

IT Legacy Displays

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Introduction

An Objective of the VIP Club Information Technology (IT) Legacy Committee is to tell the untold story, i.e. let the public know that an important part of computer history began with **Engineering Research Associates (ERA)** in 1946 and continues yet today in Minnesota. During the fall of 2011, a Legacy Committee informational display was setup at four venues as described here.

50th Annual Seminar of the Twin Cities Chapter of the National Contract Management Association

Sept. 14th & 15th, 2011

This event was held at the Earle Brown Center, University of Minnesota St. Paul Campus. Our participation was requested by the Lockheed Martin (LMCO) representative of the Association. There were approximately 120 industry and government attendees. 3M, BAE, and ATK had product displays. Lowell Benson setup and supported the display on Wednesday. Harvey Taipale supported the display and wrapped it up on Thursday.

University of Minnesota Computer Science and Electrical Engineering Forum

October 14th, 2011

This event was held in the Keller Building on the University of Minnesota's Minneapolis campus. Lowell Benson setup and supported the display. There were two dozen student project displays and a dozen company displays at this forum. Tom Turba and Lowell had supported the previous forum in 2009.

Unihogs/Uniturkeys Annual Gathering

November 18, 2011

This event was held in the Lost Spur Banquet room in Eagan, Minnesota. The display was setup by event committee member, Lowell Benson. Forty-two retirees had lunch, heard the traditional roll call of the year's deceased, then listened as John Westergren reviewed the status of the LMCO plant closure. Mr. Westergren's slides are available as the November 'Article for the Month' on the VIP Club's website, <http://vipclubmn.org/Documents/FocusontheFuture.pdf>.

Old Timer's Annual Gathering

December 1, 2011

This event was held at the Ft. Snelling Officers' Club. The display was setup by event coordinator, Lowell Benson. The event was attended by 249 retired UNIVACers and a few current LMCO employees.

Display Description

The theme at all four venues was the 65 year history which continues today with minor focus on relationships with the University of Minnesota. Some of the charts and display data had been used during the 2008 Minnesota Sesquicentennial and the 2010 U of MN Walter Library displays. The primary display board is shown here, followed by the text of the posters attached thereon.



Text of Display Board 'Posters'

Underneath the top left ERA sign is an explanation of the Minnesota's Technology Wellspring poster.

Left Side Posters**POSTER EXPLANATIONS (Middle top) ⇒**

This poster on the right was created for the Minnesota Sesquicentennial to illustrate the 60⁺ year Information Technology Legacy which began with Engineering Research Associates (ERA) in 1946.

- The time line across the chart's middle shows the corporate names beginning with ERA. Of note is **1986** when Burroughs bought Sperry to form **UNited Information SYStems**. UNISYS then sold their Eagan based defense operations to Loral in **1995** who in turn sold to Lockheed Martin in **1996**. UNISYS in Roseville continues to provide commercial industry systems and services.
- On the poster's left are the four Engineering Research Associates 'founding officers' – the **1946** early employees are listed across the top left.
- At the top right is a listing of spinoff companies, the most significant of which was in **1957 when** one of the founding officers, William 'Bill' Norris formed Control Data Corporation.
- Above the time line are some of the significant milestones, i.e. the **1958** delivery of the University's first computer and a listing of many of the spinoff companies.

The chart's lower half illustrates just a few of the computer systems developed in St. Paul.

The left bottom poster is:

U of MN and the ERA IT Legacy (1)

- **Since 1946:** Thousands of University graduates have worked for ERA, Remington Rand UNIVAC, Sperry UNIVAC, Sperry, Burroughs, **UNISYS**, Loral, and **Lockheed Martin**.
- **1958:** Remington Rand Univac donated an 1103 computer to the University, the beginning of the Computer Science Program in Electrical Engineering under Dr. Marvin Stein.
- **1977:** Former ERA engineer/manager Erwin Tomash and wife Adelle founded the International Charles Babbage Society, renamed the Charles Babbage Institute (CBI) in **1979**, and then moved it to the University of Minnesota in **1980**.
- **1989:** With support from industry and individuals, the University established the '*Engineering Research Associates Land-Grant Chair in the History of Technology*', initially held by CBI Director Arthur Norberg. Under Dr. Norberg's leadership, CBI developed into the world's leading research center for the history of information technology.
- **~2005:** A University '*Wall of Discovery*' display item is the Remington-Rand UNIVAC Nike-Zeus missile launch computer block diagram credited to Mr. Rolland Arndt, a 1948 U of MN BEE graduate hired by ERA in 1952.
- **2006:** CBI Director Norberg retired - Dr. Tom Misa was hired as his replacement, now holds the ERA Land-Grant Chair. Dr. Misa is also an advisor to our VIP Club Legacy Committee.
- **September 2008 through May 2009:** A lecture series "*Minnesota's Hidden History of Computing*" presented by Dr. Misa of the Charles Babbage Institute, started with ERA.
- **January 2009:** VIP Club representatives put documents reflecting the University relationship to the ERA Legacy into Minnesota's bicentennial time capsule for a 2058 event!
- **January 2010:** Univ. & VIP Club signed a display contract for the Walter Library.

