

# Nike-X System Hybrid Integrated Circuits

## INTRODUCTION

This Legacy paper is the communications sequence initiated by a Micah Mabelitini. The response is primarily from Larry Bolton, a 1965 BEE graduate from the U of MN and a 10-year Legacy Committee volunteer who had a 40+ year career working as a component engineer for UNIVAC/Sperry/Unisys/LMCO, <http://vipclubmn.org/People1.html#Bolton>.

## Contents<sup>1</sup>

INTRODUCTION..... 1

COMMUNICATIONS SERIES ..... 1

    November 18<sup>th</sup> message to the VIP Club Webmaster..... 1

    November 19<sup>th</sup> reply to Mr. Mabelitini, cc to Bolton, Westergren, Weidenbach ..... 2

    19 November, Larry Bolton note to webmaster, Cc to others ..... 2

    19 November, Larry Bolton note to webmaster with attachments..... 3

        Nike-X Hybrids, snapshots & descriptions ..... 3

        Card Connections ..... 6

        Database extract ..... 7

    19 November, more from Larry ..... 7

    12 December, Larry to Micah w/cc to Lowell ..... 7

    15 February, from Don Weidenbach..... 8

EPILOGUE..... 8

*Paper created with Microsoft Word*

## COMMUNICATIONS SERIES

### November 18<sup>th</sup> message to the VIP Club Webmaster.

Hello, I recently came across your hardware artifact log (HW\_ArtifactsNov2010.pdf) which lists three Western Electric hybrid Integrated Circuits (ICs):

GF-40162, GF-40174, and GF-40178, and identifies them as components of the Nike-X system. I have a number of ICs from this same series, which I have been attempting to research for the past decade or so. The Smithsonian also has some of these devices, which have been apocryphally identified as parts of the SAGE processor. The Museum of Communications in Seattle has a large circuit card which includes about 200 GF-401xx devices, appears to be a CPU segment of some sort. I was hoping you could provide more information about how they were used in the Nike-X system, such as whether they were used in the ground segment or the missiles (or both.) The hardware artifact log document also has non-working links to photos of these devices, and I was wondering if it would be possible to obtain copies of these photos. Any help you can provide would be greatly appreciated.

<sup>1</sup> Click on a section for a quick scroll thereto.

Established in 1980

Micah Mabelitini, <http://www.decadecounter.com/>

My own article on these devices can be viewed here:

<http://www.decadecounter.com/vta/articleview.php?item=746>

{Editor's note – the hardware artifacts .pdf paper contents referred to by Mr. Mabelitini is now on-line at <http://vipclubmn.org/Artifacts.html#PCcards>.}

November 19<sup>th</sup> reply to Mr. Mabelitini, cc to Bolton, Westergren, Weidenbach

Dear Sir: Thanks for your message, in response we plan a few actions:

- 1) Fix our website broken links (pictures) -

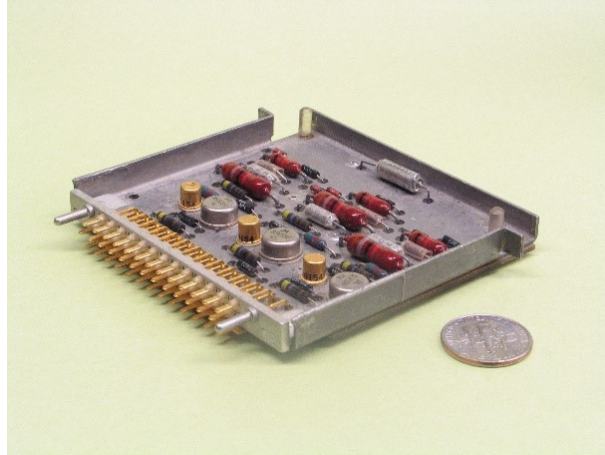
The photo listed in your message is attached hereto.

- 2) BCC your request about component information to a Legacy Committee member with 40 years' experience as a component engineer. I will also forward your request to a nonagenarian who was the Nike-X processor project engineer. I will compile their recollections into a message back to you.

