HUMAN-COMPUTER INTERACTION HISTORY

A VIP Club IT Legacy paper by Lowell A. Benson.

PROLOGUE

Today's cell phones are personal communication instruments. Even more, they embody a microcomputer with an **O**perating **S**ystem, stored program application software, a graphic user interface, voice recognition technology, image capture & processing, speakers, and air-wave communication features. Their human-computer-interaction (HCI) methodology is now a part of many, many lives from preschoolers to senior citizens.

An amazing 3/4-century long evolution from the man-machine HCI consoles of the early stored-program computers based on the John von Neumann automatic digital computing concepts, (http://vipclubmn.org/Articles/2003-08-TheFirstDraft.pdf)!
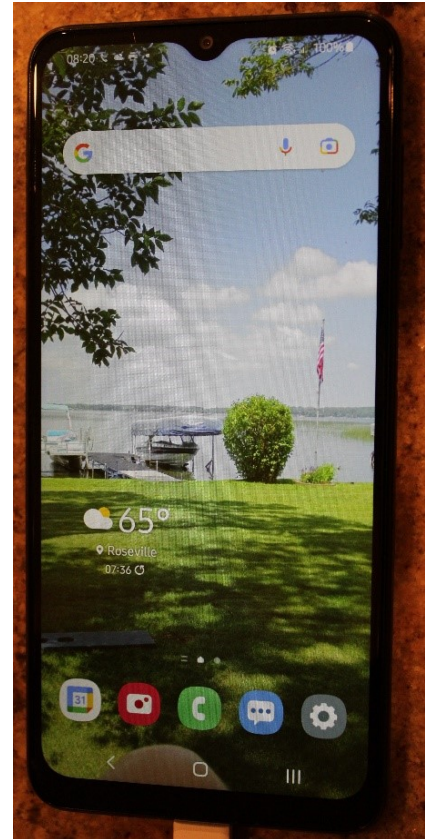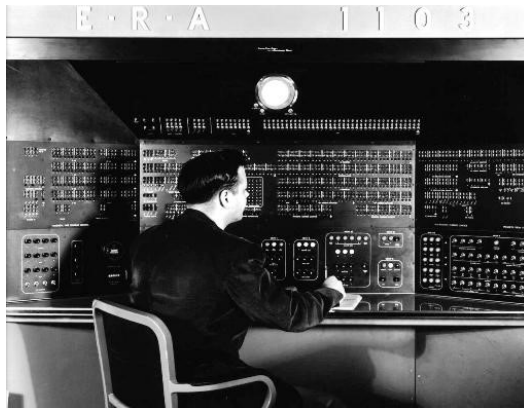

Figure 1. Bill Klingner interacts with an ERA 1103 computer via the maintenance/operator console, www.vipclubmn.org/Spinoffs.html#Northport – circa 1954.

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Produced with Microsoft Word, last edit October 13, 2022.

Life is the time-space continuum of human interactions. LABenson

INTRODUCTION

This paper is the VIP Club's submittal for the Charles Babbage Institutes' (CBI) 2022 Annual Ben Shneiderman Award: our *Legacy Anthology* **website** chapters - http://vipclubmn.org/Legacy.html.

> The CBI Ben Shneiderman Award in Human-Computer Interaction History recognizes excellence in advancing the history/social study (focus must be change over time) of HCI. The principal award is for a published book, article, documentary, podcast, **website**, or other media on HCI's past; a second award is for a top dissertation or thesis (Ph.D./Master's degree) on HCI history. From CBI website

The HCI evolution could be told from many perspectives. We, the VIP Club Legacy Committee, have some HCI stories within our **website**[1] as presented and linked hereinunder. Over 400 people[2] have contributed items to this website. Our Information Technology (IT) Legacy began with Engineering Research Associates (ERA) in 1946 and continues yet today at Unisys in Eagan, MN. The corporate names changed but innovations were continual. Our Information Technology *Legacy Anthology* theme consists of **People** at **Locations** who **Engineered Computers** and **Systems** used throughout the world.

