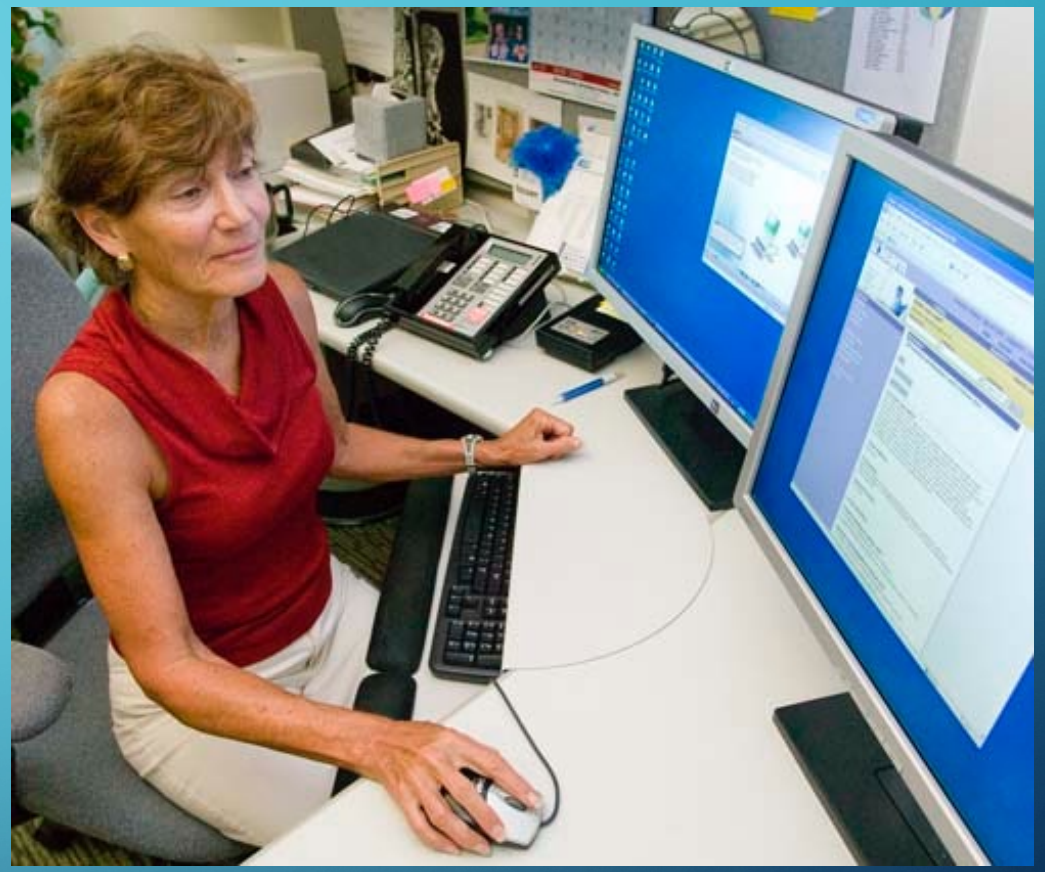
55 YEARS IN HPC: ONE WOMAN'S EXPERIENCES AND PERSPECTIVES

IN CONVERSATION WITH JEAN SHULER



WITH MARK MILLER MODERATING

FOR THE BEST PRACTICES FOR HPC SOFTWARE DEVELOPERS WEBINAR SERIES

NOVEMBER 10, 2021

1961-1965

- Biggest bug: Mariner 1 ($152M)
- Best movie: The Invisible Boy
- Digits of Pi: 100,265
- Fastest: CDC-6600 (3 MFLOPS)

EMPLOYMENT AS A HUMAN COMPUTER

The Age of Female Computers

The burden of mathematics before machines

David Skinner

Today, mathematics and computer science often appear as the province of geniuses working at the very edge of human ability and imagination. Even as American high schools struggle to employ qualified math and science teachers, American popular culture has embraced math, science, and computers as a mystic realm of

Review
Spring 2006

The Technological Condition
Math

The Computer Girls

BY LOIS MANDEL

A trainee gets $8,000 a year
...a girl "senior systems analyst"
gets $20,000—and up!
Maybe it's time to investigate....

Ann Richardson, IBM systems engineer, designs a bridge via computer. Above (left) she checks her facts with fellow systems engineer, Marvin V. Fuchs. Right, she feeds facts into the computer. Below, Ann demonstrates on a viewing screen how her facts designed the bridge, and makes changes with a "light pen."

Twenty years ago, a girl could be a secretary, a school teacher . . . maybe a librarian, a social worker or a nurse. If she was really ambitious, she could go into the professions and compete with men . . . usually working harder and longer to earn less pay for the same job.

Now have come the big, dazzling computers—and a whole new kind of work for women: programming. Telling the miracle machines what to do and how to do it. Anything from predicting the weather to sending out billing notices from the local department store.

And if it doesn't sound like woman's work—well, it just is.

