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America's Great Leaders – Volume I

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INTRODUCTION

This course contains five distinctive classifications of America's leaders who have impacted American culture and changed the engineering boundaries under which we live. Three popular categories have been omitted, including political, religious, and military, primarily because they do not have a significant correlation to engineering.

While there have been some truly great political leaders in our nation, there would be a high degree of difficulty by citing any one political leader once we get past Abraham Lincoln. We might consider Franklin Delano Roosevelt because, after all, he was elected president of the U. S. on four occasions. In addition, he did lead us through World War II for most of the nearly four years that we were engaged before Polio tragically took his life. However, his first nine years in office was marked by a severe national depression, which lasted until the war came along. Nevertheless, his overall guidance and leadership probably would have placed him on our list.

The category of religion is simply too broad a base due to the many different mainline religions as well as the numerous factions within each of those frameworks. Once we define someone like Billy Graham, who was an inspirational leader to numerous American presidents, and Martin Luther King, who was an inspiration to Christians of all denominations, the list of those who might have had a role as a national religious leader diminishes quickly.

And in the military, where **leadership** is the key to how and why millions of men and women have performed their duties and met their obligations, we went back again to World War II to seek the type of leadership that we were striving to find. One choice might have been General George S. Patton, Jr., a brilliant military strategist, who was actually known for "leading his troops into battle from the front". Another was General George C. Marshall, Jr., a decorated World War II general. As Secretary of State under President Harry S. Truman, Marshall was largely instrumental in rebuilding the European continent after the war under the "Marshall Plan". The results of that plan can still be seen today. A third selection might have been General Dwight Eisenhower, a brilliant military strategist, who later became president of the United States. Not so highly regarded by many Americans was General Douglas MacArthur, who was willing to risk up to one million American military lives in order to invade a Japanese country whose navy and air force had been decimated, while many of its major cities had been almost 50% destroyed by American Super B-29 bombers.

The five major categories considered in this series of publications are:

1. **Business**
2. **Entrepreneur**
3. **Engineering**

4. Industry

5. Sports

The following is a brief description of each of the chosen categories and how they might have developed meaningful leadership in the United States of America:

1. Business

This first category is meant to distinguish those individuals who have developed a business model, a method or service rather than a product, which has impacted the majority population of the United States in a large way. As you will see in this and similar publications in the future, most - if not all - who made this list either were graduate engineers, or else had very strong engineering backgrounds. This is not meant to imply that only engineers have the acumen or the desire to create and develop a thriving business. Many businesses are created by lawyers, celebrities, bankers, and other professions with great success. This series, however, is not dedicated to individuals who have developed a successful business, but rather to those whose business has made a lasting impact on America and the world. Future publications in this series may feature persons with little or no technical backgrounds who have fulfilled this criterion.

2. Engineering

The second category is meant to celebrate those individuals who have provided an engineering service which has benefited Americans, and possibly all of mankind, without necessarily deriving a direct financial benefit. These Americans were true to their disciplines and may have created or invented items or objects which are well-known and familiar to all Americans. This list is long and extensive, and certainly could date back to the Nineteenth Century. However, this particular segment of the publication is dedicated to those who graduated from American universities, had an idea, and went on to invent or discover something of universal proportions. In many instances, you probably would not recognize these engineers by name, but only by what they created.

3. Entrepreneur

This third category is meant to define those individuals who have invented and developed a product which has impacted the United States as well as the rest of the world in some way. While not all of these entrepreneurs may have been graduate engineers, there can be no doubt that engineering and technical knowledge have played an enormous role in the development of those products. In general, these individuals stayed with their plans and ideas through some difficult times and seldom, if ever, wavered in their intensity to bring a unique product to the market place.

4. Industry

The industry category, or manufacturing, may also go back further in time than some of the other categories. The group in this category involves those individuals who had the foresight to create

dynasties with known commodities that impact the everyday lives of all Americans. This list currently includes those who took an idea or an invention and developed a product that is now manufactured throughout the civilized world. Despite the fact that we witness new and improved products every year, many that we utilize on a daily basis may have had their origins decades ago.

5. Sports

As was noted in the opening statement of this document, including this category is meant to distinguish an individual (or individuals) who has developed a leadership role in a particular field of athletics. Furthermore, that endeavor has probably impacted the citizenry of the United States in a large way. Most of us Americans, particularly those who read these publications, consider and follow sporting activities in their everyday lives. We, as sports fans, have come to recognize those individuals who have blazed a trail in their particular sport with their own unique leadership style.

As we travel through the first course of these five categories, which is not meant in any way to be more significant or more important than the following three courses, you will find a commonality in the characteristics of the individuals featured. The very first is **discipline**. None of these individuals punched a time clock or filed an unemployment claim. There never was an eight-hour day, but only a strong desire to meet their objectives and their ultimate goal. I doubt that any of them were clock-watchers, and probably they seldom even knew what day of the week it was. However, they most certainly kept good notes and must have maintained a clear line of communication with those in their inner circle.

Another common trait among our group of distinguished leaders is **integrity**. In this day and age when so-called “journalists” are searching for mud or dirt, or even a slight smudge, on the character of renowned individuals, I found no such situation with any of the leaders that I have chosen. When they gave their word or made a commitment, they followed through, even though many obstacles and dire circumstances may have impeded their progress.

Maybe foremost of the characteristics that these individuals surely had early in life was a sense of **perseverance**. Most of these leaders acquired this trait, often because they were obsessed with the notion that their ideas would prove to be better than what was currently on the market and how things were being done. In some instances, the thought of achieving success in their endeavor was foremost in their minds, whereas the realization that they might actually reap the financial benefits of their ideas was secondary.

I. BUSINESS – JEFF BEZOS (AMAZON)

This particular selection is not meant to elevate Mr. Bezos to any particular ranking, since **Business** is the first category in our overall list of leader types. In addition, Mr. Bezos might have been listed under another category such as **Entrepreneur**, but I reserved that category for those who actually created a product rather than a service or method. Bezos has been controversial because his net worth has continued to grow to such a high amount, whereas some believe his reputation for being a philanthropist and his contributions to the welfare of humanity in general are less than stellar. Nevertheless, his impact on the American society, almost from the first day of his college graduation, has been significant.

1. Early Life

Jeffrey Preston Bezos, ne Jorgensen, was born January 12, 1964 in Albuquerque, NM. At the time of Bezos' birth, his mother was a 17-year-old high school student and his father was 19 years old. After completing high school despite challenging conditions, his mother attended night school while bringing her son along as a baby. His parents later divorced, and his mother married Cuban immigrant Miguel "Mike" Bezos in April 1968. Shortly after the wedding, Mike adopted four-year-old Bezos, whose surname was then legally changed from Jorgensen to Bezos.

Bezos was raised in Houston and Miami and attended Princeton University, where he received a degree in electrical engineering and computer science in 1986. He initially worked on Wall Street in a variety of related fields from 1986 to early 1994. He transitioned into the banking industry when he became a product manager at Bankers Trust. He worked there from 1988 to 1990. He then joined D. E. Shaw & Co., a newly founded hedge fund with a strong emphasis on mathematical modelling in 1990 and Bezos worked there until 1994. He became D. E. Shaw's fourth senior vice-president at age 30.

In late 1993, Bezos decided to establish an online bookstore. He left his job at D. E. Shaw and founded the company in his garage on July 5, 1994, after writing its business plan on a cross-country drive from New York City to Seattle. Tiring of the hectic New York lifestyle, but prior to settling on Seattle, Bezos had investigated setting up his company at an Indian reservation near San Francisco in order to avoid paying taxes. Bezos initially named his new company **Cadabra**, but later changed the name to **Amazon** after the Amazon River in South America, in part because the name begins with the letter **A**, which is at the beginning of the alphabet. At the time, website listings were alphabetized, so a name starting with "A" would appear sooner when customers conducted online searches. In addition, he regarded "Amazon," the name of the world's largest river, as fitting for what he hoped would become the world's largest online bookstore. He accepted an estimated \$300,000 from his parents to invest in Amazon, but he warned many early investors that there was a 70% chance that Amazon would fail or go bankrupt. Several investors bailed, but most of them as well as the private equity funds stayed with Bezos and Amazon.

