engaged in Afghanistan since 2001.

Iraq, by contrast, is a modernized country with a GDP per capita over \$4600. This number was over \$10,000 before the 1991 Gulf War (Finance, 2017). Iraq has been at war in one-way shape or form since 1991. The United States has been involved in Iraq since 1991.

The terrain and weather conditions of these two countries would define how tactical communications would be employed. Iraq is a desert environment that lends itself to the line of sight communications. But weather conditions like massive sand storms can be a factor.

Afghanistan on the other is steep mountainous terrain in much of the country, the arid desert terrain over approximately ¼ of the country. The high mountainous terrain in the north and east

is ideal terrain for an insurgency. It borders Pakistan and lends itself to infiltration through terrain that in some places have never seen a human being, much less an American soldier.

Communications during the first decade of the 21<sup>st</sup> Century advanced exponentially. However, the terrain in these two theaters of war will have an impact on communications and leadership.

### **Means and Methods**

At the turn of the century, satellite communications were being used in the civilian and military sector quite effectively. From satellite radios to cell phones, the satellite is the primary means for the military to communicate. New methods were being developed though. The military needed better ways to send and receive tactical messages and orders. There was also a need for a capability that allowed commanders on the battlefield to maintain situational awareness of friendly forces, known in the military as "Blue Forces," and the enemy situation. This capability would be realized through satellites.

Tactical communications or a lack of can hinder military operations. What type of media leaders elect to use for communications will have an impact on how the communication is received?

**Force XXI Battle Command Brigade and Below (FBCB2).** FBCB2, also more commonly known as "Blue Force Tracker (BFT)," developed by Northrop Grumman, was implemented in the late 1900's with a future that was planned for well into the 21<sup>st</sup> Century. The ability to differentiate forces on the battlefield is a major tactical and strategic advantage. This command and control (C2) system utilize both lines of sight and satellite means to move data across communications networks.

The FBCB2 system is running on a military ruggedized computer processing unit with a touch screen display unit. These computer systems are mounted in combat vehicles, aircraft, and hardstand tactical operations centers (TOC). FBCB2 provides near real-time situation awareness (SA) of friendly forces as they maneuver on the battlefield and positioning for unit tactical operations centers. Satellite-based Global Positioning Systems (GPS) provide for accurate position reports of friendly units. The position of friendly forces is depicted on the touch screen monitor in the form of a blue icon. This was instrumental in preventing fratricide. However, in 2003, not every combat vehicle was equipped with BFT.

In April of 2003, a convoy of maintenance vehicles made a wrong turn as their unit advanced toward Nasiriyah, Iraq, and the convoy was attacked by Iraqi forces. Subsequently, eleven soldiers were killed and seven more taken prisoners of war (Starr, 2003). If this unit had been outfitted with Blue Force Tracker this tragic turn of events may not have occurred for the following two reasons. One, the situational awareness provided by BFT would have enabled everyone in the unit to see that those vehicles made a wrong turn. Two, graphical control measures would have been displayed on the monitors of the vehicles involved and therefore would have reduced the likelihood that the unit turned the down the wrong road.

Along with the situational awareness that BFT provides, there is also the capability to send a variety of combat messages. Situational reports, enemy spot reports, medical evacuation request, position reports and combat orders, just to name a few. Operations sections within units create graphical control measures in the form of overlays that can be displayed on the individual systems displays. These graphical control measures provide a visual aid to help control battle orders. Some examples of graphical control measures are main supply routes, an axis of advances, boundary lines, and phase lines.

FBCB2 is reaching the end state of the software development. Meaning, that when it was initially developed, the military had a vision of where it would end up before new technology needs to be put into production. The final software product is designated Joint Battle Command-Platform (JBC-P), and it is being fielded to the military now. JBC-P will a more robust satellite-based communications network, better mapping features, and improved security.

FBCB2 is more than just a communications system, for echelons from the Brigade down to the entity level it provides complete communications and command and control. This benefits the soldier on the ground and enables the ground commander in making critical time-sensitive decisions on the battlefield.

**Cell phone and internet revisited.** Satellite technology improved considerably during the first decade of the 21<sup>st</sup> Century. Leaders now can maintain communications with subordinates and superiors anytime, anywhere in the world. Cell phones are issued to commanders and key personnel within military units so that contact could be made on a moment's notice. The operational tempo has become such that units maintained very short notification times for deployments. As mentioned earlier the BlackBerry was the cell phone of choice (Hoffman, 2014). Pew Research Center indicates that 95% of Americans now own some type of cell phone (Pew, 2017). Soldiers are required to have a telephone of some type, whether it be a landline or a cell phone. Supervisors must be able to contact soldiers at any time. A soldier is a soldier, twenty-four hours a day, seven days a week, ALWAYS!

