REPORT DOCUMENTATION PAGE

FORM APPROVED - - - OMB NO. 0704-0188

1. AGENCY USE ONLY *(LEAVE BLANK)*	2. 04/28/06	3. REPORT TYPE AND DATES COVERED ***STUDENT RESEARCH PAPER***

4. TITLE AND SUBTITLE RIFLE INNOVATION: FROM THE M1903 SPRINGFIELD TO THE M1 GARAND	5. FUNDING NUMBERS ***N/A***
6. AUTHOR(S) LCDR John H. Snyder, Jr, US Navy	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) ***USMC COMMAND AND STAFF COLLEGE*** ***2076 SOUTH STREET, MCCDC, QUANTICO, VA 22134-5068***	8. PERFORMING ORGANIZATION REPORT NUMBER ***NONE***
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) ***SAME AS #7.***	10. SPONSORING/MONITORING AGENCY REPORT NUMBER: ***NONE***

11. SUPPLEMENTARY NOTES

NONE

12A. DISTRIBUTION/AVAILABILITY STATEMENT ***NO RESTRICTIONS***	12B. DISTRIBUTION CODE ***N/A***

13. ABSTRACT *(MAXIMUM 200 WORDS)*

As the US Army and Marine Corps searched for a semi-automatic rifle to replace the M1903 Springfield, the M1 Garand was eventually chosen by both services. The Garand bested the Johnson and Pedersen rifles in providing increased firepower over the M1903 while maintaining an acceptable level of reliability.

14. SUBJECT TERMS (KEY WORDS ON WHICH TO PERFORM SEARCH) M1 Garand Johnson Rifle Springfield Armory John Pedersen	NUMBER OF PAGES: 28 16. PRICE CODE: N/A

	18. SECURITY CLASSIFICATION OF THIS PAGE: ***UNCLASSIFIED***	19. SECURITY CLASSIFICATION OF ABSTRACT ***UNCLASSIFIED***	20. LIMITATION OF ABSTRACT N/A

United States Marine Corps
Command and Staff College
Marine Corps University
2076 South Street
Marine Corps Combat Development Command
Quantico, Virginia 22134-5068

MASTER OF MILITARY STUDIES

TITLE:

Rifle Innovation: From the M1903 Springfield to the M1 Garand

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

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AY 05-06

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EXECUTIVE SUMMARY

Title: Rifle Innovation: From the M1903 Springfield to the M1 Garand.

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Thesis: The military tested and compared several rifles to replace the M1903 Springfield, and ultimately both the Army and Marine Corps selected the Garand. Was the M1 the best rifle available?

Discussion: During the Inter-War period, the military was searching for a dependable and accurate rifle to replace the Springfield. While almost any semiautomatic rifle would be more susceptible to malfunction than the hand-operated bolt-action M1903, the services were willing to forego some dependability in the name of firepower. In the late 1920's, the competition of providing a rifle rested mostly with John Garand and J.D. Pedersen. They offered two very different rifles: gas-operated and recoil-operated weapons, respectively. Pedersen was also able to convince the Army Ordnance Board that a .276 caliber bullet would be better than the .30 cal. This he attributed to the .30 being too strong for self-loading actions. While Pedersen developed strictly a .276 Cal weapon, Garand continued to develop his .30 cal in addition to the .276. In 1932, Army Chief of Staff, General McArthur, rejected the .276 caliber bullet, and ordered the search for a dependable .30 cal semi-auto continue. At this point, the Garand was the only choice available.

With the Marines, the competition came down to the Garand, a rifle by Marine Lieutenant Marvin Johnson, and a Winchester rifle. With the Winchester in its infancy of development, only two were available for testing, and each suffered many breakages. The Garand and the Johnson were the only choices for the USMC. After intensive testing in San Diego in 1940, the Board to Conduct Competitive Test, Caliber .30 Rifles, declared the Garand to be the best of the rifles tested, but recommended that no rifle be selected until more reliable models became available. That recommendation lasted only two months, when the Marine Corps adopted the Garand as its standard issue shoulder weapon.

Conclusion: The M1 Garand continued to emerge as the superior rifle when tested against other models. In 1936, it earned the selection by the Army based not only on its superior performance, but also by default as it was the only .30 cal semi-auto available, as mandated by MacArthur's insistence that the new rifle be of .30 caliber. Five years later, when the Marines needed a semi-automatic weapon, the Corps was not initially sold on the Garand. They wanted to wait until an even more reliable weapon was available. Two months later, however, the Marines realized that the Garand was good enough, it was also already in production, at a rate of 600 per day. The Marines, too, fought with a weapon that was, at the time, the only one truly available.

Preface

This paper addresses the military's recognized need for a semi-automatic standard shoulder weapon after World War I, and its final adoption of the M1 Garand just prior to and during the Second World War by the United States Army and Marine Corps, respectively. It demonstrates the difficulty in breaking paradigms and the resistance to change often encountered with innovation, i.e., that a rifle should look the same as the one it replaced. Also shown is the ability of a person of influence to lead a project in a direction not in keeping with the standard, due to personal bias. Notably, well-known arms maker John D. Pedersen's drive to switch the standard military cartridge from a .30 caliber to a 7mm solely based on his belief that a weapon could not withstand the physical abuse of a .30 cal. Most importantly, it emphasizes the point that many innovations continue to develop, test, and improve in the name of perfection, when a "good enough" implement could have benefited the troops at a much earlier date.

This paper does not address the financial aspect of the M1's innovation, with the exception of mentioning dollar amounts available for initial production. Also absent is a demonstration of the American people behind the war effort, and the fact that production of weapons was outsourced to other manufactures, e.g. Remington. Another issue not addressed is nepotism involved in the process of developing a semi-automatic weapon; LtCol James S Hatcher, a member of the Army Ordnance Board and assigned to several tours of duty at the Springfield Armory, approved the continuation of work on a rifle being developed by his son, Capt. James L. Hatcher. Such an action in today's politico-military environment would border on the illegal.

This paper is relevant in that today's Marines and soldiers are again seeking a new standard shoulder weapon, and work is in progress to provide them with one. While engaged in a war which evidently will not end any time soon, the government and manufacturers must make every effort to provide them the weaponry they need now, not when the perfect weapon arrives, and especially not when the war is over.

The Grey Research Center on Marine Base Quantico, VA, was very helpful in writing this paper. The book section on Small Arms was plentiful, as would be expected for a library on a Marine Corps installation. Most impressive was the ease of accessing World War II era publications such as Leatherneck and the Marine Corps Gazette, both professional journals associated with the U.S. Marine Corps.