2. Amazon's Growth

Although Amazon was originally showcased as an online bookstore, Bezos had always planned to expand to other products. Three years after Bezos founded Amazon, he took it public with an initial public offering (IPO). Bezos maintained that the growth of the Internet would overtake competition from larger book retailers such as Borders and Barnes & Noble. The company which began as an online bookstore has since expanded to a wide variety of other e-commerce products and services, including video and audio streaming, cloud computing, and artificial intelligence. Amazon is currently the world's largest online sales company, the largest internet company in terms of revenue, and the world's largest provider of virtual assistants.

Bezos continued to grow Amazon while founding Blue Origin, the aerospace manufacturer and sub-orbital spaceflight services company in 2000. In 2015 Blue Origin's vehicle reached the definition of space, and afterwards successfully landed back on Earth. This success has enabled the company to develop upcoming plans for the beginning of commercial suborbital human spaceflight. On July 20, 2021, Jeff Bezos flew to the edge of space alongside his brother Mark, aboard the Blue Origin NS-16. The suborbital flight lasted over 10 minutes and reached a peak altitude of 66.5 miles (107.0 km).

Bezos has always been a strong advocate of the Internet. Recognizing that the advent of the Internet could expand the national as well as international reach of a major newspaper, he moved into the political arena in October 2013 when Nash Holdings, a holding company established by Bezos, purchased the major American newspaper The Washington Post from the Graham family for \$250 million. Journalists from the Post have recently won Pulitzer Prizes for such investigative journalism as the Russian influence on the 2016 Presidential election.

3. Leadership Technique

Bezos' leadership style is hardly what we advocate in our publication "Advanced Leadership for Engineers". He used what he called a "regret-minimization framework" while he worked at D. E. Shaw, and again during the early years of Amazon. While he never regretted leaving Wall Street, he did regret missing out on the beginning of the Internet. During the 1990s and early 2000's at Amazon, he was characterized as trying to quantify all aspects of running the company, often listing employees on spreadsheets and basing executive decisions on data. To push Amazon forward, Bezos developed the philosophy of "Get Big Fast", establishing the company's need to grow its operations to produce market dominance. He favored diverting Amazon profits back into the company in lieu of allocating it amongst shareholders in the form of dividends.

During his twenty-seven-year career with Amazon, Bezos seldom met with Amazon investors for more than six hours a year. Bezos required high-level employees to present information with six-page narratives. In his annual letter for Amazon shareholders, he frequently referred to five principles: focus on customers not competitors, take risks to gain market leadership, facilitate staff morale, build a company culture, and empower people. Bezos maintained a customer email address (jeff@amazon.com), although he never responded to the emails. Bezos has cited Jeff Immelt, Warren Buffett, and Jamie Dimon as major influences on his leadership style.

Bezos was known for creating an adversarial environment at Amazon, as well as insulting and verbally abusing his employees. As journalist Brad Stone revealed in his book *The Everything Store*: Bezos issued remarks to his employees such as "I'm sorry, did I take my stupid pills today?",

"Are you lazy or just incompetent?", and "Why are you ruining my life?". Additionally, Bezos reportedly pitted Amazon teams against each other, and once allegedly declined to give Amazon employees city bus passes in order to discourage them from leaving the office.

Whether it's his questionable leadership style or his "off-the-chart" intellect, Bezos has grown Amazon to the place where it has had an effect on nearly every American. Amazon Prime is in millions of U. S. and Canadian households with movies, shows, and free delivery on hundreds of thousands of items. Amazon distribution centers and warehouses (Amazon has at least 110 Fulfillment Centers in the United States) are in or near every major city in the U. S. and Canada. The very clear objective of Amazon is to continually expand into new markets, building premium capability along the supply chain, and finding new ways to take market share from traditional retail. As a result of this dynamic approach, Bezos' personal wealth grew by approximately \$24 billion during the Covid-19 pandemic in 2020.

4. Bezos' Future

On July 5, 2021, Bezos stepped down as the CEO of Amazon and transitioned into the role of executive chairman. Andy Jassy, the head of Amazon's cloud computing division, replaced Bezos as the CEO of Amazon. In his final letter to Amazon shareholders, Bezos quoted geneticist Richard Dawkins thus: "Staving off death is a thing that you have to work at...If living things don't actively work to prevent it, they would eventually merge with their surroundings and cease to exist as autonomous beings. That is what happens when they die."

In a not-so-subtle effort to "come to the aid of his fellow man", Bezos co-founded Altos Labs in September of 2021 with Russian investor and entrepreneur, Yuri Milner. Altos Labs is a generously-funded biotechnology company dedicated to harnessing cellular reprogramming to develop "longevity" therapeutics. The company has recruited prominent scientists in the areas of reprogramming in mammalian cells and epigenetic aging. Milner reportedly originally considered pursuing reprogramming philanthropically, having already awarded three-year grants of \$1 million a year to several biomedical engineering and geroscience researchers, but was convinced that a generously-funded biotech company would lead to faster progress. Perhaps Bezos, if he lives as long as Methusaleh (969 years), will own half the world's wealth by then.

Seriously, the first centibillionaire as listed in Forbes, Bezos was named the "richest man in modern history" after his net worth increased to \$150 billion in July 2018. By August 2020, thanks in large part to the Covid-19 pandemic which affected America greatly, according to **Forbes Magazine**, **Bezos had a net worth in excess of \$200 billion.**

II. ENGINEERING – DR. THOMAS KELLY (GRUMMAN AIRCRAFT)

This name may come as a surprise to most of you who read this, but **Dr. Thomas Kelly**'s deeds and exploits would not come as any surprise to the 400,000 personnel who worked on NASA's first space program. Without much argument, the single greatest engineering and technical achievement in the history of mankind was "landing a human being (in this case sixteen American Astronauts) on the Moon and returning everyone safely back to Earth."

When President John F. Kennedy issued this challenge to America in his famous speech on 25 May 1961, this was just a few short weeks after Alan Shepard had been the first American to barely reach outer space. NASA personnel were extremely perplexed with Kennedy's timing and unsure that such a goal could be accomplished. Nevertheless, the Apollo Project for landing a man on the Moon was actually (and unbelievably) begun almost immediately before anyone in NASA had evaluated a method for providing such a landing. Three options were being considered to land an American on the Moon, which some in NASA did not think was even possible, while many more had serious doubts the project would accomplish its goal by the end of the 60's. Those lunar landing options included the following:

- A) Direct flight from the Earth to the Moon
- B) Earth Orbit Rendezvous (EOR)
- C) Lunar Orbit Rendezvous (LOR)

Option A was quickly ruled out because of the extreme weight requirements necessary for a flight of that magnitude. Options B and C were heavily debated for over a year, while the U. S. continued to fall further behind Russia in the "Space Race". NASA engineers recognized that, once they arrived at the Moon, lowering a large craft onto the Moons' surface would be extremely difficult. Furthermore, they would be required to perform this landing operation in a low-gravity, zero-atmosphere environment.

Option C, the LOR process, finally won out, and Project Gemini began to materialize in the summer of 1962. NASA engineers and officials knew that a comprehensive intermediate program would require extensive planning. This "bridge" project, as it came to be known, is well-documented in our publication: **America's Greatest Projects – Project Gemini**.

In late 1962, Grumman won the \$2 billion government contract from NASA for a Lunar Excursion Module (LEM). Thomas Kelly was promoted to lead the design team for the (LEM). He was in charge of more than 7,000 employees in design and building the Lunar Module (LM), Kelly's group came up with the idea of a two-stage spacecraft (ascent & descent stage), that would take two astronauts to the Moon's surface while a third astronaut would stay in lunar orbit.

