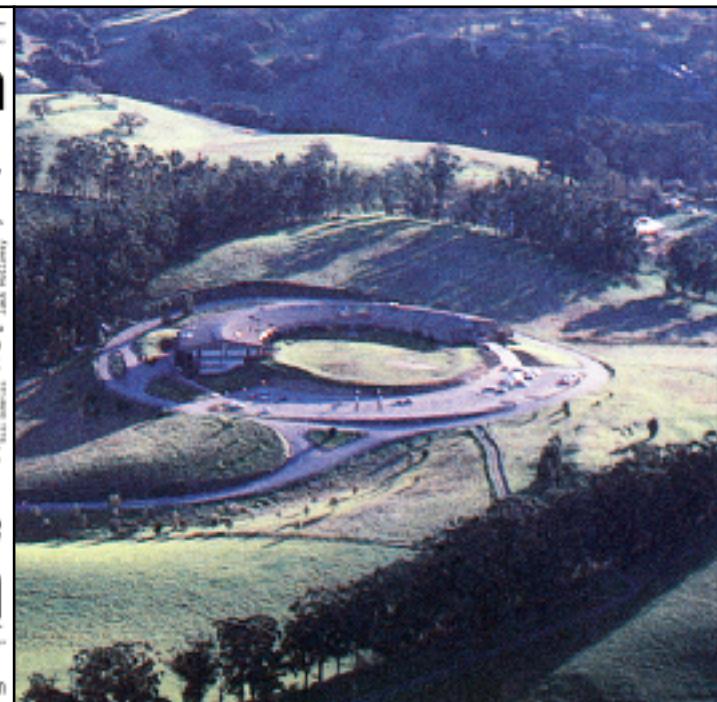
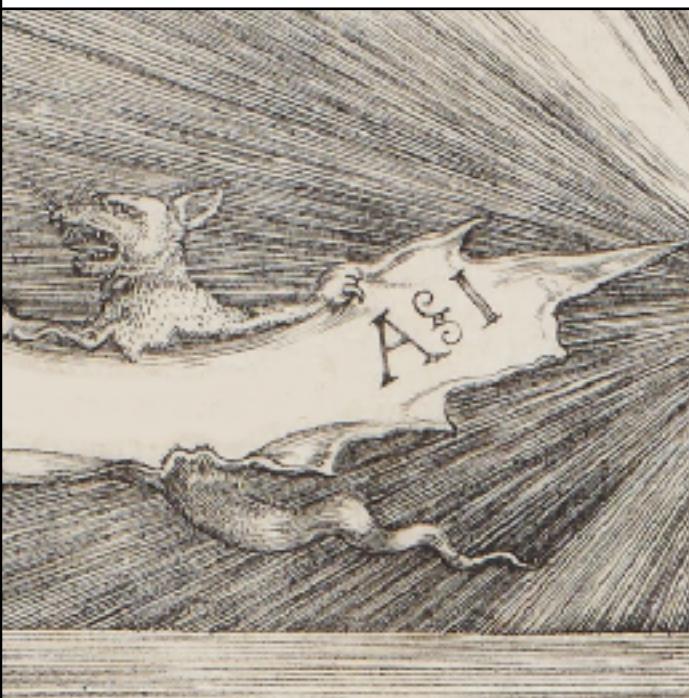




Zohar Manna Martin Frost
Richard Weyhrauch
Robert Maas Dick Gabriel
Curt Widdoes John Grey
John McCarthy Scott Kim
Bill Fought Arthur Samuel Randy Davis
David Stoll David Ballew John Hwang Arthur Thomas
Paul Martin Tovar Hans Moravec Ron Daniels
Mike Fordyce Paul Wieneke Jeff Koen Jussi Nekonen Derek Dopen
Mike Bostick Tom Binford Rosemary Napier Tim Pihlala George Matthes Ross Felt
Carolyn Talcott George Schnurle Friedrich VonHenke Kari Heikkila Kari Ranta
Mike Witzel Mike Bostick Tom Binford Rosemary Napier Tim Pihlala George Matthes Ross Felt
Leland Smith George Schnurle Friedrich VonHenke Kari Heikkila Kari Ranta
Les Earnest Yonatan Malach Ralph Gorin Goran Losic Peter Arnett
Russell Greiner David Wilkins Shahid Mujtaba Andy Bechtolsheim



MSG
PC DIR PRF IN DO PLN NEW GDO OLD GRF
PC DIR PRF IN DO PLN NEW GDO OLD GRF
SAIDMP PRO TXT FAS PLT FOR
BIN SND PRT RUL SAV POX OUT LIBFOL HDR F4 300 PSC
INSERR TST WEB FNT
MF51 DMD MSSS DES
LSP LAP CHA TMP TOC PLA PUB MID
PRE DIA DRW BAKUCO MS LET TFX
DOC XGP DIS FAI FUN BKP LOG PAS PAK



SAILDART
Archive
Preview
June 2019

inside front cover

The SAILDART Archive

Preview — June 2019

SAIL was the lab. DART was the backup program.

SAIL — The first Stanford Artificial Intelligence Lab.

DART — Dump And Restore Tape program, wrote

50 Gigabytes on a final set of 229 reels of magnetic tape.

SAILDART is a digital archive

promulgating records from SAIL.

The DART backup tapes span from 1972 to 1990.

The year 1974 is convenient for re-enacting the software.

Computer expertise is required to run the simulation.

Computer enthusiasm suffices to read this history.

In 1974
disks were huge
capacity was tiny



Four feet in diameter
Five megabytes per side

When Once upon a time near the dawn of A.I.

I was one of the crew at a lab
named *SAIL*, on a voyage of discovery,
for six years, 1969 to 1974, I worked at SAIL,
it was the springtime of A.I. – Then a quarter century
later, in 1998 – our captain leader JMC, John McCarthy,
essentially said to me, “The tapes ! The tapes !

Bruce, please save all the data off the DART tapes !”

Time Line Table

1958	M.I.T. A I project started by John McCarthy and Marvin Minsky.
1963	Stanford A I project started by John McCarthy.
1966	Stanford A I project moved off campus into D.C.Power Lab. PDP-6 computer installed.
1968	PDP-10 KA computer installed.
1972	Spacewar competition at SAIL reported in the Rolling Stone magazine.
1974	First DART tape is written. Software re-enactment for a typical day at SAIL, Friday 26 July 1974.
1976	PDP-10 KL computer installed.
1979	SAIL moved to Margaret Jacks Hall on the Stanford campus. SAIL merged with Stanford Computer Science Department.
1986	D C Power Lab building is demolished.
1990	Final DART tape is written.
1991	Final E-mail message from SAIL-WAITS Timesharing System sent.
1998	SAILDART started by John McCarthy with Baumgart, Selker, Ernest & Frost.