("I had this idea I'd be standing at a big machine and pressing buttons all day long," says a girl who programs for a Los Angeles bank. I couldn't have been further off the track. I figure out how the computer can solve a problem, and then instruct the machine to do it."

"It's just like planning a dinner," explains Dr. Grace Hopper, now a staff scientist in systems programming for Univac. (She helped develop the first electronic digital computer, the Eniac, in 1946.) "You have to plan ahead and schedule everything so it's ready when you need it. Programming requires patience and the ability to handle detail. Women are 'naturals' at computer programming."

What she's talking about is *aptitude*—the one most important quality a girl needs to become a programmer. She also needs a keen, logical mind. And if that zeroes out the old Billie Burke-Gracie Allen image of femininity, it's about time, because this is the age of the Computer Girls. There are twenty thousand of them in the United *(cont. on page 54)*

Photos by Henry Grossman. Dress by Gino Charles.

NASA LANGLEY, DATA REDUCTION CENTER, 1960s

EXAMPLE CALCULATIONS AND HAND DRAWN PLOTS

Case A, eastward launch.- For case A, eastward launch, the given launch position is ϕ_1=28.50° N.,λ_1=279.45° E.; the selected position is ϕ_2=34.00° N.,λ_2=241.00° E.; the number of orbital passes n is 3; and the equivalent selected longitude λ_{2e} is 309.689° E. The values of the first approximations are

$$\left[t(\theta_{2e}) - t(\theta_1)\right] \approx 7.693$$

$$\Delta\lambda_{1\text{-}2e} = 32.162$$

$$\theta_{2e} = 51.89$$

$$t(\theta_{2e}) = 12.702$$

$$\psi_1 = 70.468$$

$$i = 34.081$$

Parameter	2d iteration	3d iteration	4th iteration
$t(\theta_{2e}) - t(\theta_1)$	6.860	6.603	6.594
$\Delta\lambda_{1\text{-}2e}$	30.926	30.862	30.859
θ_{2e}	50.866	50.809	50.806
$t(\theta_{2e})$	12.445	12.436	12.436

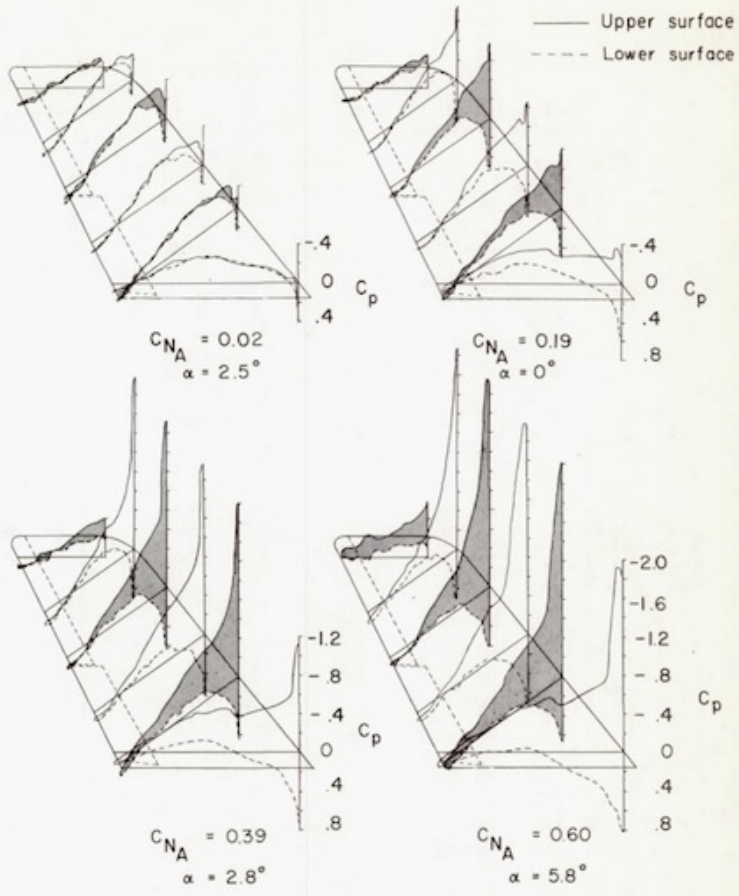
The final values are as follows:

