

# TOOLS of the TRADE



## Garmin Head-Up Display

The Garmin portable HUD (Head-Up Display) is a windshield projection system for smartphone navigation apps. The HUD projects bright, sharply focused directions onto a transparent film on the windshield or an attached reflector lens. It receives its navigation information from a Bluetooth-enabled smartphone running a Garmin StreetPilot 1 or NAVIGON app. The HUD displays turn arrows, distance to the next turn, current speed and speed limit, and estimated time of arrival. It indicates the proper lane to be in for the next maneuver and alerts you if you exceed the speed limit. The HUD also notes traffic delays. When turn-by-turn directions are announced, the

smartphone will automatically fade out any music from the phone. The unit will continue to display navigation information while you take incoming calls. Setup is simple: You apply the transparent film to your windshield or attach the reflector lens, place the HUD unit on your dash, and then pair it with your phone using the Bluetooth connection. The navigation apps run on iPhone, Android, and Windows 8 phones. The HUD weighs about 10 oz. and is 4.25" × 3.46" × 0.73". It projects in two colors (green and red), and the operation temperature range is 5°F–158°F.

[www.garmin.com](http://www.garmin.com)

## Modo: Modular Desktop Organizer

Modo, the Modular Desktop Organizer, was a successful Kickstarter project that showed immediate promise when it doubled its original investment goal in one month. The design is very simple and effective. The base, a bamboo board, is drilled out with 36 holes to receive 20 brushed aluminum pins—16 long and four

short pins in black or silver. The pins can be spaced in any configuration to store tablets, notebooks, phones, hard drives, letters, or anything that takes up space on your desk. There are four deeply rooted grooves to hold connecting wires like phone chargers, and three rectangular-shaped, rounded slots on the end can hold USB thumb drives (standing up). An expandable band that wraps around the pins forms a flexible cup that can hold pens, pencils, and other items. There are 10 black rubber caps for the pins to protect your devices and convert any spare pins into usable styluses. Modo is available at [www.amazon.com](http://www.amazon.com) and other retailers.

## Pico Projector

The Pico PK320 palm-sized projector from Optoma projects presentations, graphics, and

movies in a bright, widescreen view. The pocket projector weighs 8.3 oz. and measures 4.7" × 1.2" × 2.7". It projects widescreen images as large as 150" diagonally in a 16:9 aspect ratio. Brightness controls include 25 lumens in standard mode or 100 lumens with an AC power adapter or optional high-power battery pack. An internal Microsoft Office viewer lets you share files and documents without a PC, and the compatibility includes PowerPoint, Word (DOC and DOCX), Excel (XLS, XLSX), and PDFs. Inputs can be from computers, smartphones, tablets, digital cameras, camcorders, Blu-ray players, set top boxes, and game controllers. The LED light source has a lifetime of more than 20,000 hours—equivalent to four hours per day for 13 years. A mini-jack audio output supports external amplifiers plus speakers and headphones. A micro SD slot and USB flash drive input allow additional sources for playback. Standard HDMI connections are possible with an optional mini-HDMI to full-size HDMI cable. The projector includes a universal-to-VGA cable, composite AV cable (RCA to 2.5 mm),



# TECH FORUM

## Beauty and the U-boats— Wi-Fi's Beginning

By Michael Castelluccio, Editor

The release this month of Endgame Entertainment's movie *Jobs* reinforces that old Hollywood bromide that life is endlessly more fascinating when the players are beautiful. In this instance, the actor playing the temperamental geek, Steve Jobs, is the ex-Calvin Klein/Versace model Ashton Kutcher.

In the real world, the two universes (geeks and glamor) rarely collide. There is, however, one amazing exception where an actress, dubbed by her studio "the most beautiful woman on Earth," worked out several basic engineering paradigms that were later adopted in the development of Wi-Fi, Bluetooth, and GPS. And to make the story that much more unbelievable, the actress quit school when she was 16, and her coinventor of a radio-controlled torpedo system was a serious music composer, who also lived in Hollywood.

Born in Vienna, Austria, in 1913, Hedwig Eva Maria Kiesler began her acting career in Europe when she was 20 years old. She later changed her name to Hedy Lamarr while under contract to Louis B. Mayer in Hollywood, Calif.

Her education in warfare technology, however, began when she married Friedrich Mandl, one of the wealthiest men in Austria, when she was 19 years old. Mandl was a munitions manufacturer, and his young wife often accompanied him on business trips. There was much to learn, as well, at dinner parties for foreign munitions purchasers and developers. The marriage only lasted four years, but in that time, Lamarr accumulated an essential background of many of the weapon systems used during World War II.

