Enduring Legacies; 80, 40, 20!

People innovating solutions to customer problems with world-wide results!

INTRODUCTION

Our legacy was and is the people, mostly working in teams with team leaders given credit for their successes. The unsung heroes of each success story were the spouses and families who tolerated employees' long working hours, erratic short notice travel calls, and out-of-town work assignments. A few people may recall the 'Energizer Bunny' ads that "*keeps going and going and going…*" Our employees were like that. OR you may recall the Timex ads "*took a licking and kept on ticking*." Our products and systems were like that!

Legacy company names kept changing as business ownerships merged and diverged. This paper is Wikipedia-like in that we've included links to supplemental writings.

Contents

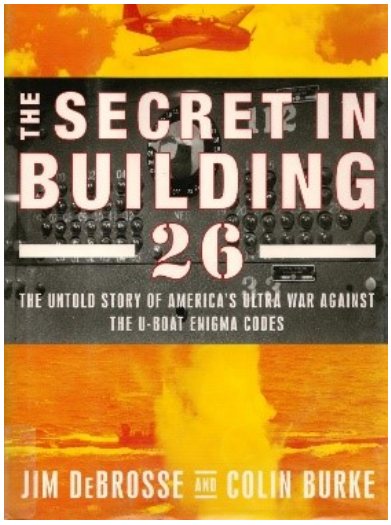
Created and edited with Microsoft 365 Word software.

1946, 80-yrs ago ERA Opened Their St. Paul Doors

The WWII years

The Engineering Research Associates (ERA) founding has been documented by several researchers analyzing information from Minnesota, Ohio, and Washington DC.

- John M. Lindley authored "Born of a Wartime Necessity". *From Combat Gliders to Computers in Minnesota, 1941-1946*. This manuscript was submitted under Grant Number 1510-07526 of the Minnesota Historical Society's Historical and Cultural Heritage Grants Program. It provides the history of Northwestern Aeronautical Corporation (NAC) and its post war transformation into Engineering Research Associates (ERA). The focus of this book is on the human side of those involved with building the gliders at Northwestern Aeronautical Corporation. NAC was the 2nd largest WWII glider manufacturer, https://www.vipclubmn.org/Documents/Born%20of%20a%20Wartime%20Necessity.Complete%20Ms.Revised.11.14.16.pdf.
- Jim DeBrosse and Colin Burke authored "The Secret in Building 26," The untold story of America's ultra war against the U-boat enigma codes. This book relates the WWII activities of William 'Bill' Norris, Ralph Meader, and Howard Engstrom who were three of the four founders of ERA. The main facility at that time was the Naval Computing Machinery Laboratory (NCML) located in Dayton, OH at a National Cash Register (NCR) plant.



- Declassified by NSA (National Security Agency) 11-13-2013, author William Friedman in 1954 – "*Machines in the service of Cryptanalysis*" This discusses several ERA machines and IBM equipment, i.e. "Very few of us know as a matter of personal experience that in 1932 the Navy Security Group began using standard IBM accounting machines. Two years later the Army obtained similar machines to assist in the arduous task of preparing code books, https://www.vipclubmn.org/LegacyDocImg/NsaA66701.pdf.
- Found in the archives of the U of MN's Charles Babbage Institute, William 'Bill' Norris, WWII Experiences: https://www.vipclubmn.org/Articles/Norris2.pdf.

In a nutshell, as WWII was winding down the Navy wanted to continue building equipment for cryptanalysis but IBM, Kodak, NCR, et' al were not interested in low-profit endeavors. Mr. John Parker, President of NAC, headed a St. Paul MN WWII glider factory that had no new orders. Ergo, the Navy need and an available office, factory space, and a financier resulted in a new company! [1902 Minnehaha Ave. in St. Paul, MN]

Engineering Research Associates: 1946-52

Electronics Firm Formed in St. Paul

Establishment in St. Paul of a corporation to serve as a consulting and research organization in electronics and related fields for the army, navy and industrial firms, was announced today.

The new concern, Engineering Research Associates, Inc., expected to employ about 1,000, will be located in the plant of Northwestern Aeronautical Corp., 1902 W. Minnehaha avenue.

John E. Parker, president of the latter firm, was elected president of the new organization, which is to operate separately from Northwestern Aeronautical Corp.

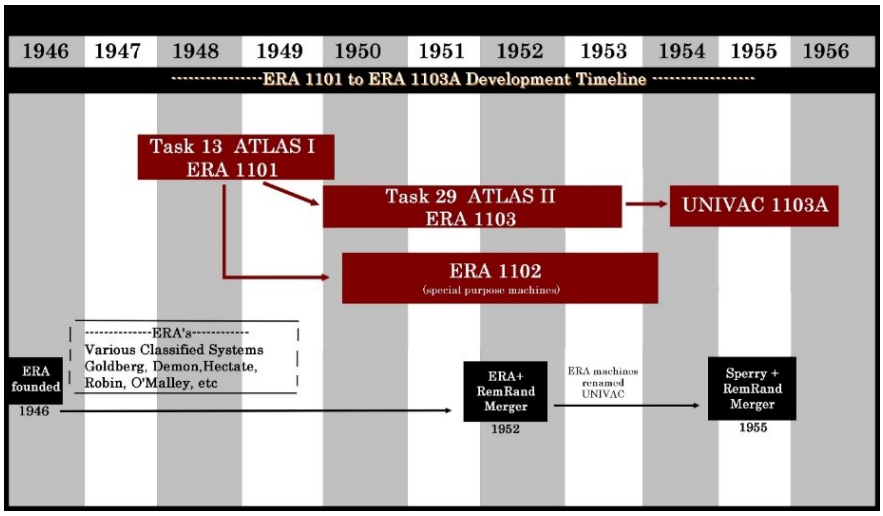
About 40 scientists who worked as a navy technical team during the war will be associated with the new concern under present plans, Parker revealed.

Directors of the new firm, in addition to Parker, are Nelson S. Talbott, Dayton; R. C. Lilly, chairman of the board of First National bank, and E. W. Dichman, both of St. Paul.

Certain naval officers are expected to be made directors after their discharge from service.

About 40 NCML scientists moved from Dayton, OH to St. Paul. [clipped from the April 1946 Star Journal] Several NAC employees continued as NAC management in St. Paul accepted 'Navy' contracts on behalf of ERA until ERA became qualified to accept and work on government contracts. Task 1 from Office of Naval Research (ONR) contract N6-ONR-240, called for "an investigation and report on the status of development of computing machine components." This included analysis of the two principal all-electronic machines then in operation, the Harvard Mark III and the ENIAC that had been sponsored by the Navy Bureau of Ordnance and the Army Ordnance Department. The ONR later authorized publishing the report; no mention therein of the magnetic drum work nor machines under development at ERA.