$$\psi_1 = 70.541$$

$$i = 34.043$$

$$(\lambda_{\mathrm{II}})_{\mathrm{ref}} = 225.971$$

$$\omega = 34.497$$



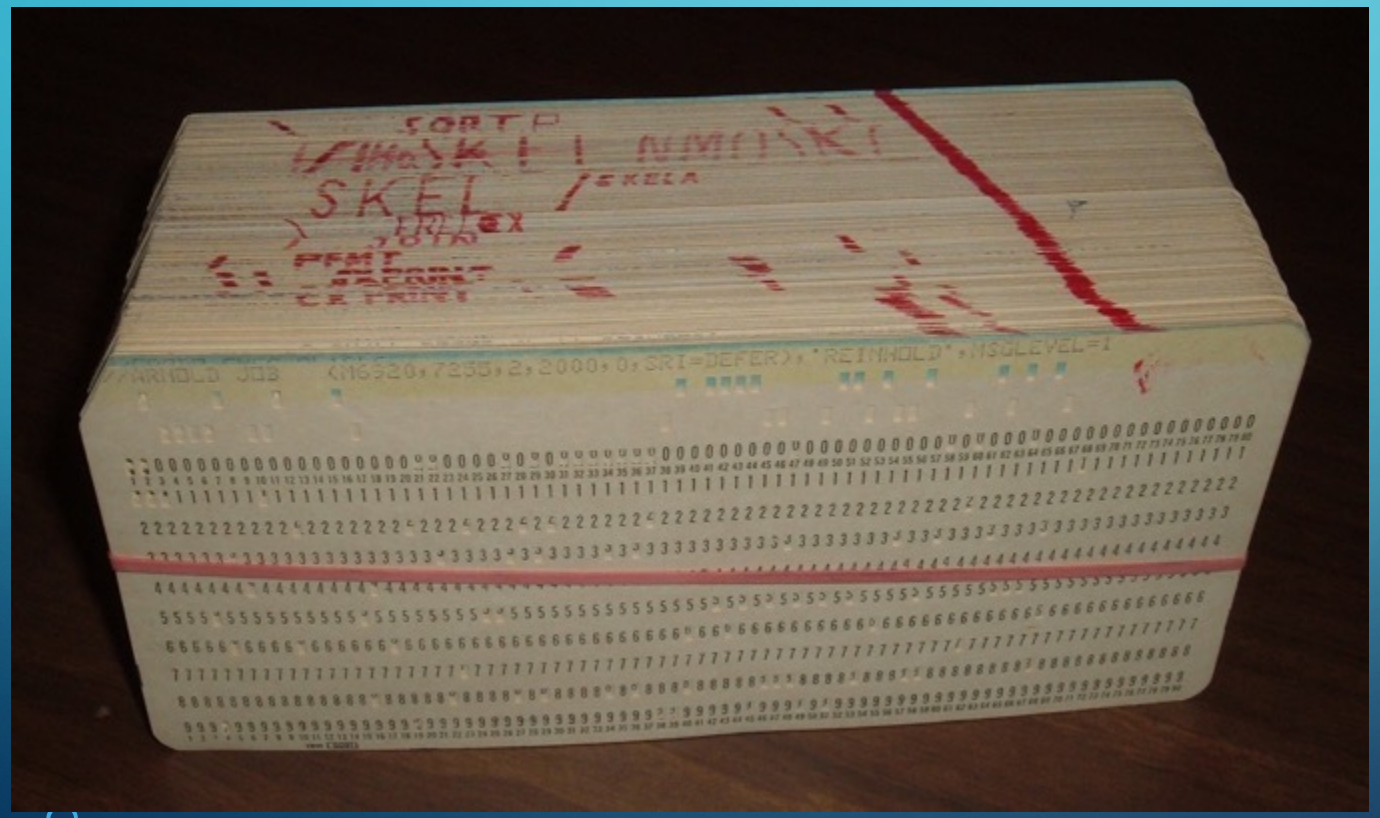
(a) M ≈ 0.73.

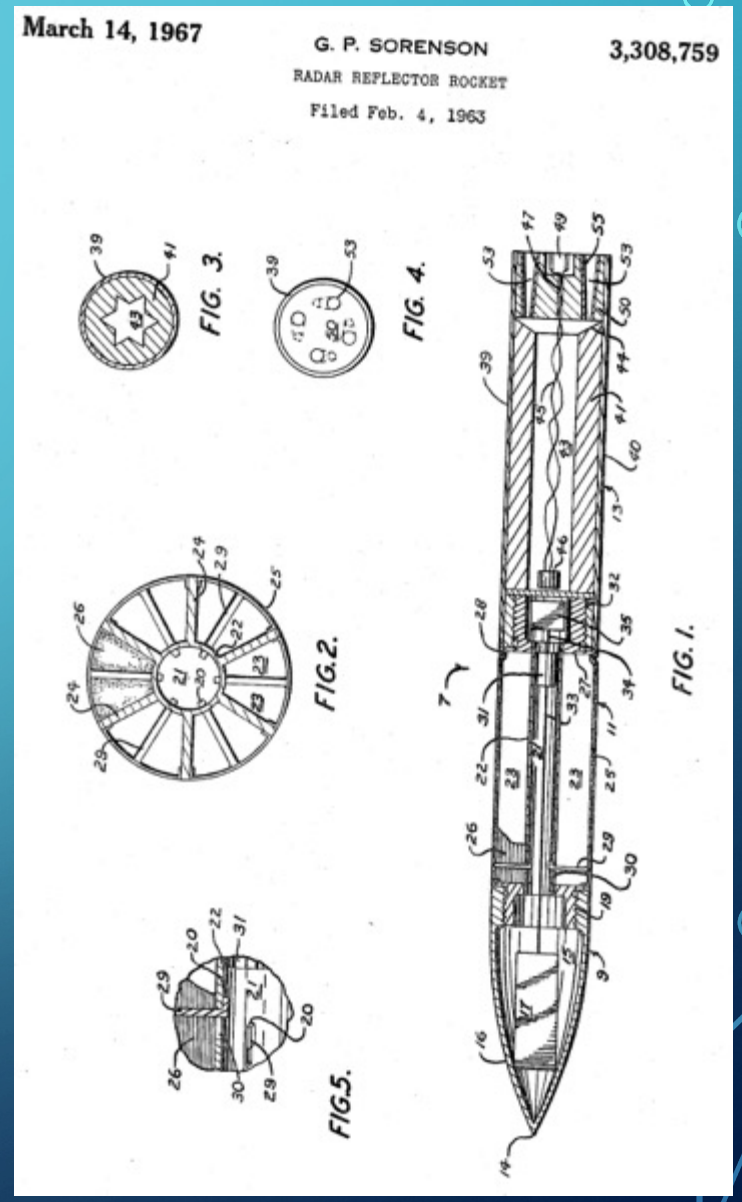
Figure 4.- Wing plan views showing the effect of lift on the D-558-II wing pressure distributions at representative Mach numbers.

