



# The AMA History Project Presents: Biography of NIKOLA TESLA

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## TESLA – The Father of RC

On September 2, 1897, the Chief U.S. Examiner of Patents visited the laboratory of Nikola Tesla in New York. This visit was prompted by his belief that this inventor's latest patent application went far beyond the realm of possibility in his claim of a practical wireless control system for vessels and vehicles from a great distance. It should be noted that the above date preceded the Wright brothers' airplane by more than six years. Tesla gave his control system the name of Teleautomatics. It is now known as the guided-missile principle, RPV (remotely piloted vehicles) and radio control, which the model aircraft fraternity calls RC. This article was written for model aircraft builders and fliers, so the writer will refer to it as RC.

Four years before Tesla shook up the Chief U.S. Examiner of Patents with his application for a patent on RC, he demonstrated a vacuum-tube radio for voice and music at the 1893 World's Fair in Chicago, so anyone with any electronic knowledge at all can easily see that his next logical step would be to convert his frequency control and tuning knowledge to other uses such as RC and automation. Tesla showed his bench-mounted RC components in working order. They included transmitters and receivers on different frequencies with tuned antennas, reversible electric motor-driven servos with gear reductions, electric motor-driven escapements with gear reductions, which had a separate control function at each quarter turn of the shaft and a reversible electric motor with driveshaft and propeller, which was intended to power a model boat he was constructing.

The Patent Examiner returned to his office in Washington, D.C. a firm believer in the new art of RC. He only issued Tesla a patent-pending classification of RC because the law required a thorough patent search and other red tape. The official patent number 613,809 was ultimately issued on November 8, 1898. That date marks the official birthday of RC but it was demonstrated in public by Tesla in his model boat – several feet long- every night for a week, two months earlier in September 1898. The RC boat is the one outlined in his patent specifications and drawings.

At the same time that Tesla was constructing his model boat with a single electronic circuit to control all of the RC functions, he worked out the preliminary designs for a submarine, which he intended to submit to the powers that be of the U.S. Navy because of the inevitable Spanish-American War. It used multiple circuitry and was all electric power by storage batteries. It was

large enough to carry six 14-foot Whitehead torpedoes mounted vertically in two rows. The firing was controlled by the transmitter operator on the mother ship but the reloading of the torpedo tubes was automatically triggered by the previous firing. Submerging was to be controlled by RC valves, which admitted water ballast. Electric motor-driven Westinghouse air compressors would purge the water ballast for surfacing.

Tesla's negotiations with the Navy brass were fruitless so he hinted to the press and magazine editors about his "mind-powered" war weapon to enlist their support to force the Navy's hand. Up to that time, they supported him because he had a way of making impossible dreams come true, but not a single one of them believed that this electronic magician could pull another rabbit out of his hat this time.

Briefly, Tesla's announcement went something like this. "Gentlemen, the investigations on my latest invention were begun in 1890 but I only recently rushed it to the stage where it is entirely practical and reliable. It is a method of and apparatus for controlling vessels and vehicles by wireless at a great distance from the operator. In other words, it makes a crewless "mind powered" torpedo boat entirely possible and practical. All that needs to be done is to build the boat and wire it properly. This is a new art for which I suggest the name of Teleautomatics. It is the art of absolutely controlling any machine such as a vessel or vehicle; I mean all of its translator operations such as forward and reverse motive power, its steering mechanism, and the loading and firing of the torpedoes by the mere exercise of the will of the operator on the mother ship. In the impending Spanish-American War, a small fleet of these boats, which operate completely submerged, could utterly destroy the entire Spanish fleet in an hour if the enemy fleet was in one single armada. If our Navy had to seek out the remainder of the fleet, then change that claim to a few months. The state of the art as I have advanced it is sufficient for this impending war, which fostered my recent extensive investigations, but we will not stop at this. We intend to show that this same art of Teleautomatics will allow the war weapon to expedite its own mission automatically by itself without an operator to dictate its movements. That is, left unto itself, it will be able to distinguish between what it ought to do and what it ought not to do; still it will be able to complete the mission assigned to it accurately with dispatch. It can zero in on the enemy ship by bouncing wireless signals off its hull.

I have already perfected such a plan. When I was in college, I designed a long cylindrical metal airship, which was completely devoid of control surfaces or stabilizing fins of any kind. It was propelled by an imaginary reaction engine. We now have the theoretical design of an airship, which is powered and guided entirely by reaction and a proven wireless control system to route the reaction power for steering. All we need is a prime mover with sufficient power to propel it and we have a Teleautomatic aerial torpedo, which can destroy a target thousands of miles away with accuracy. Such things as this can only be financed by the government because private investors are only interested in profit and loss statements – not technical progress."