- 3) Add your website,

<http://www.decadecounter.com>, to our

Contacts/Links page, section 4. [<http://vipclubmn.org/Contact-Links.html#Others>]



One of the NIKE-X design engineers, Rolland Arndt, is no longer with us - before he passed away, he had donated 4 boxes of history documents to the Charles Babbage Institute at the University of Minnesota. There is some possibility that those boxes contained some of the Nike-X info that you are seeking. I'm not sure when I'll have time to request a review of those box contents. {Editor's note - Lowell had worked with Rollie briefly during the summer of 1963.}

To my knowledge, the UNIVAC work on NIKE-X system was in the Targeting Intercept Computer and the missile launch computer - I don't think that we had any of the on-board electronics.

Good luck with your history research.

Webmaster, aka Lowell Benson: UNIVAC 1960 => UNISYS 1994 <http://vipclubmn.org>

{Editor's note – the hardware artifacts paper information referred to by Mr. Mabelitini is now on-line at <http://vipclubmn.org/Artifacts.html#PCcards>.}

19 November, Larry Bolton note to webmaster, Cc to others

There are several photos of these hybrids which I have previously supplied to the committee and museum<sup>2</sup>. No doubt, the locations and links to these photos have been misplaced or not processed. I can resurrect the photos and any other information I have. How many do you want? I recall that there were several boxes of documentation in the vault in Eagan but all that was likely destroyed

---

<sup>2</sup> Lawshe Memorial Museum in S St Paul, MN – see <http://vipclubmn.org/Exhibits.html#Lawshe>

Established in 1980

when the vault was closed. All the hybrids I had had were transferred to the museum as hardware artifacts. *Larry Bolton*

[19 November, Larry Bolton note to webmaster with attachments](#)

See all attached data I have found with my comments. Photos have been cropped and file size shrunk. More HD versions can be provided upon request.

[Nike-X Hybrids, snapshots & descriptions](#)

The following info has been recovered from my files.