1966-1970

- Biggest bug: Gemini 5 splashdown miss
- Best movie: 2001 A Space Odyssey
- Digits of Pi: 500,000
- Fastest: CDC-7600 (30 MFLOPS)

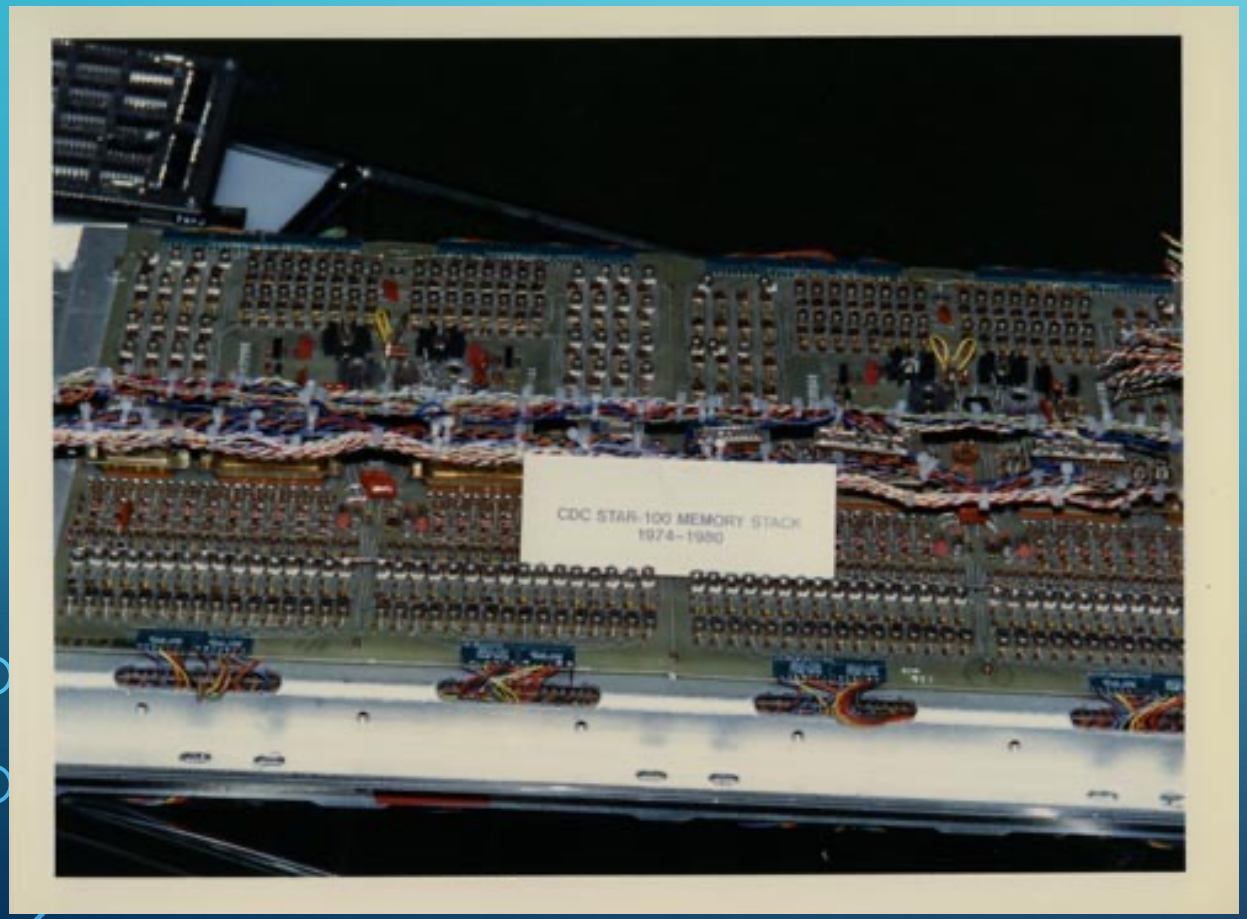
MB Associates, San Ramon, CA.