The design and construction of the Lunar Module was arguably the most serious, if not the most complicated, technical challenge of the Apollo program. Begun more than a year later than most of the other parts of the Apollo project, the LM was consistently behind schedule and over budget.

The design which NASA decided to use, the Lunar Orbit Rendezvous (LOR), was based on having two docked modules travel to the Moon and enter into lunar orbit. While the LM separated and landed, the CSM (Command/Service Module) would remain in lunar orbit, usually at an apogee of between sixty-eight and seventy miles above the lunar surface. After the lunar landing and debarking, the LM would ascend, the two craft would rendezvous and dock in lunar orbit, and the CSM would return the crew to Earth. The LM and service module would be jettisoned in space, while the command module would be the only part of the space vehicle that returned with the crew to the Earth's surface.

1. Early Life

Thomas Kelly was born in 1929 in Brooklyn, New York, and raised in Merrick, New York. He attended Wellington C. Mempham High School, played the trumpet, and was an outstanding student. He eventually graduated Mephram as valedictorian at age seventeen one year after the end of World War II. Kelly attended Cornell University beginning that year under a Grumman scholarship. During this time, he worked his summers at Grumman, eventually earning himself a bachelor's degree in mechanical engineering and an ROTC (Reserve Officer's Training Corps) commission in 1951. Kelly later earned a master's degree from Columbia University and a Ph.D. from the Polytechnic Institute of Brooklyn in aerospace engineering.

After graduation, Kelly started working at Grumman, located in Bethpage, New York, as a propulsion engineer working under the Rigel Missile Program, a proposed U. S. Navy submarine-launched, nuclear-capable cruise missile from 1951 to 1953. After this project, he was moved to the F-11 Tiger program (a supersonic, single-seat carrier-based U. S. Navy fighter aircraft), and later promoted to group leader at the age of just twenty-three.

In 1956, Kelly was called into active duty and was stationed at the Wright-Patterson Air Force Base in Dayton, Ohio. During his duty, Kelly was a performance engineer on a Convair cruise missile as well as various supersonic aircraft, including the F-105 Thunderchief and the B-58 Hustler. After two years of service, he was discharged in 1958. For a short time, Kelly worked at Lockheed Corporation in their missile and space division. Kelly was the group leader of their rocket propulsion development engineering division, primarily because of his leadership skills that included being a good listener, paying attention to details, and never taking anything for granted, where he worked until 1959.

Kelly was drawn back to Grumman, in which he took up the position of assistant chief in propulsion from 1959 to 1960. In 1961 he was moved to Grumman's Apollo and Lunar Module proposals department. During this time Kelly was instrumental in developing the Lunar Orbit Rendezvous concept. When Grumman was finally awarded the LM contract in late 1962, most of Kelly's ideas and innovations were adopted, and his management skills as a good listener and decision maker served Grumman well.

2. The Apollo Project

The LM portion of the Apollo Project proceeded immediately, but not without a great degree of difficulty. The LM was the last piece of major equipment to be placed on the Apollo Project, which had begun almost eighteen months. Furthermore, the four-year "bridge" project (Project Gemini)

had not even been finalized. Most of the problems with the LM consisted of designing and developing a propulsion system for the descent stage of the LM in tandem with a propulsion system for the ascent, all of this in a no-atmosphere, near-weightless environment. Guidance and maneuverability in those conditions, with one or two astronauts standing at the LM controls, was also critical or the astronauts could have been stranded on the lunar surface. To add to the difficulties with Grumman's design, the LM had to be fairly lightweight, but sturdy and mostly shock-proof, but Kelly and his team were up to the task. Kelly was managing the LM design and construction with about four hundred engineers and designers, but every time Gemini changed, so did the LM.

The Apollo Lunar Module was a two-stage vehicle designed by Grumman to ferry two astronauts from lunar orbit to the lunar surface and back. It was 23 feet high (with landing gear extended), 31 feet wide, and 31 feet deep. The upper ascent stage consisted of a pressurized crew compartment, equipment areas, and an ascent rocket engine. The lower descent stage had the landing gear and contained the descent rocket engine. It was capable of operation only in outer space; structurally and aerodynamically it was incapable of flight through the Earth's atmosphere. Due primarily to much politicking by the American astronauts and their supporters, it was eventually designed for lunar orbit rendezvous by Grumman to carry a crew of two from lunar orbit to the surface of the Moon and back. Its ascent stage and descent stage would be ferried to lunar orbit by the command service module.

At launch, the LM weighed about 33,500 pounds and would sit directly beneath the CSM, with its legs folded, inside the CSM-LM Adaptor, which was designed and built by North American Aviation as part of their CSM contract. The Adaptor was in turn attached to the S-IVB, which was the third stage of the Saturn V rocket. It would remain there through Earth parking orbit and through the Trans Lunar Injection (TLI) rocket burn, which would propel the entire spacecraft toward the Moon.

Soon after TLI, the Adaptor would open and the CSM initially would separate from the LM and turn around. It would then come back to dock with the Lunar Module, and then would extract the LM from the S-IVB. During the flight to the Moon, the docking hatches would be opened and the LM Pilot could enter the LM to temporarily power up – it was battery-powered - and test its systems (except for propulsion). Throughout the flight to the Moon, an astronaut could perform the role of an engineering officer, responsible for monitoring the systems of both spacecraft modules.

Once the spacecraft was placed into a Moon parking orbit, the two modules would undock, and the CSM would raise and optimize its circularized orbit for the remainder of the mission at the Moon. The LM would engage the descent stage and gradually land on the lunar surface. When ready to leave the Moon, the LM would separate the descent stage and fire the ascent engine to climb back into orbit, using the descent stage as a launch platform. After a few course-correction burns, the LM would rendezvous with the CSM and dock for transfer of the two-man crew and

any souvenirs and/or rock samples. Having completed its transfer, the LM would be separated from the CSM and sent into solar orbit or to crash into the Moon.

In all, Grumman built fifteen lunar modules, but only six of them had the opportunity to land on the Moon's surface. Each one of these modules had significant upgrades compared to the last one. The Lunar Module is undoubtedly the most significant accomplishment of Kelly's career, as it is still the only spacecraft that humans have flown to another celestial body. To this day, Kelly is still known as "The Father of the Lunar Module."

3. First Lunar Landing

Kelly had just turned 40 when Neil Armstrong took his first historic step on the Moon July 20, 1969. During the landing, ice had formed in a fuel line, clogging it. If the heat from the engine defrosted the clog, the fuel could have detonated. Luckily for Kelly and the Grumman crew, the problem corrected itself and the crew was able to relax and realize what they had done. In an interview in 1998 Kelly stated, "It was the greatest thing in my career. And, in hindsight, it was even more significant than we thought at the time." Keep in mind that this entire Apollo Project was designed at a time when the data in your desktop or laptop would have required a room the size of three or four of your bedrooms.



Figure 1. Apollo 16 Lunar Module

Some of the additional merits and design features of the Lunar Module were borne out during the ill-fated, and nearly tragic, flight of Apollo 13. These life-saving aspects and components are well-documented in our publication: **America's Greatest Projects – Apollo Project (Part 2)**. However, despite the brilliance of his and his team's efforts, Kelly did not escape unscathed. The experience was extremely stressful, manifesting in a nervous tic he developed during the project. Kelly retired from Grumman in 1992, and died in Suffolk County, New York in 2002 at age 72.

III. ENTREPRENEUR – STEVE JOBS (W/ STEVE WOZNIAK) - APPLE

The entrepreneur, computer genius, and even digital entertainment savant **Steve Jobs** is well-known as the creator of Apple, Inc., one of the most recognized and high-impact names in the United States as well as around the world. Nevertheless, this publication would be neither truthful nor accurate if we failed to attribute a considerable amount of credit to **Steve Wozniak**, Apple's co-founder, co-creator, and the actual inventor of the first Apple personal computer. While Wozniak went his separate way after just over a decade with Apple, Jobs stayed on with Apple until his recent death, and both deserve to be honored for their contributions.