I have always been a firearms enthusiast. My first exposure to the M1 Garand was as a U.S. Navy officer candidate at Pensacola, Florida. While the Garands we drilled with were non-functioning, a certain class drill instructor, GySgt Krank, USMC, made sure I knew just how heavy a Garand could be, and how quickly its 71 parts could be disassembled! My father, a Marine, has an M1 Garand, left to him by his brother, also a Marine. That rifle will someday be mine, and writing this paper gave me insight in to how that weapon became a legend in American history.

Prologue

As the United States approached entry into World War II, the military was in the process of adopting a new standard shoulder weapon. The M1903 Springfield rifle had been in service for decades after replacing the Krag-Jorgensen models M1892 and M1896. While the M1903 was both extremely accurate and dependable, there was a recognized need to modernize. That modernization would surely mean a self-loading, or semi-automatic, rifle. Ultimately, the Army, and then the Marine Corps, adopted the M1 Garand over the competing Pedersen and Johnson rifles as the standard shoulder weapon. How did these weapons evolve? How did the industrial processes of the time affect innovation? Was the Garand the right choice?

The idea of a self-loading weapon was certainly not new. In fact, while the United States was adopting the M1903, there were then a few semi-autos being developed. While none were reliable at that time, the possibility of increased firepower intrigued ordnance experts.[1] One of the first official references to auto-loading rifles is in a letter from Captain O. B. Mitcham, U.S. Army, in Berlin to the Chief of Ordnance in August 1900. Mitcham noted, "the question of automatic small arms is being taken up seriously in Europe," and when in Copenhagen he, "saw in the small arms factory 100 such guns made for the use of sea coast fortification of the same caliber (8mm) as the Krag-Jorgensen rifles used in that country."[2]

LTC Frank Phipps, the Commanding Officer of the Springfield armory at the time, requested the acquisition of samples of the European semi-autos. In 1902, he recommended the Ordnance Department study all of the "best known systems" for auto-loaders, with a goal to design a weapon embracing the best features of all.[3] General William H. Crozier, Ordnance Chief, in his 1902 annual report, stated that the only radical improvement in military arms being studied was the development of a weapon which would load itself. Such a weapon would foster

greater firepower for the infantryman, and also allow him more accuracy since his aim would not be interrupted by the awkward manipulation of the bolt.[4]

Increased firepower was indeed the Army's major interest in a self-loading weapon. Hiram S. Maxim's self-actuating machine gun, introduced in the last decade of the 19th century, clearly indicated the balance on the battlefield was shifting towards the defense. Some officers felt that the self-loading rifle might help shift the advantage back to the offense. As a result, in the years prior to World War I, the Ordnance department tested several self-loading weapons.[5]

Weapon Development

The pre-World War I semi-automatic weapons tested by the U.S. Army Ordnance Department were generally unreliable, especially subjected to parts breakage. Designers were pushing the state of the art in machine design and metallurgy. The quest for a truly reliable and rugged auto-loading rifle would require extensive experimentation.

While it would take 34 years for the military semi-automatic rifle to be developed, tested, and adopted, sporting auto-loading rifles were on the market only four years after the Ordnance Chief's 1902 report. John Browning received a patent in 1902 for a long-recoil mechanism, which in 1906 was being manufactured in the Remington Model 8. Winchester also produced a weapon for the market, the model 1905, and later the higher-powered model 1907. But while these rifles were fine for sporting cartridges, they could not handle the power and chamber pressure of the 30 caliber standard cartridge*.[6]

The existing weaponry had a great influence on the semi-autos being developed. The first self-loaders looked like the bolt action rifles which were in use at the time. In fact, designers initially had difficulty breaking with the past. There were certain paradigms which influenced how a weapon should look. Economics was another reason the weapons were so similar. New

* Ironically, that cartridge, the .30-06, is now one of the most popular sporting cartridges available.

weapons were patterned after older ones in order to use existing parts. Arms inventors were aware that if they used existing parts, they might overcome any economic resistance to self-loaders. The trend was most clearly seen in the attempt to convert the M1903 to a self-loader. (Characteristics of the M1903 and other weapons in this paper are available in Appendix A.) There were at least five different attempts to modify the Springfield, although none were successful. In 1911, after rejecting Franklin K. Young's attempted conversion, the Board noted, "few alterations would have to be made in machine tools and fixtures."[7]

The Pre-World War I effort to develop an auto-loading rifle at least resulted in the establishment of specifications for such weapons. A basic requirement was for the weapon to be a simple, strong, and durable mechanism. Although no parts number was set, inventors were urged to keep the number to a minimum; also, disassembly should be accomplished with as few tools as possible. Interestingly, no standard cartridge had yet been mandated, but the magazine was to hold eight rounds. At the outset, the specifications were a guide more than a requirement.[8]

As World War I became imminent, the Army found itself short of its standard rifle.[†] The development of semiautomatic rifles, already limited in scope, was halted as the War Department directed its full attention to production of M1903 weapons. Two things became obvious: America's involvement in the European conflict, and the inability of the Springfield Armory or Rock Island Arsenal to produce sufficient numbers of M1903 Springfield rifles. The Ordnance Department had to look elsewhere for weapons. This production problem led to the M1917 (Pattern 17 American Enfield), an adaptation of the British designed P-14 being produced in the United States. It became the standard World War I infantry weapon, despite people's belief that the U.S. Army primarily used the Springfield. In fact, by 1918, 2.2 million M1917s had been accepted, as compared to only 313,000 M1903s.[9]

[†] According to Ezell, the Army found itself short of its standard rifle in 1861, 1898, and 1917, and would again in 1941, 1950, 1961, and 1966-67.