There was the usual question and answer session, as was the case in all Tesla interviews. His answers were just as fantastic as his prepared statement. Tesla's plan to enlist the support of the

press and magazine editors who normally supported him had a negative effect. The newspaper and magazine editors editorially reprimanded him for resorting to cheap sensationalism to get a defense contract to build a weapon, which couldn't possibly be more than a figment of his imagination. This is why he rented Madison Square Garden in New York for a week in September 1898 – to publicly refute his critics. His feathers were so badly ruffled by the editors who normally supported him that his display covered the entire field of radio, radar, and electronics. This included Wireless Morse Code dot and dash signals, vacuum tube voice and music radio, radar, wire photo, shadowgraph (the first successful X-ray experiment), and RC.

Tesla's RC boat was the star of the show. It performed for packed houses every night for a week; first under the radio guidance of the inventor and then by volunteers from the audience to prove its simplicity to the press and public. He explained the operation of his not yet constructed submarine without revealing any secrets, and the press and magazines took up his cause but to no avail. The Navy still preferred antiquated methods to technical warfare.

A wealthy friend of Tesla's, John Hays Hammond, gave Tesla \$10,000 with which to rent Madison Square Garden for a week, so he completed several larger model boats which were under construction even though his hopes to sell the Navy on RC warfare were shattered. Their vacuum-tube detector, multiple circuitry, and loop form of antenna inside the hull were left out of his RC patent application as a national defense secret. U.S. Patent number 613,809 substituted a specially designed cylindrical detector for the vacuum tube and shows only a single electronic circuit with relays and semi conductors directing the battery current to the desired devices.

When Tesla was ready, he allowed the Navy officers to send all of his model submarines out into the Atlantic Ocean, completely submerged except for hooded lights on the bow and stern so that they always knew which way the bow was pointed. They recalled the boats to the dock and surfaced them with air compressors inside the hull. The Navy still dreaded the extra intelligence required for technical warfare so they buried their heads in the sand.

It is ironic that Tesla never did get any subsidies from the U.S. government because even minor engineers and inventors in our time work on defense projects. He failed to sell a modification of his 20-year-old radar system in 1917, which he claimed would bounce signals off the hulls of the deadly World War I German submarines. Mysteriously, the Navy didn't even offer to finance a demonstration. Tesla once again enlisted the press and magazines' help, and they responded because they knew that their friends and relatives would be exposed to these U-boats on their way to France. Once again, the Navy brass buried their heads in the sand.

Shortly before the end of World War I (in 1918), Tesla's RC system was employed in an Army Air Corps biplane by the Sperry Gyroscope Company to fly a pre-programmed mission to prove the feasibility of warfare without risk of life and limb. It made its take-off by ground-operated transmitter, then flew automatically for a hundred miles where it dropped its bombs on an imaginary target, made a 180-degree turn, and returned to its take-off point where the landing was made by RC transmitter. It had analog proportional closed-loop servos throughout. The

Sperry gyroscopes were equipped with the same potentiometers as the ground transmitter for automatic pilot control after take-off. The war ended before a defense contract was awarded. This happened in World War I!

It wasn't until 20 years later that the Army Air Corps revived Tesla's RC when they issued a master contract for a 10-foot wingspan RC model with a two-cylinder two-cycle engine for use as a target drone for machine gunners to practice anti-aircraft fire. The left and right wing panels were alike and interchangeable. They were made of spruce with fabric covering. The fuselage was of thin-walled 4130 chrome moly tubing. Three longitudinal tubes formed a triangular cross section with two parallel tubes at the top and a single tube at the bottom. The RC unit was an analog feedback potentiometer proportional on three channels with no ailerons. This writer witnessed many of their flights while I was in the Army Air Corps in World War II. They had such robust turn response that I couldn't believe that they flew without ailerons until I noticed a large movable rudder area in the design. (Three channel fliers take note of this.)

In our day, Tesla's RC is everywhere. Thousands of modelers in each state use it for fun and pleasure. It has orbited other planets and has been to the moon many times with and without a crew. It carries out combat missions automatically with accuracy in the form of guided missiles. A byproduct of it is the array of computers used all over the world. It operates stationary machinery and mobile machinery.