NSA Report 6586785, declassified on 07-19-2017: "In 1950 the Navy and industry working together produced the first real general-purpose computer for the government. Built by Electronic Research Associates, a company headed by Howard Engstrom, who himself had worked on the Navy Bombe during the war, it was called ATLAS. This machine cost nearly $1 million, used 2,700 vacuum tubes, and relied on drum memory technology. One of ATLAS's greatest assignments was to attack iso-logs in messages codenamed VENONA, intercepts of Soviet espionage communications during the height of World War II." https://www.vipclubmn.org/LegacyDocImg/Nsa%206586785-nsa-key-role-in-major-developments-in-computer-science.pdf. The report also discusses ERA's NOMAD, BOGART, and Howard Engstrom. It mentions UNIVAC 490, and 1108s plus CDC and Cray equipment.



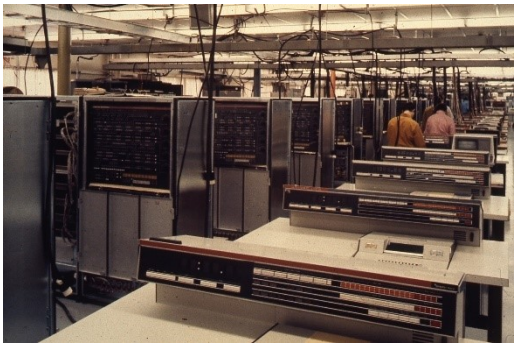
1. Timeline provided by CHAP (Computer History Archives Project), Director Mark Greenia.

Mr. Greenia's chart illustrates the first three of the 1100 series of computers. ERA shipped an ATLAS computer via railcar to Washington, D.C. in October 1950. On December 12th CSAW began decrypting operations; ссср ничево не знали, слава Божу! "It's my belief that the ATLAS I was the first American stored-program electronic computer to be delivered - delivered in finished, working condition." wrote Dr. Arnold Cohen.

Titled ERA 1101 for commercial sales, existence of the ATLAS application was classified into the late 60s. This was the beginning of the 1100 family of commercial computers. ATLAS II [also classified] was the technology base for the ERA 1103 and 1103A. Most of the system deliveries included peripherals and some executive software packages.

System	1st unit	Last	qty		System	1st unit	Last	qty
1101	1950	1953	3		1100/10/ 20/30	1975	1980	359
1102	1952	1955	3		1100/60	1979	1988	2863
1103	1953	1956	11		1100/70	1982	1987	77
1103A	1956	1959	19		1100/80	1976	1985	1121
1104	1954	1959	10		1100/90	1983	1990	1318
1105	1957	1960	10		1100/90Dyad	1987	1988	28
1106	1969	1976	338		1100/70 Dyad	1987	1988	28
1107	1962	1965	38					
1108	1965	1975	303		System 11	1984	1988	603
1110 /40	1972	1979	455		2200/200	1986	1990	966

Enduring Legacy #1: After 1987 the 1100 series continued as the Unisys 2200 series into the 21st century, many systems yet in operation in 2026 – a 75-year commercial computer line! This table represent the 10s of thousands of current and former employees who innovated, designed, built, programmed, and supported these computer systems not only in Minnesota but throughout the world. For example, Roseville management and engineers led some 1100 series systems manufacturing in Rödelheim Germany beginning in the 70s.



Pictured here is the Roseville 1108 systems' test room.

Remington Rand UNIVAC: 1952-56

During the Korean Conflict the U.S. Navy realized that their 'Grease Pencil' markings on situation-boards in the fleet operations center(s) were inadequate for tracking jets, shooting at incoming missiles, etc. Published in 1987: *When Computers Went to Sea - The Digitization of the United States Navy* – principal author Capt. David L. Boslaugh. Chapter 3 therein describes the Naval Tactical Data Systems (NTDS) requirements issued in 1955.

Commanders Edward Svendsen and Irvin McNally then lead a dedicated project office to effect NTDS, including research and development, production procurement, shipboard installation, lifetime maintenance and system improvement.

Principal contractors starting in the mid-50s were Univac Division of Sperry Rand Corporation (processors, tape units, consoles, and software), Collins Radio Company (communications), and Hughes Aircraft Company (displays). https://ethw.org/First-Hand:McNally%27s_Challenge,_Conceptualizing_the_Naval_Tactical_Data_System_-_Chapter_3_of_the_Story_of_the_Naval_Tactical_Data_System.

Enduring Legacy #2: The NTDS specification required use of emerging transistor technology. In the mid-50's a transistor circuit specialist was a 1951 U of MN engineer, Seymour Cray, who created some of the circuits for the AN/USQ-17 and AN/USQ-20 NTDS computers. First-shipboard machines were delivered to the Navy in the spring of 1958.

Figure 2. Models of NTDS 1st and & 2nd generation computers at the Lawshe Memorial Museum – scale 1" = 1 ft. AN/USQ-17, CP-642A, CP-642B, CP-667, CP-789, CP-808, CP-848, CP-890, and AN/UYK-7. Germanium transistor machines were the Q-17, CP-642A, and CP-789. Silicon transistor machines were the CP-642B, CP-808, and CP-848. 2nd generation CP-890 and UYK-7 used integrated circuit technology. The1962 CP-667 used a combination of silicon transistors and integrated circuits.

In 2008 an NTDS UYK-43 third-generation computer is credited with the destruction of a failing satellite by the Aegis cruiser, USS Lake Erie. The UYK-43 computer is the central processor for the Aegis combat system which allowed a SM-2 missile to have a direct/physical impact with the 17,000-mile-per-hour failing satellite — a bullet hitting another bullet, https://vipclubmn.org/Articles/UYK-43development.pdf.

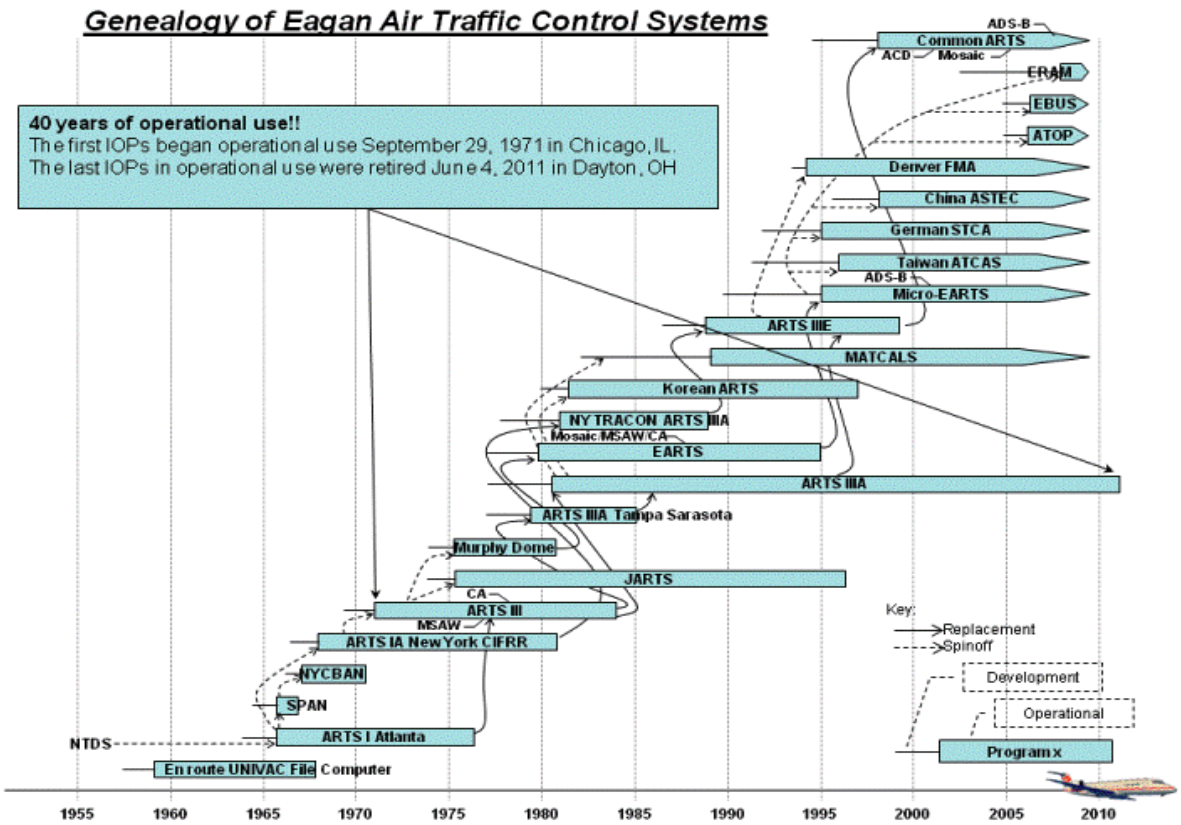
In 1994 Unisys/Loral/Lockheed Martin was awarded the contract for the fourth-generation NTDS standard, the AN/UYQ-70, https://www.vipclubmn.org/cpothers.html#Q69-70.