### Photo C3535

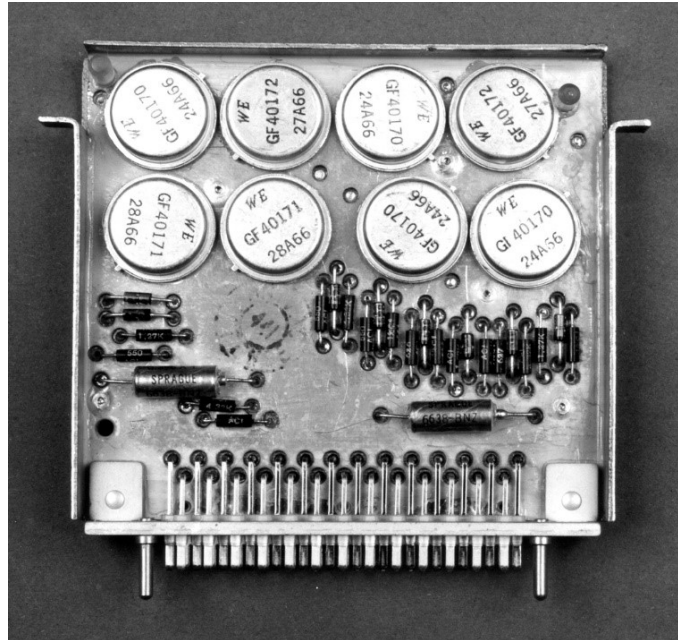
7250875 Emitter Follower-Driver

Has eight hybrids on it

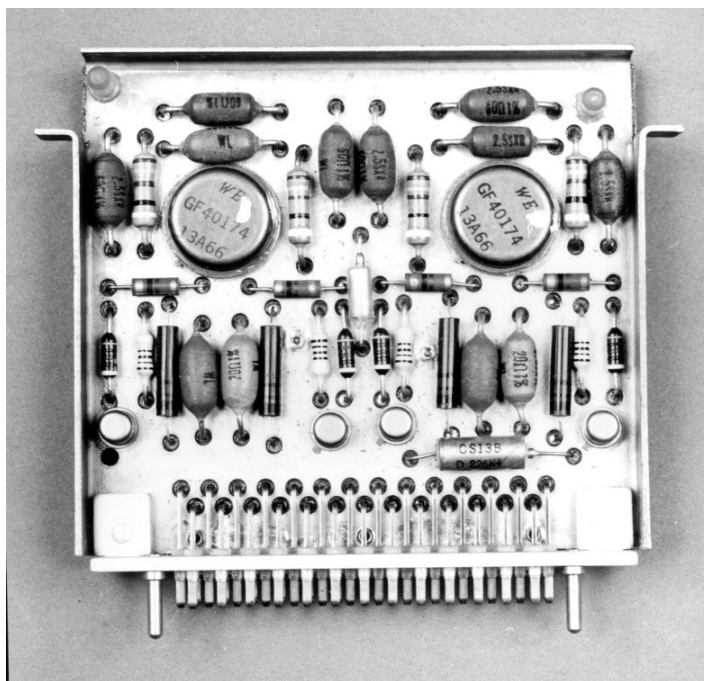
4 – GF-40170: ICP 2-2-2 Gate  
(Possible part numbers 11263865 or 7252806)

2 – GF-40171: ICP Cable Driver  
(Possible part numbers 11263866 or 7252807)

2 – GF-40172: ICP Emitter Follower  
(Possible part numbers 11263867 or 7252808)



### Photo C3537



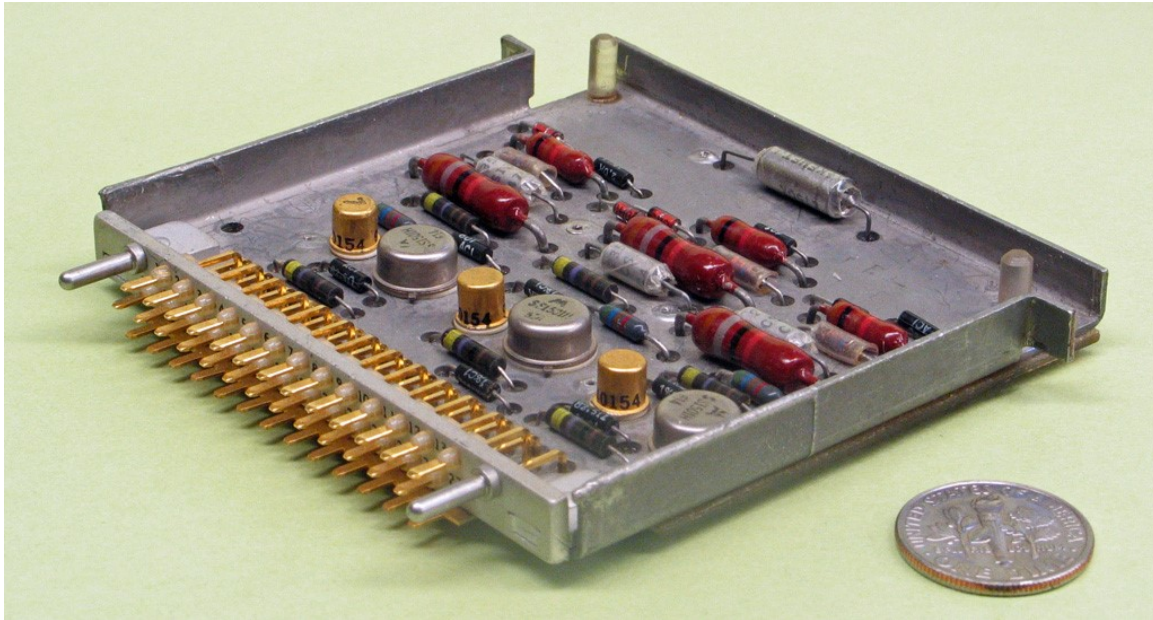
7250885 Base Line Pre-Driver.