1. Early Lives

Steven Paul Jobs was born in February, 1955, to Joanne Schieble and Abdulfattah Jandali, his biological father, who grew up in Syria, and was born into a Muslim household. While an undergraduate at the American University in Lebanon, he was a student activist and spent time in prison for his political activities. He pursued a PhD at the University of Wisconsin, where he met Joanne Carole Schieble, a Roman Catholic. As a doctoral candidate, Jandali was a teaching assistant for a course Schieble was taking, although both were the same age. Schieble's parents were not happy that their daughter was dating a Muslim, and that Schieble's father "threatened to cut Joanne off completely" if she continued the relationship.

Schieble became pregnant with Jobs in 1954, when she and Jandali spent the summer with his family in Syria. According to Jandali, Schieble left Jandali and moved to San Francisco to have the baby. Schieble gave birth to Jobs in February, 1955, in San Francisco and Jobs was placed with Paul and Clara Jobs, neither of whom had a college education, and Schieble refused to sign the adoption papers. She then took the matter to court in an attempt to have her baby placed with a different family, and only consented to releasing the baby to Paul and Clara after the couple pledged to pay for the boy's college education. Jobs' adoptive father, Paul Reinhold Jobs, was a Coast Guard mechanic. After leaving the Coast Guard, Paul Jobs married Clara Hagopian in 1946. Their attempts to start a family were halted after Clara had an ectopic pregnancy, leading them to consider adoption in 1955.

By the time he was ten, Jobs was somewhat of a child phenom and was deeply involved in electronics, befriending many of the engineers who lived in the neighborhood. Jobs, despite his difficulty functioning in a traditional classroom, was asked to skip two grades. His parents relented and allowed him to skip fifth grade. They then used all their savings to move to the Cupertino area, allowing Jobs to attend Homestead High School, which gave him a pathway to Silicon Valley, and he was able to graduate at age 16. By his senior year in 1971, he was taking freshman English class at Stanford and working on a Homestead underground film project.

By comparison to Jobs, Wozniak's early life was pretty much standard American fare, with only a minor glitch or two along the way. **Stephen Gary Wozniak** was born in August, 1950, in San Jose, California to Francis Jacob "Jerry" Wozniak (1925–1994) and Margaret Louise Wozniak (née Kern) (1923–2014). Mrs. Wozniak was from Washington state, and his father Francis was from Michigan. Francis was an engineer and was employed by the Lockheed Corporation.

Wozniak graduated from Homestead High School in 1968, and enrolled at the University of Colorado, with the intention of getting a BS in electronic engineering. However, he was expelled from the university before the end of his first year for hacking the university's computer system. In 1969, Wozniak returned to the San Francisco Bay area, maintaining his keen interest in electronics. We should recall that the era of the 1960's was an electronic era, in which a computer that required a two-car garage to store previously could now fit into a small closet.

In the early 1970s, Wozniak developed a "blue box" design, earning him the nickname "Berkeley Blue" in the telephone-hacking community. A **blue box** was an electronic device that produced tones similar to those used to generate the tones formerly used within the North American long-distance telephone network. The user, known as a phreaker, could surreptitiously place long-distance phone calls that would be billed to another number or dismissed entirely as an incomplete

call. A number of similar "color boxes" were also created to control other aspects of the phone network.

In 1971 after Wozniak began attending the University of California, Berkeley, he started to get visits from Jobs, sometimes as often as two or three times a week. Jobs, who could have easily been the Poster Boy for Hippies in this era of the anti-Vietnam War and the aftermath of the Kent State shootings the previous year, simply believed that he was much too intellectual for that lifestyle. Jobs, immediately recognizing the robust Wozniak system, convinced Wozniak that he would sell them and split the profit with Wozniak. All went well and perhaps planted the seed in Jobs' mind that electronics could be both fun and profitable. This practice came to an end when the phone company switched from analog to digital devices, but Jobs' experience with Wozniak led him to study in nearby Stanford University's student union.

In June of 1971 while working on a self-taught engineering project, Wozniak designed and built his first computer, with the help of his friend Bill Fernandez. It had no screen, microprocessors, or keyboard, used punch cards, had only 20 transistor-logic chips, and they named it "Cream Soda". This experience by Wozniak was a good prelude to his thinking five years later with the Apple I and Apple II computers.

The following year he dropped out of Berkeley and worked for Hewlett-Packard, where he designed calculators. In the meantime, Jobs enrolled at Reed College in Portland, Oregon. He insisted on applying only to Reed although it was an expensive Liberal Arts school that Paul and Clara could ill afford. During this time, he befriended Wozniak, even though he was much younger and felt he was much higher intellectually. Jobs and Wozniak spent about six months during this period to fully understand the intricacies of designing and building the blue boxes. This was to become the catalyst for designing and building the first "Apple", and this experience showed them that they could take on large companies and beat them.

After just one semester, Jobs dropped out of Reed College without telling his parents, because he did not want them to spend their money on an education that seemed meaningless to him. He continued to attend by auditing his classes, which included a course on calligraphy, which he later acknowledged allowed he and Wozniak to develop multiple typefaces, letter sizes, and proportionally-spaced fonts.

At nineteen, Jobs was hired by Atari in Los Gatos, which gave him a job as a technician, largely because Wozniak had designed his own version of the classic video game Pong and gave the board to Jobs. They thought that Jobs had built it himself. Atari later described Jobs as "difficult but valuable", pointing out that "he was very often the smartest guy in the room, and he would let people know that."

Jobs traveled to India in mid-1974 in search of spiritual enlightenment, but the meeting with the Maharajah, who had died the previous year, never occurred. Nevertheless, he and a male companion made a long trek up a dry riverbed to visit another spiritual teacher, and traveled through India for seven months. During his travels in India, Jobs had changed his appearance; his head was shaved and he wore traditional Indian clothing.

2. The Beginning of Apple

In mid-1975, after returning to Atari, Jobs was assigned to create a circuit board for a video game. Atari offered a bonus for improvements in the machine, and Wozniak made them to the amazement of Atari engineers. However, Jobs took the credit and pocketed the majority (85%) of the bonus. Nevertheless, Jobs and Wozniak attended meetings of a computer club in 1975, which became an influential organization for the next decade in the Silicon Valley. In the meantime, Jobs and Wozniak had already begun the development and marketing of the first Apple computer.

By March 1976, Wozniak completed the basic design of the Apple I computer and showed it to Jobs, who suggested that they sell it; Wozniak was at first skeptical of the idea but later agreed. **On April 1, 1976, Jobs, Wozniak, and an administrative overseer (Ronald Wayne) founded Apple Computer Company.** The organization originally started in Jobs' bedroom and later moved to the garage. Wayne stayed only a short time, leaving Jobs and Wozniak as the active primary cofounders of the company. The two decided on the name "Apple" after Jobs returned from the All One Farm commune in Oregon and told Wozniak about his time spent in the farm's apple orchard. Eventually about 200 Apple I computers were produced in total. They had a base circuit board with a chip on it, a DuMont TV set, a Panasonic cassette tape deck and a keyboard. Jobs' primary function at the time was spending hours on the phone trying to find investors for the company.

Investors began to line up after they saw the crowds at Apple's booth in the Home Brew Computer show. They received major funding from Arthur Rock, a venture capitalist. Much to Jobs' displeasure, Mike Scott was named and served as Apple's first CEO for the next four years, presumably because of Wozniak's and Jobs' inexperience.

In April 1977, Jobs and Wozniak introduced the Apple II at the West Coast Computer Fair, and it was the first consumer product to have been sold by Apple Computer. The Apple II became one of the first highly successful mass-produced microcomputer products in the world.