Garand Enters a Bid

John C. Garand came on the weapons scene at the end of the war. (A short biography of the designers in this paper is provided in Appendix B.) He had a strong mechanical background, and had previously been employed as a tool and gauge maker. Garand had also been reading about machine guns, and found most articles contained examples of jamming and breakage. With the government accepting bids to develop a light machine gun, Garand submitted a design to the Naval Board of Invention. He was put in touch with the National Bureau of Standards, who asked him to build a working model. Garand's model used a novel concept: a primer-actuated action. Upon firing, the pressure in the case pushed the primer back, driving the firing pin rearward with enough force so as to unlock the rotating bolt. At that point, the residual pressure in the barrel could force the rest of the action rearward and eject the spent casing. Then an actuator spring would push the action to close again and cycle a new cartridge into the chamber. As the bolt slammed forward, the inertia of the heavy firing pin would continue to move forward and strike the primer, thus repeating the cycle again.[10]

Unlike many of the models introduced at that time, Garand's actually worked. He proved to the Ordnance Department that he was knowledgeable about machine design and was ahead of most other small arms inventors. The Ordnance Department of the Army hired Garand, and financed his invention. He was sent to the Springfield Armory to work on a semiautomatic shoulder weapon at a salary of $3500 per year.[11] This first Garand worked well, but it was more of a light machine-gun than a rifle, and was designed with no knowledge of the rifle requirements discussed earlier. Arriving at Springfield in November 1919, he started work on a new design, rooted in the desires of the Infantry and Cavalry branches who previously complained they had limited involvement in weapons development.[12]

Garand spent the next five years working on rifle designs. All of them used the rearward movement of the primer to unlock the bolt. Further development of this new system was halted by the Ordnance Department's refusal to adopt a special cartridge. In 1925, the Department took action which would prevent further developement of Garand's action: it switched from a fast-burning powder to a slow-burning one. The Garand action would only operate with the older propellant.[13] Also, a crimped primer pocket was introduced. This would prevent the dangerous condition of primers blowing out of their pocket. While this was an added safety feature, it rendered Garand's system useless as it was this condition of primer blow-back upon which the rifle depended on. [14]

John D. Pedersen and the 7mm

In 1923 another development entered the gun-designing industry: the introduction of a 7mm round. Mr. John D. Pedersen had also been contracted by the Ordnance Department to develop an auto-loading rifle. Pedersen had a great and well-earned reputation as an arms designer. He was responsible for developing many Remington Auto-loading and slide-action (pump) firearms, as well as an auto-loading pistol. He also invented the Pedersen Device[‡], a bolt device which was inserted in to the action of a model M1903 (after original bolt was removed) to convert it to semi-automatic fire.[15]

Now Pedersen was pushing for a new standard caliber. He believed that many of the difficulties of designing a self-loader would be eliminated if the cartridge were shorter, lighter, and produced less heat and recoil. He provided convincing numbers for a 7mm/.276 caliber bullet. The Ordnance Department approved development of .276 caliber arms to Pedersen, but the caliber had not yet been adopted as the standard.

[‡] Pedersen devices are on display at the USMA Museum at West Point, and at the Aberdeen Proving Grounds in Maryland.

With all the changes in ammunition, Garand gave up on the primer-actuated system. However, he was also authorized to proceed with development of a gas-operated, turning-bolt semiautomatic. Most rifles of this type used a ported barrel, allowing gas to escape in to a cylinder below the barrel and operate a piston-like operating rod to work the action. Garand did not like the idea of a piston lying in a gas cylinder, and instead, developed a muzzle cap system. The muzzle cap is located on the end of the barrel. As the bullet escapes, the gases built up behind it are allowed to escape rapidly. The cap catches those gases, which in turn pulls the cap forward. The cap is linked to the action by a wire, which then is manipulated and cycled.[16]

Garand carefully considered the muzzle cap system, but developed an alteration. Rather than having a floating muzzle cap, he made his stationary. He eventually adopted the use of a piston rod in a gas cylinder. However, his system directed the flow of escaping gases around the muzzle against the piston, rather than have gases ported from the barrel directly. Early M1's operated on this principle, although modifications were made later. A U.S. patent had already been awarded to L. Silverman of Kent, England, for such a muzzle cap system, but this had long expired, and could be used by anyone. [17]

.30 Cal vs. 7mm

In December 1927, the Ordnance Committee recommended manufacturing a Garand rifle in .276 caliber. Garand stopped manufacture of the .30 cal and started developing the 7mm. At this time, the selection of a standard caliber had still not been resolved. The Army took two steps in order to resolve this issue. It appointed a board to determine the wounding effects of the .30 (flat and boat tail), .276 (flat and boat tail) and .256 (flat based) bullets. (This board was known as the Pig Board, and its finding are listed in Appendix C.) It also appointed a joint Army, Navy, and Marine Corps board to determine what caliber should be made standard for any semi-auto

rifle developed.[18] This board was named the Semiautomatic Rifle Board, met three times, and conducted a series of tests at each meeting.

On July 1st, 1929, the Semiautomatic Rifle Board convened its second meeting. It tested six rifles, and the results were strongly in favor of the Garand and the Pedersen models. It was noted that Garand had the following features superior over the Pedersen: fewer parts, did not require lubricated ammo, easy to disassemble, was lighter, would be easier to manufacture, and the War Department would not have to pay any royalty. Following the board, twenty test model .276 Garands were produced, and in 1931 sent to the Infantry and Cavalry. Acceptance or rejection of these rifles was in the hands of the forces that would fight with them, and they could also make change recommendations. The Infantry report concluded that the Garand was far superior to the Pedersen; it also contained verbage indicating that the issue of .30 or .276 was still not settled.[19]

The Semiautomatic Rifle Board met for its third series of test from 9 October 1931 through 4 January 1932, at Aberdeen. The Garand .30 cal had been completed and was now ready for test. The board also again tested the .276 cal Garand and Pedersen rifles. The .30 cal Garand was almost an exact duplicate of his .276. On the first day, it passed an excellent round of testing, but on the second day, during an endurance test, it suffered a cracked bolt, and the test was discontinued. It was sent back to Springfield to be reworked.[20]

Both the .276 Pedersen and Garand rifles worked very well. The Pedersen had one major advantage: it was easier to load. In fact, the clip system of the Garand was a problem, and would continue to be one for some time. The Pedersen had one major disadvantage: it required lubricated ammunition, a most undesirable feature. The Garand had one significant advantage: by using the muzzle cap system, the operating gas was taken after the bullet had left the barrel. This meant the breech would stay locked and prevent blowback, a consideration for ported

barrels. Also listed as an advantage for the Garand was the ease in which the clip could be removed to unload the rifle. But this was greatly outweighed by the loading problem, as the emphasis was on rapid loading, and not unloading. The muzzle cap system required a longer operating rod than would a ported barrel, and this was listed as a disadvantage. Both rifles used a short metal hand guard, which would become hot enough to burn the shooter's hands. Hence, a wood barrel covering was recommended. This would also serve to eliminate the mirage effect caused by rising heat vapors.[21]