Where

1600 Arastradero Road
Palo Alto, California



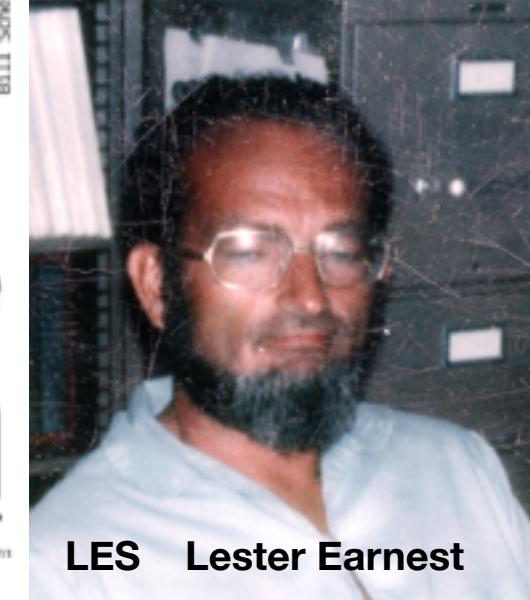
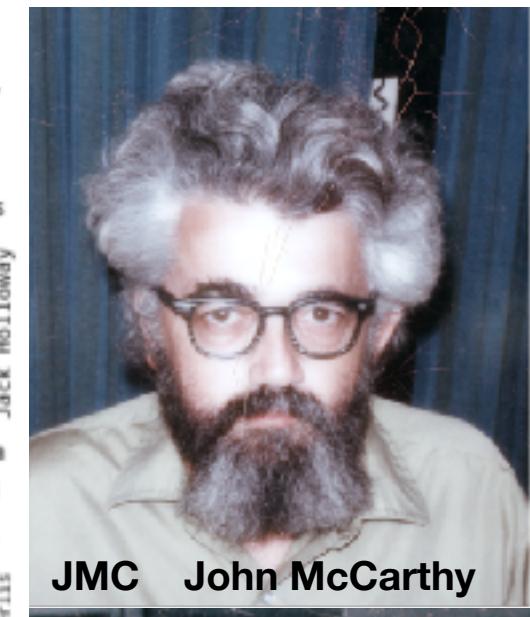
The first Stanford A.I. Lab resided in the D.C. Power Lab from June 1966 to November 1979.

"Hackers thought this was very funny, because the obvious connection to electrical engineering was non-existent, the building had been named for a telephone company executive Donald Clinton Power."

- Hackers Dictionary.



Who



For the 18 years of SAIL that are visible via the DART tapes, user login access to the computer system required a 1 to 3 alphanumeric programmer code.

When I was a grad student the lab leaders were JMC John McCarthy, LES Lester Earnest , and ALS Arthur Samuel.

— *I took the three snapshots in 1970.*

The top 200 names in the word cloud are ranked by quantity of data in the SAILDART archive.

What + Why

What is in the SAILDART Archive is like what is found in an ancient kitchen midden where broken shards of pottery and tool fragments are embedded in heaps of trash. The bulk of the data on the DART tapes is not Artificial Intelligence Research.

Nevertheless, the *born-digital* originals of half the AIM technical reports published between March 1963 and June 1984 can be found in the SAILDART archive. Some of the 1970s software can be demonstrated.

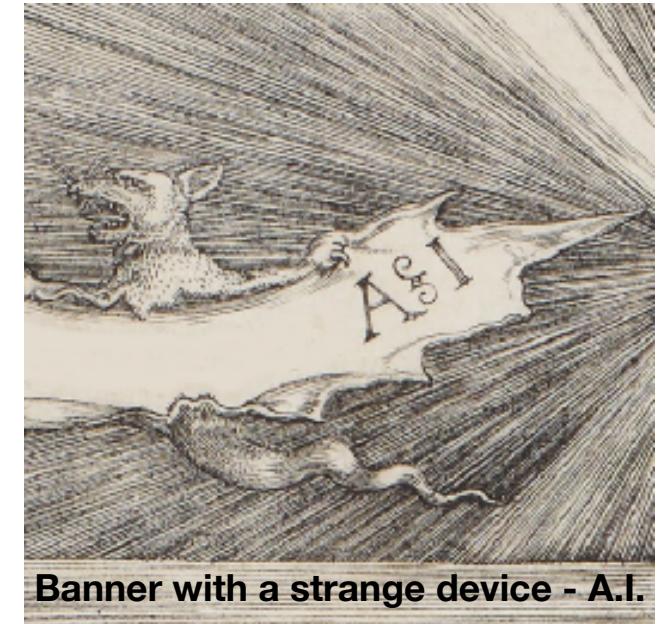
* * *

Why SAIL ? The simple answer is because WW2 advanced electro mechanical computation, John McCarthy coined the label '**Artificial Intelligence**' for a 1956 conference, the label stuck. The Sputnik surprise of October 1957 lead to the creation of ARPA where one person J.C.R. Licklider funded the A.I. research proposed by John McCarthy et al at MIT, then Stanford.

