This paper is structured to be read while clicking through the PowerPoint presentation by the same name. The presentation occurred on 2/9/2012 at the Ft. Snelling History Center.

Code Breaking and the Beginning of Computers

Good Evening Ladies and Gentlemen. When I volunteered to follow Colin Burke and speak about ERA history, I went to the library **[CLICK]** to borrow and read one of his books. I'm using the theme **[CLICK]** 'sequel' because of a common customer and some of the employees. **[CLICK]** I'm also using 'Another untold story' because we in the twin cities have not had much press about the beginning of the computer age.

[CLICK] Here is a shot of a personnel assembly in the old glider factory. Note the two glider body frames in the foreground and the workers at this assembly. As some of you know, Villaume Industries in Eagan is presently supporting a group in re-furbishing (rebuilding) one of those gliders.

[CLICK] Mr. Burke has already mentioned the founders of ERA. **[CLICK]** CSAW was the Navy portion of what was to become the National Security Agency – there was also a somewhat comparable Army agency. The NCML is the organization described in Mr. Burke's book. The bombe was used to decrypt messages encrypted by the German enigma machine. **[CLICK] [CLICK]** John Parker had headed the Northern Aeronautics Corporation which was building gliders for the war effort. **[CLICK]**

There is a 93 page 1964 report that had been classified for 40 years. **[CLICK]** An excerpt from that report shows that they'd started using punch cards in 1935 **[CLICK]** I used some of those 'punched card' equipments in 1959 when with the Army Security Agency in Germany. Yes, the processes using punch cards were slow and laborious.

At that time in history, people decrypting codes took advantage of what tools were available.

Let me digress a bit – How many of you do the Crypto Quizzes in newspapers?

- First: Those are just simple letter substitutions! And, they give you a single letter substitution clue.
- Second, in the English language the A and the I are single letter words so knowing this when looking at a crypto quiz – there are only two substitution possibilities for single characters.
- Thirdly, do a character count – in general English writing, E is the most commonly used letter and T is the second most commonly used letter, A is 3rd, O is 4th,…

Write down ETA ON RISH DLUC – This is half the alphabet in quantity used in general literature. Knowing this makes crypto quizzes easy.

BUT, if the substitution is changed half way through or ¼ way or 1/3 way through a 'message', those simple methods don't work thus extensive hours of looking for patterns or duplications or … then if the pattern is

identified – translating to English from the encoded language such as German, Russian, Chinese, etc…– **[CLICK]**.

In this previously classified document, four of the nine machines mentioned in an early section came from ERA – UNIVAC, designed and manufactured right here in St. Paul Minnesota. After these sponsored developments, NSA did procure commercial machines from IBM, UNIVAC, CDC, etc. **[CLICK]**.

This is an aerial view of the ERA facility at 1902 Minnehaha Avenue. Minnehaha runs diagonally from the bottom center to the right center of the picture. Prior Avenue begins at the top right – if we were to follow it off of the picture up to the VIP Club logo, we'd find a Menards store today. The top, right center rectangular part of the building is where the glider photo you saw previously was taken. Center right is a two story building where the Navy offices were. The cafeteria was between the navy offices and the assembly/engineering part of the factory. Bottom center was a 'building 6' where the most classified work was done. **[CLICK]**.

In October 2005 Richard 'Ole' Olson, then an LMCO systems engineer, came to the VIP Club asking us to begin preparing some legacy info in preparation for the Lockheed 100th year celebration.

We formed a committee, met with the Charles Babbage Institute in January 2006, then started a web page in March of 2006. The Defense Industry lineage from ERA to LMCO was quite clear. We began gathering career summaries, artifacts, etc. So far in addition to the web site stories, we have 460 hardware artifacts, about 1200 documents, and over 6,000 photos or slides. We've catalogued the artifacts and documents and are still working on the photos.