In September 2013 when the Navy commissioned a submarine the USS Minnesota, **SSN 783**, it included a dual screen Q-70, Serial Number 8,000. The Q-70s were also aboard the USS Minneapolis-St. Paul, **LCS-21** on May 21, 2022, when it was commissioned in Duluth, MN. UYK-43 computers are yet in service today and the Q-70s are projected to be in the fleet into the 2030s. Several Q-70 configurations are on display at the Lawshe Memorial Museum. Yes, almost 70 years of NTDS computers and software developed by our companies is an amazing legacy, rarely obvious to the general public.

Sperry: 1956-86

Enduring Legacy #3: Air Traffic Control Systems, in 1956 the FAA tapped Sperry UNIVAC to find out how to use computers for Air Traffic Control (ATC). The UNIVAC File Computer was used to process flight information at five ATC enroute centers. In 1964 two UNIVAC 1218 computers brought automated ATC to Atlanta via the ARTS I (Automated Radar Tracking System.) A ruggedized version of the 1218, the CP-789 was being used within NTDS for the IFF (Identification – Friend or Foe) radar ping – response system. ARTS IA used 1219 computers. Then in 1971, the ARTS III used the Sperry designed IOP (Input Output Processor). The Instructure Set Architecture (ISA) of the IOP was the same as the NTDS 30-bit computers, USQ-20A and USQ-20B.

As illustrated below, the IOP is a 40-year legacy within the now 65-year legacy of ATC systems built, programmed, and tested in the Twin Cities of Minneapolis/St. Paul, MN. Yes, we had employees working in the control tower at the MSP airport for many years. If you have flown on any domestic or oceanic flights since 1970; computer software and hardware developed in the Twin Cities have helped to keep your take-offs and landings safe. The common ARTS developed in the mid-90s also used Unisys software and hardware for enroute flight control. We do have a retired IOP on display at the Lawshe Memorial Museum in S. St. Paul.



Enduring Legacy #4: In the early 60s the US Navy realized that their Anti-Submarine Warfare (ASW) systems could not keep up with the 'Run Silent, Run Deep' Soviet submarines. This became somewhat of an urgency during the Cuban 'missile crises.'

In 1962 UNIVAC learned of a Naval Air program at the Naval Air Development Center at Johnsville, PA, called ANEW. ANEW is not an acronym, it is simply 'a new' approach to ASW, i.e. using a digital versus an analog computer. The objective of this program was to greatly improve the Anti-Submarine Warfare (ASW) capabilities of the P-3 aircraft. The then P-2 aircraft had an analog system that needed to be updated to the digital world. With our NTDS work and proven capability in building military digital computers, we were a good fit to help the Navy air with their program.

Our first attempt was the use of a "left over" computer from the Titan program called ADD (Advance Digital Development) and a display system to show the possibilities of a digital airborne ASW system. Programming of this CP-754 proved to be very difficult. Retired Navy Captain and UNIVAC marketing employee, Marwood Clement, suggested an airborne version of a machine using the ISA of the NTDS computers for software compatibility.

In 1963 we sold the development of a computer (CP-823U) for the ANEW test aircraft. This aircraft made test flights so our programmers could add programs and make changes.

The system continued development and the flight testing was set up at the Patuxent Naval Air Testing Center (Pax River) in Maryland. These tests required some of our programmers to go on these flights. Some tests were made from St. Paul to Lake Superior to test dropping sono-buoys with the digital system, https://vipclubmn.org/flyingps.html.. After many months of hardware and software problems, a sea test was set. An American submarine was used as the target and the ANEW system with our computer and software tracked it. The system did work. If you see the movie or read 'Hunt for Red October', you'll see the plane in action.

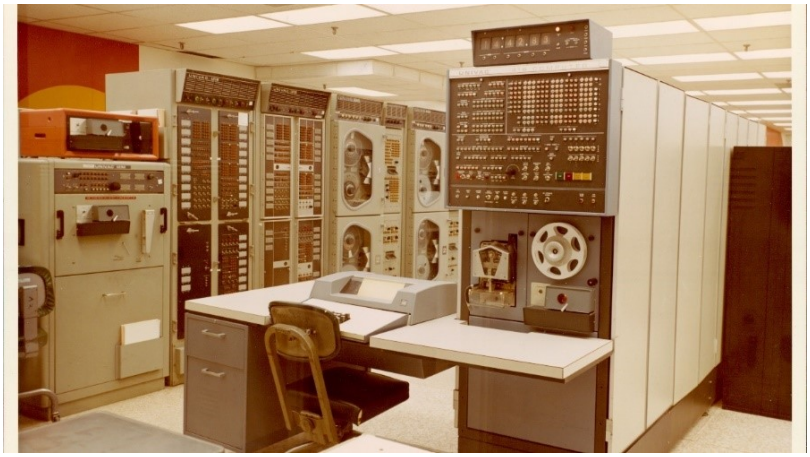
The next step was a pre-production system. In 1966 we received our first contract for the CP-901 computer. Programming for the new computer was also our job. The system requirements were set by the Naval Air Development Center (NADC) so a Univac programming office was set up at Johnsville, PA [Westminster.] Programming was also done in St. Paul. After many months of software and hardware development the system was coming together: software at Johnsville, hardware and software in St. Paul, the aircraft and other system components in Burbank.