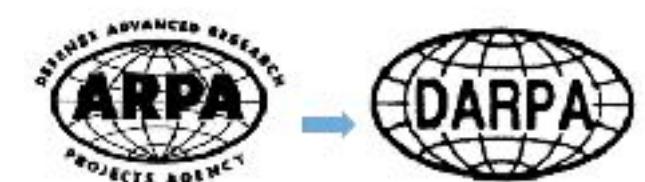
* * *

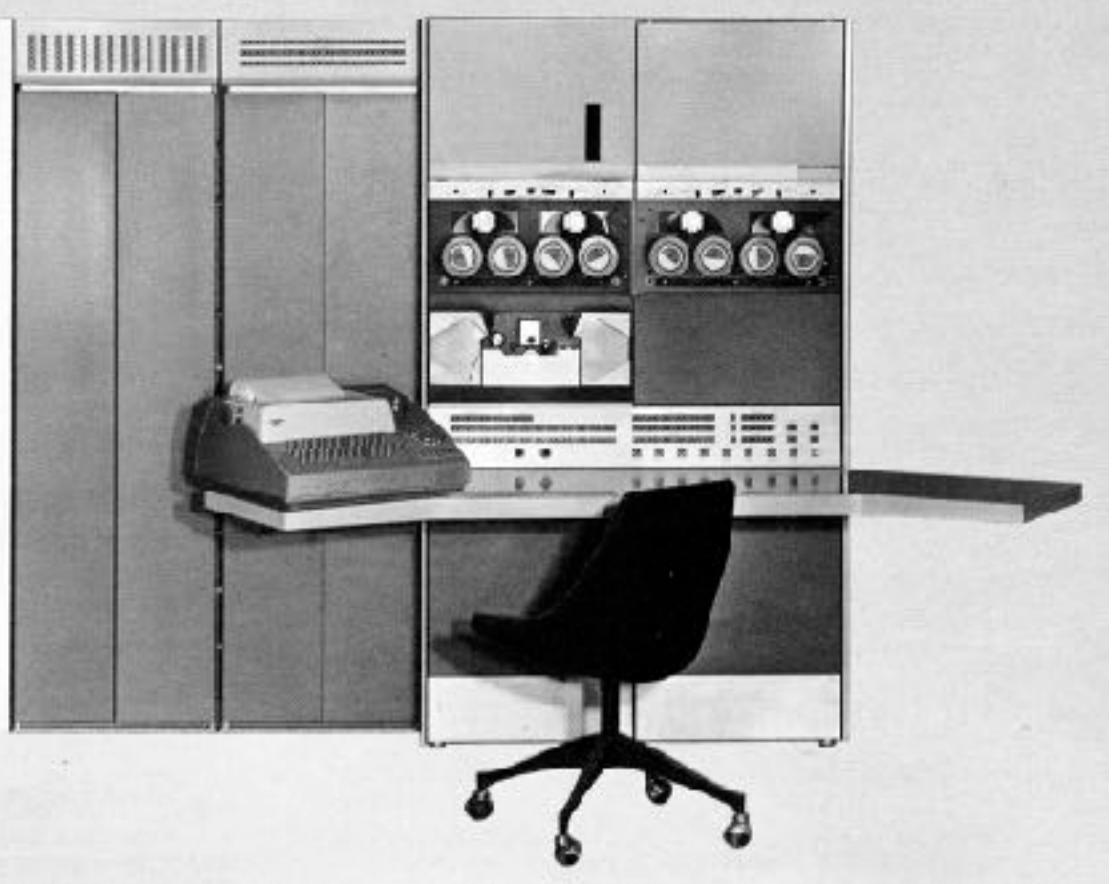
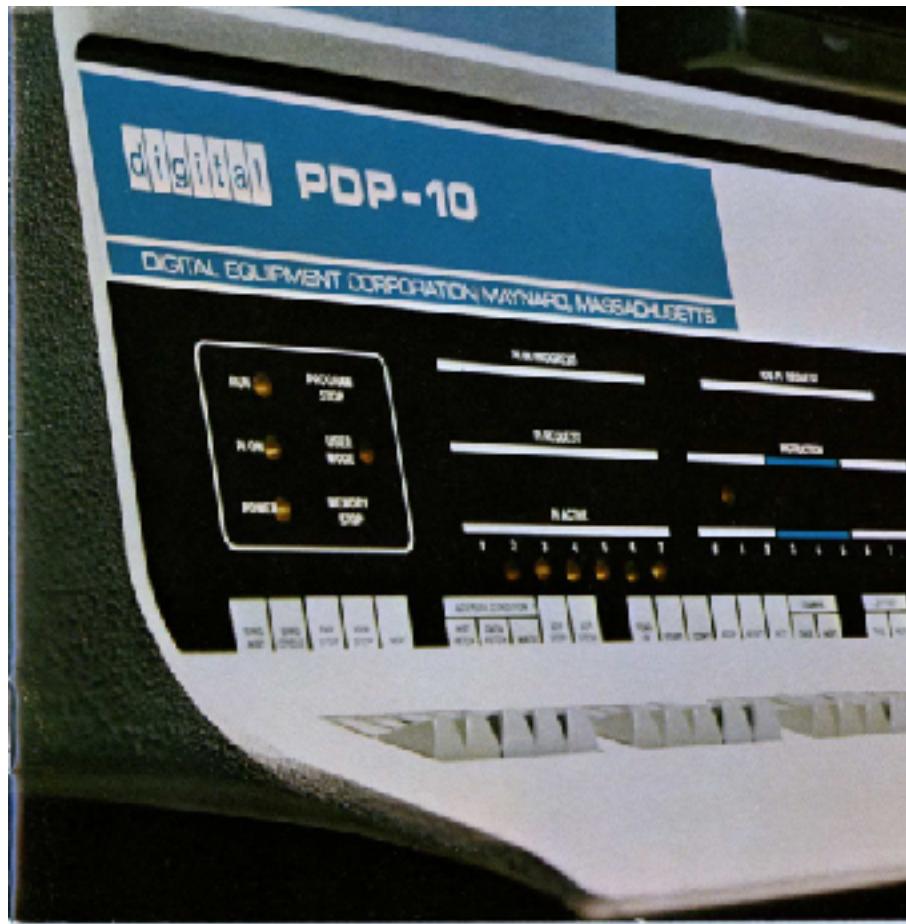
The official SAIL Research Topics [Earnest73] were

- * Robotics: Vision + Mechanical assembly + Vehicle navigation.
- * Heuristic programming: Theorem proving
 - + Automatic program generation
 - + Symbolic computation + Board games + DENDRAL.
- * Theory: Mathematical theory of computation
 - + Representation theory + Grammatical inference.
- * Natural language: Speech recognition + Semantics
 - + Machine translation.
- * Planetary (Mars) image processing.
- * Computer music synthesis.



Banner with a strange device - A.I.





Two machines shared by 100 people in 1974 were the PDP-10 KA at a half MIP and the PDP-6 at a quarter MIP. The machine I am using to write this sentence in 2019 has 120 thousand bogo MIPS.

Hardware

SAIL Computer Room, *named Mordor*, 1972 left-to-right is the LPT drum printer, 7 Track tape drives, back wall of tapes, the Stanford Cart, Librascope disk, the PDP-10 is behind FW, BgB then XGP.



The fastest PDP-10 was the Foonly F1 at five MIPs. It was operational by 1980.

FOONLY

Read Gordan Bell, then let's talk about 6/10 vs x86, ARM, and Berkeley RISC-V.



Computer programs are fun to write, and well-written computer programs are fun to read. One of life's greatest pleasures can be the composition of a computer program that you know will be a pleasure for other people to read, and for yourself to read.

— Donald Ervin Knuth

*The farther back you can look,
the farther forward you are likely to see.*

— Winston Churchill

SAILDART is a raw storage basement for a software museum. The old SAIL files are a heap of shattered pottery shards. The software pottery fragments need to be inspected, sorted and re-glued together to form program vessels that have enough shape to be assembled, compiled, loaded and executed in the present. Professor Knuth pioneered <<Literate Programming>> while working on the SAIL system. Unfortunately most of the software to be read in the SAILDART is painfully primitive and requires a level of expertise similar to that of an Egyptologist who can read 2nd Dynasty Hieroglyphics. I believe there are fewer than 1K persons alive now who can easily read PDP-10 assembly language. For that narrow readership, the SAIL table of programs is available at all the old file names some of which are:

Time Sharing **Operating System**: SYSTEM . DMP [J17, SYS] WAITS . DMP [S ,
SYS] **Assembly**: Macro FAIL Midas DDT RAID RPG **Programming Languages**: LISP
SAIL Fortran Pascal Prolog Basic **Design (aka CAD)**: SUDS GEOMED SCORE
Games: Chess Checkers Go Spacewar Adventure **Mathematics**: Reduce LCF **Music**:
Score Publication: XGP PUB TeX **Robotics**: Hand/Eye and Cart **Text Editors**: Teco
SOS TVED E Vision: Mars CRE Moravec.

SPACEWAR



Ralph Gorn, nearest the display tube, warms up Spacewar contestants. Rocket controls are visible on knee of player at left - four buttons, one for thrust, one for torpedoes, one each for turn to the left and to the right.