Figure 2. Apple II with an external modem, designed primarily by Wozniak

Jobs had a net worth of over \$1 million in 1978, when he was just 23 years old. In 1980, Apple went public to instant and significant financial profitability, making Jobs and Wozniak both millionaires. Jobs' net worth grew to over \$250 million that year, and he was one of the youngest "people ever to make the Forbes list of the nation's richest people - and one of only a handful to have done it themselves, without inherited wealth".

Jobs began directing the development of the Macintosh in 1981, when he took over the project from early Apple employee Jef Raskin, who had conceived the computer. Wozniak, along with three other passengers who were injured, had been in a plane crash soon after takeoff from the Sky Park Airport in Scotts Valley, California. He was piloting a Beechcraft Bonanza, which he was not qualified to operate. He suffered an apparent concussion, which caused low grade amnesia for several weeks, not even having any recollection of the accident. Meanwhile, the Apple II's intended successor, the Apple III, released the same year, was a commercial failure and was discontinued in 1984. The primary reason for its numerous hardware failures was that the system was designed by Apple's marketing department, unlike Apple's previous engineering-driven projects. During the early design and development phase of the original Macintosh, Wozniak had a heavy influence over the project, which would become the first mass-market personal computer featuring an integral graphical keyboard and mouse.

Later in 1981, after recovering from the plane crash, Wozniak re-enrolled at UC Berkeley under an assumed name to complete his degree, although he did not officially receive his degree in electrical engineering and computer science until 1987. In May 1982 and 1983, Wozniak tried his hand as a concert promoter, but lost considerable money. Wozniak returned to Apple product development, desiring no more of a role than that of an engineer and a motivational factor for the Apple workforce.

In the mid-1980s he designed the Apple Desktop Bus, which became the basis of all Macintosh and NeXT computer models. At the time, Apple II products provided about 85% of Apple's sales, but he felt that Apple's corporate leadership, including Steve Jobs, increasingly disrespected the Apple II series—and Wozniak along with it. In early 1985, Wozniak left Apple again, this time for good, believing that the company had been going in the wrong direction for several years.

Beyond engineering, Wozniak's second lifelong goal had always been to teach elementary school because of the important role teachers play in students' lives. Eventually, he did teach computer classes to children from the fifth through ninth grades, and teachers as well. He founded several companies to support these activities, and funded additional teachers and equipment. Throughout the first two decades of the new century, Wozniak continued to found and work with other companies, but he stayed in touch with Jobs until his death. Wozniak, though permanently leaving Apple as an active employee in 1985, chose to never remove himself from the official employee list, and continues to represent the company at events or in interviews. He receives a stipend from Apple for this role, and is also an Apple shareholder.

The Macintosh was widely acclaimed by the media with strong initial sales supporting it, even airing a 1984 Super Bowl television commercial titled "1984". However, the computer's slow processing speed and limited range of available software led to a rapid sales decline in the second half of 1984. John Sculley, who had become CEO of Apple in 1983, and Jobs had differing visions for the company. The former favored open architecture computers like the Apple II, sold to education, small business, and home markets less vulnerable to IBM. Jobs wanted the company to focus on the closed architecture Macintosh as a business alternative to the IBM PC. President and CEO Sculley had little control over chairman of the board Jobs' Macintosh division; it and the Apple II division operated like separate companies, duplicating services. Although its products provided 85 percent of Apple's sales in early 1985, the company's January 1985 annual meeting did not mention the Apple II division or employees. Many left, including Wozniak, who stated that the company had "been going in the wrong direction for the last five years" and sold most of his

stock. Despite being frustrated with the company's dismissal of the Apple II employees in favor of the Macintosh, Wozniak left amicably and remained an honorary employee of Apple, maintaining a lifelong friendship with Jobs.

3. Jobs Leaves Apple

In September, 1985 and following some heated proposal difference between Jobs and Sculley, Jobs resigned from Apple, taking with him five senior Apple employees. Bill Gates succeeded in receiving a licensing agreement from Apple, but there were now several IBM PC clones on the market that, by the early 1990's, clearly Apple couldn't indefinitely compete against the whole IBM-clone market.

Following his resignation from Apple in 1985, Jobs founded NeXT, attracting the attention of billionaire Ross Perot, who invested heavily in the company. NeXT workstations were first released in 1990 and priced at US\$9,999, but were largely dismissed as cost-prohibitive for educational institutions. However, the NeXT workstation was known for its technical strengths, chief among them its object-oriented software development system. The new operating system was renamed OS X and was adapted into the embedded multimedia platforms of IOS to serve as the basis of Apple's later hardware lines such as the iPhone, iPad, Apple Watch, and Apple TV. English computer scientist Timothy John Berners-Lee, making use of a NeXT computer invented the World Wide Web in 1990 while at CERN (**European Organization for Nuclear Research**) in Geneva, Switzerland.

In 1986, Jobs funded the spinout of The Graphics Group (later renamed Pixar). The first film produced by Pixar with its Disney partnership, Toy Story (1995), was a financial success with Jobs credited as executive producer. Over the course of Jobs' life, under Pixar's creative chief John Lasseter, the company produced several box-office hits, seven of which won Academy Awards for Best Animated Feature. In 2006 Jobs' Pixar merged with Disney, and Jobs joined the board of directors as the largest individual shareholder.

In 1996, Apple announced that it would buy NeXT for \$427 million, bringing Jobs back to the company he had cofounded. Jobs became Chief Executive Officer when the existing CEO was ousted in September 1997. In March 1998, to concentrate Apple's efforts on returning to profitability, Jobs terminated a number of projects, and many employees developed a fear of encountering Jobs. Jobs did change the licensing program for Macintosh clones, making it too costly for the manufacturers to continue making machines.

Much of the NeXT technology found its way into Apple products, most notably NeXTSTEP, which evolved into MacOS X. The company increased sales significantly with the introduction of the iMac and other new products; since then, appealing designs and powerful branding have worked well for Apple. The company subsequently branched out, introducing and improving upon other digital appliances. With the introduction of the iPod portable music player, iTunes digital music software, and the iTunes Store. In 2001, Jobs was granted stock options in the amount of 7.5 million shares of Apple with an exercise price of \$18.30. On June 29, 2007, Apple entered the cellular phone business with the introduction of the iPhone, a multi-touch display cell phone, with its own mobile browser, which revolutionized the mobile browsing world.

4. Leadership Style

Jobs was perceived as a demanding perfectionist who always aspired to position his businesses and their products at the forefront of the information technology industry by foreseeing and setting innovation and style trends. He often complained about the nation's shortage of software engineers, and proposed that any foreign student who got an engineering degree at a U. S. university should automatically be offered a green card.

In October 2003, Jobs was diagnosed with pancreatic cancer, although it was a much less aggressive type. Jobs resisted his doctors' recommendations for medical intervention for nine months, relying instead on alternative medicine with no basis to thwart the disease. As his health declined, he eventually decided to undergo surgery which appeared to remove the tumor successfully. During Jobs' absence, Tim Cook, head of worldwide sales and operations at Apple, ran the company. In 2006 his cancer had returned. Over the next two years, while Jobs continued to address shareholder meetings and conferences, the state of his health was a major concern to Apple management as well as to the shareholders.

In January, 2009, Jobs finally admitted that he had "learned that my health-related issues are more complex than I originally thought". In April 2009, Jobs underwent a liver transplant at Methodist Hospital in Memphis, his prognosis was described as "excellent", and he returned to work three months later. However, a year and a half after Jobs returned to work following the liver transplant, Apple announced that he had been granted a medical leave of absence. In August 2011, Jobs announced his resignation as Apple's CEO, became chairman of the board and named Tim Cook as his successor as permanent CEO. **Jobs continued to work for Apple until the day before his death six weeks later, on 05 October 2011.** A small private service was held, Apple, Microsoft, and Disney flew their flag at half-staff, and well-wishers were encouraged to send their remembrances to a pre-designated email address. On 16 October 2011 a memorial was held at Stanford University, attended by many dignitaries, including childhood friend and fellow Apple co-founder Steve Wozniak. Jobs is buried in an unmarked grave at Alta Mesa Memorial Park. Since his death, the former Apple CEO has won 141 patents, more than most inventors win during their lifetimes. Currently, Jobs holds over 450 patents.