Following these tests, two officers from the Ordnance Board determined that the $170,000 available for weapon manufacture would procure 125 rifles. Of course, this included purchasing all of the machinery required to place the rifle in to production. The board felt that development of self-loading rifles had reached a point where a decision as to type and caliber should now be made. In other words, cease developing and testing new weapons and updating older ones in the hope that a better one would become available. Because it was believed that the .276 Garand could be later adapted to .30 cal without scrapping all of the jigs, fixtures, and production tooling, Colonel Edward Croft, President of the Board, made four formal recommendations to the Secretary of War: (1) the caliber of the semiautomatic rifle be fixed at .276, (2) the .276 Garand be approved as type for limited procurement, (3) 125 Garands be manufactured for service use of not less than one year, and (4) development of the .30 cal Garand be continued.[22]

McArthur Intervenes

As the board members signed their final report, it seemed the Army finally had its new service weapon. However, before production commenced, the report would have to be approved by the War Department, and then transmitted to the Ordnance Department for action. The report, however, never reached the Ordnance Department. The Chief of Staff of the Army, General

Douglas McArthur, disapproved the change in caliber, and recommended work be intensified to find a suitable .30 cal semiautomatic. A letter of 25 February 1932, from the Adjutant General to the board reflected MacArthur's disapproval. It stated that committing the American Army to caliber .276 was not wise or desirable, that it had not been definitely demonstrated that a satisfactory .30 caliber could not be produced. The letter directed that no further obligations be made to the development of the .276 semiautomatic shoulder rifle, work should be intensified to develop a .30 cal, and 77 rifles should be manufactured for extended test.[23]

This letter shifted emphasis to correcting problems with the rifle which suffered a cracked bolt on 10 October. With the rework of the bolt, Garand also made some minor changes. When retested at Aberdeen on 21 and 22 March 1932, the rifle performed very well and warranted production of the 77 rifles called for in the Adjutant General's letter. At the time, $80,000 was available for production, and Springfield would build them on a semi-production basis. Built by hand, the cost would be about the same, but the rifles would lack parts interchangeability. Semi-production would require basic jigs, fixtures, and tooling, most of which were designed by Mr. Garand himself.[24]

On 3 August 1933, the rifle's designation was switched from T1E2, to US Semiautomatic Rifle, Caliber .30, M1. The 80 rifles were completed in May 1934. Fifty were sent to the Infantry, and 25 to the Cavalry. The rifles were tested in the most combat-like conditions, with the results documented and evaluated. A number of minor changes were incorporated. Also of significance was the weakness of the long operating rod (previously noted as a disadvantage.) The rifles were sent back to Springfield, and refitted with new rods. The trials were completed in October 1935, with both Infantry and Cavalry recommending adoption to replace the M1903. The Adjutant General approved it for standardization on 9 January 1936: the Army now had a new standard shoulder rifle.[25] The Springfield armory immediately tooled up for mass

production. (Appendix D provides a brief overview of the Garand's manufacture, including some production problems.)

The Johnson Rifle

The first Marines saw their first action in World War II while carrying a weapon from World War I. This was not due to an unavailability of Garands, but due to Marine Corps' preference. The Marines were in love with their tried and true M1903 Springfields, and were not sold on the idea of replacing it with a semi-automatic rifle.[26] Many Marine officers favored the Johnson rifle over the Garand. A Marine himself, Melvin Johnson had access to the Corps.

Johnson developed an auto-loading design in his garage in Boston in early 1936. Nine months later, he was displaying his take-down model at Headquarters, U.S. Marine Corps. Even the Commandant, Major General John Russell, made time to see the new device. Before leaving, he met with three top Marine shooters (Majors Jacob Lienhard and Merrit A. Edson, and Chief Marine Gunner Calvin Lloyd[§]), and was invited to Quantico to shoot some rounds. The observers were all satisfied with it. After conferring with the editor of the American Rifleman, Johnson proceeded to develop several perfected models, and by 1938 had four rifles and a light machine gun.[27]

The Johnson semi-automatic, cal .30 M1, is a short-recoil rotary bolt type action. It is furnished with a fixed or detachable magazine, holding ten or five rounds, respectively. The fixed magazine is of a rotary design, which can be loaded with the rifle's action open or closed, regardless of the number of shells remaining in the magazine. (This rotary magazine essentially eliminates the loading problems associated with the Garand, detailed later.) A standard M1903 barrel is attached to Johnson's receiver, with the standard Springfield bayonet stud used on the

[§] The rifle range at Marine Corps Base Quantico, Virginia, is named after Lloyd.

military version (Johnson also made sporting versions.) It could be made with a full wooden hand guard over the barrel, or left open using a radiating hand guard.[28]

The rifle also could be disassembled and reassembled very easily. The entire weapon can be reduced to its component parts in one minute, and reassembled in 90 seconds. It can be disassembled, and rebuilt, without any special tools. The bolt handle doubles as a screwdriver for the stock screws, and the firing pin serves as a drift to set or remove all pins.[29]

Upon firing, Johnson's barrel and bolt, locked together by eight locking lugs, move rearward by recoil. As they move aft, a camming arm and cam slot rotate the bolt, which when rotated 20 degrees unlocks from the barrel. The barrel and bolt continue to move back, but are free of each other. As the barrel hits a barrel stop in the forward part of the receiver, the bolt's inertia keeps it moving back. The spent cartridge is being pulled back by an extractor on the right side of the bolt, while on the left side of the receiver there is an ejector. When the cartridge hits the ejector, it is flipped out of the receiver. The bolt continues aft to cock the hammer and compress the action spring until a buffer plate is contacted. The spring decompresses and pushes the bolt forward, taking another round from the magazine.[30]

The Marine Corps' Rifle Tests

On 12 November 1940, the Marine Corps convened a board at its base in San Diego to conduct comparative tests on four rifles which were submitted to it: The M1903, M1 Garand, Johnson Rifle, and a Winchester rifle. Two of each of the four weapons were tested concurrently and given equal treatment. The tests, 37 in all, would last four weeks. (Not all tests will be discussed.) The board assembled a group of 40 shooters, representing a cross section of the Marine Corps, from those with experience of only six months to others qualified as sharpshooters or expert riflemen.[31]

Three tests were fired to evaluate the rifles accuracy at different levels of barrel wear. When fired new, the order of accuracy was Garand, Johnson, M1903, and Winchester. After 2600 rounds had been fired, the order was Garand, M1903, Johnson, and Winchester. The Garand's accuracy fell off sharply after 9000 rounds. The order then was M1903, Johnson, Winchester, and Garand. While the Garand did appear to be more accurate than the other semi's, the board found all three auto-loaders to be comparable to the M1903 in accuracy.[32] (A sample of the test results are provided in Appendix E.)