Software

LISP eval in LISP

```
apply[[n;x;a] =  
    [atom[fn] -> [eq[[n;CAR] -> caar[x];  
                    eq[fn;CDR] -> cdar[x];  
                    eq[fn;CONS] -> cons[car[x];cdr[x]];]  
        eq[tn;ATOM] -> atom[car[x]];]  
    eq[fn;EQ] -> eq[car[x];cdr[x]];]  
    | -> apply[eval[fn;a];x;a]];]  
    eq[car[fn];LAMBDA] ->  
        eval[caddi[[n];pairlis[cadr[[n];x;a]]];]  
    eq[car[fn];LARFE] -> apply[caddi[[n];x;  
                                         cons[cons[cadr[fn];caddr[fn]],a]]];]  
eval[e;a] ->  
    [atom[e] -> corlassoc[e;a];]  
    atom[car[e]] -> [eq[car[e];QUOTE] -> cadr[e];  
                      eq[car[e];COND] -> evcon[cdr[e];a];]  
                      | -> apply[car[e];evlis[cdr[e];a];a];]  
                      T -> apply[car[e];evlis[cdr[e];a];a];]  
evcon[c;a] -> [eval[caar[c];a] -> eval[cadar[c];a];]  
                  T -> evcon[cdr[c];a];]  
evlis[m,a] -> [null[m] -> NIL;  
                  T -> cons[eval[car[m];a];evlis[cdr[m];a]]];]  
pairlis[x;y;a] -> [null[x] -> a;  
                      | -> cons[cons[car[x];car[y]];]  
                            pairlis[cdr[x];cdr[y];a]]];]  
assoc[x;a] -> [equal[caar[a];x] -> car[a];]  
                  T -> assoc[x;cdr[a]]];
```



Access

Portions of SAILDART are visible on public web sites. The full SAILDART archive is curated as a private research collection by former SAIL personnel at the 1998 request of the Principal Investigator, professor John McCarthy.

All DART records will be out-of-copyright by the year 2100.

The meme I wish to illustrate using a Mid Peninsula Free University catalog photo, is that during the 1970s the computer research culture at Stanford A. I. changed from left to right, from hippie hackers into entrepreneurial geeks. The anti war protests of 1969, forced classified government research off campus to SRI, and in parallel, at Xerox PARC, computer knowledge sharing became NDA secret keeping.

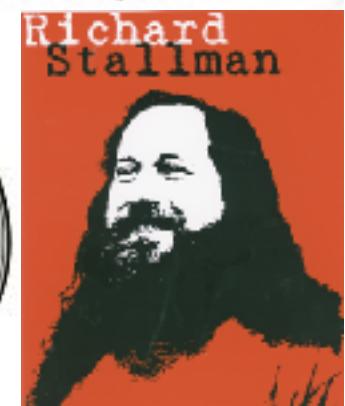
Some hackers (e.g. Richard Stallman) in the A. I. community responded with the GNU Copy Left license, FSF, EFF, and later Creative Commons. Other A. I. hackers muddled ahead into startups, some achieved extremely great commercial success. Railroad Robber Baron, Leland Stanford, Sr. would be proud, the Silicon Gold Rush was on.

One notorious story in the 1980s portion of the SAILDART archive, concerns the origin of Sun Microsystems founded by Andy Bechtolsheim and Cisco Systems founded by Leonard Bosack, and Sandy Lerner when they were at Stanford University. The circuit board for both the first Sun work station and for the first Cisco Router is one and the same as designed by Bechtolsheim using SUDS. The Sun-1 board was then used in Stanford "blue box" routers which are nearly identical to the first routers sold by Cisco.

"On July 11, 1986, Bosack and Lougheed were forced to resign from Stanford and the university contemplated filing criminal complaints against Cisco and its founders for the theft of its software, hardware designs, and other intellectual properties." - Wikipedia



WHICH UNIVERSITY ARE YOU GOING TO THIS FALL?



Provenance

PROVENANCE of a digital archive has two parts, first is the chain of custody of the media, and second is the fidelity of the data transcriptions into working copies for preservation, circulation and presentation.

CUSTODY - The final high density tapes have never left the Stanford campus. On 26 April 2011 we (Baumgart, Earnest, Frost and Hartwig) moved the 229 reels of DART tape from the Computer Science Department at Gates to the special collections at Green Library.

The low density tapes, reel#1 to reel#1583, were written in the computer room at SAIL in the D.C. Power Lab. Those tapes were moved to MJH in November 1979. Tape reel#1584 to reel#2984 were written in MJH Margaret Jacks Hall.

The MCOPY tape conversion software was developed and tested in early 1988, but not used until May 1990. Only the first three high density tapes were written in 1988, the remaining 226 reels were written in 1990. There was no tape conversion work done in 1989. The 229 high density tapes were moved from MJH to WmGB in December 1995 or January 1996, then moved again to the Green Library in April 2011.

Authenticity

FIDELITY - The bytes found on each high density tape in 1998, were read using the GNU/Linux 'dd' utility and were aggregated into 229 compressed tar balls and MD5 hashed. The hash numbers assure that the present 229 tar balls are the same as the 1998 ones. In 2015, the GNU/Linux 'tar' dependency was removed and one long DART byte string written into a single file.

***Farb** is a derogatory term used in the hobby of historical re-enacting in reference to participants who are perceived to exhibit indifference to historical authenticity.*

My new **Farb definition** is that Farb is an authenticity scale #0 to #9, so Farb level #0 is the original media as-is.

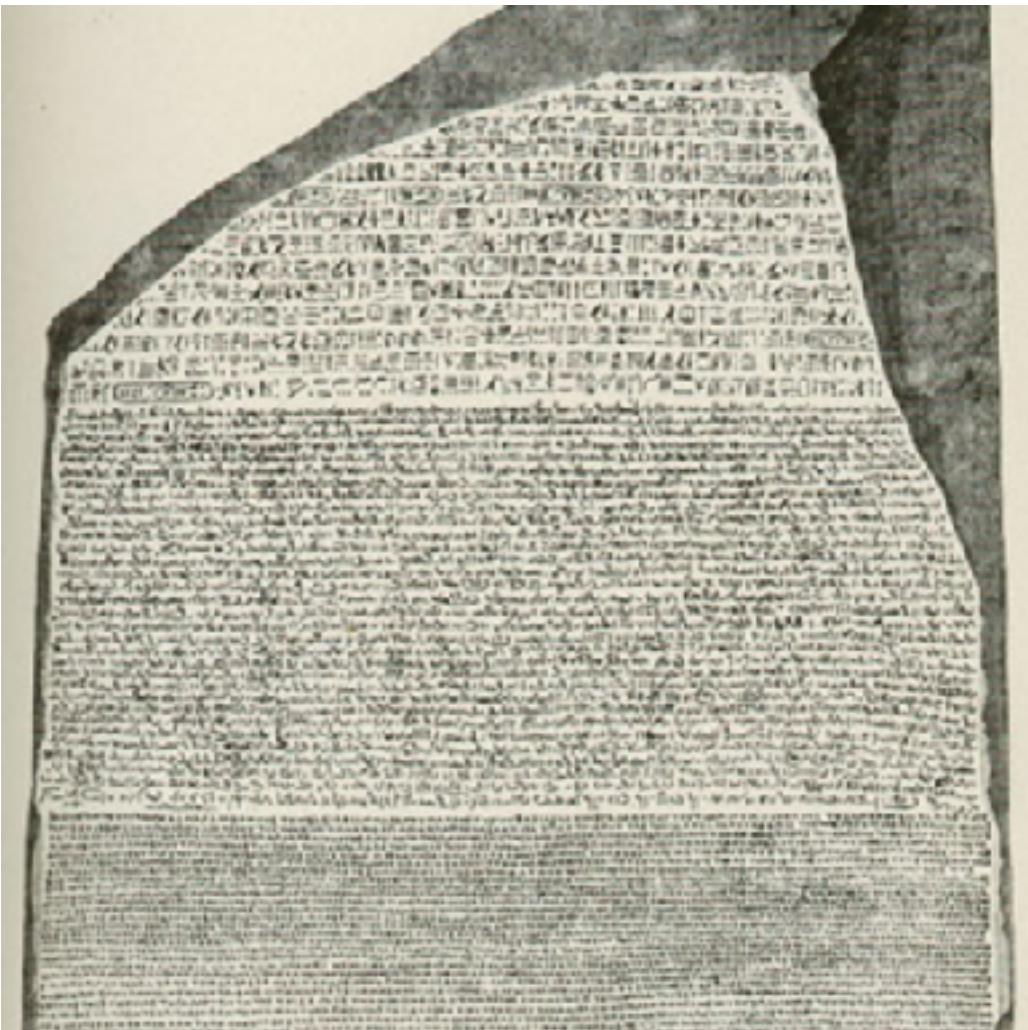
Farb level #1 is data that is a bitwise exact copy, hash MD5 checked.

