William D. Mensch, Jr.

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Summary   William D. Mensch, Jr. American electrical engineer, founder (1978) of The Western Design Center, Inc. (WDC) an Arizona, corporation, Chairman, CEO, CTO, and President of WDC.

Mr. Mensch, a recognized pioneer of the microprocessor and information technology industries, has twenty-two patents for microprocessors, microprocessor peripheral devices, microcontrollers, microcomputers, circuits, and microprocessor systems. Mr. Mensch was recognized in both 1991 and 1996 at the Microprocessor Forum as a pioneer in the microprocessor industry.

Although Mr. Mensch was an inventor of both Motorola's 6800 and MOS Technology's NMOS 6502 integrated circuit microprocessor families it is the 6502 technology that has been credited with creating the PC and video game industries. It was first used in the Commodore PET personal computer; VIC20 consumer computer; Commodore 64 consumer computer (6510); Acorn personal computer; Apple I personal computer; Apple II personal computer; Atari video game system (6507) and personal computer (6502); and Nintendo video game system.

Education   Associate degree in Electrical Engineering Technology (ASEET) from Temple University in Philadelphia (1966)

Electrical engineering courses at Villanova in Villanova, Pennsylvania (1967-1969)

Bachelors' degree in Electrical Engineering (BSEE) from The University of Arizona, Tucson (1971)

Graduate courses toward a Masters' degree in Electrical Engineering (MSEE)at Arizona State University, Tempe Arizona (1971-1979 no degree received)

Taught graduate classes on system-on-chip (SoC) within ASU's Polytechnic (1995-1999)

Employment Experience

1967 March to June at Polyphase, Inc., Bridgeport, Pennsylvania

Mr. Mensch worked as a laboratory test technician testing inductors, coils, and transformers. Polyphase was an industry leader in their area of expertise at that time.

1967-1969 Semiconductor Laboratory test technician

Mr. Mensch was employed by Philco-Ford's Advanced Semiconductor Laboratory in Blue Bell, Pennsylvania. Mr. Mensch worked on various projects including automotive solid-state alternators, single-chip radios, high-speed amplifiers, solid-state thermal coefficient measurements, and tested and corrected the design of an 8-bit United Aircraft jet engine control system. This controller used and was originally designed by AME using AME 1024-bit PMOS memories and small scale integrated circuit logic microprocessor-based controller. AME was acquired by Ford Motor Company which was the first company to commercialize the MOS technology.

1970-1971 Undergraduate Researcher for Fusion Nuclear Energy at The University of Arizona

Worked in nuclear physics for Dr. R.N. Carlisle simulating the Tokamak fusion nuclear physics research at The University of Arizona, Princeton and UCLA. The simulation was done in FORTRAN on the University's CDC6600 super computer. This work set the stage for my work in software engineering of simulators, microprocessors and personal computers.

1971-1974 Design engineer at Motorola, Phoenix, Arizona

Designed the flow chart, oscillator and sinewave generator for the 6860 low speed modem, first IC modem. Designed the first FORTRAN simulator of a triple diffused ECL process, MECL-N, created a FORTRAN spread sheet for Motorola's marketing department for quoting RAM memories for IBM, completed Motorola's first logic cells for PMOS, NMOS and CMOS Local Logic standard cell library. Designed the process control monitor for verifying the NMOS enhancement mode load and depletion mode load processes was as specified for manufacturing all of Motorola's NMOS microprocessor family of chips including the memory chips. Verified that the simulation parameters matched the M-TIME circuit simulator by taking and comparing the laboratory results to the simulator results. Mr. Mensch's first ten

(10) patents were used on Motorola's original NMOS 6800 microprocessor family, 6860 modem, 6800 microprocessor, 6820/21 Peripheral Interface Adapter (PIA), 6850 Asynchronous Communications Interface Adapter (ACIA), 6840 Programmable Timer Module (PTM).

1974 – 1977 Design engineer and manager of the Microprocessor Department at MOS Technology, Norristown, Pennsylvania

Mensch holds the patents on the decimal correct circuitry in the 6502 CPU, 6522 VIA used in the CBM VIC20 Consumer Computer, 6530 RRIOT used in the KIM-1 system, and 6532 RIOT used in the Atari 2600 game system.

Mr. Mensch, was the 6502 integrated circuit architect and was responsible for the basic circuit design, transistor sizing, instruction decode logic (wishing to minimize the number of levels of logic so as to achieve higher speed operation), oscillator design and buffer design.

1978 – Present, Western Digital Center (WDC), CEO.
The first major effort of Mensch and his team was the development of the WDC 65C02, an enhanced version of the NMOS 6502 microprocessor. The 65C02, in addition to being implemented in CMOS circuit technology that reduced power consumption and improved noise immunity, added some new instructions and corrected a number of defects that were present in the NMOS 6502. The 65C02 was subsequently adopted for use in the Apple IIc computer and, later, in an enhanced version of the Apple IIe. Mensch's next design, which was to become an important product at WDC, was a 65C02-compatible 16-bit microprocessor, the 65C816 (now designated the W65C816S). The 65C816's design came about following a consultation with Apple and was adopted by them for use in the Apple IIGS computer. The 65C816 was later chosen as the core of the processing unit that powered the popular Super Nintendo Entertainment System. Mensch developed the Mensch Computer as a means to promote the W65C816S microprocessor. It was a computer system designed around the WDC W65C265S microcontroller, which contains a W65C816S core. The Mensch Computer, which includes the Mensch Works software suite, was produced for a time by WDC and was geared toward hobbyist and educational applications.