The actress possessed a keenly analytical mind. In his biography *Hedy's Folly—The Life and Breakthrough Inventions of Hedy Lamarr*, Richard Rhodes offers Lamarr's own take on her striking good looks. "It annoyed her deeply, however, that few people saw beyond her beauty to her intelligence. 'Any girl can be *continued on next page*



type A to micro-USB cable, rechargeable Li-ion battery, remote control, power adapter, and a pouch. [www.optomausa.com](http://www.optomausa.com)

### Amped High-Power Router

The Amped Wireless RTA15 Router is a high-power 700mW dual-band AC Wi-Fi router that provides extra range over next-generation 802.11ac Wi-Fi standard. Wi-Fi speeds can be up to three times faster with 802.11ac than 802.11n, and the RTA15 also has long-range access because of 10 high-power amplifiers and three high-gain antennas (two 2.4GHz 700mW amplifiers, four 5GHz two-stage 700mW amplifiers, four low-noise amplifiers, and three 5dBi high-gain antennas). The coverage produced, according to Amped, is up to 7,500 sq. ft., which makes it ideal for offices, warehouses, larger homes, and backyards. You can attach an external hard drive or flash drive with a USB connection to share files with other networked computers or remotely over the Internet using

an FTP client. Access and security are flexible. You can create up to eight additional wireless networks for guests or conference rooms with access to the Internet, while protecting local computers and servers from access by these guests. You can block specific websites with an advanced SPI (Stateful Packet Inspection) firewall. You can establish specific users to have access and set a daily time schedule for access. There's even control over how far your network coverage reaches through wireless output power adjustments. A basic setup wizard walks you through the setup process. [www.ampedwireless.com](http://www.ampedwireless.com)



glamorous,' she famously and acidly said. 'All you have to do is stand still and look stupid.'"

Rhodes points out that making two or three movies a year, each one occupying about a month of her time, left her a lot of time to work on her hobby. She developed a love for experimenting with and inventing new things. He explains, "In Hollywood she set up an inventor's corner in the drawing room of her house, complete with a drafting table and lamp and all the necessary drafting tools."

As a child, she was encouraged by her father to investigate how the world worked. She continued that mind-set as an adult, inventing "to challenge and amuse herself and to bring order to a world she thought chaotic," Rhodes says.

The most significant invention that she worked on with George Antheil, her composer colleague, was the remote-controlled wireless torpedo, which was navigated by a jam-proof, frequency-hopping command signal. There were several other weapons, like the proximity anti-aircraft shell, which produced a magnetic field that would drive itself toward large metal bodies, such as an aircraft. But the torpedo and the larger notion of a secret communication system, based on stepped radio signals, were the most influential of their patents.

### MOTIVATION

Lamarr's work on the torpedo system was strongly driven by the sinking of the SS *City of Benares*, an evacuee ship sailing from Britain to Canada, by a German U-boat on September 17, 1940. Among the 245 lives lost were 77 of the 90 children aboard the vessel.

Lamarr remembered discussions about remote-controlled, wakeless torpedoes from the dinner parties in Austria, but those were wire guided. She wanted to work out a remote radio signal to replace the wire. Fortunately, as she began work on this project, she met Antheil, a musician who experimented widely in synchronizing player pianos by remote control.

Rhodes describes Lamarr's original idea: "If a radio transmitter and receiver are synchronized to change their tuning simultaneously, hopping together randomly from frequency to frequency, then the radio signal passing between them cannot be jammed."

Antheil and Lamarr submitted their blueprints and directions for the torpedo in December 1940, and in June 1941 they filed patent applications for a much broader and even more significant communication system based on the frequency-



Studio publicity photo for *Algiers*, 1938.

hopping technique. They called it the Secret Communication System.

### SPREAD SPECTRUM

The movie star and musician's system was declassified many years later and presented in a 1976 textbook by Robert C. Dixon, *Spread Spectrum Systems with Commercial Applications*, which a colleague claimed was "the first comprehensive, unclassified view of the [spread spectrum] technology."

*MicroTimes* writer Anna Couey explains, "Spread spectrum holds the potential to revolutionize wireless communications because it renders radio spectrum—a resource currently deemed so precious that only the largest of corporations can afford to buy it—plentiful for all of us," she says. "It enables multiple users to share radio frequencies at the same time, without interfering with each other." This is accomplished by using a version of frequency hopping within the limited number of frequency bands.

Lamarr and Antheil were granted a U.S. patent on August 11, 1942, for their Secret Communication System, which has developed a wide reach into many areas of 21st Century life. The development of spread-spectrum technologies was encouraged by the Federal Communications Commission (FCC) allowing spread-spectrum communications to operate unregulated and without an FCC license in the ISM (Industrial, Scientific, and Medical) radio bands as well as the low-power bands. Those are the places where Wi-Fi networks live, along with Bluetooth, NFC (near-field communications), cordless phones, GPS, barcode readers, and UAVs (unmanned aerial vehicles).

### RECOGNITION

There was little or no recognition of the pioneering efforts of Lamarr and Antheil during the early years of spread-spectrum development. That changed, however, when retired U.S. Army Colonel Dave Hughes, who was occupied by installing free wireless access for rural schools in Colorado, took up the cause. Hughes persuaded the Electronic Frontier Foundation (EFF) to consider Lamarr's contribution as the inventor of frequency-hopping spread spectrum for an EFF Pioneer Award.

In 1997, Hedy Lamarr, 82, and George Antheil, who had died in 1959, were granted the Sixth Annual Pioneer Award, putting them in the company of computer and Internet giants Doug Engelbart, Linus Torvalds, and Tim Berners-Lee. **SF**