Newly declassified documents astound communications experts!

The Use of Pringles™ Containers To Enhance Network Security

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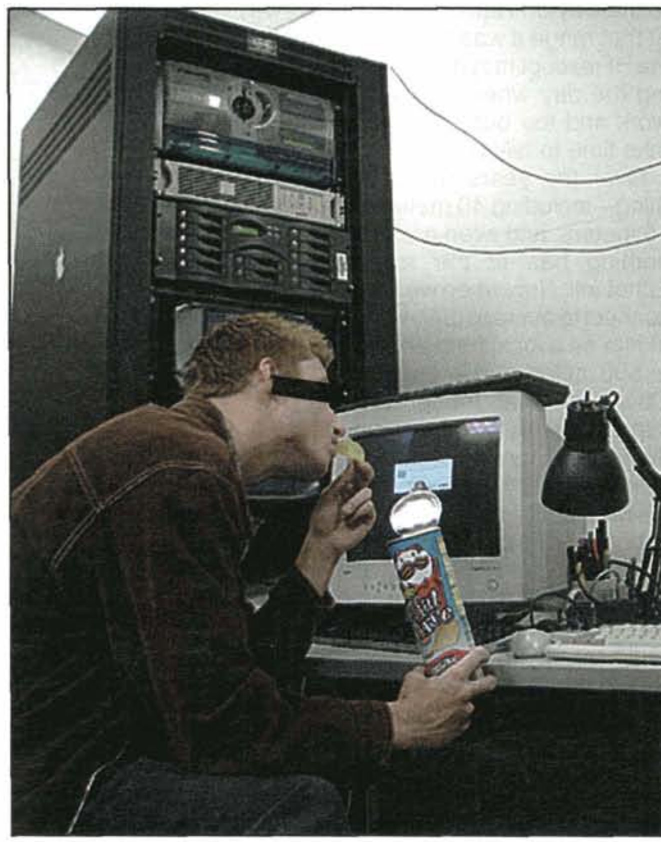
*It isn't often that we are able to pry open the lid of secrecy on esoteric communications-related equipment used by the intelligence community. But in this startling article, based on documents that were classified for almost 35 years, Professor Heisseluft reveals how a partnership involving a U.S. intelligence agency, Proctor and Gamble, and the Lauton Institute produced a unique cavity resonator in the late 1960s that is used today, for example, to sniff out holes in wireless network security. —W2VU***

Dear friends, it is not often that one is able to part the veil on technologies so revolutionary that they are classified to prevent disclosure. While I, as a graduate student at the Lauton Institute studying under the direction of Dr. Jerzy Ostermond-Tor (ex-YM4XR),[1] worked on the project I will reveal below, I have been unable, because of your country's secrecy laws, even to talk about it to this day. Now, however, through the normal process of classification downgrading and eventual declassification, I can tell you my story...a story so astounding that most of you will find it totally unbelievable.

In the mid-1960s, with use of the UHF (300–3000 MHz) and SHF (3–30 GHz) bands accelerating rapidly, one of your intelligence agencies headquartered in northern Virginia sent an agent to the Lauton Institute to ask for our assistance in developing a cavity resonator that could be used as an antenna for receiver systems operating in the low gigahertz region of the radio spectrum. The requirements were that the antenna had to be relatively inexpensive to build and that a non-technical person could rapidly fabricate one from components available worldwide.

About the same time, Proctor & Gamble (P&G), your large consumer products corporation, came to the Lauton Institute for help in developing a potato chip that was characterized by having the same, uniform shape and size, piece after piece after piece. Many in the American public and others around the world had become dissatisfied with the uneven shape and size of the chips they found in bags, and they were looking for something better. It took almost ten years to develop a manufacturing process that used dried potato flakes, but in 1967 P&G, with the assistance of the Lauton Institute, was ready to introduce its new product—Pringles.[2] There was only one hitch: How should the new chips be packaged, not only to ensure that they were not damaged in shipment, but also so that they stayed dry until the package was opened?



A technician at a classified site in northern Virginia begins the difficult task of preparing a Pringles canister for conversion to a cavity resonator.

** Professor Heisseluft currently is vacationing in the South Pacific following his successful work on the redesign of Pringles so that the chips do not become airborne during the high-speed manufacturing process used by P&G. Mail conveniently may be sent to the professor c/o CQ Magazine, 25 Newbridge Road, Hicksville, NY 11801*

** * For other antennas built using Pringles Potato Chip and Nalley Beef Stew containers, see: <http://www.turnpoint.net/wireless/index.html>.*

It was then that I saw the answer to both the intelligence agency's and P&G's problem: Create a canister with an inside diameter slightly larger than a Pringles chip *that used an aluminum lining to provide both the vapor barrier needed to protect the potato chips and the requisite conductor for a cavity resonator.* The only requirement for the height of the canister was that it had to be high enough to contain a good helping of chips *and* a multiple of half wavelengths at frequency of choice. To see why this is so, consider the physics of a cavity resonator.