Another group of tests focused on operations under adverse conditions. In a test subjecting the rifles to dirt and dust, it was found that while all rifles could be operated by hand, they probably wouldn't self load. After submersion in a thin-consistency mud bath, the M1903 could be operated, although it became progressively more difficult. Of the auto's, the Johnson was found superior, only because it could be hand operated. After such conditions, the Johnson and Winchester had to be completely disassembled, while the M1903 and Garand only required field stripping. In another test designed to simulate an amphibious assault, assuming rifles exposed to light surf and dropped in sand, the M1 could not be manually operated after the second or third shots. The order of efficiency for this test was M1903, Johnson, Winchester, and Garand.[33]

The board concluded that the M1903 was the most dependable and accurate rifle submitted to it. In assessing the autoloaders, the comparative standing was Garand, Johnson, and Winchester. It should be noted that this was in accordance with the amount of time each rifle had been in development. Also of note, the Johnson weapon had many parts breakages during various tests.

The Marine Corps believed the Garand was the best semiautomatic rifle available. The board, however, recommended that the M1903 remain the standard weapon of the Marine Corps

until a semiautomatic could be produced which was comparable in efficiency and dependability to the Springfield, or until the M1903 could no longer be procured.[34]

In fact, the Marines adopted the Garand as their standard weapon in less than two months after the report. Ultimately, the Corps put more emphasis on the Garand's firepower than the Springfield's reliability. In fact, the decision was probably easier when considering the Springfield Armory was producing upwards of 600 M1 rifles per day at this time. In a letter to The Marine Corps Gazette, Johnson, having been transferred to active service, admitted that the Garand was needed in the Corps. The fate of the Johnson Rifle as the standard shoulder weapon was sealed when Johnson wrote, "as a Marine on active duty, I too, shall have a new rifle, the M1 Garand. More than this I can not say."[35]

The M1 in Combat

History had taught the Army that rifles that tested well weren't always the best in combat, and vice-versa. This was particularly evident with the Enfield and the Canadian Ross rifle. The Ordnance Department tailored its tests so that this wouldn't be the case with the new standard rifle. The rifles were returned to the engineers with harsh and often conflicting demands. It must be more rugged, it must have a heavier barrel so as to stand more heat, yet it must be lighter over all. The M1 met most of these conditions, as proven across the globe in various climates and terrain.

The initial reports of the Garand in combat came during the days after Pearl Harbor, when excellent reports came from Bataan. General McArthur reported, "the Garand rifle has proven itself in combat conditions in the Philippines." He noted the rifle had been used in foxholes with no stoppages due to dust and dirt, and that it had been engaged in almost continual combat for a week without lubrication or cleaning.[36]

A great testament of the Garand came from the Marines at Guadalcanal. Arriving on the island with M1903's, they were followed by the Army equipped with Garands. The Marines were impressed with the Garand's firepower, superior sights, and mechanical soundness and reported this to Washington. Later Leathernecks arriving on Guadalcanal were equipped with Garands. The sand and salt water encountered during landings, as well as the mud and rain of the jungles, certainly put the M1 through the most severe conditions imaginable, and it performed nobly. The Garand had earned its popularity as a combat arm.

The Marines' early experience with the M1 came when the Fifth Marine Regiment arrived at Guadalcanal, equipped with eighteen Garands having telescopic sights used by snipers. These sharpshooters easily picked off their enemy at ranges from 600 to 700 yards, usually in swimming holes or at river crossings. The Japanese could not believe these shots were anything more than luck. [37]

The Garands, which performed so well in the jungles of the Pacific, were equally impressive in the desert of North Africa. While at first there were some stoppages and excessive wear due to the whirling sand entering the actions, reducing lubrication overcame this. The dry actions seemed to work almost as well as a lubricated one, yet avoided the problem of gumming due to the mixture of sand, oil, and grease.[38]

The Garand's clip remained a problem. The rifle was unable to be loaded with just one or two rounds. It could only be placed in the rifle loaded to capacity, eight rounds. When engaged, a rifleman might shoot five or six rounds, leaving two or three in the rifle. The rifleman obviously was not happy with this. If there was a lull in the action, he would unload the rifle and insert another clip. It was sometimes noted that a shooter would simply blast away the last remaining rounds just to make it easier to insert a new clip. Thus, clip design wasted ammunition, with its ensuing effect of resupply.[39]

The Garand clearly proved its worth in combat. Eventually even the die-hard Springfield fans were admitting the rifle's place on the battlefield. The firepower of the M1 had a demoralizing effect on the enemy. In village fighting, where it might often be required to fire from the hip, especially when meeting head-on in a hallway or shooting around a corner, this can only be delivered effectively with a semiautomatic rifle. With one man delivering the fire power of three, the other two men were freed for other tasks.[40]

Conclusion

The Garand is certainly one of the greatest rifles developed for combat. The character of the Garand rifle was instilled to it by the inventor, an accomplished machinist and tool maker who not only designed the weapon for functionality but also for ease of production. It survived many vigorous tests before its adoption. The rifle was more accurate than any of its early competitors, and had a higher rate of fire. The Garand did not require lubricated bullets, which was a major defect of the Pedersen rifle.

The most significant problem for the competing Pedersen weapon was its designers insistence that a reliable .30 caliber semiautomatic rifle could not be produced. Pedersen always maintained that the power of the cartridge would be too damaging to a semi-automatic action. His outstanding reputation as an arms designer gave him influence, and he initially persuaded the Army Ordnance Board that the .276 was a better caliber for a self-loader. Hence, that Board recommended the .276 cal be adopted as the standard for semiautomatic rifles, and encouraged both Garand and Pedersen to work on rifles using the .276. Significantly, Garand retooled to make his rifle for both .276 and.30 caliber.

MacArthur's refusal in February 1932 to adopt the .276 cal as the standard cartridge temporarily ended the search for a new standard rifle. He mandated that all work appropriations for the development of .276 cal rifles be stopped. This left Pedersen out of the race, while

Garand simply shifted his focus back to the .30 cal, which was already a working model. Even with a working rifle, it still took another four years before the Garand became the standard shoulder rifle of the US Army.