[CLICK]. Tonight's presentation is telling a part of the 65 year story that has merged and diverged through several corporate ownerships

[CLICK]. The Twin Cities Defense industry Legacy is ending! We are transferring the documents and identified photos to the Charles Babbage Institute. Most of the hardware artifacts will go to the Dakota County Historical Society **[CLICK]**.

In 1986 Sperry commemorated ERA's 40th anniversary with this booklet. **[CLICK]**A quote within it shows the connection back to NCR and the people from Dayton Ohio. **[CLICK]** A couple of subsequent 'projects' used cables which had been transferred to St. Paul from there.

[CLICK] An ERA engineer began use of these terms for computers. **[CLICK]** Today's engineers all know the difference between RAM and ROM – volatile and non-volatile integrated circuit memory.

Data was loaded onto these early drums from paper tape. Then a plug board controlled sequence would do various comparisons of data on the drum. Although not stated, they were probably looking for patterns or doing various counts. **[CLICK]** The prototype of the first drum is in the Minnesota Historical Society Museum. **[Click]**

Was ATLAS the America's first stored –program computer? YES, with the caveat of delivered and working condition. Eckert Mauchly Computer Corporation had delivered the BINIAC in 1949 – however the recipient 'claimed' that it never worked properly. **[CLICK]**

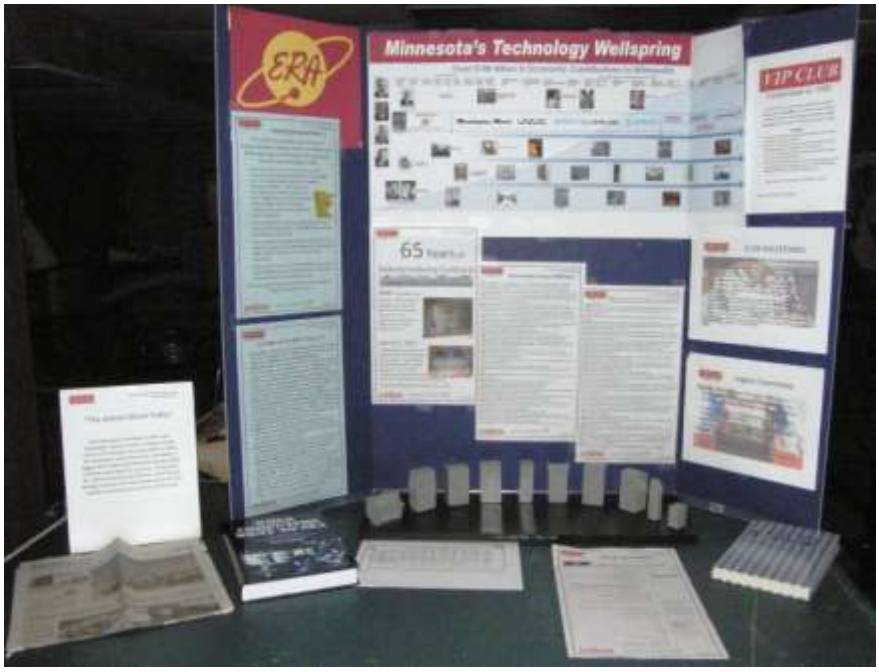
Even reading the NSA report, there are some machines whose sponsors and applications are not known YET. **[CLICK]** A full genealogy chart is on our display at the side of the screen – take a look at it later. . **[CLICK]** I also have a 1959 Sperry Product book that lists additional classified equipments. **[CLICK]** Some of these represent systems which also had data prep and detection peripheral equipment which were also kept 'secret' **[CLICK]**

I read a book about the CIA tapping communications lines underwater between Kamchatka and Vladivostok – it had a UNIVAC 1124 computer not in any of our product books. I'd guess that this may have been a variation of NSA's 1224. **[CLICK]** Initially the Naval Tactical Data System development was classified! I'll talk more about that in a minute or two.