Our first quantity production contract for the CP-901 computer was received in 1968. The last CP-901, S/N 499 was delivered in 1992. Systems for ocean surveillance were also sold to Norway, the Netherlands, Australia, Germany, and Japan. In the mid-90's the US Navy started to replace the CP-901 computers with the CP-2044 designed in St. Paul using embedded micro-processors.

In 2012 Lockheed Martin program manager, Bob Pagac, noted that there were still 40 CP-901s flying in Japanese P-3C ocean surveillance aircraft, 45-years after the initial delivery of S/N 1 CP-901 to NADC in September 1967 and 50-years after the CP-754 beginning of digital ASW. Peruse https://vipclubmn.org/Articles/ASWhistory.pdf by Les Nelson, 50 Years of Airborne Anti-Submarine Warfare (ASW) Experiences. We have a CP-2044 at the Lawshe Memorial Museum, donated by the Lockheed-Martin factory in Clearwater, FL.

Enduring Legacy #5. 18-bit ISA machines. We had mentioned type 1218 computers as being used by the FAA and the military version CP-789 being used by NTDS for IFF. The first 1218 was delivered in 1963; 326 units were built and delivered. The next in the 18-bit series was the type 1219 using silicon transistors. Type 1219A was used in the ARTS IA system. Type 1219B (CP848) was used by the Navy for the MK-152 Digital Fire Control system, i.e. shipboard launch of the Tartar, Terrier, and Talos missiles. Our records show first delivery of the CP-848 was 5/25/1965; there were 367 units built.

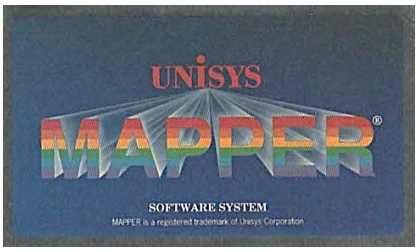
Some were used by NASA for telemetry in the space program, plus the commercial 418 machines. This NASA backroom has two 1218 computers at the left and a 418 in the center during the Apollo moon missions. [Photo from our Lawshe Museum collection.]



Located in Bozeman, MT, The American Computer & Robotics Museum is the oldest continually operating museum of its kind in the world, http://www.compustory.com/. They acquired a UNIVAC 418-II that was used in Houston during the Apollo Moon Missions at the Mission Control Center. That UNIVAC computer was implemented along with the three UNIVAC 493 computers for the reception of the telemetry data prior to it being passed on to the IBM 360s on the other side of the room.

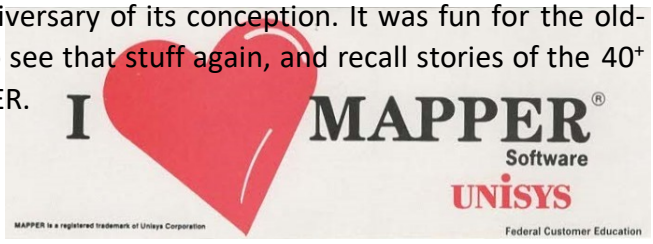
During the 2010's a 1219B from Johns Hopkins Labs was restored at the Vintage Computer Federation museum, Wall, NJ. A note from a former 1219B technician who did some of the restoration: "You 18-bit guys would be happy to know that the last Navy 1219Bs were just turned off in 2015! They were at a shore site AN/SPN-42 Automatic Carrier Landing System." A fifty-year use of a St. Paul designed and built 18-bit computer types.

Enduring Legacy #6: MAPPER Development as written by Gery Del Fiacco, Sperry/Unisys Corporation Software Engineering Manager. In 1968, the Unisys software product known as MAPPER (Maintaining, Preparing, and Producing Executive Reports) was conceived to serve an internal need. Sperry Univac was building its computer systems in Roseville, Minnesota. A complex of four buildings spread over several acres of land and populated by thousands of employees on three work shifts was required to house activities that encompassed engineering, procurement, storage of parts, assembly, diagnostics, testing, certification, packaging, order entry, inventory management, shipping and receiving, accounts payable and receivable, customer support, etc. Hardware technology was characterized by discrete components, an infinite amount of wire, the lack of any subassemblies from outside vendors, and the construction of massive hardware units. Forklifts, oscilloscopes and slide rules were popular tools. *PC's were unknown even in concept.* Pencil and paper means of planning and record keeping were routinely used. Filing cabinets were precious resources. As the business grew and prospered, the rudimentary methods of running the business that were being used became unmanageable. In fact, this became the limiting factor on what could be accomplished in terms of business volume, revenue, net income and customer satisfaction. It wasn't printed circuit layout, power supply design, or robots or any other aspect of sophisticated engineering or manufacturing technology that was the major stumbling block in business growth and success. It was the lack of an electronic means for planning, tracking and execution of the technical, administrative and operational regimen for running the factory. From this milieu emerged the need for the software tool that became known as MAPPER. Its first important characteristic was that it was conceived, designed, built and deployed by the end users who needed it, https://vipclubmn.org/Software.html#MAPPERDevelopment.



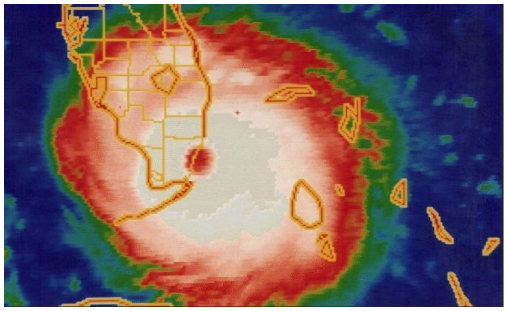
A few years after MAPPER was deployed internally, a Sperry UNIVAC customer observed MAPPER in operation during a tour of the Roseville engineering and manufacturing plant. The customer demanded that MAPPER be available on the Series 1100 system they were intending to purchase. The rest, as they say, was history. By the late 1970's, MAPPER was a driving force in the sale of Series 1100/60/70 systems. It was translated for use in 15 foreign languages and ported to the Sperry type 418 and type 490 computer systems as well as UNIX and PC based systems, https://vipclubmn.org/Articles/MAPPERHistoryPresentation.pdf.

At the UNITE 2008 conference in Orlando, FL, there was a "MAPPER Museum" on the exhibition floor to celebrate the 40th anniversary of its conception. It was fun for the old-timers who were fortunate to be there, to see that stuff again, and recall stories of the 40+ year long and application history of MAPPER.



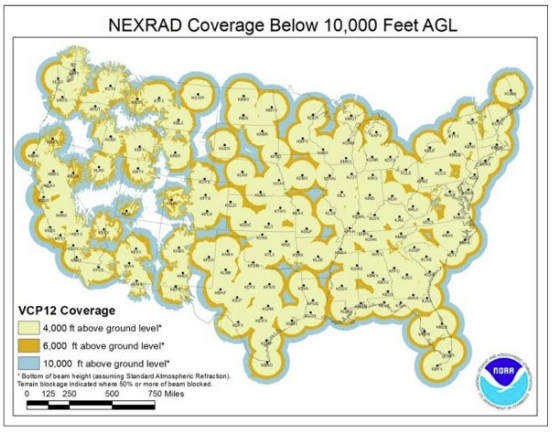
Even today, OS2200 MAPPER is deployed usefully at most of the 2200/Clear Path/IX accounts in the worldwide Unisys customer base.