In light of all the evidence that proves the M1 Garand was the right choice for the Army's combat arm, MacArthur's decision essentially made it the only choice for his service. As for the Marines, time was not on their side. While the Corps tested various new semi-automatic rifles, the Leathernecks on Guadalcanal, impressed with the firepower demonstrated by Army units equipped with M1s, sought Garands. They didn't have time to keep testing weapons, they needed an available one. Johnson himself admitted that the Garand was the only rifle in production on a daily basis. Just as the Garand was the only satisfactory weapon truly available to the Army in January 1936, it was again the only weapon available to the Marines five years later. Fortunately for both, the Garand was the superior weapon at the time.

Military innovation is always subject to friction. In the case of the Garand, the friction came in the form of economics, personal preferences, and resistance to change. Finances were short for the Springfield armory, which led to manufacturing problems with the Garand. Both the Army and Marine Corps were caught in the trap of forever seeking a better weapon, rather than accept the one which was proven to be "good enough," unwilling to accept a great rifle today in lieu of a perfect rifle next year. The Marines Corps seemed simply to be resisting change. After developing, improving, and continually proving his weapon to be the best choice, it seems Garand and his rifle never really received the public respect they deserved - at least not until 26 January 1945, when General George S. Patton, not known for giving praise, said of the Garand, "The M1 rifle is the greatest battle implement ever devised."[41]

ENDNOTES

[1] Edward C. Ezell, The Great Rifle Controversy. (Harrisburg, PA: Stackpole Books 1984), 10.

[2] Ezell, The Great Rifle Controversy, 10.

[3] Ezell, The Great Rifle Controversy, 13.

[4] Julian S. Hatcher, The Book of the Garand. (Highland Park, NJ: The Gun Room Press, 1948), 13.

[5] Ezell, The Great Rifle Controversy, 13.

[6] Hatcher, Book of the Garand, 14

[7] Ezell, The Great Rifle Controversy, 13

[8] Hatcher, Book of the Garand, 45.

[9] John Walter, Military Rifles of Two World Wars. (Mechanicsburg, PA: Stackpole Books 2003), 116

[10] Hatcher, Book of the Garand, 31

[11] Hatcher, Book of the Garand, 31

[12] Ezell, The Great Rifle Controversy, 24.

[13] Hatcher, Book of the Garand, 74

[14] Ezell, The Great Rifle Controversy, 25

[15] Hatcher, Book of the Garand, 56

[16] Hatcher, Book of the Garand, 17

[17] Hatcher, Book of the Garand, 75

[18] Hatcher, Book of the Garand, 80

[19] Hatcher, Book of the Garand, 100

[20] Hatcher, Book of the Garand, 101

[21] Hatcher, Book of the Garand, 104-106

[22] Hatcher, Book of the Garand, 108

[23] Hatcher, Book of the Garand, 110-111

[24] Hatcher, Book of the Garand, 113

[25] Hatcher, Book of the Garand, 114

[26] Hatcher, Book of the Garand, 141

[27] Chandler Gardiner, "The Johnson Semi-Automatic Rifle," Marine Corps Gazette, Volume 23, Issue 1. (March 1939) , 8

[28] Gardiner, "The Johnson Semi-automatic Rifle", 8

[29] Fred Ness, "The New Johnson Rifle," American Rifleman, November, 1938, as reproduced in The Book of the Garand, Hatcher, 1948.

[30] Gardiner, "The Johnson Semi-automatic Rifle", 10

[31] Author Anonymous, "Marine Corps Rifle Tests," Marine Corps Gazette, Volume 25, Issue 2, page 14 (June 1941)

[32] Anonymous, "Marine Corps Rifle Tests", 14

[33] Anonymous, "Marine Corps Rifle Tests", 15

[34] William, Ashurst "Extracts from report of Board to conduct comparative tests, .30 cal rifles." letter to Commandant of the Marine Corps, 16 January 1941. Copy is located in M1 Garand file, USMC Historical Division, Quantico, VA.

[35] Melvin Johnson, "The M1 Rifle", Marine Corps Gazette, Volume 25, Issue 1, (March 1941), 42

[36] Hatcher, Book of the Garand, 242

[37] C. B. Cates, "Officers Article, Barracks Gossip," Army-Navy-Air Force Register, 16 April 1949.

[38] Hatcher, Book of the Garand, 248

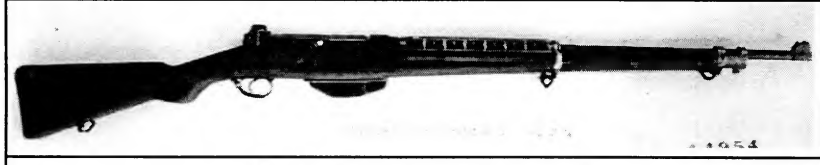
[39] Hatcher, Book of the Garand, 244

[40] Hatcher, Book of the Garand, 249

[41] Robert Bruce, The M1 Does My Talking! (Richmond, VA: Carter Printing, 1992), 20

Appendix A - Characteristics of Rifles

* Information copied from Hatcher's Book of The Garand

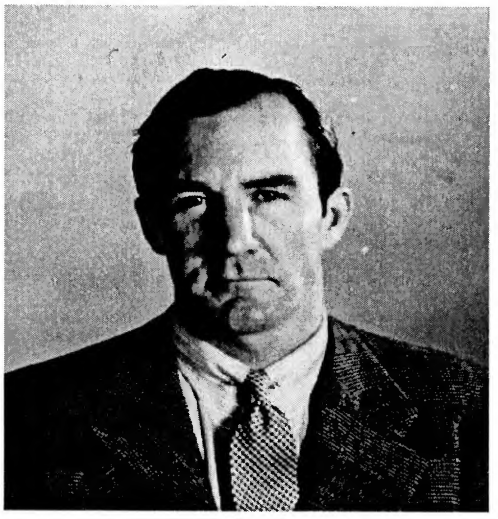
	Weapon	Action	Number of parts	weight	length	Magazine capacity
	M1903 Springfield	Manual Bolt action	94	8lb-5oz	43.5 in	5
	M1 Garand	Gas-operated Semi-automatic	71	9lb-10oz	43.5 in	8
	Pedersen .276	Retarded-blowback semi-automatic	99	8lb-14oz	44.0 in	10
	Johnson '41	recoiling-barrel semi-automatic	140	9lb-13oz	45.8 in	Fixed - 10 detachable-5

Appendix B - INVENTOR'S BIOGRAPHIES

John C. Garand was born in Quebec in 1888, and moved to Connecticut as a child. He attended school until the age of twelve, and then became employed in the textile mill, where he was later promoted to machinist. He was later hired by a tool factory in Rhode Island.