A major cultural change began in America with the innovation of the first **iPhone**, which was released in June 2007. The iPhone created such a sensation that a survey indicated six out of ten Americans were aware of its release, and it was designated as the "Invention of the Year" for 2007. The completed iPhone had multimedia capabilities and functioned as a quad-band touch screen smartphone. Year after year the iPhone has been introduced with additional features, including better GPS support, YG data and tri-band UMTS/HSDPA. Improvements included a better camera, a faster processor, thinner than previous models, video recording capability in HD, and a secondary front-facing camera for video calls. A major feature, introduced back in October 2011, was Siri, a virtual assistant capable of voice recognition. Home phones are virtually a remnant of the past, as Apple became the first company in history to exceed one trillion dollars in capital value.

IV. INDUSTRY – HENRY J. FORD (FORD MOTOR COMPANY)

The invention of the internal combustion engine is generally credited to **Nickolaus Otto**, a German engineer, dating as far back as 1862. **Karl Friedrich Benz**, was a German engine designer and automotive engineer. His Benz Patent Motorcar from 1885 is considered the first practical automobile put into series production. He received a patent for the motorcar in 1886.

Across the northern United States, mechanical engineers and mechanics experimented with a wide variety of prototypes. In the state of Iowa, for example, by 1890 Jesse O. Wells was driving a steam-powered Locomobile. There were numerous experiments in electric vehicles powered by storage batteries. First-time buyers ordered the early gasoline-powered cars, including the Haynes, the Mason, and the Duesenberg automobiles. Blacksmiths and mechanics started operating car repair shops and gasoline stations (Note: This will be discussed in greater detail future publications). In Springfield, Massachusetts, the Duryea Motor Company was founded in 1893, becoming the first American automobile manufacturing company. The Autocar Company, founded in 1897 in Pittsburgh by Autocar founder Louis Semple Clarke, who was a very successful mechanical engineer, established a number of innovations such as the drive shaft, circulating motor oil, sparkplugs, and the American convention of placing a vehicle's steering wheel on the left. Autocar is still in operation today as a heavy-duty truck manufacturer, and remains the oldest operating motor vehicle manufacturer in the United States.

Others of this era included Ransom E. Olds, with its mass-produced Oldsmobile that would dominate the early 1900's, and the Thomas B. Jeffrey Company which developed the world's second mass-produced automobile. They built and sold 1,500 Ramblers in their first year, which represented one-sixth of all existing motorcars in the United States at the time. At the time there were few gas stations, fewer mechanics, and the roads were narrow and made of dirt or gravel. There were no dealerships, and only the above-average-income family could afford a car.

Each vehicle was given a power rating in horsepower, but seldom was it greater than 25. The term "horsepower" had been defined back in the 1760's by Scottish engineer James Watt, when he came up with a greatly improved version of the first commercially available steam engine. By adding a separate condenser, Watt's design eliminated the constant coal-wasting cycles of cooling and re-heating required old-style steam engine. Watt was also a dedicated realist. He knew that in order to prosper from his ingenuity, he had to actually sell his new steam engine to people who had relied on horses for centuries to handle their workload. So, Watt created a simple terminology to explain the power of his improved steam engine in a way that his potential customers could easily understand. He deduced that a mill horse could push approximately 33,000 pounds one foot per minute. This term, although proven somewhat inaccurate over the years, was carried over to all steam-driven engines, including railroad locomotives, and eventually to steam-driven and gasoline-driven automobiles.

Replacing a horse with an automobile was hardly a foregone conclusion in the 1890's and very early 1900's. The vast majority of travel was either by rail or horse-drawn carriage. Nearly 100% of farmwork (the U.S. was still a heavy agrarian society) was either by horse or manual labor. There were far and away more livery stables than gas stations. There were few mechanics and no auto repair shops. And there were no highways or paved roads, only dirt paths and dusty, pot-filled

trails. In fact, at one point in the early years of the Roosevelt (Teddy) administration, there was still considerable controversy over whether to continue building cars or return to horses and buggies.

1. Ford's Early Life

Henry Ford was an American industrialist, business magnate, and founder of the Ford Motor Company, and chief developer of the assembly line technique of mass production. While the U.S. had undergone a very substantial industrial revolution in the last quarter of the 1800's, the main population of America at that time were immigrants and first-generation families. By creating the first automobile that middle-class Americans could afford, he converted the automobile from an expensive curiosity into an accessible conveyance that profoundly impacted the landscape of the 20th Century.

Henry Ford was born July 30, 1863, on a farm in Springwells Township, Michigan. His father, William Ford was born in Ireland, and his mother, Mary Litogot Ford was a native of Michigan as the youngest child of Belgian immigrants; her parents died when she was a child and she was adopted by neighbors, the O'Herns. Henry Ford had four siblings: two younger sisters (Margaret and Jane) and two younger brothers (William and Robert). in his early teens. When he was 12, his father gave him a pocket watch, and he also witnessed the operation of a Nichols and Shepard road-engine, the first vehicle other than one horse-drawn that he had ever seen. In his teens in his farm workshop, Ford built a steam wagon and a steam car, but thought steam was not suitable because the boiler was dangerous. At 15, Ford also dismantled and reassembled the timepieces of friends and neighbors dozens of times, gaining the reputation of a watch repairman.

Ford was devastated when his mother died in 1876. His father expected Henry to take over the family farm eventually, but he despised farm work. In 1879 at age sixteen, Ford left home to work as an apprentice machinist in Detroit, first with J. F. Flower & Bros., and later with the Detroit Dry Dock Company. In 1882, he returned to Dearborn to work on the family farm. There he became so adept at operating a Westinghouse portable steam engine that he was later hired by Westinghouse to service their steam engines. During this period, Ford also studied bookkeeping at a business college in Detroit.

2. Ford Turns to Gasoline

In 1890, Ford switched away from steam, turning completely to internal combustion engines and started work on a two-cylinder engine. In 1891, Ford became an engineer with the Edison Illuminating Company of Detroit. In 1892, he completed his first motor car, powered by a two-cylinder, four horsepower motor, with a two-and-half-inch bore and a six-inch stroke, which was connected to a countershaft by a belt and then to the rear wheel by a chain. The belt was shifted by a clutch lever and a throttle to control speeds up to 20 miles per hour. Other features of Ford's first motorcar included 28-inch wire bicycle wheels with rubber tires, a foot brake, a 3-gallon gasoline tank. After his promotion to chief engineer at Edison in 1893, he had enough time and money to devote attention to his experiments on gasoline engines. That year he installed a water jacket around the cylinders for cooling his first motorcar. Ford tested his design by driving that motorcar over one thousand miles in the next two years. In 1896 he started a second motorcar,

eventually building three of them in his home workshop. One of these Ford named the Ford Quadricycle, a self-propelled vehicle.

Ford that year met Thomas Edison, who approved of Ford's motorcar experiments and gave him strong encouragement. Ford sought investors, and proceeded to build a second self-propelled vehicle, completing it in 1898. Ford then resigned from the Edison Company and founded his first motorcar company in August 1899. However, the automobiles produced were of a lower quality and higher price than Ford wanted, so he ultimately dissolved the company in January, 1901.

With the help of a young mechanical engineer named Harold Wills, Ford designed, built, and successfully raced a 26-horsepower automobile in October 1901. With this success, he formed the Henry Ford Company in November, 1901, with Ford as chief engineer. However, in a dispute with one of the major investors, Ford left the company bearing his name the following year. With Ford gone, the company had no choice and it was renamed the Cadillac Automobile Company.