Middle bottom three posters are:

65 Years of Defense Industry Contracts



1946 - Technology Study Contract – ERA developed a Magnetic Drum Memory, the world’s first computer ‘Hard Drive!’ (*This experimental model is now on display at the Minnesota Historical Society.*)



March 2, 2011 Delivered S/N 8000 AN/USQ-70 Dual Display and Processor - Today’s Naval Tactical Data System standard hardware. (*This unit will be installed aboard the USS Minnesota (SSN-783), a new Virginia Class attack submarine.*)



Government Contract Milestones (two 8 ½ x 14 posters)

1947: ERA delivered the Goldberg I with a drum memory for a U.S. Navy crypto-analytic system. Goldberg I and II were developed for the Navy, for classified purposes. They are historically significant as the first magnetic drum was built for use with the Goldberg I analytical processor. This drum memory was the [world's first delivered, operational hard drive](#).

1948: Delivered the Demon I and II 'Analytic Machines' to be used for cryptography work by the U.S. Government. These 24-bit machines were programmed with plug boards while using the drums for data storage and manipulation.

1950: Shipped the Atlas computer to CIA's predecessor in October 1950. This computer is believed to be the world's first stored program computer operational at a customer's site. The site and application were classified until 1977 thus didn't appear in any early computer technology books.

1953: Completed the UNIVAC Flight Plan Storage System for automatically accepting, storing, and delivering flight plans and weather information for the FAA predecessor, the Civil Aviation Authority.

1955: US Navy, Bureau of Ships Contracts with Remington Rand UNIVAC for the Naval Tactical Data System (NTDS) computers, peripherals, software, and systems integration.

1957: Delivered the **Bomarc** Guidance Computer for the USAF anti-missile system.

1958: Delivered the first Naval Tactical Data System (NTDS) USQ-17 computer to counter the power of a growing airborne threat to the U.S. fleet. This system included advanced digital techniques.

1959: Delivered the first Athena rocket launch computer to the USAF. This hardware and UNIVAC developed software is credited with over 300 successful launches from the Cape and Van den Berg Air Force Base.

1960: Delivered the **Target Intercept Computer** for the Nike Zeus anti-missile system.

1961: AN/USQ-20 computer installed in the USS BAYA (AGSS-318). This was the first installation of a USQ-20 NTDS computer aboard a US Submarine.

1962: First operational 'Hands Off - arrested carrier landing using the AN/SPN-42 system with the UNIVAC 1218 computer.

1963: Delivered the first of 239 NTDS standard computers (CP-642B (1212))
Delivered the first of 326 1218 computers (CP-789) for shipboard as well as the ATC ARTS I systems.
Delivered the ADD 1020 (CP-754/A) to the Navy as the first airborne Anti-Submarine Warfare (ASW) computer.

1964: Delivered the first 1824 missile borne solid state guidance computer.
Delivered the first CP-667 ruggedized 36-bit shipboard computer.
Delivered the first CP-808, for the Marine Tactical Data System.

1965: Delivered the first of 39 real-time computer systems (CP-855/UYK(1230)) for the NASA global tracking and data acquisition network used in Project Apollo.
Delivered the first of 367 shipboard missile launch computers (CP-848/UYK (1219B))
Delivered the CP-823/U (1830) to NADC to begin ASW software development.

1967: Delivered the first CP-901 (1830A) in September for the P3-C ASW data system. Two decades later, the Tom Clancy book and movie, "Hunt for Red October" showed a P3-C dropping sono-buoys to track the 'Red October'.
Delivered the first of many 1230 Expanded Memory Units to NASA.
Delivered the first of 19 CP-808/TYK (1213) computers to the Marine Tactical Data System.

1968: Delivered the first of 164 CP-890/UYK computers to Sperry Systems Management for submarine applications.
Delivered the first of 17 1230 MTC computers to the USAF for tracking 'space' junk.

1969: Delivered the first UNIVAC AN/UYK-7, the standard computer for United States Navy Command and Control as well as a couple of cooperating NATO Navies.