Farb level #2 to #5 are curated interpretations.

Farb level #6 to #9 are for shades of re-enactment up to steam punk historical fiction.



**Farb
Level**



Remix

UNDART, as well as REMIX, generate database CSV (Comma String Value) tables for SAIL content blobs (sn, hash) and for the SAIL name tags (pathname, date time, word count and prot_mod).

There are fewer than one million unique DART content blobs, serial numbered, sn, from 000001 to 999999. There are fewer than two million name tags. Content blobs with many names are boiler plate (or software farts) that appear in many user file directories.

Further REMIX does four-D — de-dup, de-damage, de-flate and de-tox to remove duplicates, damaged copies, excessive record padding, ephemera, and obvious legal / ethical hazards.

Final REMIX steps assist digital curation to provide T-Shirt sized corpora for the Large, Medium and Small collector; translated into the most au courant formats for archives and for presentation.

TIME-CAPSULE

The original SAILDART was 50 Gigabytes.

A convenient DATA8 flat file copy packing
36 bits into 64 bits comes to 85 Gigabytes.

The file is named:

flat_DART_data8

Its MD5SUM hash is now and forever:

3adbff17fd7f9f6eb9107755594ae0b9

So you will know it, when you find it.

UNDART

Regular DART wrote to low-density 7 track tape.
In 1990, MCOPY re-wrote the data to 9 track tapes.
In 1998, DD/TAR copied the 9 track tapes into
GNU/Linux "tar-ball" tgz files, which UNDART writes
into unix files as DATA8 and UTF8 for conversion into
html / js / css / pdf / svg / png / csv / jason / yaml

EXEGESIS

DART text is encoded
in a modified 7-bit ASCII
packed into 36-bit words.

Octal code	STANFORD	ASCII
00 nul	10 λ	20 c
01 +	11 tab	21 ▷
02 α	12 lf	22 n
03 β	13 vt	23 u
04 ^	14 ff	24 ∄
05 ~	15 cr	25 ē
06 ε	16 ∞	26 ø
07 π	17 ø	27 ø
175 Stanford-ALT-\$		176 }

Converted to GNU / Linux the one million content
blobs are encoded as both UTF8 text files and as
DATA8 binary with the 36-bit PDP-10 words packed
right justified into eight byte 64-bit words.

FILNAM [PRJ , PRG]
or
FILNAM . EXT [PRJ , PRG]
or
FILNAM . EXT [PRJ , PRG] {version}
FILNAM . EXT [yym , PRG]

'yym' is a hack to pack version date-time inside the limited SAIL Ralph UFD notation for re-enactment.

The SAIL-WAITS file system is primitive. It was a tool for pioneers at the frontier. It stayed the same for 25 years, it could not be changed — which benefits the archivist, but was a fatal limitation for SAIL-WAITS.

File names were one to six characters long, optionally followed by dot and a one to three character extension.

Only the 26 uppercase letters and 10 digits were widely used. Special infrequent hacks used punctuation or spaces in file names (*delimited by down arrows ↓*F00*↓.TXT*).

Each file belonged to a User File Directory, its UFD, specified by left square bracket project code comma programmer code right square bracket. The project and the programmer codes were each one to three characters long. UFD is aka PPN. My home SAIL user directory is at [1,BGB] now and forever.



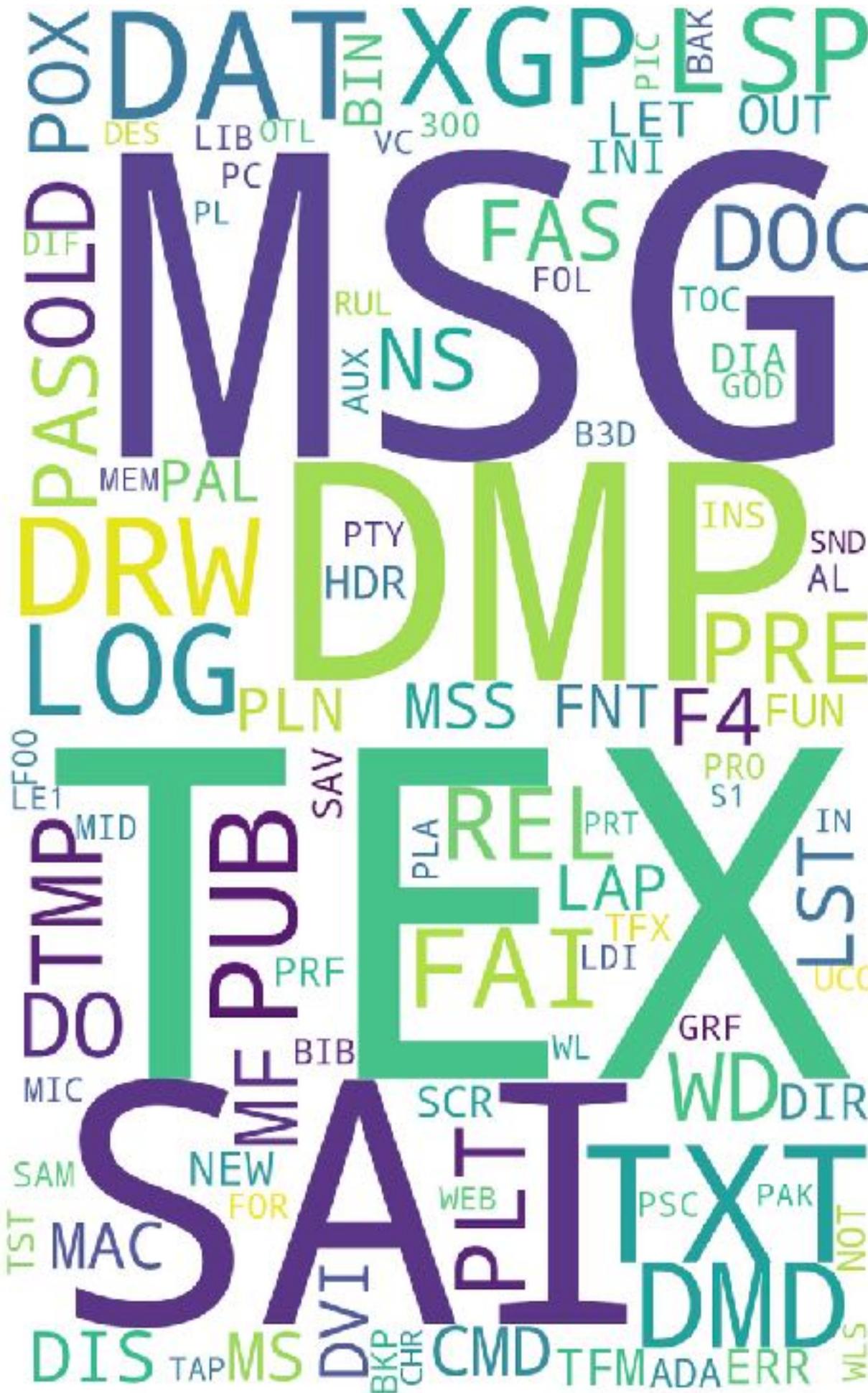
The explicit DART meta data is just FILNAM.EXT [PRJ,PRG], date-time, word count size, a nine bit protection code and a four bit write mode code; so called DT, WRDCNT and PROT_MOD.