His fondness for machinery and target shooting led to a hobby in designing guns, which took a more vocational turn in 1917. After reviewing his light machine gun, Garand was appointed a position with the Bureau of Standards with the task of improving his design. The design was not completed in time for service in World War I, but Garand was retained as a consulting engineer for the Springfield Armory.

Here Garand had the task of designing a semi-automatic rifle. After fifteen years of development, testing and improvement, the M1 Garand started mass production in 1936. For his work with the Springfield Armory, Garand was awarded the Medal for Meritorious Service in 1941 and the Medal for Merit in 1944.[1]



Melvin Maynard Johnson Jr. was born in August 1909 into an affluent Boston, Massachusetts family. From an early age he drew a fascination from firearms and how they were designed. He attended Noble and Greenough School, and then Harvard Law School, from where he graduated in 1934 and practicing law in Boston until 1939. He was posted as the Marine Corps' observer at the Springfield Armory, reporting on the Garand and Pederson trials being held there. Not being impressed by either design, he designed a retarded blowback operated rifle in 1935. Johnson held four U.S. Patents on various design features used in his rifle.

He set up the Johnson Automatics Trust in Brookline, Mass., with the aid of his father. The Trust, later Johnson Automatics Inc. found production facilities first at the Taft Pierce plant and then in Cranston, both situated in Rhode Island. The model '41 rifles were manufactured under the "Cranston Arms Company Inc." name.

Johnson also designed the Johnson Light Machine Gun which was issued to US Forces in larger numbers than his rifle, again to specialized army and Marine units. Both models of which (the 1941 and the 1944) saw action in all theatres of operation in World War II.[2]

John Douglas Pedersen was a prolific arms designer who worked for Remington and later the U.S. Government. Born in Denmark, he lived in Wyoming for a long period. He is most famous for the Pedersen device, which converted a standard M1903 rifle to a semi-automatic intermediate caliber firearm. He designed several guns for Remington, including the Model 51 pistol, and the Models 10, 12, 14, and 17. The model 17 shotgun later became the Ithaca model 37.

Pedersen designed two weapons which were bested by the competition. His 45 caliber automatic pistol, based on the same design as the Model 51, was accepted by the Navy Board for production, but World War I drove Remington to retool to produce model 1911's. He also designed the competing design to the M1 Garand. His rifle used a toggle-lock and waxed cartridges. The Garand was selected over the Pedersen.[3]

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[1] Wikipedia, available, http://en.wikipedia.org/wiki/John_Garand
[2] Unknown, available, http://www.johnsonautomatics.com/Biography.htm
[3] Wikipedia, available, http://en.wikipedia.org/wiki/john_pedersen

Appendix C - The Pig Board

The board to determine wounding effects of the bullets consisted of three Medical Corps officers and one from the Ordnance Department. The board met at Aberdeen Proving Grounds in June 1928. Previous work had been done along these lines, but always using a slab of meat or some other substance. This board wanted to see the results of the bullets when fired in to tissue which was still living and full of fluid, hence without rigor mortise. To meet this requirement, pigs were used. Eighteen were chosen, which were anesthetized prior to being shot.

Surprisingly, the .256 gave worse wounds than the others. At 300 yards, the .256, and then .276, produced the most damage. At 600 yards, it became more difficult to tell, with the .256 having a slight advantage. Not until firing from 1000 yards did the .30 cal have a clear advantage. But the overall consensus was that, at about 300 - 400 yards, where it was deemed most shooting would occur, any of the bullets were satisfactory when only considering wound effectiveness.[1]

[1] Hatcher, Book of the Garand, 81

Appendix D - Manufacturing the M1 Garand

The M1 had 69 parts as originally designed. Now engineers had to develop the best way to produce and assemble them for mass production. This included building all of the required fixtures and jogs, as well as purchasing required machinery. Production of delivery Garands began in September 1937, with 10 per day being built. That number quickly rose to 20 per day in March 1938, and eventually to 200 per day in January 1940.[1]

While the hand built models performed superbly, the first production models had many problems. These all seemed to have a common root cause: when the Armory was tooled up for production, slight changes or modifications were made to the shapes of some parts in order to facilitate convenient machining methods. Driving these faults was the fact that Mr. Garand had not been consulted in the development of tooling for many of them. As an experienced tool maker, Garand shaped each piece of his rifle with two goals: to accomplish its function, and to be shaped for efficiency of production. The problem was that once Garand's rifle had been adopted, he was treated as an outside contractor whose patent had been bought. In fact, one official recommended that in light of appropriations, Garand be dropped from the payroll in order to save his $3500 salary. Fortunately, this suggestion was rejected.[2]

One early problem was known as *Seventh-Round Stoppage*. The clip held 8 rounds in two staggered rows of four each. The clip could be loaded in two ways, which would result either with the top round on the left or the right. It was found that when the top cartridge was on the right, meaning the seventh round would also be on the right, the seventh round would fail to feed, and instead jump up and have the point of the round jammed in to the receiver. When loaded so that the top and seventh rounds were on the

left, this jamming did not occur. The initial fix was modifying a slide follower which prevented the seventh round from being loaded on the right. After comparing an older receiver to a new one, it was realized that the older had two ribs inside the magazine wall just forward of the follower. The new production models also were designed with the ribs, but the top corner was being beveled off when the receiver was drilled for the barrel. This process was modified, and the seventh round stoppage corrected.[3]

Another problem with the early weapons was the *Jumping Clip*. This was a tendency of the clip to jump out of the rifle with the last live round, after firing the seventh round. This was caused by a problem with the accelerator, a piece which releases the operating rod when a full clips is inserted, allowing the action to close. This was corrected with minor alterations. The operating rod itself was also a problem. The cam at the end of it, which turns the bolt, had a tendency to stick or become burred. This happened most often when rain would wash away the lubricant. Use of graphite grease seemed to be the correction, and a small container of Lubriplate was included in the butt of the rifle.[4]

The only major alteration to the Garand was to the gas operating system. Critics were not satisfied with the muzzle cap system, and said it provided a weak attachment for the bayonet. The space between the muzzle cap and the barrel was impacted with carbon build up, which affected both accuracy and the power of the action. This system was replaced, going to a more traditional ported barrel. The new ported barrels were placed in production in early 1940, and reached troops in June of that year.[5]

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[1] Hatcher, Book of the Garand, 119
[2] Hatcher, Book of the Garand, 120
[3] Hatcher, Book of the Garand, 122
[4] Hatcher, Book of the Garand, 123
[5] Hatcher, Book of the Garand, 124

Appendix E - USMC Testing Data

This appendix gives a sample of the tests and results obtained during the USMC's thorough rifle testing, commenced 12 November 1940. This is in no way a complete listing, and represents the tests most relevant to the main body of this paper.[1]

Table 1 represents data from the initial test, determining accuracy from a new barrel. The weapons were fired from the ranges given, in both slow fire and rapid fire scenarios.

