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A FUTURE DRIVEN BY THE PAST… WHICH CAME FIRST? THE RED LIGHT OR THE ANTENNA?

Police Officer William L. Potts of Detroit, Michigan, decided to do something about the problem caused by the ever-increasing number of automobiles on the streets. What he had in mind was figuring out a way to adapt railroad signals for street use. Potts used red, amber, and green railroad lights and about thirty-seven dollars worth of wire and electrical controls to make the world's first 4-way three-color traffic light. It was installed in 1920 on the corner of Woodward and Michigan Avenues in Detroit. Within a year, Detroit had installed a total of fifteen of the new automatic lights. Potts was a government employee so he could not patent his invention. Although Potts' achievement was not recognized at the time, a United States Court decision in 1928 established that he was, indeed, the inventor of the first 4-way, three-color signal. (URL: www.marktraffic.com)

In 1923, Garrett Morgan of Cleveland, Ohio realized the need to control the flow of traffic so he invented the first electric auto-

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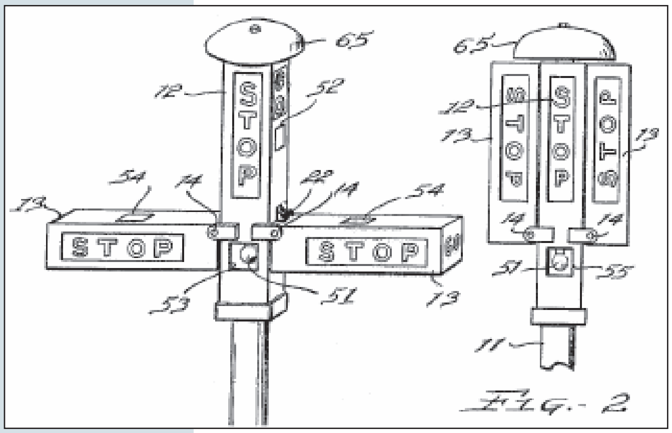
WIRELESS MAKES SENSE!

By Roger Owens, Chief RF Engineer, SkyWave Antennas, Inc.



US Patent Office Patent #1,475,024. G.A. Morgan.

Photo Credit: Broadstreet Corridor (web site no longer active).

The antenna is the key to maximize RF coverage. By selecting the right antenna, you may be able to shorten the application design cycle while achieving maximum performance at the best possible cost. In most designs you need to carefully consider range, coverage of signals, gain, radiation patterns, and efficiency. Each one of these areas can be manipulated through an effective use of the correct antenna. **We believe that you can have the best electronics in the world — but it is the antenna that makes all the difference.**

WHY?

Wireless networks serve many purposes including improving passenger safety, security, productivity of personnel, and increasing operating efficiencies. With budget cuts and revenue shortfalls, it is critical to look for product improvements while saving money. **Utilizing wireless technologies in the transportation market is becoming more prevalent to saving operating cost and reducing set up time.** Companies have saved millions in cost by not having to work with traditional copper and fiber. Different tools are important for assessing your network needs and choosing the correct antenna is vital.

WHAT?

Although any metallic object will radiate, this doesn't make the antenna efficient. There are many different antenna configurations: Omni Directional, Directional Arrays, Yagi, Loops, Dipoles, Circular, Polarized, Patch, Base-loaded Whips, and collinear types, just

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matic traffic light, though it looked more like the semaphore signals you see at train crossings today. Many others had obtained US Patents for traffic signals but Morgan's Patent was purchased by General Electric Corporation for $40,000 and provided the protection they needed to begin building a monopoly on traffic light manufacturing.

In 1886, Heinrich Hertz developed a wireless communication system in which he forced an electrical spark to occur in the gap of a dipole antenna. He used a loop antenna as a receiver and observed a similar disturbance. By 1901, Marconi was sending information across the Atlantic. For a transmit antenna he used several vertical wires attached to the ground. Across the Atlantic Ocean, the receive antenna was a 200-meter wire held up by a kite. **So the antenna was invented first.** (B. Constantine. "Antenna Theory: A Review," IEEE, vol. 80, January 1992.)

