

Inventor of Wireless

Ms. Hedy Lamarr

The Improbable Inventors of Frequency-Hopping Radio

She was gorgeous, glamorous and talented. And she had a mind for technology. In 1941 actress Hedy Lamarr, along with the avant-garde composer and musician George Antheil, filed for a patent to cover their "Secret Communication System," a device designed to help the U.S. military guide torpedoes by radio signals that would continually jump from one frequency to another, thus making enemy interception and jamming difficult.

Born Hedwig Maria Eva Kiesler in Vienna, Austria, Lamarr may have gotten the idea of "frequency hopping" while she was married to Fritz Mandl, an arma-

ment manufacturer who sold munitions to Adolf Hitler. Through a marriage arranged by her parents, Lamarr was Mandl's trophy wife, and she accompanied him to the many business dinners and meetings, where, unbeknownst to the participants, she silently learned about Axis war technology. After four years with Mandl, Lamarr, a staunch anti-Nazi, fled to London, where MGM's Louis B. Mayer "discovered" her and convinced her to move to the U.S.

In Hollywood she met Antheil, who helped her figure out a way to synchronize the frequency hopping between the radio transmitter and receiver. Their invention, which they gave to the U.S. government for free, called for two paper rolls, similar to those used in player pianos, punched with an identical pattern of random holes. One of the rolls would control the transmitter on the submarine while the other would be launched with the receiver on the torpedo. Though ingenious, the device was deemed too cumbersome for use in World War II.

Still, the seminal idea of frequency hopping lingered. By the late 1950s U.S. Navy contractors were able to take advantage of early computer processors for controlling and synchronizing the hopping sequence. Since then, the U.S. military has deployed more sophisticated techniques with ever faster processors in costly, classified devices, including satellite communications systems. And today the technology has become widespread in cell phones and in personal communications services (PCS), among other civilian applications. —D.R.H.

HEDY LAMARR, the Hollywood actress, was the co-recipient of a patent (*inset*) for basic technology that is now widely used in cell phones and personal communications services (PCS).

"Spread-Spectrum Radio" by David, R. Hughes and Dewayne Hendricks, *Scientific American*, April 1998, p 94-96