The internet and e-mail are used as much if not more than cell phones. E-mail has become so prevalent in society and the military. People can have a face-to-face conversation and then request an e-mail of the same conversation. This is partially due to a need of an account of communications and out of laziness, so they don't forget the conversation. Military units have

established networks with e-mail and internet portal pages that are secured for exclusive use by authorized military personnel only. The military also utilizes social media such as Facebook.

The following conversation is a personal account of a conversation with a soldier. A soldier was assisting a lieutenant looking for a room that he had reserved for a video teleconference with his unit that was deployed to another country on the other side of the world. The lieutenant asked, "Where is the person facilitating the video teleconference?" The lieutenant was told that the individual was off for the day. The lieutenant then replied, "That it was okay, I will just "Facebook" them". This is just an example of the many forms of media that are used for interpersonal communications by soldiers and commanders. This medialization will be discussed in the following section.

**Interpersonal communications.** In previous chapters, emphasizes has been placed on non-personal means and methods. Devices such as flags and drums, telephones, radios, wireless and non-wireless means of transmitting communications. Considering all the technological advances that have been made in the field of communications over the last 241 years, face-to-face communication, interpersonal communication is how leaders make the biggest impact on superiors and subordinates. The need to look at interpersonal communications cannot be overlooked.

**Intercultural.** Interpersonal communications in the U.S. military has far-reaching consequences. Military operations around the world require the cooperation and coordination of multi-national forces. Cross-cultural communications will ensure better understanding between multi-national forces. With the increase of multi-national military missions around the world, the necessity for positive intercultural communication, respect, and understanding will be critical to the success of United Nations (U.N) and NATO missions. The need for intercultural competence

in the military academies of the countries that comprise the (U.N) has been identified. Basic knowledge and language training are conducted by the majority of countries before deployment in support of joint operations.

Intercultural education needs to extend beyond knowledge and language competence. The higher educational institutes must focus on changing the way we think and behave in the same manner that knowledge and information are trained. For joint operations to be successful the countries involved need training on the cultures of one another as well as the countries in which the operations will be conducted. The way multi-national forces think and to be truly competent in a culture is the key. This level of intercultural awareness needs to be trained at all rank levels, not just commissioned officers.

Questions exist about the common core that defines intercultural issues. Defining these common core of competencies is essential in meeting the objectives established by the European Council. Also, language proficiency is the bases of intercultural understanding. Intercultural communications should not be measured just regarding knowledge, skills, and attitude, but how the future officers will interact within different cultures. Competence in cultural awareness, understanding, and tolerance are as important as proficiency in the language.

NICULESCU, DRAGOMIR, & BUŞE, O. (2015), made a statement about how intercultural communication competency is trained in other higher education institutions compared to that of military higher education:

Intercultural communication is an implicit element in all forms of training and courses across all disciplines of higher education. It may be an autonomous subject having the content theoretically grounded in a specific discipline (linguistics, sociology), it can be connected interdisciplinary to other fields of study, such as business or economics, but,

most frequently, it is taught not only as knowledge and a skill, but also with the greater aim of promoting an appropriate attitude of awareness towards other cultures, as an integrated part of language teaching and learning.

Military higher education needs to train not only skills and knowledge but also include into the common core the real-life competencies necessary for multi-national forces to be successful interacting with the cultures where missions are conducted.

The competencies that the future officers need to possess are operational language and professional characteristics. Terminology that is NATO compliant, knowledge of military acronyms and abbreviations are crucial when conducting joint military training exercises. Training cultural awareness before joint exercises will ensure better interoperability in the multi-national force. It is recommended that soldiers learn to use English pre-deployment as English is one of the operational languages of NATO. Standardization Agreement (STANAG) 6001 level 2 is recommended for all non-U.S. officers. STANAG 6001 is Military English exams and tests. Officers should be able to interact with their counterparts in all intercultural facets of, from operational interaction to social affairs. They should be able to do so without offense, recognize cultural gestures and follow rules of etiquette conducive to their counterparts (NICULESCU, 2015).

Language training is an implicit part of acquiring intercultural competence. The ability to speak a language that is understood by all will suffice for informational purposes. However, there are more competencies necessary for communications. Understanding of attitudes, values, and the different points of view that cultures have aided in completing intercultural communications.

When the multi-national mission can exercise intercultural communication to the fullest, orders can be disseminated and executed more efficiently. Integrating intercultural communication training and language training into the international military mission will increase the overall success of the missions.