The CBI founder, Erwin Tomash, was an early ERA engineer in Minnesota before he and Adelle moved to California to form Data Products Corporation. Appropriately, the Charles Babbage Institute Director holds the **E**ngineering **R**esearch **A**ssociates Land Grant Chair for the History of Technology at the University of Minnesota.

Today's Human-Computer Interaction is almost commonplace as people at homes call out '*Alexa, what's happening today?*' When did Human-Computer Interaction History begin - with the plug-boards of the ENIAC in PA or with the wirings of the Colossus at Bletchley Park in England?

Who was watching TV 50+ years ago when Neil Armstrong said, "That's one small step for a man, one giant leap for mankind…"? His microphone was linked to a computer that used telemetry[3] to transmit to earth computers[4] which in turn connected to monitors and speakers so that humans could interact. A lot of HCI teamwork put a man on the moon!

Figure 2. NASA's Apollo scientists interacted with many computers in the control room, photo from a Kennedy Space Center presentation. Snapshot by LABenson.

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[1] Our site map has a Table of Contents.
[2] Anthology contributors are listed at www.vipclubmn.org/PeopleIndx.html.
[3] www.vipclubmn.org/sysmissles.html#NASA.
[4] http://vipclubmn.org/Articles/Apollo.pdf.

HUMAN-COMPUTER INTERACTION HISTORY

The following HCI history stories are extracted/linked from the Legacy Anthology's 60-chapters thereby relating Human-Computer Interaction technology changes over several decades.

Visual Technology Discussion

The first computer console's indicators were wired directly to computers' internal registers.   Some of the indicators[5] are/were push button switches to facilitate reading or setting values in operational registers.   For example, most ERA/UNIVAC/Sperry/Unisys computers have a **P**rogram address register, the value therein is the memory location of the next instruction to be executed.   Consoles also have control switches; Stop, Start, Step and power on/off.

If a computer is stopped, a programmer or operator could load the **P** register with the binary/octal address of a routine or 'App' to be executed next.   He/she could then step through the routine one instruction at a time or start the routine to run until it reaches a pre-programmed Stop.   When the 'routine' stops, the operator could read the value of the **A**rithmetic register, etc...

Figure 3. Robert 'Bob' Blixt at the UNIVAC 1104 console, circa 1955 - www.vipclubmn.org/Articles/BOMARC.pdf.

Navy computers put the maintenance panel atop the computer to save deck space aboard ships (figures 4 and 5). The CP-667 panel had a switch to change Instruction Set Architectures (ISA); either the new 36-bit instruction set or the 30-bit ISA of the CP-642B[6] – pictured are development engineers Hy Osofsky and Glen Kregness.
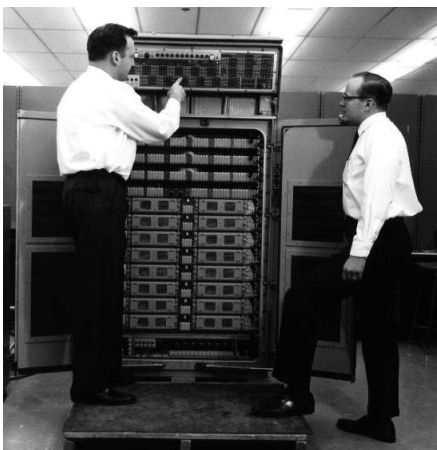
Figure 4. CP-667, www.vipclubmn.org/cp36bit.html#CP667. Figure 5. CP-642B, www.vipclubmn.org/CP30bit.html#CP642B.

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[5] www.vipclubmn.org/Engineering.html#Maintenance.

[6] The Computer History Museum has a CP-642B among its artifacts, http://vipclubmn.org/Exhibits.html#CHM.