3. Actual Beginning of Ford Motor Company

Ford received the backing of an old acquaintance, Alexander Malcomson, a Detroit-area coal dealer, who knew Ford from his time at Detroit Edison. They formed a partnership, "Ford & Malcomson, Ltd." to manufacture automobiles. Malcomson, who had immigrated to the U. S. in 1880 at age 15, owned six coal yards by 1902. With Malcomson's backing, Ford designed the Model A, at that time a relatively inexpensive car designed to be sold for \$750. In 1903, the firm moved to a new building, and soon they were doing business as the Ford Motor Company. The first Ford dealer was William L. Hughson who opened his dealership, Standard Motor Car Co., in San Francisco, CA in January, 1903. Hughson ordered \$5,000 worth of vehicles, but had trouble selling them and ended up renting most of them out as taxi cabs. By 1906 however, the cars were selling much better and Hughson became established as a dealer, eventually having 120 dealerships associated with his name.

The **Ford Motor Company** was almost an immediate success. Earnings in the first six months were over \$100,000, and the company declared a 100% stock dividend; in the first year, the company made over \$250,000 profit. However, sales slowed considerably during the next two years, and the early Ford Motor Company was not without its problems and disputes. It had agreed to purchase over \$160,000 in parts from the Dodge Brothers, but could not make the payments. As part of a settlement, the Dodge Brothers each received 10% of the shares in the new company in return for materials provided.

In addition, Malcomson wanted to increase profits, and, believing luxury cars were the most attractive sector of the automobile market, directed Ford to design and build the larger and more expensive Model B and Model K. Both were upscale touring cars with price tags that were three to four times higher than the Model A. Ford was reluctant, but Malcomson was backed by his majority coalition on the board, and Ford capitulated. Those two cars were in production from 1904 through 1907.

In 1905 and uncertain about Ford's intentions, Malcomson formed Aerocar to produce luxury automobiles. which included a 24-horsepower, four-cylinder, air-cooled engine, Hartford shock absorbers, Gabriel horn and a speedometer. It also came with an extra tire and inner tube plus a toolbox with full equipment attached to the exterior running board, all for just \$2,800. However,

other board members at Ford became upset, because the Aerocar would compete directly with the Model K, and demanded Malcomson give up his shares in Ford. Henry Ford was still upset at being dictated to by Malcomson and formed the Ford Manufacturing Company explicitly to make parts for Ford Motor. Ford Manufacturing charged Ford Motor inflated prices, shifting the profits to Ford Manufacturing and leaving Ford Motor profitless. Malcomson, recognizing that he had been outmaneuvered, reluctantly sold his stock in Ford Motor to Henry Ford in 1906 for \$175,000, and Henry Ford then had complete control of the Ford Moto Company.

4. Genesis of Mass Production

Ford adopted mass production with his introduction of the Ford Model T automobile in 1908 revolutionized transportation as well as American industry. The automobile was successful not only because it provided inexpensive transportation on a massive scale, but also because the car signified innovation for the rising middle class. It became a powerful symbol of the United States' age of modernization for the next twenty years. Ford continued to improve on his mass production and supply chain, to the point that by 1914 he was able to reduce the price even further, all the way down to \$595, at which point Ford had produced almost 90 percent of the world's automobiles.



Figure 3. Ford Assembly Line (1913)

Sales passed 250,000 in 1914. By 1916, as the price dropped to \$360 for the basic touring car, sales reached 472,000. By 1918, half of all cars in the United States were Model T's. All new cars were black; as Ford famously said: "...any customer can have a car painted any color that he wants so long as it is black." By the time it ended production in 1927, more than 15 million had been sold. As the Ford Motor Company's majority owner, Ford became one of the richest and best-known people in the world.



Figure 4. A 1926 Ford Model T Roadster

He is universally credited with “Fordism”, the mass production of inexpensive goods coupled with high wages for workers. Ford also had a global vision following World War I, often citing consumerism (the acquisition of goods and services in ever-increasing amounts) as the key to peace. His intense commitment to systematically lowering costs resulted in many technical and business innovations. These included a franchise system that put dealerships throughout North America as well as major cities on six continents. Ford left most of his vast wealth to the Henry Ford Foundation, which his family permanently controls

Henry Ford turned the presidency of Ford Motor Company over to his son Edsel Ford in December 1918. Henry retained final decision authority and sometimes reversed the decisions of his son. Ford started another company, Henry Ford and Son, and made a show of taking himself and his best employees to the new company; the goal was to scare the remaining holdout stockholders of the Ford Motor Company to sell their stakes to him before they lost most of their value, as he was determined to have full control over strategic decisions. His strategy worked, and Ford and Edsel purchased all remaining stock from the other investors, thus giving the family sole ownership of the company. Under Edsel’s guidance, Ford also purchased the Lincoln Motor Company, a premium car maker, but Henry displayed relatively little enthusiasm for luxury automobiles in contrast to Edsel, who actively sought to expand Ford into the upscale market.

Not surprisingly, in 1999 a panel of 126 automotive experts, combined with the votes of the general public, **named the Model T as the Car of the Century.**

V. SPORTS – VINCE LOMBARDI

As we noted at the beginning of this publication, this series is about **leadership**. Even engineers, architects, and land surveyors sometimes need an outlet of interest different from their chosen professions. Consequently, although the previous four categories featured either a graduate engineer or someone who performed in a technical capacity as an engineer, this category is

intended to hold your interest while still providing a large measure of quality on the subject of leadership.

There was a great football coach more than fifty years ago who told his professional team to "...strive for perfection every day. You will never become perfect, but you will achieve a standard of excellence." He instilled this thought in his players so often that they came to believe his words. And they did achieve excellence, five times over an eight-year period.

In case you hadn't heard this story before, the coach was Vince Lombardi and the players that he was addressing were the Green Bay Packers of the National Football League (NFL). In 1958, the year before Mr. Lombardi arrived in Green Bay, the Packers had won one game and had lost eleven, and the NFL was serious considering moving the franchise from Green Bay, where it had been since the 1920's.

1. Lombardi's Early Life

Vincent Thomas Lombardi was born on June 11, 1913, in the Sheepshead Bay area of Brooklyn, NY to Enrico "Harry" Lombardi and Matilda "Mattie" Izzo. Harry's mother and father and Mattie's mother and father had emigrated from the poverty areas of South-Central Italy. Vince was the oldest of five children. The entire Lombardi and Izzo clans settled in Sheepshead Bay. At about the time of Lombardi's birth, Harry, and his brother, Eddie, opened a butcher shop in the Meatpacking District of Manhattan. Despite The Great Depression, which began in 1929, the butcher shop did well, and Vince's family prospered, allowing Lombardi to grow up in an ethnically diverse, middle-class neighborhood in Sheepshead Bay.

Outside their local neighborhood, the Lombardi children were subject to the rampant ethnic discrimination that existed at the time against Italian immigrants and their descendants. Although Lombardi helped his father at his meat cutting business as a child, it held no interest for him. At the age of 12 he started playing in an uncoached but organized football league in Sheepshead Bay.

Lombardi considered becoming a Catholic priest, but decided after high school graduation not to pursue the priesthood. He had continued to play football off-campus throughout his studies in high school, and earning a spot on the virtual All-City football team in 1933, and this allowed him to receive a football scholarship to Fordham University in the Bronx. During his freshman year, Lombardi proved to be an aggressive and spirited player on the football field. Lombardi was only 5'8" and about 180 pounds and was classified as undersized for the position, but by his senior year of 1936, he was the right guard in the Seven Blocks of Granite, a nickname given by a Fordham University publicist to the Fordham University football team's offensive front line. In a game against the University of Pittsburgh, he suffered a serious injury and missed most of the remainder of the game, until he was called in on defense for a successful goal-line stand that preserved a scoreless tie. The Fordham Rams were undefeated before losing in their final game to an underdog opponent, costing them a trip to the Rose Bowl. This taught Lombardi a lesson he would never forget — "... never underestimate your opponent."