Has two hybrids on it;

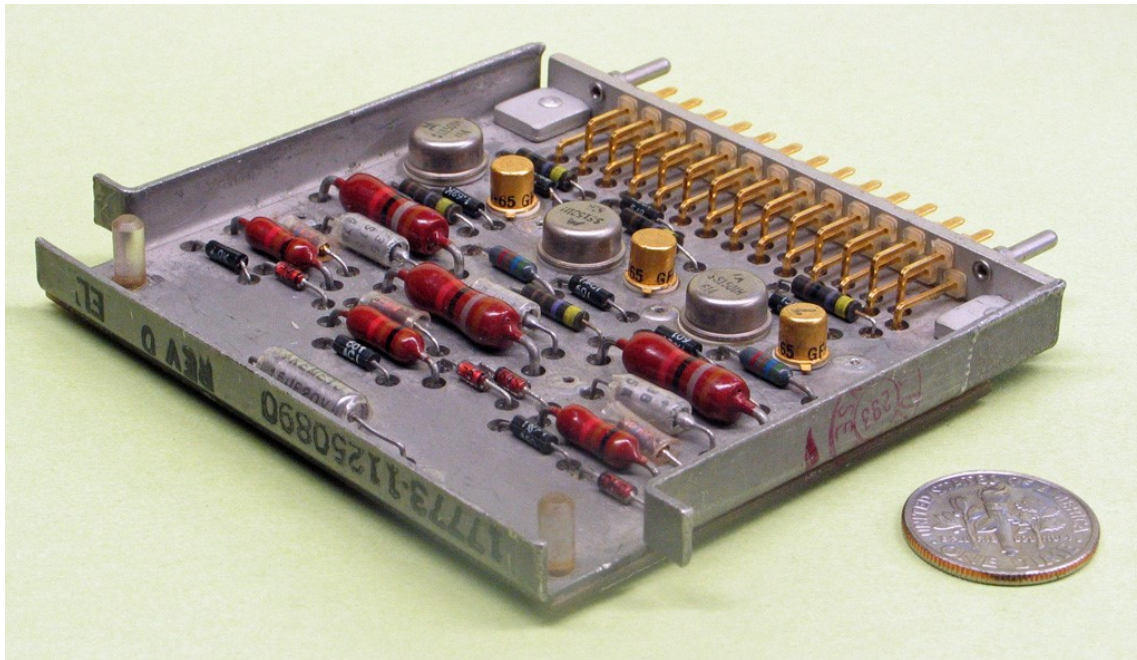
2 – GF-40174: No functional description (Possible part numbers 11263869 or 7252810)

Originals of these photos should be in the museum. I scanned them when we still had them.