The first evolution of human-computer interaction after plug-boards was to incorporate a keyboard-typewriter combination communicating with the computer's operating system. The software needed for using these peripheral devices was part of the emerging operating systems (OS) or executive software. The first stored program computers used punched paper tape to load programs, then when magnetic tape[7] technology became reliable, it was the preferred program load media. Drums, discs, internet, USB sticks and the *Cloud* evolved over the decades for program loading and mass storage media.
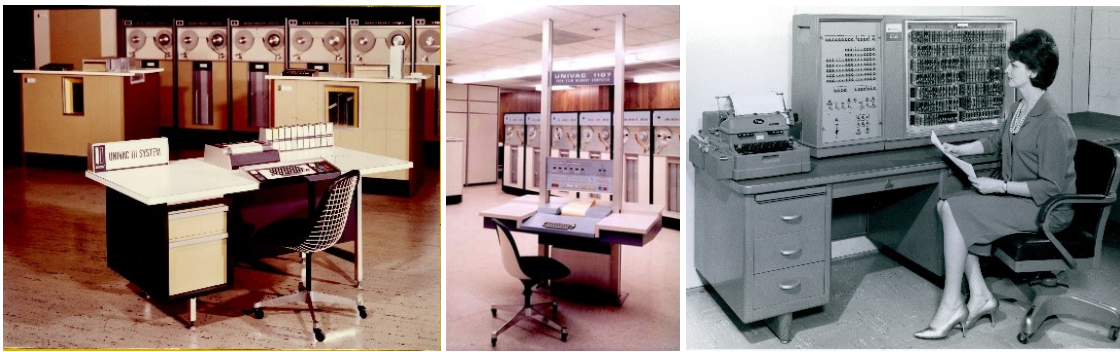

Figure 6. A UNIVAC III center, a UNIVAC 1107 center, and a 'desk-top' digital trainer[8] with a Friden Flexowriter.

Cathode Ray Tubes (CRT) – Radar sweep displays, television, then computer interface monitors were the technology application sequence. The electronic beam within the CRT must be steered to generate alphanumeric characters. Patent #4,081,799[9] created this technology. Subsequently, another engineer working in the same laboratory invented the blinking cursor[10].

For discussion and illustration purposes, see photo at the right. This is an air traffic controller interacting with airplane tracks on a CRT. The display is computer driven. The controller's right thumb is on a trackball (before the mouse was invented) which allows him to point a cursor at specific blips on the screen. Once a blip is selected, expanded 'plane' information can be called up from databases – which have flight plan data, aircraft IDs, etc.

This tracking technology was founded by the Naval Tactical Data Systems, http://vipclubmn.org/EngDocImg/9.%20Computers%20At%20Sea.pdf.   During the Korean conflict, the US Navy determined that their battle center 'grease pencil' method of keeping track of jet aircraft and other ships could not keep up. They installed transponders aboard US planes, used a special radar to ping for transponders, then captured echoed aircraft types via a UNIVAC 1218 computer. Thus, the **I**dentification **F**riend or **F**oe methodology was used to discern US planes versus 'Soviet or Chinese or …'. The Federal Aviation Administration (FAA) then implemented transponders to track and identify commercial flights beginning with ARTS I, 1966 in Atlanta, http://vipclubmn.org/aircontrol.html. They had already 'digitized' their aircraft 'flight strips' via the UNIVAC file computer.

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[7] www.vipclubmn.org/Articles/EMCC-4.pdf.
[8] http://vipclubmn.org/cpothers.html#CP-788.
[9] www.vipclubmn.org/Patents.html#Granberg.
[10] www.vipclubmn.org/Patents.html#Kiesling.

Thus, with the invention of CRT characters and blinking cursors, the world had the digital display technology foundation for Human-Computer Interaction using main-frames, PCs, etc.

Figure 7. This suitcase computer from the 60's used 5.25" floppies and a Disk Operating System (DOS). The DOS Dir A: *typed command yielded the disc contents. First in this list (right image) is* BASIC.COM, *software used to generate* .EXE *executable files from the* .BAT *input files*, snapshots by LABenson.