Enduring Legacy #7: UNIVAC Signal Processing & NEXRAD. **In 1976** a Sperry Internal Research and Development (IR&D) project defined and developed a Sensor Processing System (SPS) for Sonar and Radar Signal Processing Applications. The system consisted of a UYK-502 single board computer, a new single instruction multiple data micro programmable signal processor with up to 16 arithmetic units (AU) as sensor processor elements. All 16 were simultaneously controlled by a 128-bit microinstruction word. The SPS was the first application of a microprocessor-based Maintenance Processor at Sperry. In 1979 a Joint Program Office consisting of the National Weather Service, Federal Aviation Administration, and Air Force Air Weather Service began definition of a Next Generation Weather Radar System (NEXRAD). In the early 80's a development contract was issued, Sperry Systems Management in Great Neck, NY was the prime. Sperry Defense Systems in St. Paul was the signal processing computer source for the WSR-88D Radar Processing.



In August 1992 a center in Camp Springs MD tracked Hurricane Andrew through Florida and Louisiana while a system in Melbourne tracked the storms eye. Image at the right shows the eye over the FL coast.

Right: A map of the completed NEXRAD installations in the contiguous United States. There are two installations in Minnesota (including KMPX - the Twin Cities weather radar) and over 150 total in the U.S.



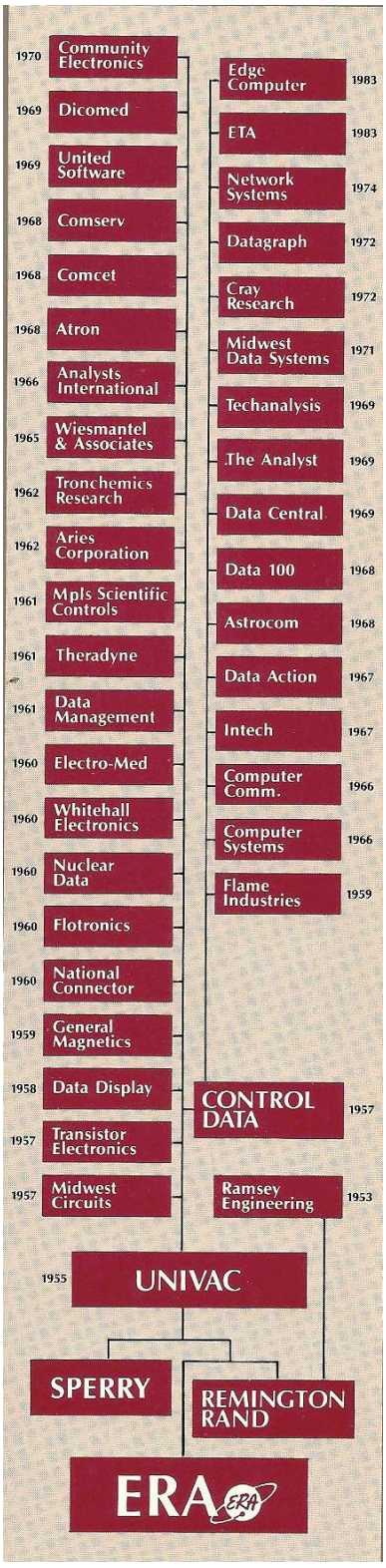
Every time we look at storms with this system, we see more information.

In 2012 the Tri-agencies committed to extending NEXRAD to 2030. So, every time you watch morning or evening news with radar reports, smile and think that the radar processing technology evolved from the Twin Cities.

Do you wonder why those radars do not show aircraft below 10,000 feet? The microcode written by Les Nelson filters out those reflected 'blips'. Les and fellow engineer Dave Boundurant presented signal processing and NEXRAD at a Sept. 2025 IEEE forum, https://vipclubmn.org/LegacyDocImg/Univac%20&%20NexRAD.pdf.

1986, Sperry Recognized ERA's 40-yr History

Sperry developed and published a history booklet, *The wellspring of Minnesota's computer industry*. Scanned copy https://vipclubmn.org/Articles/ERA40thAnniversary.pdf.



At the right is an illustration from the booklet. "The genealogical tree of Minnesota's computer companies begins with a single root: Engineering Research Associates, Inc. (ERA)." ERA's life as ERA lasted less than 10 years after its 1946 founding. Purchased in 1952 by Remington Rand which merged with the Sperry Corporation in 1955, then consolidated with other Rem-Rand divisions into Sperry's UNIVAC Division.

Enduring Legacy #8: Spinoffs from ERA/UNIVAC are widespread and very alive. Several spinoffs from the UNIVAC Division took place between the late 1950s and early 60s, and later spinoffs from those spinoffs. Best known is Control Data founded in 1957, then Cray Research from CDC in 1972.

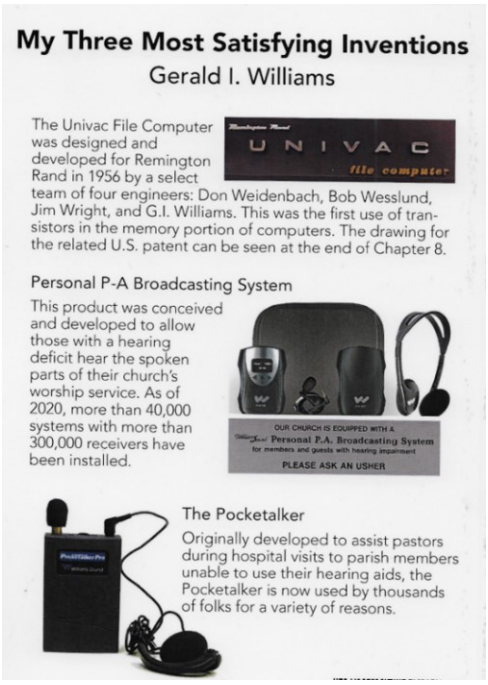
"Sperry, which merged with the Burroughs Corporation in the spring of 1986, is today [sic, was] the fourth largest employer in Minnesota with more than 13,000 people. Sperry operates the following major business units at 27 sites in the state: Information Systems Commercial marketing, Information Systems Federal Government Marketing, Integrated Business Systems, Customer Services, Information systems Products and Technology, Defense Products Group, and Systems Management Group."

University of Minnesota

This is not a direct ERA enduring legacy. However, many U of MN graduates who had multi-decade careers with the companies may consider it so – Our Stories #125, March 2009: The 40 Years of Excellence booklet from the U of MN's Computer Science and Engineering Department in 2009 relates the CSE beginning with the ERA Atlas /1103 computer. Posted with permission from the CSE department head, Dr. Vipin Kumar. https://vipclubmn.org/Articles/40Years_of_Excellence.pdf. Peruse pages 2-4 therein for ERA's part in the first decade of CSE's 40 years.