*Mediatized leaders.* Opinion leadership is a well-known concept in the communication sciences. Opinion leaders are the influential people within communities, groups, and organizations that others look to for advice and opinion. The majority of military leaders would be considered opinion leaders. Opinion leaders in the past have communicated primarily through verbal and non-verbal means. “Mediatized opinion leadership” is a term that social science professionals will have to adapt to due to the multitude of media avenues available to the opinion leader. Media goes beyond the mass-media that people are accustomed to. Social media and other avenues available through the internet enable the military leader and subordinates in ways not realized before.

The model has followed the notion that there are two parties in the communications process, the opinion leader, and the follower. As the initial model was tested and communications medium changed, other studies continued. These studies exposed several new ideas. It became obvious that opinion leaders were more concerned with certain topics and the use of the media than were the recipients of this material. It was also determined, that there are numerous steps in the communications process.

A study conducted by (Merton, 1949) demonstrated that:

Opinion leaders differ in the scope of the issues about which they provide leadership, ranging from “cosmopolitans” (oriented toward the larger society) to “locals” (oriented toward local issues). They also vary in the number of issues over which they

lead, with "monomorphic" opinion leaders having one specific area of leadership and "polymorphic" ones functioning as opinion leaders across topics.

Lastly, it was recognized that in addition to opinion leaders and recipients there were "inactives," parties that did not look for opinion or advice from opinion leaders. As technology continues to change the concept of opinion leadership should be reviewed based on experience and observation to determine if the existing concept needs revision.

The changing nature of mass media, social networking, and other mediums to communication leaves the question as to whether or not they will positively contribute to opinion leadership or even replace the face-to-face mode of communications that we are accustomed to. There are hypotheses to these questions, however, there are contradictions in the hypothesis. Some limited the focus of the study, while others relied only on the opinion leader and not the other parties involved. How many "Likes" an opinion leader gets on Facebook does reflect the true influence the opinion leader has on the follower or inactive.

(Schäfer, 2015), conducted a study that focused on three questions:

1. What communicative roles can be found in opinion leadership under changed media conditions?
2. To what extent is opinion leadership itself enacted via media, i.e., to what extent it is "mediatized"?
3. To what extent are communicative roles still associated with the characteristics of opinion leaders, opinion followers, and inactives that were found in previous studies?

(Schäfer, 2015), used firsthand data covering individuals' information and several different communications media such as radio, newspaper, and social media. Traditional means of communicating are also used as a method of analysis.

The findings for questions one and two were as follows. Opinion leaders were rated better than followers and inactives in temperament. This confirms their position as opinion leaders from an interpersonal view and more outmoded views. Opinion leaders tend to use different kinds of media more when it applies to matters that concern them. Opinion leaders also use informational media more often than followers and inactives to inform themselves on different subjects. This study found that opinion leaders and opinion leaders considered “mediatized” had notably higher interest levels in the different topics used, compared with followers and inactives.

With the different types of media use in modern times, it is necessary to see how leadership at all levels will change, to include how communications with peers and subordinates need to be modified to ensure the proper information is conveyed. With the increased use of interpersonal media, the advice and opinion given by senior leaders will be filtered by the time it reaches the lowest levels thus reducing the impact that face-to-face information would have imparted.

Telegraph, telephones, radios, cell phones, and the internet are all just different types of media for military leaders to communicate their intent. Certainly, the different types of media already have had an impact on how military leaders communicate with subordinates. During day-to-day operations, leaders convey orders more and more via e-mail and or text messaging. In turn, this has eliminated unnecessary formations or meetings that once were used to disseminate information.

There was a time before cell phones and text messaging that a small military unit would conduct four different formations per day just to put out information. Although this may allow small unit leaders more time with their soldiers, the commanders and senior non-commissioned

officers of the unit have less of an impact on the unit due to the absence of face-to-face interaction that was present during formations.

Will mediatization impact how orders are received, interpreted, and carried-out. As mediatized communications between commanders and subordinates become more prevalent, will the military's communications remain effective?

### **Key Persons During This Period**

The below list will differ from previous chapters because of the lack of invention in the defense communications arena. Some notable corporations are more appropriate for developments.

- The developer of FBCB2, Northrop Grumman, was key in advancing the communications, situational awareness, and command and control in combat units in the U.S. military and many ally countries. The system has been instrumental in preventing fratricide among combat units.
- Although not mentioned much, Facebook needs a mention because most military units now maintain a Facebook page to communicate unsecure information about that unit.
- Defense Information Systems Agency (DISA). This is the military agency that oversees all informational aspects within the U.S. Government and DOD.

### **Impact of Communications on Leadership**

At the beginning of the 21<sup>st</sup> Century, the U.S. military went through a reduction in force of over 600,000 troops across all four services. The U.S Army was reduced by over 230,000 soldiers in a decade. After the Gulf war in 1991, the U.S military started a drawdown. When the September 11, 2011, terrorist attacks happened, the U.S Military's overall active duty strength was approximately 1.3 million (Coleman, 2017). This reduction in force would be significant as

the U.S begins the 21<sup>st</sup> Century going to war again. There was a need for improved communications capabilities. Commanders would have to do more with less. This would only exasperate the communications arena.