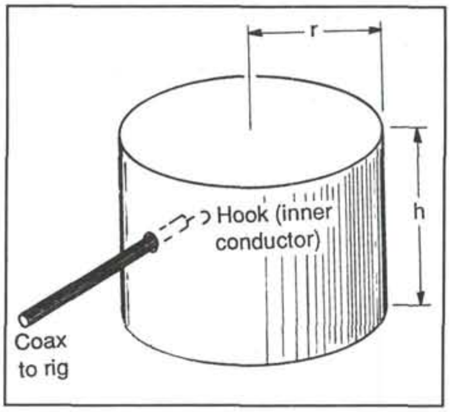


Fig. 1– For a cavity resonator, the wavelength is given by $\lambda = 2.61 \times r$ (lowest mode); h must be a multiple of half wavelengths at the resonant frequency.

Cavity Resonators

Cavity resonators are nothing more than a section of a waveguide. They are used at frequencies where wavelengths are on the order of centimeters. The frequency at which a cavity is resonant depends on the dimensions of the waveguide and the mode of oscillation. As seen in fig. 1, and for the lowest mode, the resonant wavelength for a cylinder is 2.61 times the radius of the cavity. When the height is less than one wavelength, the resonant wavelength is independent of the cylinder's height. For all other modes, the height must be a multiple of half wavelengths. *(Readers interested in learning more about cavity resonators are referred to the* The ARRL Handbook.[3]*—ed.)*

To ensure that a Pringles container could also be used as a cavity resonator in the low gigahertz region of the spectrum, where intelligence and military operations were planned at that time, the Lauton Institute team, under my direction, selected 3 GHz as a nominal resonant frequency. Further, because we were told that Pringles potato chips are roughly elliptical, measuring 4 cm (minor axis) by 6 cm (major axis), I fixed the inside dimension of the aluminized container at a diameter of 7.5 cm.

To see why I selected this diameter, consider the following calculations:

$$\begin{aligned} \lambda &= 2.61 \times r \\ &= 2.61 \times (7.5/2) \\ &\cong 10 \text{ cm (9.8 cm, to be exact)} \end{aligned}$$

The corresponding resonant frequency, as planned, is roughly 3 GHz.

P&G also told us that they intended to pack roughly 105 chips in each container (7 servings, 15 chips per serving). For the number of chips specified, and for a multiple of half wavelengths, this would suggest a container height of roughly 20 cm.

In reviewing the suggested dimensions with P&G personnel, they insisted that additional room be provided at the top to accommodate variations in chip thickness and in the actual number of chips placed in any given container; the additional height also was desired to accommodate future changes that P&G might make in these two parameters. We finally settled on a height of 22.5 cm, which while slightly higher than I wanted, did not compromise the use of the container as a cavity resonator for frequencies around 3 GHz. (Those seeking the absolute best performance certainly can saw off the end of the container, bringing its length into conformance with the desired measurement.) The final dimensions of the container (7.5 cm diameter, 22.5 cm height) are still used today.

When used as a cavity resonator, we determined that nothing more than a small hole need be punched in the side of the can at the point where the most intense part of the electric field would be found. We then inserted a small "hook" (coupling device) fashioned from the inner conductor of a piece of coaxial cable into the can. By turning the coax, we could vary the orientation of the coupling device and in so doing, the signal level produced in the coaxial cable.

The results of this research were classified at the highest levels of the intelligence agency involved. Also, despite frequent inquiries into why the U.S. intelligence agencies, the U.S. military, and other government activities appeared to be such great consumers of Pringles over the years, often receiving tractor-trailer loads of the product on a weekly basis, the reason for this apparent compulsion on the part of the personnel involved could not be revealed until now: The Pringles canisters were being fashioned into cavity resonators for use as intercept antennas in the low-GHz region of the radio spectrum. Consider, for example, the accompanying photo, taken in a secret government laboratory in early 2001. Even then, the technology still was protected under your security laws, and so, we cannot reveal the identity of the technician shown creating a cavity resonator of the type described here.

Uses for the Pringles Cavity Resonator

As noted above, cavity resonators produced using Pringles canisters have been used as intercept antennas by your country's intelligence agencies and military services for the past 35 years. Even today, according to the IEEE,[4] U.S. agents are using Pringles cavity resonators for "...sniffing out holes in wireless network security...."

The uses of this technology are, of course, only limited by the imaginations of users. Now that the Pringles cavity resonator has been declassified, radio amateurs worldwide can begin experimenting with this device in the low gigahertz region of the spectrum. Of importance, too, at higher frequencies they will find that metalized, frozen orange juice containers are required.

Notes

1. The claims of former U.S. Vice President Gore notwithstanding, it is Dr. Ostermond-Tor who is recognized universally as the Father of the Internet. In his seminal article "Special Subscriber Service: The Telephone Company's Answer to Amateur Radio" (*CQ*, April 1967, pp. 24–26), Professor Ostermond-Tor presented the essential elements for what we know today as the internet. Basically, the article described a future system in which telephones replaced transmitters, receivers, and antennas; licenses would no longer be required; and there would be no more QRM or frequency problems.

2. The name Pringles came from a street named Pringle Drive in Cincinnati. According to a spokeswoman for P&G, the name is cheerful, is a bit nostalgic, and sounds good when used with the words "potato" and "Proctor & Gamble."

3. *The Radio Amateur's Handbook*, 30th Edition, American Radio Relay League, 1953, pp. 425–426.

4. News Analysis, BRIEF, "Snacktech," IEEE SPECTRUM, November 2002, p. 16. ■