Williams Sound

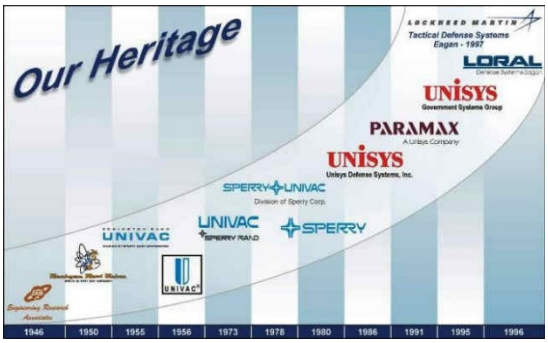
Not a direct legacy, however this is included as an example of ERA being the wellspring of Minnesota's computer industry! Our Stories April 2023 #279: *My Three Most Satisfying Inventions* by Gerald 'Jerry' Williams. Mr. Williams led the 1957 spinoff of Transistor Electronics.



He then went to work for CDC in 1963. In 1976 he left CDC to form Williams Sound Corporation. The middle invention shown on the back cover (right) of his biography is an example of reaching 10s of thousands of people. As of 2020 more than 40,000 systems had been installed in churches to allow those with a hearing deficit hear the spoken parts of their worship services, https://vipclubmn.org/Articles/SatisfyingInventions.pdf.

Paramax, Loral, and Lockheed Martin

The defense industry part of our heritage was separated from the commercial part by Sperry Rand in 1962 for accounting reasons! Military contracts limited profit and required auditing of actual costs. Separation meant that profit centers without Military contracts could charge whatever the market would bear for the 1100 series systems, etc.



As illustrated by Our Heritage logos, this Information Age Legacy merged and diverged through several corporate ownerships. After Burroughs bought Sperry in 1986 to form Unisys, they began divesting most of the Sperry divisions. At that time, one of the Burroughs divisions was Systems Development Corporation (SDC); which merged with Defense Systems because a major SDC program was the Air Traffic Control systems at 120 small airports while a Defense Systems program was the ATC at the 64 major airports. [IBM had hardware & software at 24 enroute centers.]

Unisys had continued the Defense Systems as a separate entity, naming it PARAMAX, with the intention of spinning it off as a new company. When the predicted IPO price feedback from Wall Street was only $5 compared to the wanted $20 - the company plans changed and the Paramax name was dropped. Loral, led by businessman Bernard L. Schwartz, purchased the Unisys Defense Systems. In 1996 Loral sold its core business to Lockheed Martin.

2006, 1st Legacy Committee Meeting at CBI

In October 2005 a committee was formed to tell the untold story of Engineering Research Associates, its seminal start of the Minnesota computer industry, its impact on the state's technology evolution, and the inspiration to drive people to create new companies with technology applications.

Dick Lundgren arranged a meeting with Dr. Arthur Norberg in his office, Charles Babbage Institute (CBI) at the University of Minnesota (U of MN). Dick subsequently wrote a report, https://vipclubmn.org/Articles/FirstVisitToCBI.pdf. Dr. Norberg held the *U of* MN's *Engineering Research Associates Land Grant chair For the History of Technology*.

Dr. Norberg told us that we should do oral interviews and if we could get 200 mini-bios from people we would have told 'The Story'. Ole said that he would solicit mini-bios and product/systems development stories. Lowell started a web site in March 2006 to make the stories and mini-bios public. The Legacy Committee set three objectives:

- to capture whatever remaining material and information we can,
- to catalog and archive all the material collected, and
- to publish/publicize our history and heritage in a way that interests others within our industry and our fellow Minnesotans.

Harvey Taipale wrote: "The committee quickly realized that the history of Engineering Research Associates (ERA), continuing to the present, was a remarkable story of technological innovations and contributions to the computer industry in general and specifically Minnesota. This story, particularly in the early years, has never really been completely told, e.g. the ATHENA computer launched over 300 missiles at the beginning of the space age with never a launch abort, caused by the computer system! To be sure, there are some accounts written from the business history perspective, from various customer and user perspectives, and partial documentation or timelines in many places. However, we are unaware of any account, which properly gives credit to the ingenuity, vision, and hard work of ERA and its successor company employees, and their contributions to Minnesota and the world. "

In 2008 the committee participated at the Minnesota Sesquicentennial celebrations, first with a booth on the Capitol grounds. The Sesquicentennial committee was impressed; thus, they asked us to reset our booth at the State Fair and to conduct a technology forum. About 60 volunteers staffed the booth during the 12-day fair in August 2008.

- https://vipclubmn.org/Articles/It'sAWrap.pdf summarizes these activities.
- https://vipclubmn.org/Articles/MINNESOTAS_TECHNOLOGY_WELLSPRINGvOct.pdf, scrolling slide show at the Capitol and fairgrounds booth – by Harvey Taipale.
- https://vipclubmn.org/Articles/StateFair1.pdf, forum slides. Presenters were Dr. Peter Patton, Marc Shoquist, John Westergren, Bernie Jansen, Jack Sater, Ron Q. Smith, and Brian K. Toren.

2026, 20-years of Telling the Story!

Enduring Legacy #9: 45-years ago, July 24, 1980, there was a ribbon cutting ceremony opening the Sperry Retirees' club room, https://vipclubmn.org/history.html#Birth. Shown here are Al Mueller, 1st Club President, Bob McDonald who had just retired as President & chief operating officer of Sperry Corporation and Club founder Millie Gignac, she was Sperry's first female Sperry Director.

We celebrated the Club's 45th anniversary at our annual picnic June 18, 2025, now aiming for a 50th party in 2030! Byproducts of the legacy initiative are the VIP Club milestones, https://vipclubmn.org/history.html#Milestones; archiving two decades of newsletters; https://vipclubmn.org/newsletters.html#Archives; and our social activity histories, https://vipclubmn.org/activities.html#Geeks.

VIP CLUB Established in 1980

THE VIP CLUB IS FOR RETIREES AND FORMER EMPLOYEES OF OUR GREAT HERITAGE COMPANIES

U of MN's Charles Babbage Institute

The Charles Babbage Institute at the University of Minnesota was created in 1958 by former ERA engineer, Erwin Tomash and his wife Adele. https://cse.umn.edu/cbi. When Mr. Norris left UNIVAC with others to found Control Data Corporation; plant maintenance cleaned out his office - giving the ERA drum memory collage to Don Weidenbach, the young engineer kneeling in the collage and left in this picture.

After being in Don's home office for over 50 years, Don donated the collage [photo by LABenson] to the Charles Babbage Institute - Dr. Tom Misa, Director of CBI [2006-17], is shown accepting the collage on behalf of CBI. An interesting part of our legacy is Dr. Misa is the 2nd CBI Director to hold the Engineering Research Associates Land Grant Chair for the History of Technology at the University's College of Science and Engineering.

More of Don Weidenbach's career was featured in a January 10th 2021 Minneapolis Star Tribune article; the request topic communications and reader feedback [even a former MN governor], https://vipclubmn.org/Articles/75-Years_Ago.pdf - thanks Curt Brown.

Lawshe Memorial Museum

Located in South St. Paul Minnesota, this museum is one of three facilities owned by the Dakota County Historical Society (DCHS), https://vipclubmn.org/Exhibits.html.