1970: First defense contractor to become a node on the emerging ARPAnet, the predecessor to the internet. Other nodes at the time were government research laboratories and University laboratories.
Delivered computers used for a photo enhancement system in the Mariner 9 Mars space program.

1971: Delivered the Minuteman Weapons Systems computer, the AN/UYK-11, to the Air Force.
Delivered the UNIVAC Air Traffic Control System (ARTS III) used to provide new air traffic control safety at the 64 major U.S. airports.

1972: Delivered the first production unit of the UNIVAC 1832 computer for the S3-A carrier based anti-submarine warfare jet plane. We also did the systems programming for this mission computer at our Valencia facility.

Delivered the first AN/UYK-15 computer to ITT Gilfillan for a US Navy submarine application.

1973: Completed MIL-E-5400 testing then delivered the first of 93 AN/UYK-23 (1816) computers to several customers, Army Security Agency and NASA.

1974: Delivered the first UNIVAC AN/UYK-20, the U.S. Navy standard small to medium scale computer for tactical operations.

1975: Developed the Communication and Display subsystem (CADS), a dual-screen, high-performance display for intelligence applications.

1976: Developed the world's first point-to-point fiber optic digital interconnect system.

1978: Delivered the 100th Minuteman III Weapons System Controller, the 500th AN/UYK-7 Computer, and the 1,000th AN/UYK-20 Computer.

1979: Delivered the AN/UYK-502 computer to the Canadian Navy.

Delivered the AN/AYK-15A (1625) to the Air Force Avionics Laboratory. This jet fighter environment ready airborne computer was one of the first to implement the AF's new MIL-STD-1750 Instruction Set Architecture (ISA).

1980: Selected to design, develop, and manufacture the AN/UYK-43 computer under a three year contract with the United States Navy. The AN/UYK-43 became the Navy's next generation standard large-scale computer, while using the same ISA as the previous AN/UYK-7 and AN/AYK-10 computers.

Chosen to design and develop the AN/UYK-44 computer under a three year contract with the United States Navy. The AN/UYK-44 became the Navy's next generation standard small to medium scale computer using the same ISA as the AN/UYK-20 computer.

Delivered the SPERRY UNIVAC 1655 Dual/Single Screen Color Terminal to bunker Ramo for the Air Force Advanced Electronic Warfare Evaluation and Display System (AEWEDS) Program.

1981: Delivered the first militarized production fiber optic system used with the Ground Launch Cruise Missile system.

1982: Delivered the 2,000th AN/UYK-20 computer

1984: Delivered an AN/AYK-10 upgrade giving the S3-B ASW aircraft the capability to launch Harpoon missiles at ship or shore targets.

1986: Delivered the first mission computer for the Northrop B-2 stealth bomber.

1987: Delivered a radiation hardened CMOS 32-bit microprocessor chip set to the CIA as part of their SDI programs.

1990: Delivered 'Common Module' card sets for embedding into the YF-23 stealth aircraft as part of the Northrop development. Lockheed Martin won the fly-off in 1991 with their YF-22.

1991: Delivered the first **AirBorne Combat Communications Center (ABCCC)** just in time for deployment during the 1st Iraqi war.

Right Side Posters

The right top poster is:

The VIP Club is a non-profit, social and services organization. **Members** are retirees from UNISYS, Lockheed Martin, and heritage companies. **Club Associates*** are former employees not yet retired.

Goals:

- The CLUB shall provide an opportunity for social interaction of its members.
- The CLUB shall provide services and information appropriate to the interest of its members.
- The CLUB shall provide a mechanism for member services to the community.
- The CLUB shall provide a forum for information on the heritage and on-going action of the sponsoring business entities and their predecessors.

Dues are \$7 for one year or \$18 for 3 years.

*See a Club Officer for definition.

The right middle poster is:

CLUB MILESTONES

- 1980 – Chartered as Sperry Retirees Club with a meeting room in the Shepherd Road Plant
- 1984 – Registered with IRS as a 501(c7) non-profit organization.
- 1987 – Continued as a retirees Club after Burroughs bought Sperry to form **United Information SYStems** (UNISYS)
- 2000 – Lockheed Martin became a Club co-sponsor with UNISYS
- 2005 – Formed a Legacy Committee to tell the untold 'ERA' story
- 2007 – Began an integrated Club and Legacy web site
- 2008 – Displayed the ERA Legacy in a booth at the Sesquicentennial Celebration on the Capitol Grounds and at the MN State Fair
- 2010 – A Pioneer Press Legacy Article in January and a 30-year celebration in October.
- 2011 – Began phase out of Lockheed Martin sponsorship

The right bottom poster is:

Legacy Committee

Objective: Tell the 65-year story about Information Technology (IT) developments which began at ERA – continued by UNISYS Twin Cities heritage companies.