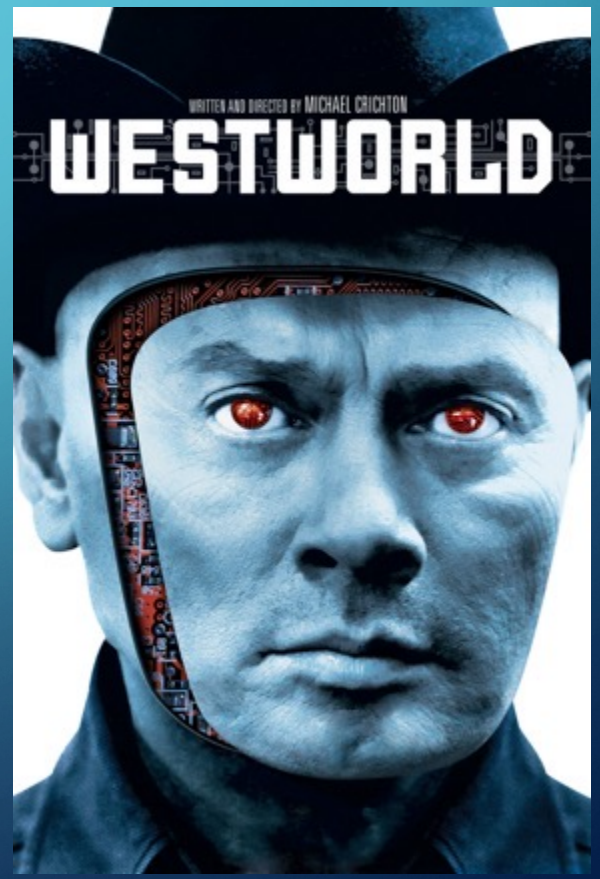




1971-1975

- Biggest bug: 12 bit dates/DEC system 10
- Best movie: West World
- Digits of Pi: 1,001,250
- Fastest: CDC-STAR (100 MFLOPS)





JEAN JOINS LAWRENCE RADIATION LAB (LRL)