Nikola Tesla was a Yugoslavian by birth and an American by choice. He became a naturalized citizen in 1889 but never got the recognition he deserved, mostly because he tangled with Thomas A. Edison and bested him. With his invention of the alternating current electric power and light system, which powers the world today, he wrested control of the electrical industry from Edison (his archenemy) and turned the industry over to George Westinghouse for the sum of \$1,000,000. After paying off the seven investors in his Tesla Electric Company, he used the remaining \$400,000 to research and develop high-frequency radio and electronic inventions. This money lasted only 11 years, but he climaxed those 11 years by transmitting high-frequency electric power by wireless a distance of 26 miles, where he lit up a bank of 200 light bulbs and ran an electric motor. What a soul-stirring way for a spectacular inventor to go broke!

His next project had to be a venture that would attract capital, so he attempted to build a Radio City on Long Island. This fell through for lack of investors. That was 33 years before Radio City was built in New York by others. He then developed a steam turbine for steam-driven electric alternating-current generators and motive power for ships at sea. He took his steam turbine design and modified it into a gas turbine. He built many prototypes from 100- to 400-horsepower. When he unveiled his gas turbine to the press, he stated that it is definitely the engine of the future. He had no doubt that the main problems concerning metallurgy would eventually be resolved. The year was 1912, and the engine was not used until Germany and Italy built some jet airplanes in 1940. Most of Tesla's inventions were 50 years ahead of their time. It is interesting to note that Marconi introduced wireless telegraphy as an industry in 1901, which gave him worldwide publicity. He was smart enough to know that a telegraph system without

pokes and wires was the only form of wireless that could attract financial backing at that time. This worldwide publicity is what led the public to believe that Marconi invented radio.

Tesla sued Marconi for infringing on his patent rights and Marconi's lawyers managed to drag the court case on until 1915, when the U.S. Supreme Court ruled against Tesla and declared Marconi the official inventor of radio. This was because the lawyers and judges of that period had absolutely no understanding of a simple electrical circuit, much less sophisticated electronics. A few months before Tesla's death, the U.S. Supreme Court of 1942-43 reversed that decision, which left the road open for Tesla to instigate legal proceedings to collect many millions of dollars in back royalties. It came too late for Tesla because it came at a time when he was a penniless semi-invalid very close to his death. He died in January 1943 at the time the atom bomb was being developed and was born on July 9, 1856, in the covered wagon days.

Nikola Tesla's RC patent number 613,809, issued on November 8, 1898, is positive proof that he is the first RC modeler. Perhaps if enough RC modelers read this article, his name will be perpetuated by starting an RC Hall of Fame or naming an important RC annual contest after him. In any case, his name will be mentioned by many RC buffs for the next year or more.

In 1956, the electronic industry honored Tesla on the one hundredth anniversary of his birth by naming the unit of magnetic field strength "the Tesla." To RC modelers, this means that the reading on the outside of your radio transmitter tells you how many Teslas it is putting out. I'm willing to bet that the guy who installed that meter has never heard of Tesla.

Tesla's inventions and discoveries are too numerous to mention. They number in the thousands. Most of them were invented in his head and filed away in a corner of his brain until he had enough money to make a working model. He hated to waste time on lecture tours but he was always in demand as a lecturer on his own developments, both here and abroad. He was well paid for them and he desperately needed the money to support his laboratory at the Tesla Electric Company.

Tesla's favorite invention was the electromagnetic pendulum known as the Tesla coil. It is the heart of radio, electronics, and automobile ignition systems. He was forced to invent it because his high frequency alternators with hundreds of poles for his early radio research work were not satisfactory for a man of Tesla's caliber. He got as high as 30,000 cycles from them but he wanted much more. He credits the coil for his rapid development of radio, radar, radio control, and electronic automation. His drive was motivated by a strong desire to keep his creative mind occupied. His most quoted statement was, "the worst criminals in the world are the voluntarily idle."

This statement aptly describes one of the prime motivations of the average RC modeler.

*(Editor's Note: in a recent release from the Jet Propulsion Laboratory, Goldstone, Calif. They are making the most powerful transmissions of electronic power that have ever been made. The possibility has intrigued scientists ever since Tesla's experiments. Until now, the concept was considered inefficient. Engineers are transmitting more than 30 kilowatts DC power to a receiving station a mile away. It is believed that an efficiency of 65% may be achieved. The JPL experiments point the way to transmission of energy through space – as to solar collectors in space.)*

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