TABLE 1		Slow Fire		RF-Target A		RF-Target D			Total Score
Range -->	200	600	1000	200	300	200	300	500	
Type of Rifle									
M1903	44.5	44.38	79.5	62.38	56.5	68.5	65.38	64.88	486
M1	42.75	44.88	72.75	67.38	63.25	73.01	73.38	63.63	501
Johnson	41.5	38.88	71.5	64.5	61.88	72.63	73	61.25	485.13

Table 2 represents data from the second accuracy test. This test used a mean deviation from center, in horizontal and vertical axis. The averages of MH and MV were then averaged to give a Figure of Merit. The lower the F.O.M, the more accurate the weapon. These tests were conducted after the rifles had shot 2600 rounds.

TABLE 2	300 Yards	600 Yards	Overall
	F.O.M.	F.O.M.	F.O.M.
Type of Rifle			
M1903	4.78	11	7.89
M1	4.52	10.85	7.69
Johnson	7.405	13.3	10.35

Table 3 represents data from the final accuracy test. This test was fired from 200 yards only, and after 9000 rounds had been fired. Mean Vertical and Horizontal deviations were averaged to determine a FOM. The lower the FOM, the more accurate the weapon. Notice the drop in accuracy in the Garand compared to previous tests.

TABLE 3	MV	MH	FOM
Type of Rifle			
M1903	6.39	4.09	5.24
M1	9.54	11.03	10.28
Johnson	7.73	5.28	6.51

Table 4 represents data obtained in a test to determine "effective rate of fire" at known distances and of fixed targets. Shooters shot prone at an "A" target at 300 yards. Equal consideration was given to volume of fire and accuracy of fire. Four shooters rotated as to fire one score with each weapon.

TABLE 4	Shots per minute	Hits per minute	Score per minute
Type of Rifle			
M1903	14.25	13.81	61.87
M1	22.31	22.06	99.5
Johnson	15.56	14.31	66.25

Table 5 represents malfunctions and repairs endured during the firing of 12,000 rounds. Two weapons of each type were used, and therefore an average is given for the repairs figure.

TABLE 5	Malfunctions (after12,000 rounds.)	Average number of parts broken, replaced, or repaired
Type of Rifle		
M1903	53	3
M1	370	12.25
Johnson	773	36

[1] Hatcher, Book of the Garand, 146-152

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Ashurst, William, "Extracts from report of Board to Conduct Comparative Tests, .30 Cal Rifles." Letter to the Commandant of the Marine Corps, 16 January 1941. This copy is located in the M1 Garand file at the USMC Historical Division, Quantico, VA. This is the letter from the testing board to the Commandant Marine Corps. It was very useful in that it shows the Corps' reluctance to adopt the Garand, even though the M1 clearly was the superior weapon during testing. This demonstrates the desire to keep searching for the perfect weapon, rather than accepting the one which was clearly good enough.

Author Anonymous, "Marine Corps Rifle Tests," Marine Corps Gazette, Volume 25, Issue 2, (June 1941). Detailed information on the tests comparing Johnson, Garand, and Winchester rifles. It was very pertinent and useful in that it provided detailed information in an easy to read format. The data clearly showed the Garand to be the better weapon.

Bruce, Robert, The M1 Does My Talking! (Richmond, VA: Carter Printing, 1992). This book is a pictorial history of the M1 Garand. It provides great pictures, but not much information. Most of the information was found in other sources. It was one of the only sources which put a date with General Patton's famous quote on the Garand.

Cates, C.B. "Officers Article, Barracks Gossip," Army-Navy-Air Force Register, 16 April 1949. This article explained the use of the Garand at Guadalcanal in final months. Significant in that it also shows the relationship between Army and Marines in the context of weapons, and how the Marines traditionally bought their rifles from the Army, so long as there was a satisfactory product.

Ezell, Edward The Great Rifle Controversy. (Harrisburg, PA: Stackpole Books, 1984). This book is a history of the development of the M-16, but includes a brief history of the M1 to draw comparisons and set the tone. It was very useful, as Ezell gives a good introduction in to the United States' early desires to obtain semi-automatic technology.

Gardiner, Chandler, "The Johnson Semi-Automatic Rifle," Marine Corps Gazette, Volume 23, Issue 1. Page 8, 6 pages (March 1939). This article gives a brief history of Johnson and his rifle. This did provide some useful information, but much of it is found in other sources.

Hatcher, Julian The Book of the Garand. (Highland Park, NJ: The Gun Room Press,(1948). The author was a member of the Ordnance Board, and was assigned at various times in his career at the Springfield Armory. It gives his first hand knowledge of production and combat effectiveness. This is the primary source of information on the Garand, and its content is repeated in many other sources.

Johnson, Melvin, "The M1 Rifle, Marine Corps Gazette, Volume 25, Issue 1, Page 42. (March 1941). The article, written by Johnson himself, concedes his rifle being bested by the M1. This is valuable in that it shows a Marine's discipline in making a very important statement to the rest of the Corps. The Garand is now the Leatherneck's weapon and he will fight with it!

Ness, Fred, "The New Johnson Rifle," American Rifleman, November, 1938, as reproduced in The Book of the Garand, Julian Hatcher(1948). Good information on the Johnson rifle, which was reproduced in the Hatcher book. It is significant in that Johnson was getting advice from an NRA executive to continue developing the rifle, for it had potential in the sporting arms market.

Walter, John, Military Rifles of Two World Wars. (Mechanicsburg, PA: Stackpole Books, 2003). This is a handbook-style collection of very basic information on weapons of all countries from World War I and the Second World War. It was useful in providing the statistics of M1903s vs. P-17s used in WW I. It did list the Johnson rifle under The Netherlands. It provides basic characteristics, but no information on development which wasn't available in other sources.