Additional meta data, from *in-band* content analysis derives attributes such as Text vs Binary, Public vs Private, copyright status, MIME-like content-type and a redaction code.

Redactions remove duplicate content, damaged copies and toxic material that legally or ethically does not need to be included in the SAILDART archive. Go look for it at Stanford in the year 2100 or so.

Computers were very expensive, so research funding required detailed bookkeeping. A lot of computer usage stats, login session stats and personnel records are within the SAILDART !

Meta Data



Data

The word cloud shows the rank number of files for the top 100 extension codes.

In round numbers, there are
52 thousand TeX files,
44 thousand MSG email/bulletin board
27 thousand DMP files
in the SAILDART.

DMP and REL files are for executable PDP-10 code. The top programming language files are SAI, LSP, FAI, PAS, MAC, F4 for SAIL, LISP, Pascal.

The PDP-10 assembly languages are FAIL, MACRO and MIDAS with extensions FAI, MAC and MID.

The data formats can be re-captured and decoded by reading the source code that generated the files.

* * *

The old files can be converted into modern formats representing Text, Digital Images, Sound, CAD drawings, 3-D models, Music, Speech, Typographical Fonts, Mars images, data bases, as well as into executable software !

Non DART

The Non-DART collection is simply archival items that were not on the DART tapes, but which are included in the SAILDART archive. Scanned documents, digitized film, re-union videos, as well as story telling and new writing about the era.

The size of non-DART material exceeds the 50 GB of the original DART tapes. Latter day videos of us SAIL survivors, are parked on Youtube as well as at Archive dot org.

Scanned paper documents include:
AIMS the A.I. Memos,
SAILONS the Operating Notes
PhD Thesis work

The digitized films and videos include:

16 mm Titles such as
Ellis D. Kropotchnov about a pre-SAIL time sharing system named Zeus.
Hear-Hear about speech recognition
Water Pump Assembly.

as well as home video
of a SAIL volley ball game.
long videos of re-union talks
and video of HPM cart demonstrations





Archival digital data preservation is now easy and cheap. Make many copies of the message. More difficult is curating the archive to be attractive and legible and not forgotten.

- Store copies in places accessible to readers.
- Provide mechanism for reading the message.
- Tell your peers and successors about your archive.

Find communities or institutions to house full or partial copies. Verify their performance. Leave copies on cloud servers.

LOCKSS = Lots of Copies Keeps Stuff Safe.
Mention Stanford, IA, CHM, LCM and even DOD, NARA and dot GOV and dot MIL archives. Cross link them.



Preservation

Preservation methods include

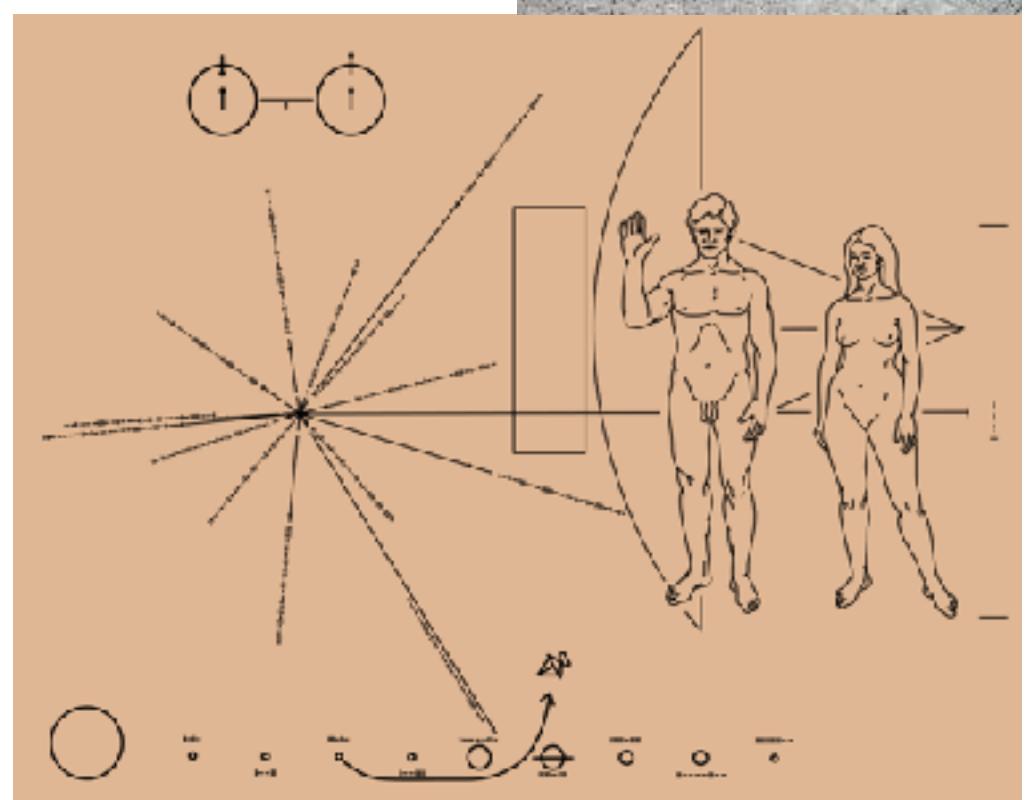
Narrow-casting: Time Capsules. Space-plaques. Write your archive on permanent media and bury it in the desert or launch it into outer space or leave it on cloud servers.