With over 1,000 artifacts that range from individual Printed Cards to operator workstations to full-sized computers, we proclaim this to be the world's largest collection of defense industry hardware items.

An upstairs side-room has a donated suite of workstations where Club volunteers are cataloging some ~20,000 photos, slides, and films on Tuesday mornings. The entrance to the downstairs great room has legacy posters on a partition along the entry path. Hardware artifacts are along the North side of the museum's great hall, snapshot by Keith Myhre.

Ramsey County Historical Society

June 15, 2023, RCHS presented an ERA commemorative plaque at the original ERA site. The theme is; "*ERA and spinoffs' technologies came to rival agriculture and mining as a leading industry in the state*." "*From this plant, an enormous contribution was made to human welfare throughout the world, and the benefits to the local economy are almost beyond measure*." VIP Club Volunteer Extraordinaire Keith Myhre created a video of the event. RCHS's Robyn Priestley converted the video into a YouTube image for the public to view, https://youtu.be/DvC3API_64I. The committee was Donald Hall (author), Dave Beal (journalist), Jay Pfaender (historian), Capital Partners (building manager), Chad Roberts (historian) and Ramsey County Historical Society President. VIP Club report is: https://vipclubmn.org/Articles/ERA-History_Talk.pdf.

Unexpected Findings – What Ifs?

Do you use GPS on your cell phone or in your car? US Navy ships started using GPS in the mid-60s with UNIVAC NTDS software, https://vipclubmn.org/Articles/TRANSIT.pdf.

'Alexa', who was your grandfather?

In 2009 Chandelle Press published "The Cello Maker" by David Andersen. A chapter therein was The Invention of Voicemail, https://vipclubmn.org/Articles/InventionofVoiceMail.pdf. In the early 1970s, Sperry UNIVAC Defense Systems in Eagan Minnesota formed a small research group whose primary mission was to develop a continuous speech recognition system for military applications. Art Olive was a mathematician who programmed the Fast Fourier Transform for us--it made possible for real-time spectral analysis, not only in speech but sonar. Lee Granberg helped out with our graphical displays. He invented the first computer CRT display for the Navy a few years earlier from which all of today's computer CRT monitors are derived [Patents #3,466,645 and #4,081,799].

Visitors to the Eagan plant were often given tours of the facilities. A talking computer was a real novelty in the early 70s, so the Speech Lab was one of the most popular stops on the tour. A computer that seemed to understand what you were saying and respond by voice in a human-like way was spooky at the time. The Speech Group's early success led to a contract with a certain defense intelligence agency that awarded us a contract to develop an algorithm called word spotting. The task was to identify certain key words being spoken in an eavesdropped radio or telephone conversation. When combined with a context analysis program, it was possible to determine the gist or topic being discussed. The word-spotting program demonstrated the feasibility of automated real-time gisting in English and Russian on a large scale. Now, thirty [sic: fifty] years later, one wonders what our government is doing with this technology.

Our unique ability to create high-quality computer-generated speech led to a contract from the FAA via our air traffic control department. Air traffic controllers routinely issue voice weather and warnings to pilots flying under Visual Flight Rules such as "*November three-seven-six. Traffic, 12 o'clock, 5 miles, southbound. Beacon reported altitude five thousand, six hundred.*" Because the air traffic controller's computer knows all this information, all it needed was a voice to automate the warnings. We demonstrated this with live aircraft in Knoxville, TN in the mid-seventies. A test of the Voice Response Unit (VRU) for automatic Minimum Safe Altitude Warnings (MSAW) was evaluated in Atlantic City, NJ. Pilots were not aware that it was a computer, so they tried to talk back to it. An FAA manager asked, "Can't you make it sound like a computer?"

The Knoxville experiments made us famous around the corporation. It led to another contract, this time with Sperry's commercial division. They had a customer in Germany, Otto Versand, the largest catalog ordering company in Germany and the third largest in the world. Otto Versand was a huge customer of Sperry – UNIVAC 1100 main frames built in Roseville,

MN. But Otto Versand threatened to give their business to IBM unless Sperry had a new technology to increase Otto's business advantage.

We designed the VRU-100 Voice Response Unit to be a general-purpose programmable machine for a wide variety of applications including connections to mainframes with large databases. For the VRU's voice we used a well-known German TV news commentator, Werner Wegle. Otto's phone lines were swamped for a few days with people wanting to talk to Herr Wegle. Automation of the call-in sales helped their business grow.

The idea of voice mail was a logical extension of our voice response work. In fact, we had a crude form of it working in the early 70s. We were commissioned by the commercial division of Sperry to build a Voice Information Processing Station (VIPS) as a stand-alone component of SperryLink, a PC-like workstation for office applications to be built in Roseville Minnesota. One VIPS customer was Eastern airlines that used it for crews scheduling, pilots and flight attendants could call in and get the time and flight number of their next work assignment, https://vipclubmn.org/Articles/VIPS%20Adventure.pdf.

Then internet came along replacing telephone lines. Speech recognition was designed into cellphones, computers, and home systems like **Alexa**. So, today people are experiencing the use of technology and methodologies that were in Sperry labs, a few VRU and VIPS systems in the 70s and 80s. Just another example being the Wellspring of Computer Technologies.

IBM bought technology from ERA!

Gerry Pickering's career summary includes: "Being a contract engineering company, ERA sold paper designs of a drum computer to IBM. These paper designs went to several IBM labs and engineering groups. IBM presumably used these design concepts to design its IBM 650 computer, which went on to capture the low-end computer market; some 2,000 IBM 650 computers were sold, catapulting IBM into a near monopoly position in the low end of the fledgling industry."

Here is a photo of the 650 found on an IBM history site. The drum at the bottom of the cabinet resembles those built by ERA and UNIVAC.

George Champine, PhD wrote: "Well before the 1101 announcement, ERA was becoming known in the infant computer industry. In 1949, ERA contracted to do a paper design for IBM

on a punched card, magnetic drum computer system intended for business use. ERA's design was to be judged competitively with those of two internal IBM groups. Few if any of ERA's technical contributions seem to have found their way into what eventually became the IBM 650. However, two extensive patents came out of the effort, and these were assigned to IBM as sponsor of the project. In addition, a cross-licensing agreement between ERA and IBM gave IBM access to ERA's then pending patents in magnetic drum storage.

Warren Burrell's career summary includes: "Computer Study for IBM - IBM, I understood, was very favorably impressed with the ERA Drum Storage Technology and therefore entered into a no revenue overall patent exchange. An effort to design the IBM 604 with an ERA Drum was not satisfactory. We three (George Hardenberg, Arnold Cohen, and Warren Burrell) were to prepare a paper design employing punched cards and drum. I had fun learning 'excess three binary arithmetic' from George. John Coombs* was persuaded to join IBM. His early ERA patents included selective alteration on drum memory. Our paper designs were circulated among the six or seven IBM laboratories. Some questions came back but no details as to application until IBM announced the 650 and it became the first large scale production computer."