Technological advances in the last decade were substantial. In the early 1990's, satellite communications had greatly improved, e-mail was just starting to be used in the business world, cellular phones still were not priced for public use. In contrast, by the early 2000's the internet was a way of life for most of the society, to include the U.S military.

Digital technology in a tactical situation allows commanders the ability to command and control more with less. The "Blue Force Tracker" system enables this. The commander can see every friendly vehicle on the battlefield on a touchscreen display from inside their vehicles. They can then determine which vehicles belong to their unit. Pre-formatted messages can be sent to individual vehicles or the whole unit, very similar to e-mail. There is a chat function within the system as well. Positioning and message communication are accomplished through two different types of satellite, GPS satellite, and a communications satellite. BFT is used in conjunction with single channel radios to provide maximum command, control, and communications (C3) on the battlefield. Many units are also provided with cell phones in a tactical environment, increasing communications more.

In the multi-national environment which the U.S military normally operates in, communications, both tactical and interpersonal, needs to be seamless. Leaders at all levels, in the U.S military, undergo formal schooling in intercultural aspects according to the theater of operations in which they will operate. This training is targeted at language proficiency and cultural competence. Military leaders and soldier alike should possess strong cultural, and language abilities to operate in multi-cultural environments.

As society and the military depends more and more on different types of communications media, i.e., social media, e-mail, cell phones, and chat programs, the face-to-face means of communication can only be less. Even talking on a phone of any type is becoming less frequent in society today. A Gallop poll showed that Americans 18 to 49, overwhelmingly send or receive text message more than receiving or making a cellphone call (Newport, 2014). Elected officials at the national level post the Nations business on social media. Soon there will be no need to talk face-to-face at all.

This lack of face-to-face, interpersonal communications, particularly at the higher levels of the military, could eventually lead to a communications environment where lower ranking individuals will be distanced from their leadership; which could lead to misinterpretation of orders or even blatant disregard of orders from a superior they perceive as disconnected or uncaring. Soldiers prefer leaders that are willing to get in the “trenches” with them, a soldiers’ soldier. Someone who will talk to them in person face-to-face.

## **Chapter 5**

### **Comparisons**

The means and methods covered during this project will be compared alternatively with one other. The intent is not to determine a best communications method, but to see how communications have evolved over the centuries. The advancements will be apparent, modern day society has seen this firsthand, yet some methods that were in use two-hundred years ago are still being employed today. The comparison will not necessarily be in chronological order; rather means will be grouped by similarity and relevance. This is intended to compare effectiveness from a military leadership perspective.

In the early days of our Nation's history communications were slow and information that was received from long distances was often timeworn. Communication of reliable, and timely information was local. It was communicated by voice or written by an individual nearby. These written communications were often put on to post (posted) scattered throughout a city or town; citizens would gather around and read the information. Over time there would be post offices established within the colonies where posts would be delivered posts.

Within the Revolutionary Army, commanders would construct hand-written orders and messages to be taken to subordinate commanders. The advantage to the hand-written message was the specifics that it would entail. When printed messages were used they could be produced in large quantities utilizing the printing press, in many cases, these were for general information, not personal correspondence. To say which means of communications was more effective is not the point as each one was used for different purposes.

There came a need to deliver these communications faster and over much further distances. A person moving on foot was only so effective. The runner on horseback was employed both militarily and for general civilian reasons. Horseback riders could deliver posts quickly over moderate distances but had limitations on how much they could carry. In the early 1800's stagecoaches were used to move larger amounts of mail over greater distances.

Military commanders used stagecoaches to deliver military messages, but stagecoaches were vulnerable to attack. The Pony Express was the fastest means of delivery; a commander could send messages hundreds of miles away in a day or less. As the expansion continued, stagecoaches and riders would be the primary means of delivering written and printed communications and settlers to the west.

Steamboats were also in use on the waterways in the east. The carrying capacity and speed were conducive to military use. Compared to stage coaches, and the railroads, steamboats could transport considerably more mail, equipment, supplies, and troops than any other form of communications transport. The railways, once a trans-continental line was established, would be a principal means of transportation throughout the country.

During the American Civil War, steamboats, railroads, and horsemen were all being employed as means of communications by the Union and Confederate Armies.

These lines of communications were very effective during their time but came with a high cost. Railroad tracks and stations were targeted as were steamboats and stagecoaches. All of these communications methods had one thing in common; they followed established routes. Commanders during the Civil War found themselves committing large amounts of effort to protecting the lines of communications, often at a heavy cost to lives.