Figure 8. The AN/UYK-502[11] developed in the 70s had typical 16-bit register indicators, whereas the AN/UYK-44[12] in the 80s used a hexadecimal keypad and a small LED screen for internal register readouts, snapshots by Keith Myhre.

These two 16-bit shipboard machine types used an internal executive [Compiling/Monitoring System[13]] communicating with displays and keyboards[14] for Navy systems' HCI applications.

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[11] http://vipclubmn.org/cp16bit.html#UYK502.
[12] http://vipclubmn.org/cp16bit.html#UYK44.
[13] http://vipclubmn.org/Software.html#Compilers.
[14] http://vipclubmn.org/peripherals.html#ruggedized.

In the 70s, the US Navy saw desktop PC's emerging in the commercial world so went to Sperry for a shipboard environment qualified HCI model. This Lawshe Memorial Museum display shows the AN/USQ-69 with an embedded processor, snapshot by Keith Myhre.

Then in 1993, Unisys Defense Systems in Eagan bid[15] on an upgrade[16]. Awarded the contract in 1994, models with single screen or double screen or triple screen were developed with AN/UYQ-70 military nomenclature. This Q-70 display with embedded processing became the U.S. Navy's standard computer[17] for multiple on-board and shore-based human-computer interaction systems (manufactured in Clearwater, FL.)

Figure 9. AN/UYK-70 Serial No. 8,000 was installed on the submarine USS Minnesota [SSN 783], launched in 2011.

Some Research and Development systems used multi-screen displays for HCI information processing. From the early 2000s, three configurations[18] are on display at the Lawshe Memorial Museum in South St. Paul, MN. Aboard ships, trackballs were the preferred point-at-screen device versus the home computer mouse use, snapshot by Keith Myhre.

Some equipment used joysticks in lieu of track-balls.

Later technologies such as the mouse, Graphic User Interfaces (GUI), and touch screens were not part of the ERA to Unisys IT Legacy history thus are not noted herein.

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[15] Somewhat ironic, 29-years ago Senior Systems Engineer Lowell Benson wrote the embedded processor section of this proposal.
[16] http://vipclubmn.org/cpothers.html#Q69-70, Q-70 designs and prototypes were done in Eagan, MN-90s.
[17] http://vipclubmn.org/EngDocImg/15.%20Q-70.pdf.
[18] www.vipclubmn.org/Articles/ValiantResurrection.pdf.

Voice Recognition Technology

David Andersen wrote 'Invention of Voice Mail[19]. This article later became a chapter in his book "The Cello Maker" and other stories of the working man. Excerpts therefrom:

➢ The Internet hadn't been invented yet, but we were a node on its predecessor, the ARPANET. We were the only defense contractor among the 12 sites connected at that time. All the others were universities. Hank, Dean, Larry, and John set this up, a major R&D project by itself. Data was transferred between sites by passing files from one node to another until it reached its destination—a technique known as token ring store-and-forward. Passing text files created a primitive form of email. If a node crashed, the ring stopped until it was fixed. Sometimes the US Mail was faster. But Mark's strategy was to be as cooperative as possible with other researchers to learn from them. It seemed to work, but I suspect they learned more from us than we learned from them.

➢ 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. In some ways this task is easier than understanding cooperative speech because the detection rate can be lower and still work. This program was the first Top Secret project at the Eagan, MN plant and resulted in the construction of a special RF-shielded lab space underground which Larry and Don designed. This project, we were told, caused our plant to become a target in the USSR's ICBM system. This form of professional recognition was received with a bit of pride. The word-spotting program demonstrated the feasibility of automated real-time gisting in English and Russian on a large scale. {Not mentioned therein is that Lowell Benson's non-English speech skills were used as examples of spotting much more than just American words, i. e. Russian and German.}

➢ We designed the VRU-100 Voice Response Unit to be a general-purpose programmable machine for a wide variety of applications. Otto Versand, the largest catalog ordering company in Germany and the third largest in the world became an early customer.