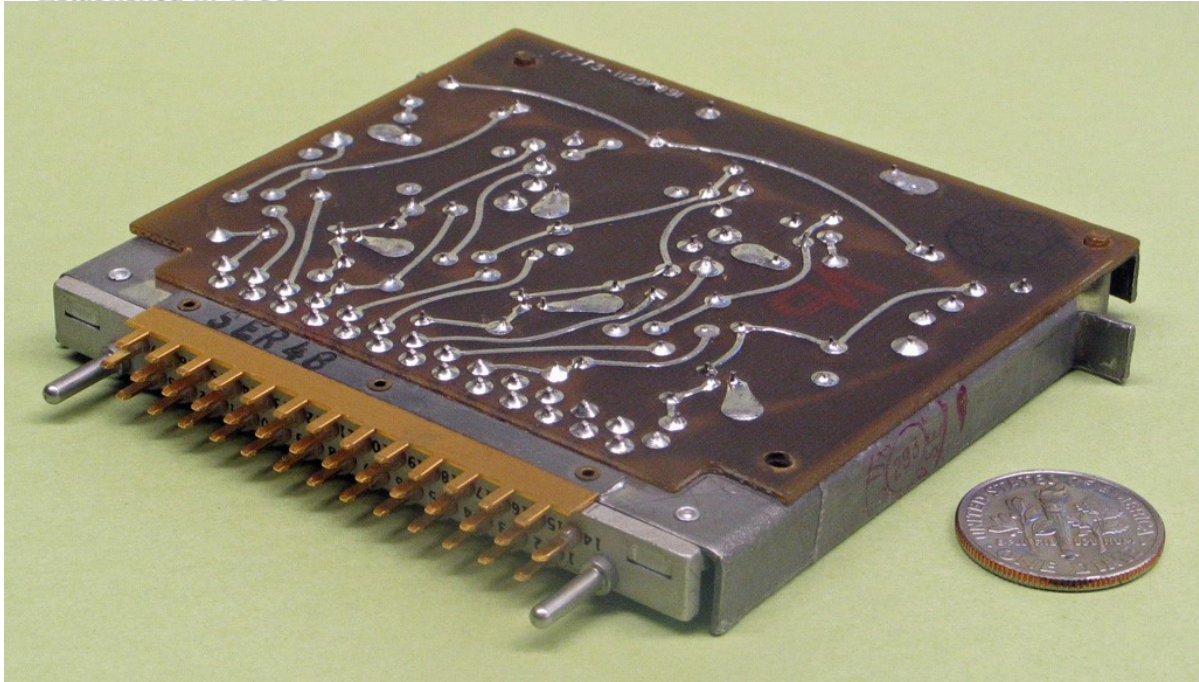


P/N 11250890 or 7250890 card; this card is in the museum's artifact collection.

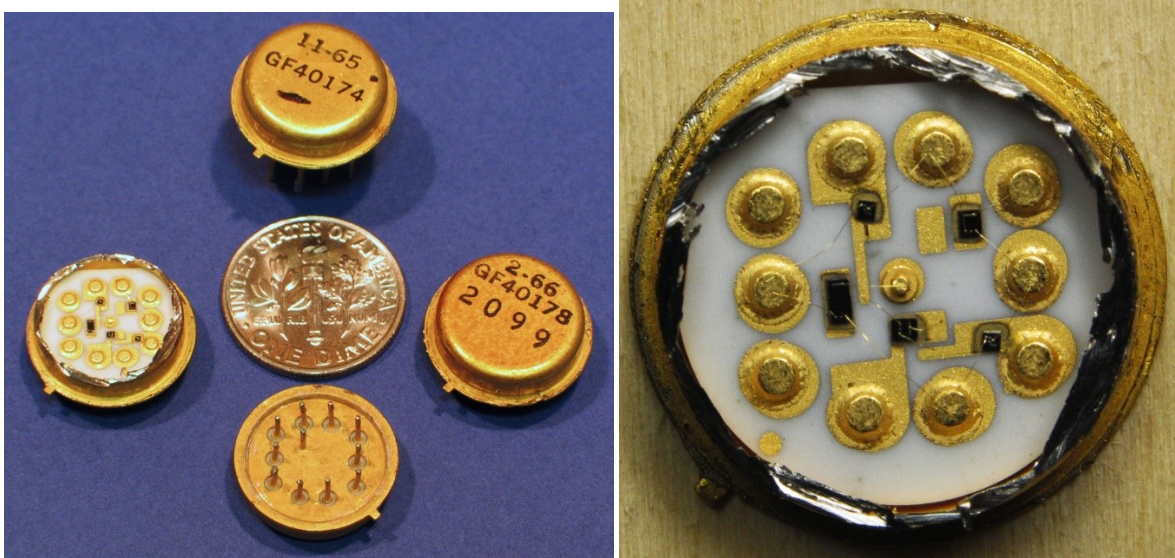


Has 3 pieces of a GF-40154 which are TO-18 transistors (11253820 or 7252820)





Photos of Hybrids, IMG\_2760cs.jpg and IMG\_2764cs.jpg, pictures at the museum.



Note the markings atop the hybrid cans: The 11-65 and 2-66 are the week and year that the device was manufactured. The GF40174 and GF40178 are the manufacturer's part number.

