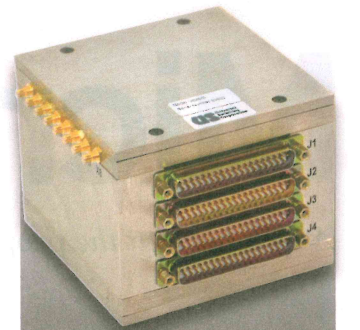
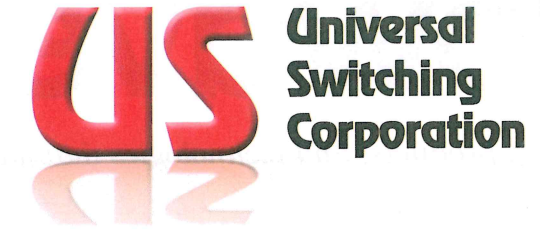


# Microwaves & RF

A look back at the people, products, and technologies that have impacted our industry.



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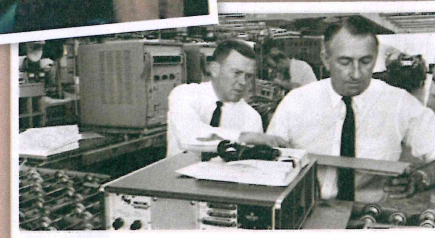
**2000**

With an initial public offering (IPO) of Agilent Technologies in November 1999, Hewlett-Packard Co would raise \$2.1 billion. Hewlett-Packard would then spin off Agilent Technologies in June 2000 through the distribution of Agilent shares to Hewlett-Packard shareholders. Agilent Technologies would continue developing electronic test equipment and software while expanding into life-science markets. Sadly, life ended for one of HP's founders, William Hewlett, a year later.



Dave Packard (left) and Bill Hewlett (right).

(Courtesy of Agilent Technologies)



(Courtesy of Bing)

**2001**

MEMtronics was incorporated to commercialize microelectromechanical-systems (MEMS) technology. The company's tiny integrated waveguide MEMS filters compete in size with printed-circuit microstrip and stripline filters but with the loss and rejection performance of much larger metal waveguide filters.

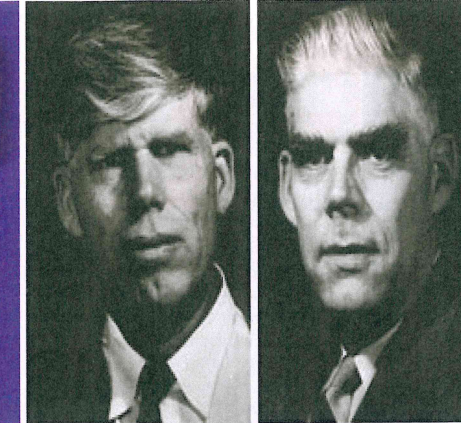
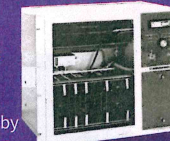
(Courtesy of MEMtronics)



**1960**

RHG Electronics Laboratory was founded in Farmingdale, NY by Arnold Rubin, Ron Hirsch, and Robert Gruber, lending the first letter of each last name for the company name. The company, a leading supplier of RF/microwave mixers, video amplifiers, and other components for military and aerospace systems, would move to Deer Park, NY a decade later and eventually be acquired by M/A-COM.

(Courtesy of WorldRadioHistory.com)



**1962**

The Varian brothers, Sigurd and Russell, celebrated the 25th anniversary of their company, Varian Associates (Palo Alto, CA) in 1962. They were responsible for key vacuum electronics sources of microwave energy including the klystron.

Automating RF connections seemed absurd at the time, but Universal Switching's roots began in 1968 with a burst of innovation as "Matrix Systems Corp" by introducing a modular coax switching line, and a 100MHz compact 8x8 matrix in a 4" cube. The founders of Universal Switching departed MSC in 1992 to introduce new technology (USC later acquired MSC in 2007) and now offers automated switch solutions to 50GHz.

uswi.com

**2007**

In August, Ajay Poddar and Ulrich Rohde of Synergy Microwave Corp. presented a patented technique to reduce phase noise in voltage-controlled crystal oscillators (VCXOs) even as they shrink in size and power consumption.



(Courtesy of Synergy Microwave Corp.)



(Courtesy of Rohde-Foundation)

**2006**

Cree Santa Barbara Technology Center in Goleta, CA (now Wolfspeed) presented one of the highlights of the 2006 International Electron Devices Meeting (IEDM) with its unveiling of a compact amplifier built with just two GaN HEMT devices but capable of 550 W peak power at 3.5 GHz for radar applications. Newer developments in GaN HEMTs include a 100-V device and 650-V power transistors from Teledyne Defense Electronics.