[CLICK] ERA not only created and applied technologies to products for customers; it served as a "Training Ground" or OJT for aspiring business people. Many used skills learned at ERA to start their own companies. **[CLICK]** Dave Lundstrom wrote about his experiences on the NTDS program and at Control Data. **[CLICK]** When I talk about spinoffs, I mean that people 'had a better idea' thus left to form their own companies.

ERA was bought by Remington Rand – some left to form Ramsey Engineering. Sperry bought Remington Rand – a few more left to form their own companies. **[CLICK]**Most notably was CDC. This time line is from the 1986 Sperry booklet -
[CLICK]

If you take a look at the top of the display in back, you'll see a graph of the billions of $s over time – light blue background. This chart was made for the Minnesota Sesquicentennial in 2008.



The impact of ERA and the spin-off companies contributed over $100B to the economy of Minnesota from 1948 to 2008.

[CLICK] As we tell the ERA Story, some of it is already in print. As Capt. Boslaugh documented the development of the Naval Tactical Data System, he included a nice chapter about the CSAW and Dayton OH precursor activities.

[CLICK] I had mentioned that NTDS was classified. Think back to the Pearl Harbor stories about the radar system which picked up 'aircraft' then was pooh-poohed because B-17's were coming in from the states. Some of you have heard about IFF, Identification Friend or Foe. Engineers created transponders which if 'pinged' by a radar signal could send a signal back with a few characters. If the pinging radar got a signal back it was a friend. If it didn't, the plane was probably a foe. You've all seen WW II movies where operators used grease pencils on plexa-glass to mark locations of ships and planes. This gave commanders the battle scenario.

[CLICK] I mentioned that NTDS was initially 'classified.' Let me read a couple of paragraphs written by Capt. Boslaugh on the present IEEE NTDS History web site. "Senior navy management did not want the Soviet Union to know that task force air defense exercises of the early 1950s had revealed that the US surface fleet could not cope with expected Soviet style massed air attacks using new high speed jet airplanes and high speed standoff missiles."

The Navy needed automation! Acting as the prime contractor, the navy came to UNIVAC for computers and software, Hughes for displays, and Collins for communications links – so that they could keep the same battle situation up to date aboard all of the ships in an area. [Click]

[CLICK] In 2009 Dr. Misa began a school-year long lecture series which began with ERA. Dr. Misa holds the Engineering Research Associates Land Grant Chair for the History of Technology.

[CLICK] One of the monthly lectures talked about the Honeywell versus Sperry law suit. Sperry held the ENIAC patents based on their acquisition of the Eckert - Mauchly. The question, who invented the computer? Or, who did what first. **[CLICK]** The Judges ruled that the patents were invalid because Eckert had visited Iowa State University where the ABC 'computer' had been assembled.

Zeus was a German unit. Colossus was British, a special purpose machine put together for Bletchly Park. …

Until 1977, the ATLAS would not have been in this list – the ERA 1101 commercial counterpart hadn't made any impressions on historians. All of these early machines had volatile memory – except for the ATLAS – my opinion is that ATLAS was the only real stored-program machine in this list. All others lost the program and data when power was turned off!

[CLICK] Had I had a week instead of half an hour to talk, I might have been able to tell more stories – there are so many that could be told.

[CLICK] Let me tell a bit about Air Traffic Control. When Congress muttered about spending all that money on NTDS, some engineer said that the NTDS IFF technology could be applied to civilian planes around airports so the ARTS I beacon project started. **[CLICK]** Then they used an IOP to drive TI displays to track planes landing

or taking off – the automated Radar Terminal System. This computer used the same basic instructions as the NTDS computers. The last ARTS III computer was just retired last April, 40+ years after the hardware design. **[CLICK]**

Thanks for inviting us to tell parts of the story. **[CLICK]**

Our Club represents the corporate transition from ERA to today's UNISYS and Lockheed Martin.

[CLICK]A bit about me, I'll be around later if you have questions.

[CLICK]My references are also available.