The Siege of Vicksburg was a classic example. The Union Army had forced the Confederate Army south across the Mississippi River. Understanding the importance of the river as a central line of communications, both armies fought tenaciously to maintain that route. There are many examples of armies cutting off lines of supply and communications as a tactic to defeat their enemies. Two of the most recent examples is the targeting of the Ho Chi Minh Trail by the U.S. military during the Vietnam conflict and again during the Gulf War against Iraq in 1991 when coalition forces cut the routes of retreating Iraqi forces from Kuwait.

Although railroads and steamboats could deliver large amounts of information they may not have been the most efficient.

In 1844 the telegraph had been developed and by the time the Civil War was in progress, thousands of miles of telegraph line was installed throughout the country. This gave commanders

the ability to send messages near real-time to subordinate commanders hundreds of miles away. It also brought about the end of the Pony Express. The telegraph and subsequently the telephone were two inventions that changed the way society communicated.

With the invention of the telegraph also came the development of Morse code, the series of dashes and dots used to decipher telegraph signals. The telephone advanced communications for commanders because now they could talk to subordinates. This would be very similar as if the two parties were standing next to each other talking. The information would not be lost in translation, the individual on the other end of the phone line could hear the expression of the other.

Anytime communications are sent through a means other than face-to-face there is a risk of misinterpretation of the information. During this era, telegraph and telephone communications are transmitted across a wire. Wireless technology has not yet been invented. Therefore the danger of interception of signals or voice being transmitted through a wire is very real. Armies did not have the capability to protect the entire lines of communications. This was particularly true once the trans-Atlantic telegraph line was established before WWI.

Technology improved tremendously from 1776 up into the first part of the 1900's. The Industrial Revolution and the knowledge that was inherited from England during the fight for America's independence contributed too many of the inventions that occurred during that period.

The telegraph would be used for another one-hundred years, and the telephone is still used today. The ironclad steamboats of the Civil War have become today's modern Navy.

Armored railroad cars of that period are the forefathers of modern tanks and mechanized armored vehicles.

The next big innovation in communications is wireless technology. In the late 1800's early 1900's the wireless telegraph or the radio was invented. The radio would be as significant during WWI as the telegraph was in the Civil War. Initially, the equipment needed to create enough power to transmit radio signals was very large and heavy. It did not lend itself to portability.

Ground stations along coastlines were used to transmit across the Atlantic Ocean and to ships at sea. Wireless radio was also being used by ships to send messages ship to ship. The English had successfully cut Germany's undersea telegraph lines, which forced the Germans to adapt to wireless radio. Vehicles would be used to transport radio equipment to the front lines smaller radio sets could be installed in the trenches so that commanders would have better communications.

Wired field phones were although used extensively during WWI required a lot of effort to maintain the lines because of the heavy artillery barrages. Radio components are being built increasingly lighter and smaller to the extent that when WWI starts the military is using hand-held radios (Walkie-Talkie). This gave ground units an unprecedented capability to communicate with one another. These radios had a range of just over one mile with good line-of-sight. This was still significant given what was available previously. Commanders had a set that was a bit more robust but was still bulky for an individual soldier to carry. An issue with the larger sets was the operator training required, radio telephone operators (RTO) were not expendable. They became targets for enemy snipers and when killed were not easily replaced.

After WWII, America and the Russians started exploring space. First, the Russians with a communications satellite named "Sputnik," followed up by the Americans with SCORE (Riccio, 2010), launched into orbit by the U.S Air Force in 1958. This was the first time in

history that stored voice data was transmitted back to Earth. Once countries started putting satellites into space, communications technology continued to advance at a rapid pace. When America went to war in Iraq in 1990, virtually every combat platform was outfitted with advanced digital radio systems. This allowed commanders to communicate down to the lowest echelons of their units.

During the 21st Century, most military communication methods utilize satellite to send and receive radio transmissions. The U.S military administers a mass communications network that enables commanders at all levels to communicate anywhere in the world. This network is more secure than conventional radio ever was. Voice communications are automatically encrypted with very little chance of interception. Where just a decade or two previously radio communications were frighteningly unsecure. Enemies of the state work diligently on intercepting strategic and tactical radio traffic. Because radio is so secure today, most nations resort to jamming radio signals instead.

The “Blue Force Tracker” family of systems provide commanders with tactical communications functions as if they were sitting behind a desk in the office. This new style of communications system allows the commander to communicate through messages, let’s them see their forces on the battlefield, showing templated enemy positions, and display graphical control measures to enhance message communications.

U.S military commanders every echelon are given government-issued cell phones and access to an intranet service for each branch of the military and the DOD.