- Ban on hiring wives lifted in 1972

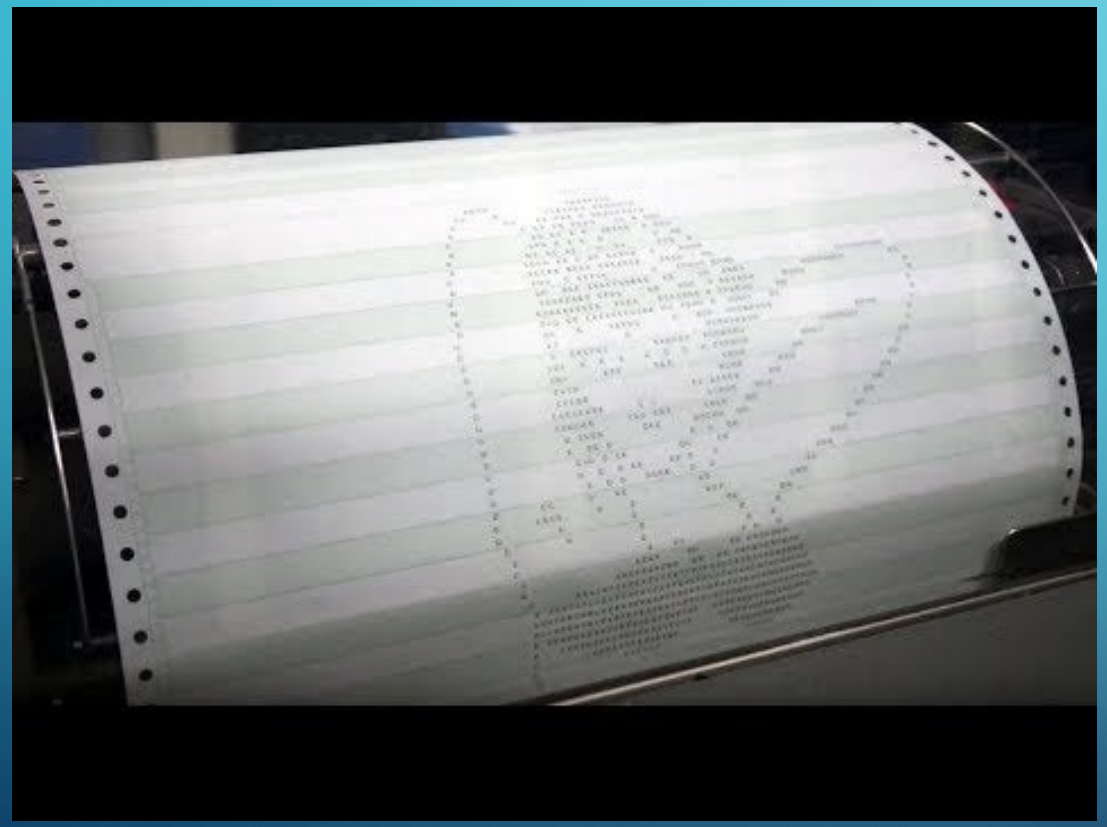
- Jean's first badge photo…

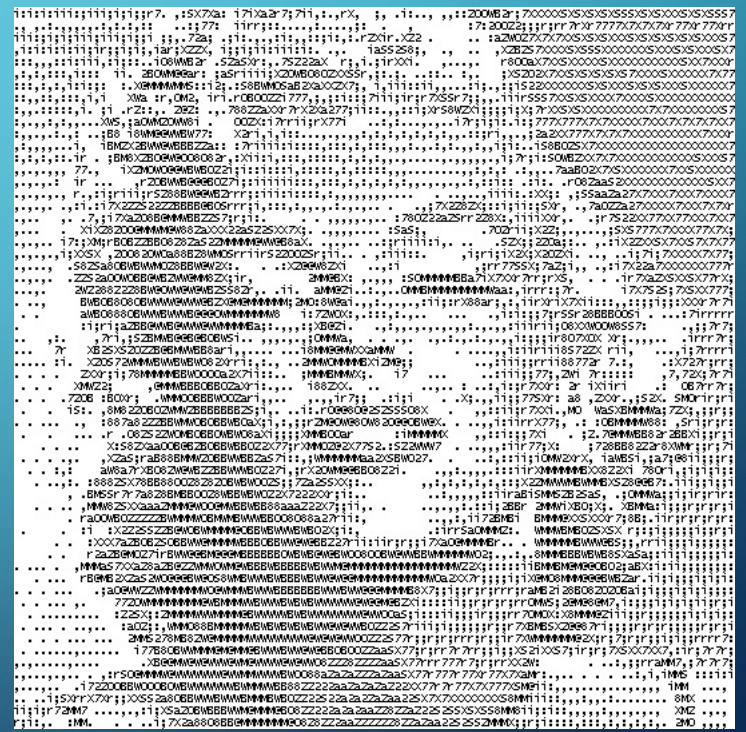

LRL (and Sandia Livermore) Site from Air


LAWRENCE
RADIATION
LABORATORY
L
R
L
VISITOR
PARKING
UNIVERSITY OF
CALIFORNIA
LIVERMORE SITE
OPERATED FOR THE
U.S. ATOMIC ENERGY
COMMISSION


Livermore, California

“PRINTER TESTS” AND RACIER STUFF (OFTEN PINNED UP IN OFFICES)





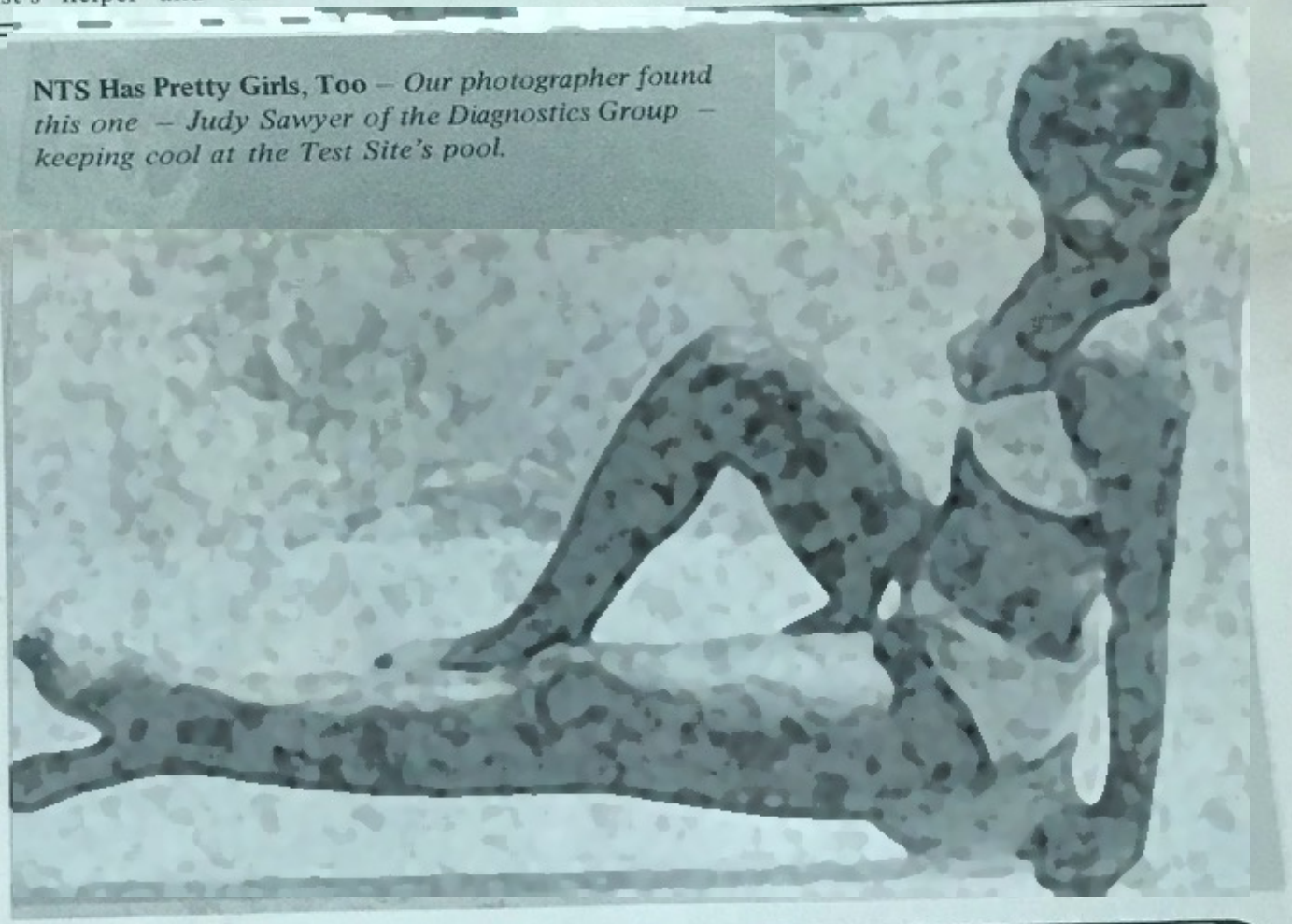
Like many similar organizations, LLNL hosted “beauty” pictures of its female workforce members.