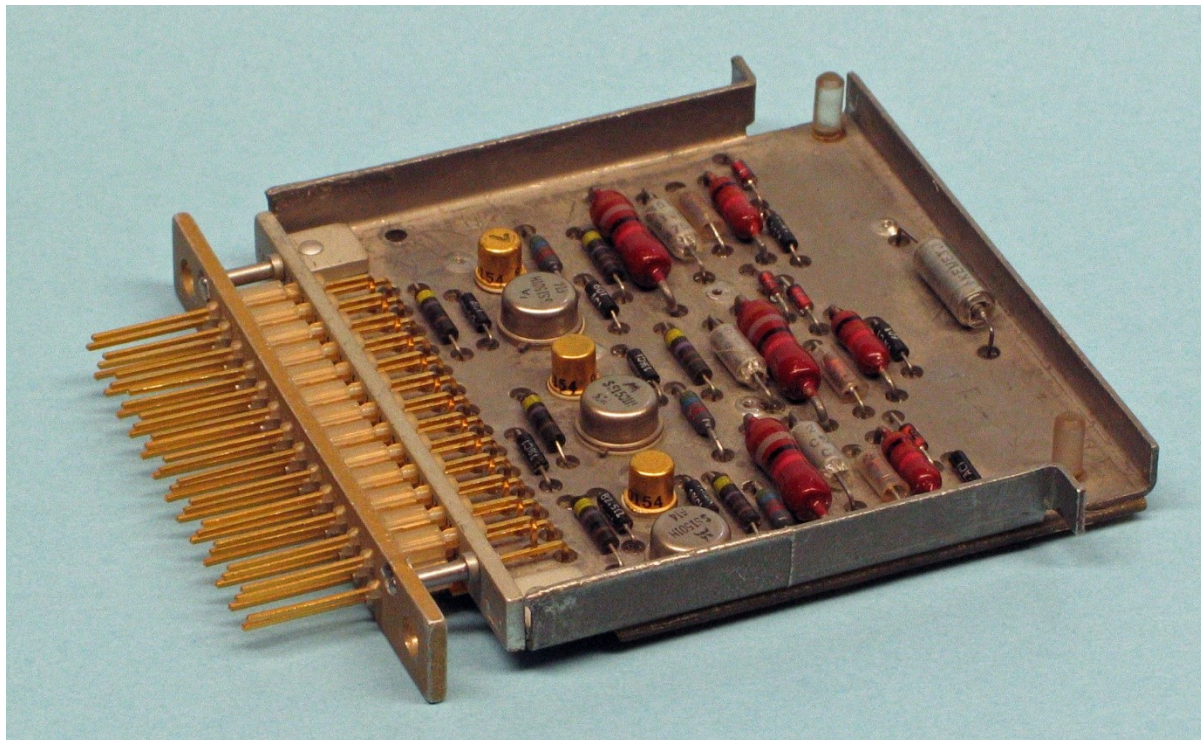
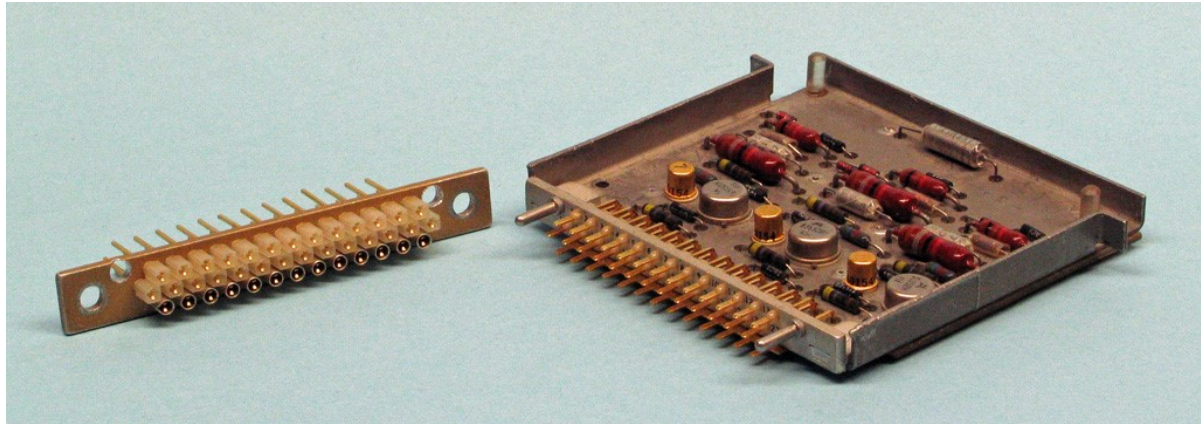
If one looks at the card photos on page 3; the hybrids all have WE on them, labeled by Western Electric. The GF part numbers are also obvious; however, the manufacturer dates have an A between the week and year, i.e. 27A66 or 24A66 or ...