Despite all this technology, the most basic means of communications are still needed and used on the modern battlefield and in day-to-day operations within the U.S military. Hand and arm signals are used by small tactical units on a daily basis. There are entire manuals written on

the proper use of different hand and arm signals. During limited visibility operations small units operate in proximity of one another, silence and stealth are critical. Hand and arm signals would be the primary means of communications. There are times when these small units can go days with little to no voice communications and accomplish complex missions under extreme duress. Mobile units and ships still use flags and signal lights to communicate when radio silence is being enforced during combat operations and training exercises.

Interpersonal communications have changed through the centuries also. There was a time when talking to each other was the main way to communicate, whether that be face-to-face or over a telephone. People are less understood, expressions, mood, and voice inflection can be seen and heard. It is more difficult for a commander to reprimand through text messaging, or an e-mail than face-to-face, even a telephone conversation has less impact. At the lower levels of the military, face-to-face communications are still widespread. But at the higher levels of command, it is less prevalent. Daily task is being conducted more through digital means than face-to-face interaction. Even meetings are conducted over applications that allow the participants to sit right in their office. No need to go to a conference room to gather for the meeting.

Militarily speaking, utilizing the communications technology available saves time, energy, and money. It is quicker than voice communications, and as stated before, speed on the battlefield equals tactical advantage.

### **Reflection**

Through the centuries, the need to communicate both socially and militarily is mandatory. The universe would not exist without the ability to convey messages between

individuals and groups of people. Whether the means is hand and arm signaling, smoke, flags, lights, musical instruments, or satellite radios, the ability to communicate is necessary.

The military has evolved the way it communicates tactically, strategically, and interpersonally. The telegraph has been replaced by satellite radio; field phones are no longer used while conducting defensive operations. Steamboats are now aircraft carriers that house thousands of troops and hundreds of aircraft, on a single vessel. Armored railcars have made way for main battle tanks that can traverse rough terrain at over fifty miles an hour, and still shoot. Satellite positioning systems that enable commanders to see where each and every friendly force is on the battlefield.

Commanders have access to their subordinates and superiors, night or day, anywhere in the world, with the use of the internet and cellular telephones. Commanders can attend briefings on the status of battles from anywhere in the world and never leave their desks.

Where will the future of communications in leadership take the U.S military? Commanders have a plethora of communications means at their disposal. Space has already been conquered, technology will be improved on. Satellites will have more communications capacity, there will be more satellites, but what is next?

Interpersonal communications have changed over the history of the U.S military. Leaders may not talk as brash as they use to, soldiers in modern times may never experience a “verbal counseling” like in the “good old days.” Interpersonal communication, in general, is being replaced by text messaging and social media.

As the culture changes in the military, the time of large-scale formations where the commander will address their troops as they stand in rank and file might be a thing of the past, but there will always be a need to stand in front of another person and talk.

### References

- Arbuckle, A. Q. (2016, March 3). *1861-1864 Ironclads*. Retrieved from Mashable: <http://mashable.com/2016/03/03/civil-war-ironclads/#yF8f9F8CyuqX>
- Begins, I. T. (2002, October 20). *1950s: Transistors Fill The Vacuum: The Digital Age Begins*. Retrieved from Electronic Design: <http://www.electronicdesign.com/defense/1950s-transistors-fill-vacuum-digital-age-begins>
- Bistarkey, D. (2016, April 12). *Army converting last heavy unit off EPLRS*. Retrieved from Army: [https://www.army.mil/article/165867/army\\_converting\\_last\\_heavy\\_unit\\_off\\_eplrs](https://www.army.mil/article/165867/army_converting_last_heavy_unit_off_eplrs)
- Brady, H. (2014, May). *Golden Age of Radio in the US*. Retrieved from DPLA Digital Public Library of America: <http://dp.la/exhibitions/exhibits/show/radio-golden-age>.
- Cannell, M. (2015). *Evolution of Two-Way Radio & Wireless Communication*. Retrieved from Sonetics: <https://www.soneticscorp.com/history-of-two-way-wireless/>
- Coleman, D. (2017, October 30). *U.S Military Personnel 1954-2014*. Retrieved from RESEARCH History in Pieces: <https://historyinpieces.com/research/us-military-personnel-1954-2014>
- Commission, U. C. (2017, September 26). *Military Use of Balloons in the Mid- and Late Nineteenth Century*. Retrieved from U.S. Centennial of Flight Commission: [http://www.centennialofflight.net/essay/Lighter\\_than\\_air/military\\_balloons\\_in\\_Europe/LTA4.htm](http://www.centennialofflight.net/essay/Lighter_than_air/military_balloons_in_Europe/LTA4.htm)
- Congress, T. L. (1827, February 28). *First U.S. Railway Chartered to Transport Freight and Passengers*. Retrieved from America's Story from America's Library: [http://www.americaslibrary.gov/jb/nation/jb\\_nation\\_train\\_1.html](http://www.americaslibrary.gov/jb/nation/jb_nation_train_1.html)
- Countries, A. L. (2017, October 21). *A List of Third World Countries: 10 Poorest Nations With Rising Economies*. Retrieved from FinancesOnline: <https://financesonline.com/a-list-of-third-world-countries-10-poorest-nations-with-rising-economies/>
- Dunkerly, R. “. (2016, February 16). *How Did They Communicate*. Retrieved from <https://emergingrevolutionarywar.org/2016/02/16/how-did-they-communicate/>
- Fanton, B. (2006, June 12). *Gas Balloons: View From Above the Civil War Battlefield*. Retrieved from HISTORYNET: <http://www.historynet.com/gas-balloons-view-from-above-the-civil-war-battlefield.htm>
- Finance, G. (2017, October 22). *Iraq GDP and Economic Data*. Retrieved from Global Finance: <https://www.gfmag.com/global-data/country-data/iraq-gdp-country-report>
- Flags and Guidons of the U.S. Army*. (2017, September 9 ). Retrieved from Army Study Guide: [http://www.armystudyguide.com/content/army\\_board\\_study\\_guide\\_topics/flags/flags-and-guidons-of-the-.shtml](http://www.armystudyguide.com/content/army_board_study_guide_topics/flags/flags-and-guidons-of-the-.shtml)