A Voice Information Processing (VIPS) system was a subsequent successful development, www.vipclubmn.org/Articles/VIPS%20Adventure.pdf.

Voice Information Processing Station

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[19] www.vipclubmn.org/Articles/InventionofVoiceMail.pdf.

Systems and Software HCI Examples

"Hi Don and Lowell: Thanks for letting me share Don's tale on the 75th anniversary of ERA pushing the power button to ignite MN's computer age. {*story copied on the Club website because the Star-Tribune web link requires a $2 membership for access*, http://vipclubmn.org/Articles/75-Years_Ago.pdf.}

Curt Brown - MN History columnist - Minneapolis Star Tribune."

"The Speed Tally computer, which Weidenbach designed in 1950 with no government money, became his "pride and joy." He quarterbacked a team of technicians and engineers that enabled a mail-order company in Chicago to store its 13,000-item catalog on a drum memory. Keyboard operators could find out how much stock was available, subtracting items that were sold and adding new merchandise when it arrived. "It sounds ridiculously simple in today's world, but 60 years ago it was on the cutting edge!" Weidenbach wrote in 2012 for the VIP Club, an association of retirees from Minnesota computer tech companies."

Some systems did not initially work as intended thus took special Human-Computer Interaction to make the systems work, i. e. http://vipclubmn.org/Articles/MississippiAssignment.pdf and http://vipclubmn.org/Articles/TRANSIT.pdf.

One Air Traffic Control computer design (IOP[20]) was in service for four decades at airports throughout the US and a few international airports; millions of air traffic controller Human-Computer Interactions keeping air travelers safe!

Our military personnel have a 24/7 responsibility:
*   During the Gulf War/Desert Storm actions, http://vipclubmn.org/sysairborne.html#ABCCC, when Scott O'Grady was shot down, this system helped to recover the F-117 pilot. [Photo at right is VIP Club and committee member Larry Bolton in the system history display at Wright Patterson AFB Museum.]
*   Some specialist' duties included Human-Computer Interactions with the Marine Air Traffic Control and Landing System, http://vipclubmn.org/sysmarines.html#MTDS, deployments in Kuwait/Somali[21].

Sections 3.7.8 & 3.7.9 of http://vipclubmn.org/CP24bit.html#CP818, have comments from Tom Van Keuren, "Previously at the U of Minnesota I had heard a computer playing a simple tune, so I just had to program the CP-818 trainer to do that. I got it to play Christmas music down the hallway by connecting an amp and speaker to a register's Least Significant Bit. Unfortunately, it's slow instruction cycles limited its tonal scale accuracy to barely an octave."

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[20] www.vipclubmn.org/aircontrol.html#Genealogy.
[21] http://vipclubmn.org/Articles/MATCALSdesc2.pdf.

Documentary

Why is this documentary part of Human-Computer Interaction History? Minute 32:40 of the hour-long show, https://www.tpt.org/solid-state/video/solid-state-minnesotas-high-tech-history-35848/, relates the beginning of educational time sharing of computers. And it shows the success of the Oregon Trail – the first HCI 'on-line' gaming. Then it presents the Gopher Way, a very early internet like communications' system between humans, their computers, and other humans.

The greatest output of our Club's Legacy initiative is detail participation in the Twin Cities Public Television's (TPT) documentary. The documentary narrator is Dr. Tom Misa [32 seconds in, with the grey beard], former director of the Charles Babbage Institute. Eight VIP Club members are among the interviewees that appear in the documentary. The filming was done at the TPT studios, at the Lawshe Memorial Museum, and at the 2019 VIP Club picnic. The documentary premiered on October 8, 2019, in TPT's studios the week before public airing. Museum volunteer curator Keith Myhre and Club President Harvey Taipale presented ERA lapel pins to TPT producer Kevin Dragseth and the premier guest speaker Dr. Jeffrey Yost, snapshot by LABenson.