Appointments	**1994 – 2006, College of Engineering Advisory Council** The University of Notre Dame (ND), Notre Dame, Indiana Chair of the Computer Science and Engineering (CSE) Review Committee at ND
	1995, Industrial Advisory Board Electronic Computer Technology Department in the College of Engineering and Applied Science at Arizona State University.
	1996, Industrial Advisory Board, for the newly created Center for Low Power Electronics (CLPE), of which WDC was a charter member.
	2004, Mr. Mensch was invited to be a charter member of two advisory boards for Temple University, Inaugural Board of Visitors of the College of Engineering (BoV) Inaugural President's Advisory Board (PAB)
Awards & Recognition	**1981,** First Microprocessor Intellectual Property (IP) Company, The Western Design Center, Inc.
	1991 and 1996, in the Microprocessor Forum, honored as one of ten (10) pioneers in the microprocessor industry.
	1996, honored for his outstanding contribution to the information technology industry at a ceremony during which the 6502 was recognized at COMDEX as the first of seven "defining" products in the twenty-five-year history of the microprocessor.
	1998, chosen to receive the Distinguished Alumni Leadership Award from Temple University.
	1998, received the Sigma Pi International Fraternity's Founders' Award - its highest individual award.
	2002, The Computer Museum of America (www.computer-museum.org/) inducted Mr. Mensch into its Hall of Fame.
	2004, the book *Leaders of the Information Age* identified Mr. Mensch as one of 250 individuals dating back to the 15th century who set the foundation of today's Information Technology industry.

2005, recognized by the University of Arizona's College of Engineering as the 2005 recipient of their Lifetime Achievement Award.

2006, member of the Industry Advisory Council for the College of Engineering at the University of Arizona.

2010, Mr. Mensch with his wife, Dianne, created The Bill and Dianne Mensch Foundation, Inc. (TMF) an Arizona 501(c)(3) not-for-profit corporation.

2014, Mr. Mensch's oral history was recorded at the Computer History Museum.

2017, IP Design Special Edition of Embedded Advisor magazine Mr. Mensch was named as one of Top 20 IP Design & Solutions provider.

Community Services

1994 - 2019, Mr. Mensch has established educational scholarships at Xavier College Preparatory in Phoenix, AZ, Pennridge High School in Perkasie, PA, Temple University in Philadelphia, PA, and The University of Notre Dame in South Bend, IN.

1994, established the Mensch Family Computer lab at Xavier College Preparatory

1996, established the WDC System-on-Chip (SoC) Lab at Temple University in Philadelphia

1997, established the WDC SoC Lab at Arizona State University Polytechnic

2017, TMF created The William D. (BILL) Mensch, Jr Best Use of Embedded Intelligence Innovation Award Endowment Fund in The University of Arizona Foundation for the Mensch Award.

2019, Endowed Mensch Innovation Award at The University of Arizona College of Engineering given on Design Day.

Current or Former Memberships

1) Tau Alpha Pi Technology Honor Society
2) Tau Beta Pi Engineering Honor Society
3) Phi Kappa Phi Honor Society
4) Sigma Pi International Social Fraternity
5) Baden Guild–University of Notre Dame

6) Sorin Society–University of Notre Dame
7) Da Vinci Circle–University of Arizona
8) Conwell Society–Temple University
9) Contributing Member of The Newcomen Society of the United States
10) Senior and Life Member of IEEE.

Patents

1) **U.S. Patent Number 6,052,792** Power management and program execution location management system for CMOS microcomputer.
2) **U.S. Patent Number 5,737,613** Method of operating microcomputer to minimize power dissipation while accessing slow memory.
3) **U.S. Patent Number 5,511,209** Programmable microcomputer oscillator circuitry with synchronized fast and slow clock output signal.
4) **U.S. Patent Number 5,438,681** Topography for CMOS microcomputer.
5) **U.S. Patent Number 5,212,800** Method and apparatus for sensing trinary logic states in a microcomputer using bus holding circuits.
6) **U.S. Patent Number 5,123,107** Topography of CMOS microcomputer integrated circuit chip including core processor and memory, priority, and I/O interface circuitry coupled thereto.
7) **U.S. Patent Number 5,097,413** Abort circuitry for microprocessor.
8) **U.S. Patent Number 4,876,639** Method and circuitry for causing the sixteen-bit microprocessor to execute eight-bit op codes to produce either internal sixteen-bit operation or internal eight-bit operation in accordance with an emulation bit.
9) **U.S. Patent Number 4,800,487** Topography of integrated circuit including a microprocessor U.S. Patent Number 4,739,475 Topography for sixteen bit CMOS microprocessor with eight-bit emulation and abort capability.
10) **U.S. Patent Number 4,739,475** Topography for sixteen bit CMOS microprocessor with eight-bit emulation and abort capability
11) **U.S. Patent Number 4,652,992** Topography of integrated circuit CMOS microprocessor chip.

12) **U.S. Patent Number 4,263,650** Digital data processing system with interface adaptor having programmable monitorable control register therein.
13) **U.S. Patent Number 4,218,740** Interface adaptor architecture.
14) **U.S. Patent Number 4,145,751** Data direction register for interface adaptor chip.
15) **U.S. Patent Number 4,099,232** Interval timer arrangement in a microprocessor system.
16) **U.S. Patent Number 4,087,855** Valid memory address enable system for a microprocessor system.
17) **U.S. Patent Number 4,086,627** Interrupt system for microprocessor system.
18) **U.S. Patent Number 4,020,472** Master slave registers for interface adaptor.
19) **U.S. Patent Number 3,991,307** Integrated circuit microprocessor with parallel binary adder having on-the-fly correction to provide decimal results.
20) **U.S. Patent Number 3,968,478** Chip topography for MOS interface circuit.
21) **U.S. Patent Number 3,942,037** MOS edge sensing circuit.
22) **U.S. Patent Number 3,906,255** MOS current limiting output circuit.