- Gabriel, R. A., & Metz, K. S. (1992, June 30). *The Evolution of Warfare and Weapons*. Retrieved from A SHORT HISTORY OF WAR: <http://www.au.af.mil/au/awc/awcgate/gabrmetz/gabr003a.htm>
- Gaudin, S. (2007, December 12). *The transistor: The most important invention of the 20th century?* Retrieved from Computer World: <https://www.computerworld.com/article/2538123/computer-processors/the-transistor--the-most-important-invention-of-the-20th-century-.html>
- History&Headlines. (2017, September 26). *June 26, 1794: First Military Use of Aircraft in Combat (Balloons)*. Retrieved from HISTORY&HEADLINES: <https://www.historyandheadlines.com/june-26-1794-first-military-use-aircraft-combat-balloons/>
- Hoffman, M. (2014, January 21). *BlackBerry Still Dominates Pentagon Pockets*. Retrieved from DEFENSETECH: <https://www.defensetech.org/2014/01/21/blackberry-still-dominates-pentagon-pockets/>
- Hubert, E. C. (1925, January). *Radio vs. Wireless*. Retrieved from Radio News: <http://earlyradiohistory.us/1925rvw.htm>
- Koenig, A. R. (2006, June 6). *Railroad's Critical Role in the Civil War*. Retrieved from HISTORYNET: <http://www.historynet.com/railroads-critical-role-in-the-civil-war.htm>
- Lira, C. (2013, May 21). *Brief History of the Steam Engine*. Retrieved from Steam History: <https://www.egr.msu.edu/~lira/supp/steam/index.htm>
- Longfellow, R. (2017, June 27). *Highway History*. Retrieved from U.S. Department of Transportation: <https://www.fhwa.dot.gov/infrastructure/back0304.cfm>
- Luhn, J. (1891, March). Postal Services in the Colonies, 1592-1775. *The Southern Philatelist* 2, pp. 87-8.
- McMillan, J. (2001). *Signaling at Sea*. Retrieved from Sea Flags: <http://www.seaflags.us/seaflags.html#contents>
- Merton, R. I.-9. (1949). Patterns of influence: A study of interpersonal influence and communications behavior in a local community. *Communications Research*, 180-219.
- MilitaryHistoryNow.com. (2014, October 13). *First Blood – History's Earliest Recorded Military Conflicts*. Retrieved from WARS YOU NEVER KNEW ABOUT: <http://militaryhistorynow.com/2014/10/13/first-blood-historys-earliest-recorded-military-conflicts/>
- Newport, F. (2014, November 10). *The New Era of Communication Among Americans*. Retrieved from GALLUP NEWS: <http://news.gallup.com/poll/179288/new-era-communication-americans.aspx>