The Nevada Test Site (NTS) wanted to show it could compete with LLNL.

LLNL also had a ”dress code” for women. Was there any for men?

Harvey E. McKinley Chester Shurtleff ist's helper and came to Livermore as a

NTS Has Pretty Girls, Too – *Our photographer found this one – Judy Sawyer of the Diagnostics Group – keeping cool at the Test Site's pool.*



ing Dept.

NEWSLINE

EDITOR: Ken Rhodie
PRODUCTION: Don Cowden
PHOTOGRAPHERS: Howard Alford,

LAWRENCE LIVERMORE LABORATORY
UNIVERSITY OF CALIFORNIA, LIVERMORE CA. 94550

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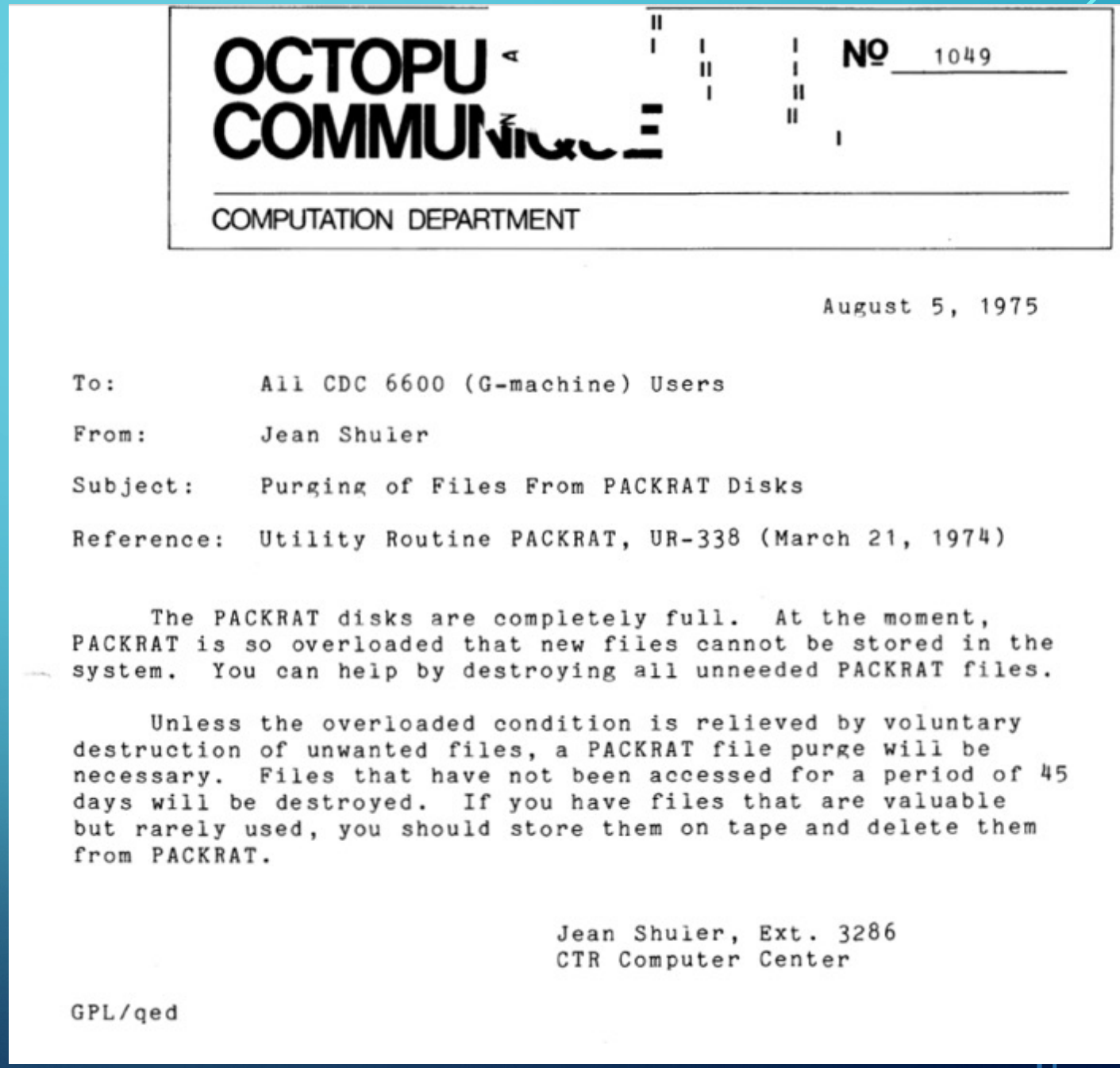
San Leandro, Ca.
Permit No. 104