Broad-casting: Write your message on cheap media, make zillions of copies, send it every direction.

Baton-passing: like in a relay race. Carry / remix / improve your archive for your lifetime.

Hand it off, early and often.

Story-telling: The first library of Alexandria was lost to neglect; not fire, not water, not censorship. Bib-Alex has been rebuilt at <https://www.bibalex.org>



Publication

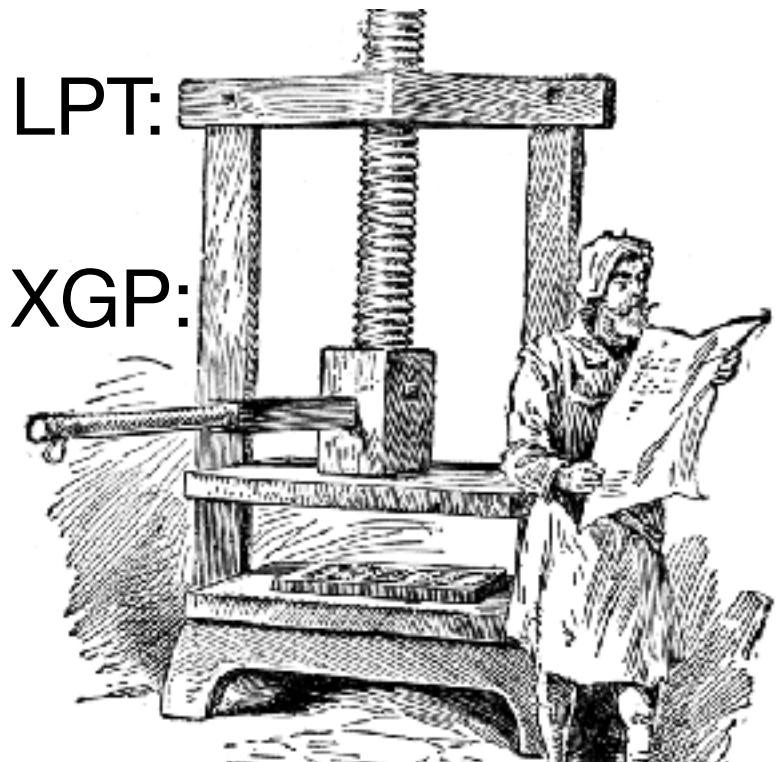
SAIL made more progress in publication technology than it did in Artificial Intelligence. This was both beneficial serendipity for printing as well as crass over promotion of our modest A. I. results.

This story starts with SAIL going it alone to extend its computer character set, which required special custom LPT mechanical drum printer, keyboards and graphics terminals; and that in turn required software for font design, document layout, and the nearly first laser XGP printer. The two famous programs are named PUB and TeX.

The story continues with SAIL spin-outs, graduates and drop-outs apply the publication research and development at other institutions: III, Xerox, Adobe, Apple, Imagen, HP, Japan and so on.

Now the story is about how to publish a digital archive in the 21st century. The SAILDART archive itself was launched and has survived for two decades, while our civilization re-implements the institutions for preserving and publishing knowledge. Review DIKW (Data Information Knowledge Wisdom) and block chain re Diffie, Lampson, Merkel.

The archival A.I. representation of knowledge,
aka "Ontology", is still in flux, 2019.



**There are 45 faces in the 2009 Walkabout picture.
At the center is Marty Frost in the white hat.**



Participation

Participation in the SAILDART Archive work is nearly zero.

Setting up the SAILDART Archive and running it for twenty years, 1998 -2018, has taken me one mythical man year, 2000 hours, of part time effort. But that guess counts time I have spent as a user of the SAILDART, rather than as its maintainer.

At my final three job sites: IBM Research at Almaden, Internet Archive, and the search engine named Cuil - each tolerated the SAILDART archive as slightly relevant to the work I was paid to be doing. At IBM in 1998, John McCarthy consulted for Ted Selker re data-mining 'Elephant' big-data.

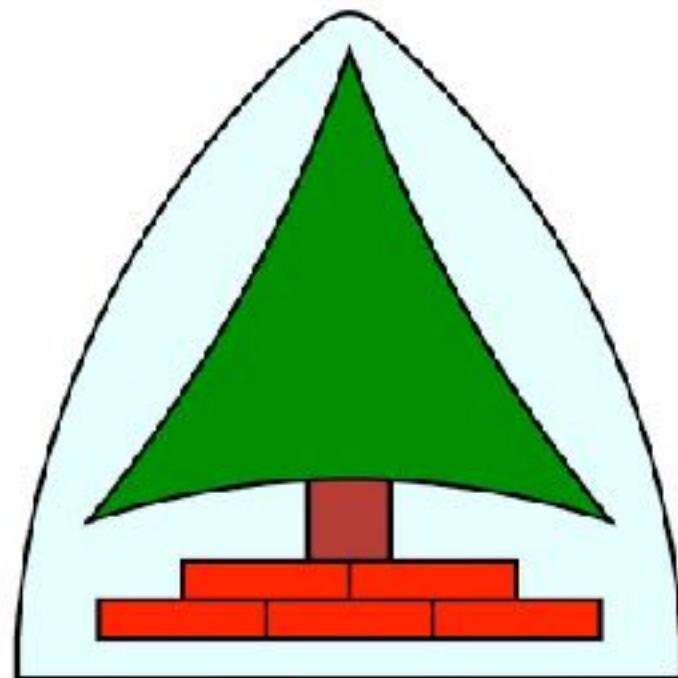


**Rogues gallery collage
portraits on the web
site at**

[https://www.saildart.org/
walkabout](https://www.saildart.org/walkabout)