- NICULESCU, B. D. (2015). Interculturality – A fundamental dimension of the modern military higher education paradigm. *Studia Universitatis Petru Maior - Philologia, 19128-138.* , 138.
- Pew. (2017, January 12). *Mobile Fact Sheet*. Retrieved from Pew Research Center: <http://www.pewinternet.org/fact-sheet/mobile/>
- Radio, A. S. (2004). *PIONEERS OF RADIO*. Retrieved from A Short History of Radio, With an Inside Focus on Mobile Radio: [https://transition.fcc.gov/omd/history/radio/documents/short\\_history.pdf](https://transition.fcc.gov/omd/history/radio/documents/short_history.pdf)
- Radio, H. T. (2017, October 9). *Handie-Talkie Radio*. Retrieved from Motorola Solutions: [https://www.motorolasolutions.com/en\\_xa/about/company-overview/history/explore-motorola-heritage/handie-talkie-radio.html](https://www.motorolasolutions.com/en_xa/about/company-overview/history/explore-motorola-heritage/handie-talkie-radio.html)
- Riccio, M. K. (2010, April 01). *Military Satellite Communications: Then and Now*. Retrieved from Aerospace: <http://www.aerospace.org/crosslinkmag/spring-2010/military-satellite-communications-then-and-now/>
- Schäfer, M. S. (2015). Mediatized opinion leaders: New patterns of opinion leadership in new media environments? *International Journal of Communication, 960-981*.
- Simmons, J. (2014, March 6). *Natural Resources during the Industrial Revolution*. Retrieved from Prezi: <https://prezi.com/nuou4gww7bfx/natural-resources-during-the-industrial-revolution/>
- Staff, H. (2009). *Alexander Graham Bell patents the telephone*. Retrieved from History.com: <http://www.history.com/this-day-in-history/alexander-graham-bell-patents-the-telephone>
- Staff, H. (2009). *American Revolution History*. Retrieved from History.com: <http://www.history.com/topics/american-revolution/american-revolution-history>
- Staff, H. (2009). *Guglielmo Marconi*. Retrieved from History.com: <http://www.history.com/topics/inventions/guglielmo-marconi>
- Staff, H. (2009). *Morse Code & the Telegraph*. Retrieved from History.com: <http://www.history.com/topics/inventions/telegraph>
- Staff, H. (2010). *Civil War Technology*. Retrieved from History.com: <http://www.history.com/topics/american-civil-war/civil-war-technology>
- Staff, H. (2010). *Cotton Gin and Eli Whitney*. Retrieved from History.com: <http://www.history.com/topics/inventions/cotton-gin-and-eli-whitney>
- Staff, H. (2010). *The Invention of the Internet*. Retrieved from History.com: <http://www.history.com/topics/inventions/invention-of-the-internet>
- Starr, B. (2003, July 10). *Father: 507th ambush a 'preposterous' tragedy*. Retrieved from CNN.com: <http://www.cnn.com/2003/WORLD/meast/07/10/sprj.irq.convoy.attack/>

- Sterling, C. H. (2008). *From Ancient Times to the 21st Century*. Retrieved from Military Communications:  
[https://books.google.com/books?id=RBC2nY1rp5MC&pg=PR28&lpg=PR28&dq=telephone+and+the+military+1900's&source=bl&ots=9E-eEXTbMe&sig=J\\_92g51wnQFtK-gJLUF2smYgoJw&hl=en&sa=X&ved=0ahUKEwiIwZbY3enWAhWKSyYKHaC7B60Q6AEIXjAJ#v=onepage&q=telephone%20and%20the%20mili](https://books.google.com/books?id=RBC2nY1rp5MC&pg=PR28&lpg=PR28&dq=telephone+and+the+military+1900's&source=bl&ots=9E-eEXTbMe&sig=J_92g51wnQFtK-gJLUF2smYgoJw&hl=en&sa=X&ved=0ahUKEwiIwZbY3enWAhWKSyYKHaC7B60Q6AEIXjAJ#v=onepage&q=telephone%20and%20the%20mili)
- The American Civil War (1861-1865)*. (2017, September 19). Retrieved from U.S. Army Transportation Museum:  
<http://www.transportation.army.mil/museum/transportation%20museum/civilwar.htm>
- Tworek, H. J. (2014, October 8). *Wireless Telegraphy*, in: *1914-1918-online*. Retrieved from International Encyclopedia of the First World War, ed. by Ute Daniel, Peter Gatrell, Oliver Janz, Heather Jones, Jennifer Keene, Alan Kramer, and Bill Nasson, issued by Freie Universität Berlin, Berlin: [https://encyclopedia.1914-1918-online.net/article/wireless\\_telegraphy](https://encyclopedia.1914-1918-online.net/article/wireless_telegraphy)
- Valve, H. o. (2017). *History of Vacuum Tube / Thermionic Valve*. Retrieved October 10, 2017, from electronicsnotes: <https://www.electronics-notes.com/articles/history/vacuum-tube-thermionic-valve/history.php>
- Warfare, W. a. (2015, October 7). *Military Communication, the Korean and Vietnam Wars (1945-1975)*. Retrieved from Weapons and Warfare:  
<https://weaponsandwarfare.com/2015/10/07/military-communication-the-korean-and-vietnam-wars-1945-1975/>