Established in 1980

Card Connections

Commonly called back panels; wires were used to link socket pins for card-to-card logic and power distribution circuits.



Established in 1980

Database extract

Nike-X line items in our hardware data base pertaining to these hybrids.

Company Part Number	Description	Vintage	Size (HxWxD) inches	Donor	Photo #
GF-40162	Microcircuit, Hybrid, 11 leads (10 in rectangular 2x3 pattern), made by Western Electric. Contains diode/transistor and diffused resistor die. Reference card photo 3535 for typical application views.	1965	0.6 dia x 0.5	Harvey Taipale	IMG_2764cs
GF-40174	Microcircuit, Hybrid, 11 leads (10 in rectangular 2x3 pattern), made by Western Electric. Contains diode/transistor and diffused resistor die. Reference card photos 3537 for actual application view.	1965	0.6 dia x 0.5	Harvey Taipale	IMG_2764cs
GF-40178	Microcircuit, Hybrid, 11 leads (10 in rectangular 2x3 pattern), made by Western Electric. Contains diode/transistor and diffused resistor die. Reference card photo 3535 for typical application view. One of the units is opened.	1966	0.6 dia x 0.5	Harvey Taipale	IMG_2760cs
11250890 or 7250890	PC card, 27-pin, with guide pins and 13 ground fingers, "Emitter Line Pre-Driver", appears to be a triple circuit function (3 transistor pairs, one type WE GF-40154 TO-18, the other a Univac 7901426 (Mot SS1501H) Silicon PNP TO-5). With mating backplane connector. <b>Card Information</b> Rev. 0 EL Ser 48 PCB 11250391	1966	3.0x3.0x0.4	Don Weidenbach  Larry Bolton (connector)	IMG_3839.

19 November, [more from Larry](#)

I found another document. Not sure where the original is. Mine is a copy, the first page is very faded. The scan seems to have enhanced the contrast, so some words do show up better. This appears to define the hybrids and semiconductor die, whether part of a hybrid or packaged separately. But several of the GF-40xxx items are defined. Let me know if there are characters that you cannot read. I may be able to look at my copy to see if I can read them. Larry Bolton. {Editor's note: This file is saved on line, see <http://vipclubmn.org/Articles/NikeXcircuits.pdf>}

12 December, [Larry to Micah w/cc to Lowell](#)

I know you are very busy. Did not want to keep Mr. Mabelitini waiting any longer so I have transmitted the files to him as is. Feel free to send him any additional info you and Don come up with and please copy me too. Thanks, *Larry Bolton*

Established in 1980

15 February, from Don Weidenbach

Lowell,

The only thing I can add about the circuit card pix is that they are definitely from Nike X and that they used WE BTL Western Electric integrated circuits.