Web Sites



BgBaumgart.org

Internet Archive is at

<https://Archive.org>

Stanford Libraries A.I. exhibit at

<https://exhibits.stanford.edu/ai>

Stanford Computer Science Department and A. I. Lab

<http://csd.stanford.edu> & <http://>

ai.stanford.edu/

Computer History Museum, example at

<http://www.softwarepreservation.org/projects/LISP/>

Living Computer Museum

<https://livingcomputers.org>

Secure |
https://
WWW.
Saildart
.ORG

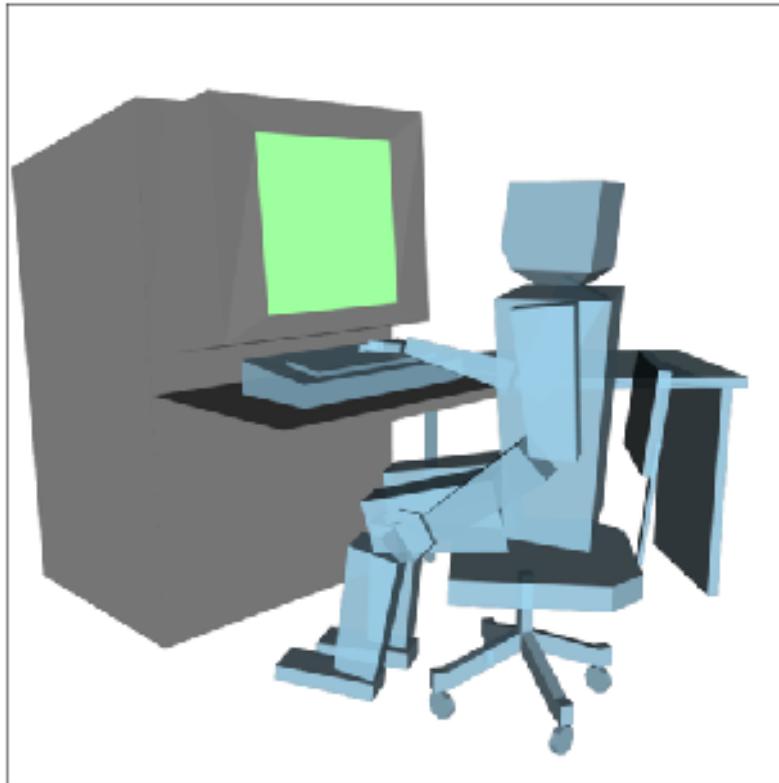


SAILDART.org

The scanned hardcopy of SAIL publications can be found on government sites as well as PhD Thesis *microfilm* sites. ProQuest has replaced University Microfilm.

My thesis title is on sites like the ACM, Google Books, dot MIL and dot GOV sites. For example:
<https://apps.dtic.mil/dtic/tr/fulltext/u2/a002261.pdf>

The SAILDART material is *born-digital* and can provide improved "OCR" and/or "page images" as well as the draft material and software that went into the SAIL work, all will be available to everyone when all the copyrights run out around 2100 and personal privacy issues become moot.



The SAIL PDP-10 KA with its time sharing system for 26 July 1974 is re-enacted in Java Script on public web sites with access to a curated set of disk files from the 1970s and 1980s.

The Re-enactment is work-in-progress, which gets stalled for months at a time by other retirement activities as well as problems with the fantasy implementation for long lost hardware and software details. Also there are many interesting matters which can be directly handled without a general solution.

In addition to a large shaggy Javascript version, there are pieces in C, D, Python, Perl and clisp. As well as custom keyboards and user-mode only projects.

Re-enactment

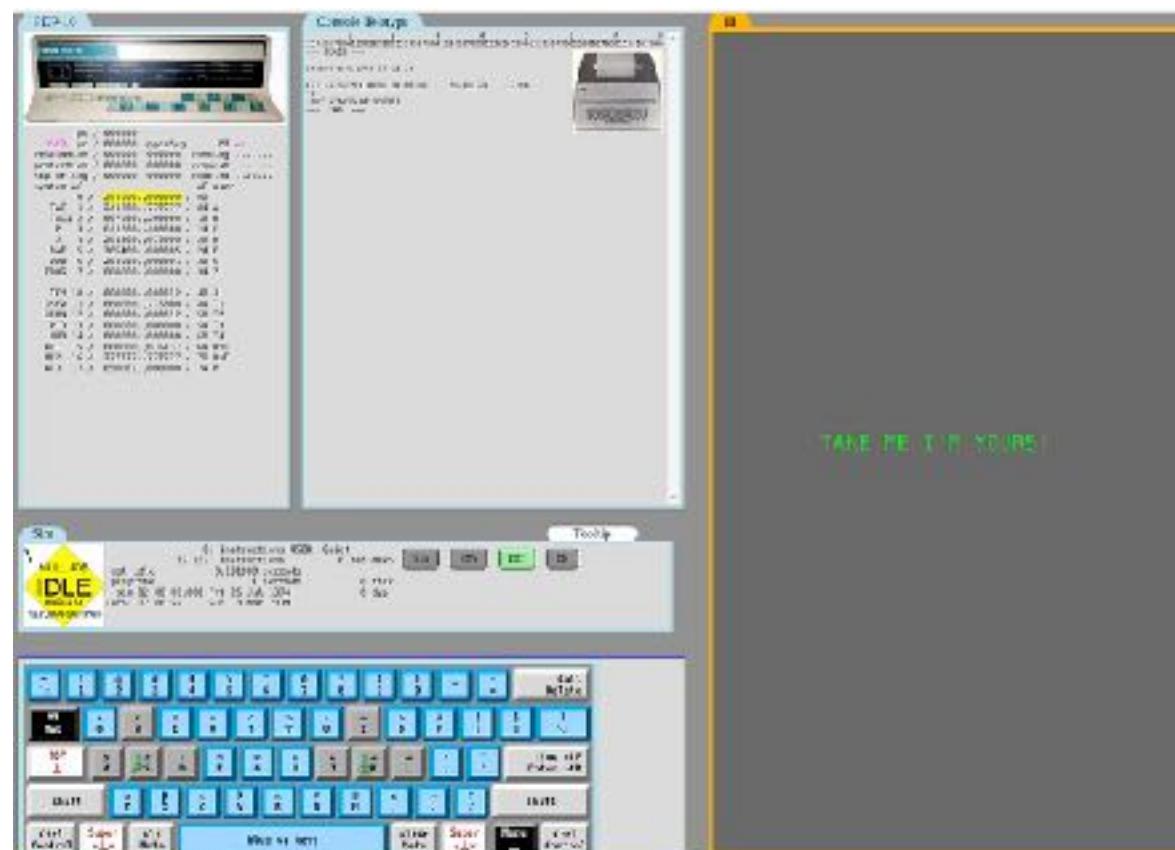
Farb level #0 (Earnest ordered from Microswitch Keyboards)
Lester's original SAIL
keyboard has green keys.
keycap-Zero is left of keycap-One



Farb level #2 (Baumgart ordered from WASD Keyboards)
Re-enacted keyboards
have blue keys.
keycap-Zero is right of keycap-Nine.



TAKE ME I'M YOURS!



My current action items:

- # Curate the SAIL Ralph SYS: file system
- # Hand out hard copy booklets titled "SAILDART Preview 2019"
- # Convert data from XGP files into PDF / A
- # Get my PDP10 / BGB10 code on Github.
- # Visit Stanford CSD, Stanford Libraries, computer museums, the Internet Archive and SAIL survivors.
- # End-of-May Spring-Orgy walk-abouts.
- # End-of-November Chinese Banquets.



Road Map Atlas

MAP : for going from flat DART data8 into 64-bit words, UTF-8, html, svg, png, ogg, pdf

MAP : for validating/regression-testing PDP-10KA implementations, with simulated I/O devices, to run the SAILWAITS time sharing SYSTEM.DMP [J17, SYS] including most of its executable DMP files.

MAP : for new publication concerning the SAILDART archive.

MAP : for renewing my computer skills each year.

MAP : for upgrading my home office computer environment.

MAP : maps for other retirement hobby projects: EFE wall paper. GEOMED / Blender. etc.

Table of image credits:

References:

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2019-06-03

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colophon:

Yes. Yes. I know that you are not suppose to use **Helvetica Neue**. Further graphics design and the history of digital font technology is contemplated. I do use TeX, Latex, Lyx as well as Adobe InDesign and the Creative Suite. This present document has been knocked off using Apple Pages which is good enough for getting something done.

Bruce Guenther Baumgart

BgBaumgart @ mac.com

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