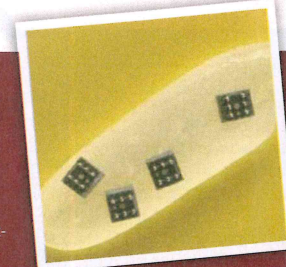
(Courtesy of Teledyne Defense Electronics)



**2005**

Agilent Technologies shipped its 100-millionth film-bulk-acoustic-resonator (FBAR) filter, just four years after it was developed in 2001, with a production rate of more than 6 million FBAR filters/month. The filters, measuring 1.6 x 2.0 mm, are used in cellular handsets and other mobile wireless devices.

(Courtesy of IEEE)



**1963**

Watkins-Johnson Co. (Palo Alto, CA) was one of several San Francisco Bay-area companies driven by U.S. DoD defense spending and the need for advanced microwave technology for defense-based systems. Started in 1957 with a goal to advance microwave EM technology, the company's founders were Dean Watkins (left), who had been a microwave engineering professor at Stanford University, and Dick Johnson (right), who had led the microwave laboratory at Hughes Aircraft Co. As part of its rapid early growth during the 1960s, the company acquired backward-wave-oscillator (BWO) developer Stewart Engineering Co. (Santa Cruz, CA) in 1963 and surveillance/reconnaissance systems supplier Communication Electronics, Inc. (Rockland, MD) in 1967. Watkins-Johnson Co. became well known for receiving systems such as the model WJ-566.



**1963**

Another two-partner Bay-area company that would play a major role in the growth of the RF/microwave industry, Hewlett-Packard Co. (Palo Alto, CA), introduced the first industry's frequency-synthesized microwave signal source. Bill Hewlett and Dave Packard started the company in 1939. The firm would contribute many significant test instruments, not only for microwaves but audio, analog, and digital electronics. For its 25th anniversary in 1964, the company launched the HP 5060A cesium atomic clock for precision time keeping and synchronization of instruments and systems.

(Courtesy of Hewlett-Packard Co.)



**1962**

One of the early RF/microwave component companies, Microwave Associates, was founded in 1950 in Boston, MA. The company formed to design and manufacture coaxial and waveguide components and assemblies, with one of the first products a magnetron for microwave radar systems. Microwave Associates would grow into a multinational public company later known as M/A-COM with its first IPO in 1957.

(Courtesy of www.Macom.com)



**2007**

Maxim Integrated Products, now part of Analog Devices, introduced the industry's first single-chip silicon-germanium (SiGe) BiCMOS transceiver for WiMAX. Now obsolete, the original model 2837 IC has been replaced by the company's model MAX2839 IC for MIMO applications from 2.3 to 2.7 GHz.

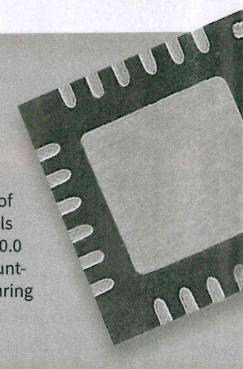
(Courtesy of Maxim Integrated Products, now part of Analog Devices)



**2008**

The model HMC613LC4B surface-mountable, successive-detection, log-video amplifier (SDLVA) from Hittite Microwave (now part of Analog Devices) set new levels of performance from 0.1 to 20.0 GHz in a 24-lead surface-mount-device (SMD) package measuring just 4 x 4 mm.

(Courtesy of M/A-COM)



The technology was put on display in Florida with the AN/FPS-85 phased-array radar, the first phased-array radar used for space surveillance.

(Courtesy of DoD)



**1968**

Harvey Kaylie founded Mini-Circuits in Brooklyn, NY, with the vision of providing high-performance, high-quality RF/microwave components for the lowest cost possible. Kaylie, a graduate of City College of New York (CCNY) who was aided by his wife Gloria and their two daughters in those early years, aggressively grew the company from a handful of basic RF components such as mixers and amplifiers to an expansive catalog of active and passive components that embraced the most practical technologies, including GaAs MMICs and LTCC filters. Kaylie passed away in mid-2018, leaving behind a company that remains a world leader in RF/microwave products.



(Courtesy of NASA)

**1969**

The decade ended with the successful landing of the Lunar Module spacecraft built by Northrop Grumman on the moon. This Apollo mission and many of the previous Apollo spacecraft relied on S-band antennas and transceiver circuitry for communications with NASA teams.