> *In the early 40s Mr. Coomb was an MIT graduate student who was hired to work for the NCML in Dayton, OH. He moved to St. Paul in 1946. In 1947 he wrote *Storage of Numbers on Magnetic Tape* printed in the Proceedings of the National Electronics Conference Vol. 3, 1947. An illustration therein shows magnetic tape mounted on a large drum, https://vipclubmn.org/Articles/DrumPrototypeDesign.pdf.

Man-Machine Interfacing.

The very early days of electronics had radar blips on Cathode Ray Tubes as object reflections from the rotating antennae. UNIVAC engineer Lee Granberg has 18 patents of steering the CRT beam to create on-screen characters, symbols, etc. Mr. Granberg's research shop in turn led to a patent for the 'blinking cursor' from Charles Kiesling, used on most of the world's early PCs, https://vipclubmn.org/Patents.html. These preceded the Graphic User Interfaces used on today's computer operator screens and cell phones.

> As I created this article my word software and PC had a vertical bar in the typing line. And while copying images to insert, an hourglass or an arrow moved around the screen controlled by a mouse. Thanks to Lee and Charles for making this possible! BTW, NTDS and ARTS screens used trackballs to move the cursor around – the mouse was invented later.

EPILOGUE

After a 2008 meeting with Dr. Tom Misa at Plant 8, Dick Lundgren asked, "When will we be done?" We had no answer then, however we now have accomplished most of the goals of *Telling the Story* via our 60-chapter Legacy Anthology for the world to read. In addition, we've posted 235 '*Our Stories*' to date, the top five in my opinion are:

➢ Honorable mention: from before the legacy committee started; a reprint of a Minnesota Monthly, July 2005 newspaper article. It was first published as "The Original Geek Squad" by James P. Lenfestey, http://vipclubmn.org/Articles/AGaggleOfGeeks.pdf.

➢ 4th runner up: a management perspective of the corporate mergers and divestitures during the career of Gerald Pickering: Our Stories #166, April 2012: CREATIVITY-SUCCESS-OBSCURITY, 'UNIVAC - What Happened?' by Gerald E. Pickering. https://vipclubmn.org/Articles/CreativityToObscurity.pdf.

➢ 3rd runner up: Dr. George Champine's historical article found by Keith Myhre in the Hagley Museum archives, www.vipclubmn.org/Articles/TheFirstComputerCompany.pdf.

➢ 2nd runner up: YouTube links to videos from Mark Greenia, Director of the Computer History Archives Project (CHAP), https://vipclubmn.org/Articles/CHAP_SummaryRev1.pdf.

➢ 1st runner up: establishment of a permanent artifact display at the Lawshe Memorial Museum, http://vipclubmn.org/Articles/DreamRealization.pdf.

➢ The best is a public television documentary, http://vipclubmn.org/Articles/TPTclips.pdf links the primary hour-long video as well as several out-takes. Seven VIP Club members, former employees, as well as 15 others from the University, CDC, IBM, etc. were interviewed by producer Kevin Dragseth for inclusion in the video. Bits of the documentary were filmed at a Club picnic and at the Lawshe Memorial Museum. Dr. Tom Misa is the featured narrator. Thanks to Keith Myhre who provided documentary theme outlining and to Unisys' VP Chuck Lefebvre for cohosting the October 2019 premiere event.

Special Thanks To:

- Chad Roberts, the 2011 Dakota County Historical Society (DCHS) Executive Director, who got the ball rolling to begin the artifact exhibit at the Lawshe Memorial Museum in S. St. Paul. Then as Ramsey County Historical Society (RCHS) President 2012-25, arranged the Unisys donation to preserve the UNIVAC/Sperry/Unisys shadow boxes for future public exhibitions.
- Dale Weeks, past DCHS President, who connected with the Minnesota High-Tech Association then led the fund raising for a U of MN/CBI computer history web site and for developing the TPT documentary, https://vipclubmn.org/Articles/TPTclips.pdf.
- Don Hall, former CDC employee who provided the seed money for the RCHS 2023 ERA Plaque at the original ERA site.
- Harvey Taipale for his twenty-years behind the scenes support of the Legacy Initiative, as an active VIP Club Board Member he is not eligible for a Volunteer Extraordinaire nomination.

- Kevin Dragseth for producing the Twin Cities Public Television documentary, https://www.tpt.org/solid-state/video/solid-state-minnesotas-high-tech-history-35848/.
- Larry Bolton for a decade support of early artifact cataloging and for writing eleven of the 235 monthly 'Our Stories' - https://vipclubmn.org/LegacyDocImg/AuthorsOurStories.pdf.
- Mark Greenia, director of the Computer History Archives Project, who has produced almost 3-dozen You Tube videos featuring UNIVAC/Unisys history topics.
- Matthew Carter, current Executive Director of the Dakota County Historical Society who has facilitated Minnesota Legacy grant applications for materials and supplies to help document and display the artifacts donated to the Lawshe Memorial Museum.
- Members Emeriti (VIP Club) Bernie Jansen and Millie Gignac who, as DCHS board members in 2011, initiated the process to establish a permanent artifact display site at the Lawshe Memorial Museum in S. St. Paul, MN.
- Mike Svendsen for documenting UNIVAC-Sperry influence on the semiconductor industry, https://vipclubmn.org/Articles/UnivacSemiconductorPaper.pdf and for describing the 1100 series shadowboxes, https://vipclubmn.org/Articles/ERA2unisysWeb.pdf. Ask Mike about his uncle who was part of the early NTDS days or about being a Gopher football captain.
- Tom Misa, PhD, former CBI Director, who gave our committee a decade of 'archiving' guidance, who included parts of our legacy in his U of MN lecture series, who included parts of our legacy in his Digital State book, who was the principal narrator for the 2019 TPT documentary, and who wrote *Gender Codes: Why Women are Leaving Computing* including interviews with several of our IT Pioneers.
- *Volunteer Extraordinaires* Keith Myhre, Richard 'Dick' Lundgren, Donald Weidenbach, Tom Turba, Patricia Myhre, Lowell Benson, John Westergren, Bob Pagac, Les Nelson, and Jon Simon for their decade+ stalwart support of the Club's Legacy initiatives.

Life is our time, space continuum of human interactions. *LABenson*

Going Forward

- *HELP!* About two years of volunteering needed at the Lawshe Memorial Museum to finish cataloging photographs and to process continuing artifact donations.
- Provide technical and documentation support to the Ramsey County Historical Society as they plan and then implement a public display of the Shadow Box sets donated to them by Unisys, Eagan in December 2025.
- Where to find a sponsor to develop public on-line access to the photos and descriptions presently in the Lawshe' archive database.
- Finding a long term 'house' to preserve our Legacy Anthology, presently a 60-chapter part of the VIP Club's web site, https://vipclubmn.org/Legacy.html.
- Celebrate 50-years of the VIP Club in 2030?

This paper was created by Lowell with editing help from Jim Andrews and Keith Myhre.

Yes, we are Almost Done!

LABenson, BEE UofMN 1966
UNIVAC 1960 => Unisys 1994
VIP Club board, 2005-2019 and ½ of 2024