Legacy Anthology Abstract

Foremost throughout this IT Legacy are the people; most now enjoying retirees' camaraderie; others still at Unisys and other companies throughout the world plus many customers/users who found and made contributions to our site. During our IT Legacy, a few management and engineering personnel left to form other companies, http://vipclubmn.org/Spinoffs.html#Corporations. Most notable was the 1957 creation of Control Data Corporation (CDC) led by Bill Norris, et al'. Seymour Cray joined him, then later left CDC to establish the super computer company 'Cray'. This site notes these industry pioneers but doesn't detail their careers after ERA, http://vipclubmn.org/Articles/Norris2.pdf.

Several threads weave their way through our corporate ownerships:

➢ A resilient cadre of management and engineering personnel, some with military training/experiences, applied to understanding the problems facing government and business customers.
➢ Availability of technology researchers and new graduates from the world-class Institute of Technology [now the College of Science and Engineering' (CSE)] at the University of Minnesota (U of MN) and several other Midwest colleges.
➢ Computer Instruction Set Architectures normalized over several product line generations.
➢ People Performing in Partnership with customers to solve complex system information and control problems!
➢ Systems for processing of real-time signals and data from radar, sonar, satellites, and other sensor sources to provide users with operational information and action options.

When we eventually write a book, because of the physical size, i. e. printed page count; we may have to publish our legacy/history as volumes - likely seven as numbered hereunder:

1. **People** – Ch 10-29, 200⁺ career summaries from and/or about the people who have experienced and been participants of this Legacy.
2. **Locations** – Ch 30-39, not only the Twin Cities of Minnesota, but facilities throughout the U.S. and a few overseas sites. Marketing Offices, Technical Services Division (TSD), Canada, etc. Operations at these sites have yet to be fully documented.
3. **Engineered** – Ch 40-49, our designs transition all electronic generations: vacuum tubes, transistors, integrated circuits, application specific integrated circuits, and embedded micro-processors. We've included specialty engineering of Antenna Couplers, Field Service support, Interfaces, Patents, Peripheral Equipment, Software Development, and Training chapters.
4. **Computers** – Ch 50-59, the world's first stored-program cryptography computer shipped to a customer in October 1950, aerospace computers, Navy shipboard computers, airborne search computers, ..., embedded micro-processors - we've done all of them.
5. **Systems** – Ch 60-69, Aerospace, Airborne, Air Force, Air Traffic Control, ASOC, Government, Naval Tactical Data Systems, Marine Systems, and Commercial systems since the File Computer systems in the 50s. This century, people might just call them packages or apps.
6. **Exhibits** – Ch 90, in January 2013 the Dakota County Historical Society's Lawshe Memorial Museum became the repository and displayer of artifacts collected by the committee since 2006. This chapter also provides information and links to other history displays of ERA/UNIVAC/Sperry/UNISYS/ equipment at museums throughout the United States.
7. **Our Stories** – Ch 100, since April 2007 we have been soliciting, editing, and posting stories as the 'Article for the Month'. Some are technology tidbits, some are committee status summaries, a few are duplication of publications from other organizations used with permission, and some developed in response to questions posed by people who have browsed our site pages/chapters.

EPILOGUE

Thanks to the CBI led review committee for considering our *Legacy Anthology* **website** as an HCI award candidate. This paper and our *Legacy Anthology* website document our parts of HCI history from early paper-tape systems into the display screen systems now in use.

If selected for the Ben Shneiderman award; our intention is to apply the $500s to replicating a lost history plaque, http://vipclubmn.org/Articles/40-Yr%20Plaque.pdf. We, the VIP Club, will post this paper as a monthly Our Story article in January 2023, our 200ᵗʰ story since April 2007.

This paper submitted to the CBI HCI award committee may have parts extracted for articles by CBI.