Lombardi graduated from Fordham in the midst of The Great Depression with no discernible career path or ambition. He tried his hand at semi-professional football for two years, but that

effort proved to be a failure. He enrolled in Fordham Law School in 1938. Although he did not fail any classes, he believed his grades were so poor that he dropped out after one semester due to those sub-standard grades (in his opinion), with a strong desire to get a job and start and support a family.

2. Early Coaching Career

In 1939, Lombardi accepted an assistant coaching job at St. Cecilia, a Catholic high school in Englewood, NJ, from Andy Palau, a former Fordham teammate, and got married. Palau left for Fordham in 1942 and Lombardi became the head coach at St. Cecilia for the next six years. St. Cecilia's was recognized as the top football team in the nation, and under Lombardi's tutelage won six straight championships. Lombardi spent one year as a coach at Fordham, before accepting an assistant's coaching position at the U. S. Military Academy at West Point, a position that greatly influenced his future coaching style.

As offensive line coach under legendary head coach Colonel Earl "Red" Blaik, Lombardi combined his spiritual discipline with Blaik's military discipline, and his coaching persona began to take its mature form. Blaik's emphasis on execution became a trademark of Lombardi's coaching style and success. Lombardi coached at West Point for five seasons, with varying results. A cadet "cribbing" scandal resulted in 43 of the 45 members of the varsity football team being discharged by administrative order. After the seasons of 1951 and 1952, not much was expected from the 1953 team, as it had also lost six players due to academic failure. The team of 1953, however, did go on to be 7-1-1, as Lombardi had a bigger role than ever in coaching the team. Following those five seasons at Army, Lombardi accepted an assistant coaching position with the New York Giants of the NFL as their offensive coordinator.

3. Professional Coaching Career

During the next several years the Giants achieved a measure of success that was unprecedented in their previous nearly four decades of team history. After their thrilling overtime loss to the Baltimore Colts in the 1958 NFL Championship game, a football game which was universally televised for the first time, Mr. Lombardi felt that he was ready for a new challenge. He had worked hard to become one of the brightest and most ingenious football coaches in the sport. His immediate attention was to become head coach of the Giants, but that position was well represented and the Mara family (the Owners) were not about to make that kind of offer to Mr. Lombardi. He was also interested in a head coaching position at one of the major universities such as Notre Dame or one of the major universities in the South, but believed that he was being discriminated against because of his Italian-American heritage.

Nevertheless, the Green Bay Packer franchise offered Mr. Lombardi the head coaching position, possibly out of desperation, in February, 1959. Although Mr. Lombardi was reluctant at first to go to Green Bay, he accepted the offer as a kind of stepping stone to better things in the future. In that first year under Head Coach and General Manager Vince Lombardi, the Packers won seven games while losing only five. During that first year Mr. Lombardi, recognizing that a winning team must have on-the-field leadership as well as sideline coaching and tutoring, named quarterback Lamar McHan as his offensive leader. He also was wise enough to make a trade with the New York Giants

for Emlen Tunnell, a defensive back who was later inducted into the NFL Hall of Fame, as the leader of the defense. However, when Mr. McHan was injured in the third game of the season, Mr. Lombardi was forced to turn to a little-known quarterback named Bart Starr, who had impressed Mr. Lombardi with his leadership skills, and inserted him into the starting lineup. Mr. Starr, who had been a 17th round draft choice from Alabama and had been with the Packers for three previous seasons without ever starting or winning one game, became the starting quarterback, and he led the Packers to four straight wins at the end of the season. Mr. Starr became the natural leader of the offense for the next decade., and Mr. Lombardi was named NFL Coach of the Year in 1959 by the football writers.

The following year the Packers were the Western Conference champions and barely lost to the Philadelphia Eagles in the NFL championship game. In 1961 the Packers won the National Football League Championship, and then went on to win four more NFL Championships, including the first two Super Bowls, in the next six years. Mr. Starr was named the Most Valuable Player in Super Bowls I and II, and Mr. Starr, along with eight of his teammates from that one-win team from 1958, are now in the NFL Hall of Fame. And one other tribute that Mr. Lombardi, who is also in the NFL Hall of Fame, received for accepting a job that he didn't particularly want, was to have the Super Bowl trophy named in his honor.

If you analyze the above situation, you might make the case that Vince Lombardi was arguably the greatest professional football coach of all time. As a coach he had a love of the game as well as a knowledge of the way the game should be played that was unparalleled. Although he had become a great coach due to his study and knowledge of the game, some of his leadership qualities may not have been conventional. He led through his dedication, his knowledge of the game, and possibly through intimidation, a leadership characteristic that might not be considered appropriate to many of us.

During his coaching career, which spanned more than thirty years, Lombardi's demeanor never changed, but his coaching strategy of managing assistant coaches and football players certainly did. There was an incident related to me by none other than Bart Starr himself. At one particular Packer practice toward the end of the 1959 season, Lombardi came down hard on Starr and verbally abused him in front of the rest of the team. If you knew anything about Bart Starr, you would know that not only did he become a great quarterback, but he was also one of the nicest guys to ever walk onto a football field. While Starr might have come across to many as a choir-boy type individual, he was anything but. He had grown up in a strong military family in central Alabama, and knew how to take orders and knew how to give them. He marched into Lombardi's office after practice completely unannounced, told Lombardi that if he wanted him (Starr) to be a team leader, then he should do his criticizing behind closed doors and not in front of the rest of the team. (Note: the Packers had won three in a row with Starr under center, and Lombardi was up for NFL Coach of the Year, which he ultimately won.) From that day forward, Lombardi never openly

criticized Starr or any other team leader, although he never lost his flair for being loud or boisterous when the situation warranted his opinion.

He was also an early champion of African-American players, due in large part to the discrimination that he faced as an Italian-American. He recruited and/or traded for many, several of whom are now in the NFL Hall of Fame. In fact, he was the first NFL Head Coach to establish these two rules:

1. Any restaurants that didn't serve African-American players were off-limits to the rest of the team as well as the Packers organization.
2. Any hotels that insisted that only a black could share a room with another black were also off-limits to the rest of the team as well as the Packers organization.

Lombardi undoubtedly had the wisdom to hire some of the best assistant coaches of his day, men who had the same dedication and characteristics as Mr. Lombardi. These individuals likely studied the game of professional football and were able to explain to the players the techniques necessary to be the best that they could be. And he chose players who, in his expert opinion, had the potential to become the leaders as well as the mentors of their teammates. By the time that he retired in 1967, Vince Lombardi had done something that no football coach before or since has done.

VI. SUMMARY

The correlation between coaching a football team and leading or managing an organization is similar in many respects. The Head Coach represents the Company that provides the ideas for victory in the immediate future, as well as the “game plan” that will carry forward to ensure long-term success in the seasons ahead. You can become the leader, the equivalent of the quarterback, regardless of your background or upbringing. You may not have even been the first choice of the Head Coach to lead the team. You may have experienced some success or failure at another level, but now you are being asked to call the plays and lead your team to victory in the big leagues. Even though you may have been given a “game plan”, you will have to overcome setbacks and use your options (ingenuity) to achieve victory (success). You may not win the Super Bowl, or even every game that you play, but every engineer should have the confidence that your efforts and the performance of your team will end in a victory.

The first four individuals (five counting Steve Wozniak) in this first volume were either graduate engineers or practicing engineers. Each of them had an idea based on his technical background and developed a plan for success. None of these great leaders, other than Vince Lombardi, performed in a 60,000-seat stadium. There were no team owners willing to pay them big signing bonuses, and each of these individuals had to forage for their own investment capital. Success didn't come overnight, but it did materialize over a period of time. Some reaped great financial rewards, while others received much-deserved accolades.

VIII. REFERENCES

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