- Almost 200 people have contributed career summaries and/or project stories for our web site.
- About 450 hardware artifacts catalogued, awaiting museums.
- 1,200+ documents catalogued, some already at CBI.
- Over 6,000 photos yet to be catalogued.
- Web site, <http://vipclubmn.org> is the story documented to date – Legacy Project company People Engineered Computers and Systems in Facilities.

Adjunct Materials

Models

Immediately in front of the display board is a set of Naval Tactical Data Systems computer models. The accompanying information sheet is on this table adjacent to the models.



Mil Type	AN/USQ17	CP-642A	CP-642B	CP-667	CP-789	CP-808	CP-848	CP-855	CP-890	AN/UYK-7
1st delivery	Spring 1958	Sept 1961	Feb 1963	2/20/1964	4/1/1963	9/14/1964	5/25/1965	7/30/1965	6/7/1967	April 1969
Customer	BUSHIPS	BUSHIPS	BUSHIPS	NEL	Navy	USMC	BTL	NASA	USN-SSM	NAVSHIP
Total Built	6	143	239	3	326	19	367	120	164	1000+
UNIVAC	M460	1206	1212		1218	1213	1219B	1230	1289	3250

Nick Name	Q-17	NTDS	20B			MTDS	Talos		C3	
Specification		DS4601	DS 4654			DS 4781	DS 4769	DS 4836		
Weight/ Lbs	2200	2320	2400	2010	950	1750	1200	2100	750	various
Vol/Ft³	54	54	54	62	32	54	33	60	21.1	
Power/W	2500	2000	2500	4200	1500	3500	2000	3500	2150	various
Module Size			1.5x 2.5"	1.5"x 2.5"	1.5x 2.5"	1.5x 2.5"	1.5x 2.5"	1.5x 2.5"	3.3x 3.5"	3.3x 3.5"
Memory Speed	8 usec	8 usec	4 usec	2 usec	4 usec	4 usec	2 usec	2 usec	1.8 usec	1.5 usec
Memory Size	16k	32k	32k	131k	16k	32k	32k	32k	64k	48k+
Word Length	30	30	30	36/ 30	18	30	18	30	30	32

Books on Display

Just in front of the display is the book: *When Computers Went to Sea* by David L. Boslaugh and a sheet relating the book to the Navy, UNIVAC, and University of Minnesota.

- Author Capt. David L. Boslaugh, US Navy ret., has a U of MN aeronautical engineering degree from the mid 50's.
- Cdr. Irvin McNally is credited with the NTDS system concepts, is the person mentioned most often in the book, and is a U of MN engineering graduate, BEE, 1931.
- The Navy was the Prime Contractor for NTDS, UNIVAC was contracted for computers and software, Hughes Aircraft was contracted for the Display subsystems, and Collins Radio was contracted for the communications.
- Top of page 255: "Hell, it don't hardly ever fail, sir!" is indicative of the ERA to LMCO reputation of designing and building reliability into their products.

On the second table were books accompanied by some descriptive 'charts'.

1. *A few good men from UNIVAC* by David Lundstrom plus a spin off chart.

"A Few Good Men from UNIVAC"


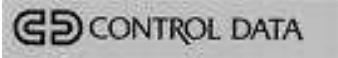

David E. Lundstrom

- 1951 – BEE from U of MN
- 1951 – '55, U.S. Navy
- 1955 – '63, UNIVAC
- 1963 – '85, Control Data Corporation
- 1987 – Book published by MIT Press, Cambridge, MA
- 1997 – re-published by Replica Press, Bridgewater, NJ

David continues to keep in touch with his former work colleagues at the Unihogs annual luncheon.

Established in 1980

The spin-off chart is:

	ERA Spinoff Organizations	YEAR	CDC spinoffs
	Ramsey Engineering	1953	n/a
	General Kinetics	1955	n/a
	Northport Engineering	1956	n/a
	Midwest Circuits Inc. (later became Fabri-tek), Transistor Electronics Corp, and Control Data Corporation	1957	
	Data Display (later acquired by CDC)	1958	
	General Magnetics Inc.	1959	Flame Industries
	National Connector Corporation (with people from Magnetic Controls), Flortronics Inc, Nuclear Data, Whitehall Electronics (later acquired by Electro-Science Investors), Electro-Med Inc. (also acquired by Elector-Science Investors)	1960	
	Data Management Inc., Theradyne Corporation, Minneapolis Scientific Controls Corporation	1961	
	Aries Corporation, Tron-chemics Research Inc.	1962	
	Wiesmantel and Associates	1965	
	Analysts International- grew out of Aries Corporation (see1962).	1966	Computer Systems Inc. Computer Communications
		1967	Data Action (NCS)
	Atron (acquired by Mohawk Data Services), Comcet (became NCR-Comten), Comserv	1968	Astrocom, Data100 (became Northern Telecom in 1979)
	United Software, Dicomed	1969	The Analyst, Data Central, Techanalysis, Data Card
	Community Electronics	1970	
		1971	Midwest Data Systems
		1972	Datagraph, Cray Research, 

	1974	Network Systems
	1979	Shugart – became Seagate
	1983	ETA, Edge Computer
Printware, Inc.	1985	
Info Pet	1991	
Product Development Association	1994	

2. *A History of the Department of Electrical & Computer Engineering 1888-2008.*

- Pages 182-83 summarize the ERA early years including some U of MN graduates:
 - Arnie Hendrickson; BEE, 1922
 - Frank Mullaney; BEE, 1943
 - Bill Keye; BEE, 1943
 - Bob Perkins; BEE, 1949
 - Arnold Cohen; BEE, 1935 – MS Physics, 1938 – Phd Physics, 1947
- Pages 188-91 summarize the spinoff of Control Data and Cray Corporation(s) mentioning: James Thorton; BSEE, 1950 and Seymour Cray; BEE 1949 – MS, 1951
- Page 221 – Dr. Richard Halverson consulted at UNIVAC between professorial appointments.

3. *St. Paul Pioneer Press, January 3rd 2010 “The almost Silicon Valley”* – accompanied with this chart:

VIP CLUB Retirees of UNISYS and Lockheed Martin
<http://vipclubmn.org>

“The almost Silicon Valley”

VIP Club Legacy Committee co-chair, John Westergren, read an Armour Company ‘history article’ in the Pioneer Press the summer of 2009. Mr. Westergren called the author, Tom Webb, to suggest that Engineering Research Associates (ERA) could be a good topic for an article.

In December 2009, Mr. Webb researched the ERA topic at the Charles Babbage Institute then interviewed several VIP Club members to develop this January 3, 2010 article.

Established in 1980

4. *High-Speed computing Devices* published in May, 1950 by direction of the Office of Naval Research (ONR) – authored by ERA staff under an ONR contract task 1. Subsequently re-printed by the Charles Babbage Institute as part of their reprint series

- Page 208 refers to an ERA “Parallel Binary Computer with Magnetic Drum Storage” without specifically identifying a model, type or name.
- Page 214-215 has a table of twenty “Large-Scale Digital Computing Machine Projects in the US” listing the Gov’t contracting agency. {circa - late 1949 or early 1950}
- *This book does not list any **ERA** machines which we now know were being developed at that time under classified contracts.*

5. *Product Book – 1947 – ‘59*

- Classified Applications (mostly Navy Contracts): Atlas I & II; Buships Computer; Demon I, II, & III; Goldberg I & II; Hecate I & II; O’Malley; Robin I & II; Warlock I & II; Analog Recorder; Comparator-Predictor; Dual channel De-multiplexor; Frequency Shift Discriminator; Firing Error Indicator; Recognition Unit; Wind Drift Indicator.
- Civil Aeronautic Authority (FAA predecessor): Flight Plan Storage; UNIVAC File Computer
- Air Force contracts: Airborne Computer; Athena – Titan Launch Computer; Type 1102 for wind tunnel and engine test; Type 1104 for Bomarc anti-missile launch (G-40); Mobile computer; Tactical Air Control; Transportable Computer.
- US Core of Engineers: Bore Hole Camera & Projector.

Author

Lowell A. Benson is a 1966 BEE graduate from the University of Minnesota. He worked at UNISYS and predecessor companies from 1960 to 1994. Lowell began his technology career as a drawing control clerk in the Antenna Coupler Department and left as a Senior Systems Engineer from the Air Traffic Control Department. He then joined the University of Minnesota’s Center for Transportation Studies to develop and manage an Intelligent Transportation Systems research laboratory. Lowell has been a VIP Club board member since 2006 serving as a Director, Treasurer, Vice President, and President. He has been the Club’s Legacy Committee co-chair since 2006 and webmaster since 2007.

Thanks to the entire Legacy Committee who gathered the materials referenced while I developed the display poster text. And thanks to Lockheed Martin for printing the large poster items, Quint Heckert was the principal creator of the main history poster.