✓ If you, as a reviewer, would like to have your Human-Computer Interaction history website linked from our site, http://vipclubmn.org/Contact-Links.html#Research, simply send a note to webmaster@vipclubmn.org or to la.gj.benson@comcast.net.
✓ If you would like to join our retirees Club as a Friend, see the Club's membership page, http://vipclubmn.org/membership.html. CBI is already a friend receiving our newsletters.

Note that our *Legacy Anthology* chapters do not have any pop-up notes nor drop down menus nor advertisements nor any donation solicitations. We are proud of the VIP Club's Legacy Committee accomplishments[22] and respectful of their individual computer industry careers!

For the VIP Club and Legacy Committee. *Lowell A. Benson*

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[22] http://vipclubmn.org/Legacy.html#Sucesses.

Legacy Committee Background

The committee was formed at a VIP Club board meeting in October 2005, then had a first meeting in January 2006[23] at Dr. Norberg's CBI office[24]. In 2007 we merged an IT Legacy information page with the VIP Club's web page. Rather than spurious entries into a Wikipedia site; we decided to solicit, then control submitted entries into the theme '*People* at *Locations* in Minnesota *Engineered Computers* and *Systems* used throughout the world'. April 2007 we initiated the *Our Stories* chapter as a monthly articles feature, http://www.vipclubmn.org/OurStories.html. In 2012 we added the *Exhibits* chapter, http://www.vipclubmn.org/Exhibits.html, as we moved artifacts from the Eagan Lockheed Martin facility to the South St. Paul Lawshe Memorial Museum[25]. In 2017 we effected a format separation of the *Legacy Anthology* chapters from the Club information pages. Over 400 people have now contributed to our Legacy Anthology mentioning almost 2,000 co-workers and customer personnel as listed at http://www.vipclubmn.org/PeopleIndx.html#People.

Author and Paper Reviewers

Lowell Benson is an octogenarian, passionate about the ERA to Unisys history. After three years of US ASA 'cold war' duties; he worked at UNIVAC and successor companies for 33.5-years. He began his engineering career as a drawing control clerk in the UNIVAC Antenna Coupler Department then left as a Senior Systems Engineer from the Unisys Air Traffic Control Department. In 1994 he was hired by the U of MN's Center for Transportation Studies to develop and manage an Intelligent Transportation Systems research laboratory – retired therefrom in 2001.

Mr. Benson was a VIP Club board member 2005-19 serving as a Director, Treasurer, Vice President, President, Webmaster, and Newsletter Editor. Plus, he co-chaired the Club's Legacy Committee 2005-19. His career and IT Legacy stories are http://vipclubmn.org/PeopleDocImg/Vol01Book1.pdf and http://vipclubmn.org/People1.html#Benson. I apologize for any egotism exuded therein and herein.

Before submittal, this award paper was reviewed by four stalwart Legacy Committee members:

- Richard F. Lundgren – Club Director and the committee's CBI liaison since 2005 - http://vipclubmn.org/People4.html#Lundgren.
- Harvey Taipale – VIP Club President, 2018-22 and committee member since 2007 - http://www.vipclubmn.org/People7.html#Harvey.
- John Westergren – former Club Director and Legacy Committee Co-chair since 2009 - http://www.vipclubmn.org/People7.html#Westergren.
- Keith Myhre – the committee's lead volunteer at the Lawshe Memorial Museum since 2012, he is also the Club's artifact curator - http://www.vipclubmn.org/People5.html#Myhre.

> This HCI **website** award candidate and IT Legacy paper started with a cell phone prologue and ends with a cell phone story, www.vipclubmn.org/Articles/ThatLittleInstrument.pdf.

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[23] http://www.vipclubmn.org/Articles/FirstVisitToCBI.pdf.
[24] http://vipclubmn.org/Articles/LegacyPartnerships2.pdf.
[25] www.vipclubmn.org/Exhibits.html#Lawshe.