

Torpedo invention laid foundation for WiFi and more

In a bid to defeat the Nazis, film actress Hedy Lamarr developed a secret communications system that would later serve as the basis for WiFi – but why did it take 20 years to be recognised?

By Bruce Berman

A frequency-hopping invention designed to secretly guide Allied torpedoes failed to impress US Navy leaders at a time when Europe most needed to slow the Nazi advance.

Some readers of this column may be familiar with the story, but what they probably do not know – and what recent film *Bombshell: The Hedy Lamarr Story* brings to life – is the background that led to this breakthrough invention and why it took 20 years to be recognised.

Curious and patriotic

Lamarr was a highly successful screen actress, billed in the 1930s as “the most beautiful woman in the world”. She was also interested in how things worked. An Austrian-Jewish *émigré* in Hollywood, Lamarr was intellectually curious and highly patriotic, and wanted to do something to help her adopted country defeat Germany. This prompted her to develop a communications system that would later serve as the basis for WiFi, Bluetooth, wireless phones and Global Positioning System, among other innovations.

Lamarr’s invention went unacknowledged, partly because it derived from such an unlikely source. She was an Austrian (like Hitler) with a thick accent; her eccentric invention partner, George Antheil, was an American *avant-garde* composer and pianist who had spent a decade in Paris associating with James Joyce and Ernest Hemmingway. His parents were German immigrants and, like Lamarr, he did not graduate high school.

“Being beautiful and smart are two forms of power,” said *Bombshell* director Alexandra Dean, “and for whatever reason women are usually allowed to own one of those forms of power, but not both... The power of ‘being smart’ [on the other hand] is an active power that allows the person wielding it to take control of their own narrative.”

What drove Lamarr to invent, and how she did it, is the focus of this fascinating and well-received documentary (available on Netflix and elsewhere), which illustrates that some of the best inventions derive from the most unlikely sources. *Bombshell* estimates that this one would have been worth \$30 billion.

Six claims

During World War II Lamarr learned that radio-controlled torpedoes – an emerging technology in

naval war – could easily be jammed and set off course. She and Antheil developed a device that evaded jamming and Antheil succeeded in synchronising a miniaturised player-piano mechanism with radio signals. They drafted designs for the frequency-hopping system, which they then patented. Eccentric billionaire Howard Hughes, a fan of Lamarr, put his research scientists at her disposal.

Using knowledge of torpedoes gained from Lemarr’s first husband, a munitions manufacturer, the pair developed the idea of using frequency hopping or secure radio transmission – in this case, using a piano roll to randomly change the signal sent between the control centre and torpedo at short bursts within a range of 88 frequencies on the spectrum (as there are 88 black and white keys on a piano keyboard).

The specific code for the sequence of frequencies was held identically by the controlling ship and the torpedo. This encrypted signal was impossible for the enemy to scan and jam on all 88 frequencies. Antheil would control the frequency-hopping sequence using a player-piano mechanism, which he had earlier used to score his *Ballet Mécanique*.

Lamarr’s and Antheil’s invention, Secret Communications System 2,293,387, had just six claims. It was filed on 10 June 1941 and granted on 11 August 1942. The invention was technologically difficult to implement and at that time the US Navy was not receptive to inventions from outside the military. In 1962, at the time of the Cuban missile crisis, an updated version of the frequency-hopping design finally appeared on Navy ships.

Hall of fame

Hedy’s Folly: the Life and Breakthrough Inventions of Hedy Lamarr was written by Pulitzer Prize-winning author Richard Rhodes, who appears in *Bombshell* and was a source for the film.

Rhodes believes that inventing has more to do with perspective and creativity than technical excellence. Lamarr, a refugee with something to prove as much as a Hollywood star, accepted challenges that others regarded as obstacles.

“That invention is different from fine art or scientific discovery suggests that inventors may be different from fine artists or scientists,” writes Rhodes. They are. Many inventors are technically trained, of course, especially those who invent professionally. Thomas Edison was home and self-educated, but Nikola Tesla was an electrical engineer. Samuel FB Morse, the co-inventor of the telegraph, was a painter.

Despite Lamarr helping to sell the equivalent of \$343 million in WWII bonds, the US government seized her invention in 1942 as property of an enemy alien. In 2014 Lamarr and Antheil were posthumously inducted into the National Inventors Hall of Fame.

“If you do good,” Lamarr said, “people will accuse you of selfish motives – do good anyway.” **iam**

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