In regard to people on the project and project names I would like to say there were two different projects. Nike Target Intercept Computer (TIC) came first. It had the same function as Nike X, to control the Intercept missile, but had completely different hardware, had far less capability than Nike X. It used WE designed circuit module hardware that we/Univac did the circuit and logic design on. It used wire wrap technology, very new at the time to connect the modules to the back plane and had no printed circuits. Rollie Arndt was a member of that project. When that project was finished, we received a new contract from WE/BTL to design and build Nike X. Most of the design team went from TIC to Nike X, but not Rollie. Tom Rowan was the Project Engineer for TIC, I took over from him on Nike X. Nike X was a very fast, multi-processor machine which used 200 nanosecond thin film memory as the main memory. That was extremely fast for a main memory at the time. It was built with multilayer printed circuit boards (seven layers if I remember correctly) with plated thru holes to interconnect the layers, which was a huge step up in memory technology. Also, a pain in the \*\*\* to build and maintain!

Well that's about all I can add for now. Don

P.S. we had no on board the missile hardware on either program.

## EPILOGUE

**Don Weidenbach:** In 1963 my group was tasked to design the computer for the Nike X Anti-Ballistic Missile (ABM). This system used many cutting-edge technologies, including the very fast Sprint missile guided by a phased array radar [no moving dish, electronically steered beam], and a high-speed multi-processor computer with 200 nanosecond thin film memory. We completed the first computer in 1967 and continued with this project until the Strategic Arms Limitation Treaty (SALT) shut down the US ABM activity in 1969. When I asked Don about this project, he said: "We were ready to go into production before the SALT agreement."

<http://vipclubmn.org/People7.html#Weidenbach>

Don was given the desk mount shown here at his 1946-1976 retirement party. It has an Athena module, an Athena vacuum tube, a Nike X sticker, and ERA sticker - partly peeled off.

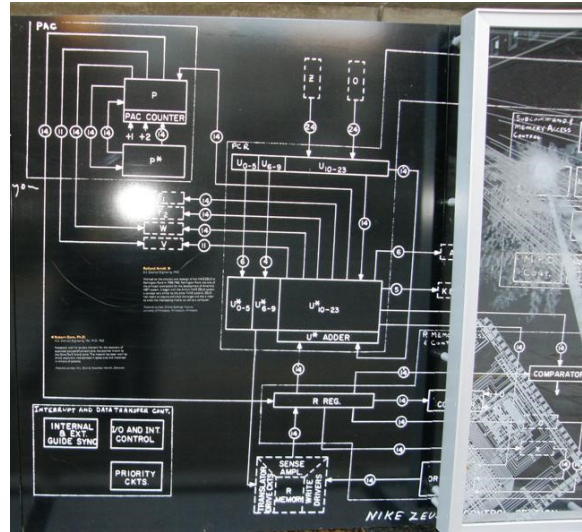




**Rollie Arndt:** The U of MN's Discovery wall <http://www.scholarswalk.umn.edu/discovery/> contains the following words about Mr. Arndt: "Rolland Arndt worked on the circuitry and redesign of the NIKE ZEUS at Remington Rand in 1958-1960. Remington Rand was one of the principal contractors for the development of America's ABM system. It began with the Army's NIKE ZEUS system, a concept very similar to the other NIKE systems. ZEUS had radars to acquire and track the target and also a radar to track the intercepting missile, as well as a computer." [by Dick Lundgren]

See [vipclubmn.org/deceased.html#Arndt](http://vipclubmn.org/deceased.html#Arndt).

{Editor's note – Etched onto the wall is this logic diagram of the 24-bit Nike-X processor. This was taken from the four archive boxes that Rollie had donated to the U of MN's Charles Babbage Institute.}



- **Lowell A. Benson;** BEE, U of MN, 1966: Mr. Benson has been co-chair of the Club's Legacy Committee since its formation in 2005 and was the Club's webmaster from 2006 through 2017. His 33.5-year UNIVAC 1960 to UNISYS 1994 career had a plethora of diverse project and program assignments, see <http://vipclubmn.org/People1.html#Benson> and <http://vipclubmn.org/PeopleDocimg/Vol01Book1.pdf>. I worked with Rollie briefly the summer of 1963, feel honored to this day to have met him!

*This article edited and formatted for our Legacy Anthology and the web by Lowell. Send any supplemental information to [labenson@q.com](mailto:labenson@q.com) and those will become a future 'Our Stories' article.*