The Transportation Industry requires innovation and partnerships to meet the ever-growing demand for wireless technology. Companies like SkyWave Antennas, Inc. have created products such as the SkyMax to forge such partnerships… meeting needs from traffic control to traffic counts. To achieve the highest level of efficiency choosing the right wireless antenna is based on four factors: 1) Low profile, 2) Rugged design, 3) No tuning required, and 4) Radiates in a vertically-polarized omni-directional wave. All of these factors provide a valuable real-time solution without the wires and poles and the excessive cost of labor and materials. Transportation companies have adapted to the reality that antennas do save time and money. **Wireless makes sense! And… size does matter.** The SkyMax is a vertically polarized low profile antenna 0.6 inch in height and a good example of engineering technology that replaces an antenna over 2 feet in length.

Just ask Potts or Hertz… The proof is in the design. **Yes, it was the antenna that came first.**

Photo credit: SwampStyle.

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to name a few. **Each antenna design has pros and cons when it comes to its operation.** For example, multiband antennas are convenient, but there will most likely be some tradeoffs in efficiency and performance. Each application will present its own unique challenges.

WHERE?

The location of the antenna should be considered when selecting an antenna. The overriding application factors are: will the antenna be used inside or outside and, will the antenna be exposed to any chemicals that require identification? **Mounting location has more effect on the ultimate gain and radiated pattern than the antenna type does.** Most communication systems do not operate in a free space environment because of the effect of the earth's surface on the propagation path. There are two key effects: ground loss and path blockage. In environments where metal objects and the ground come into close contact with the antenna, it will cause reflections, absorption, and detuning of any antenna. Think of the analogy of a flashlight beam: when it is open and free of obstructions, the light beam will shine a great distance. When placed in or on the ground, it will severely limit the distance the beam will cover. On the other hand, if you place the flashlight inside an enclosure, the beam of light will be contained by the enclosure with the exception of light escaping through the cracks. Although RF signals will pass through most plastic enclosures… it will affect your signal strength. An antenna should never be located inside a conductive or metal enclosure.

BE SPECIFIC…ANTENNAS SHOULD BE TAILORED TO FIT!

The RF transmission or reception of a signal can be enhanced when the antenna is designed and built for a specific application. The enclosure the antenna is mounted on or enclosed in will probably cause a shift in the required operating range. As a result, antennas purchased from a catalog may not meet the needs required for the application. **You will save**

time and money if your antenna can be tailored specifically to your application. It's not as much the mystery of antenna design and performance as it is experience of what does and doesn't work. The simple fact is the application and mounting location has an effect on the ultimate gain and radiated pattern.

IF IT SOUNDS TOO GOOD TO BE TRUE, IT PROBABLY IS!

You'll see all sorts of wild claims for antenna gain that seem incredible, yet highly attractive. Antenna gain is a measure of directivity of the antenna's radiated signal. **Antennas are a passive device and will NEVER put out more power than what is put in.** An antenna with gain focuses power in a particular direction at the cost of reduced power in other directions. Make sure the Gain advertised is not exaggerated. There are rules that apply to all antenna systems and these rules, like any data, can be manipulated. Note: Typically when you double the height, you'll increase your overall gain by 3db.

AN IDEAL SYSTEM TRANSMITS 100%

VSWR (Voltage Standing Wave Ratio) is a measure of how efficiently radio-frequency power is transmitted from a power source, through a transmission line, into a load (for example, from a power amplifier — through a transmission line — to an antenna). **In an ideal system, 100% of the energy is transmitted.** This requires an exact match between the impedance of the source, the impedance of the transmission line, its connectors, and the impedance of the load. As the match of a system improves, return loss increases and VSWR decreases. A well-matched antenna system should exhibit a return loss of >20dB and a VSWR reading of 1:1.22. **By choosing the correct antenna options, the correct location, and taking into consideration the gain and the importance of VSWR, your system will be efficient and reliable.**

SkyMax enables easy installation for Traffic Control.