LLNL NEWSLINE, 1971

BEGININGS OF NERSC

- Controlled Thermonuclear Research Computer Center
- National Magnetic Fusion Energy Computer Center
- National Energy Research Scientific Computing Center

AN EARLY, HARD COPY (NOT EMAIL) MEMO FROM JEAN CALLED AN "OCTOGRAM"



OCTOPUS COMMUNIQUE

№ 1049

COMPUTATION DEPARTMENT

August 5, 1975

To: All CDC 6600 (G-machine) Users

From: Jean Shuler

Subject: Purging of Files From PACKRAT Disks

Reference: Utility Routine PACKRAT, UR-338 (March 21, 1974)

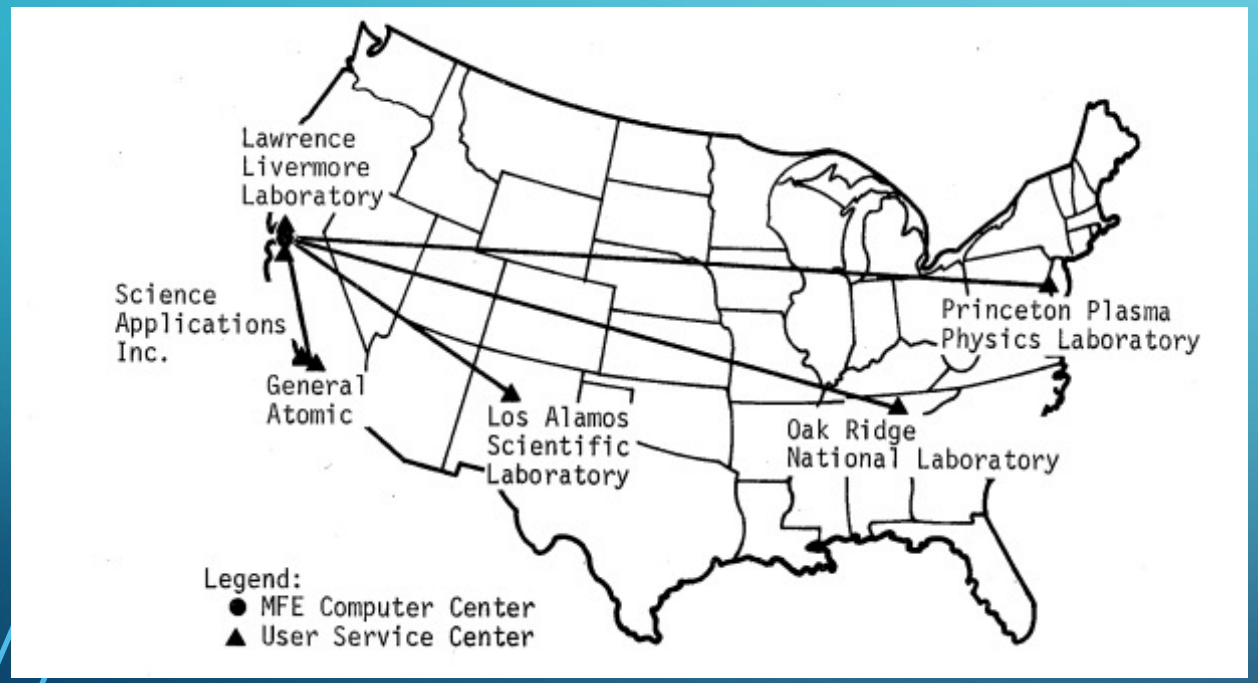
The PACKRAT disks are completely full. At the moment, PACKRAT is so overloaded that new files cannot be stored in the system. You can help by destroying all unneeded PACKRAT files.

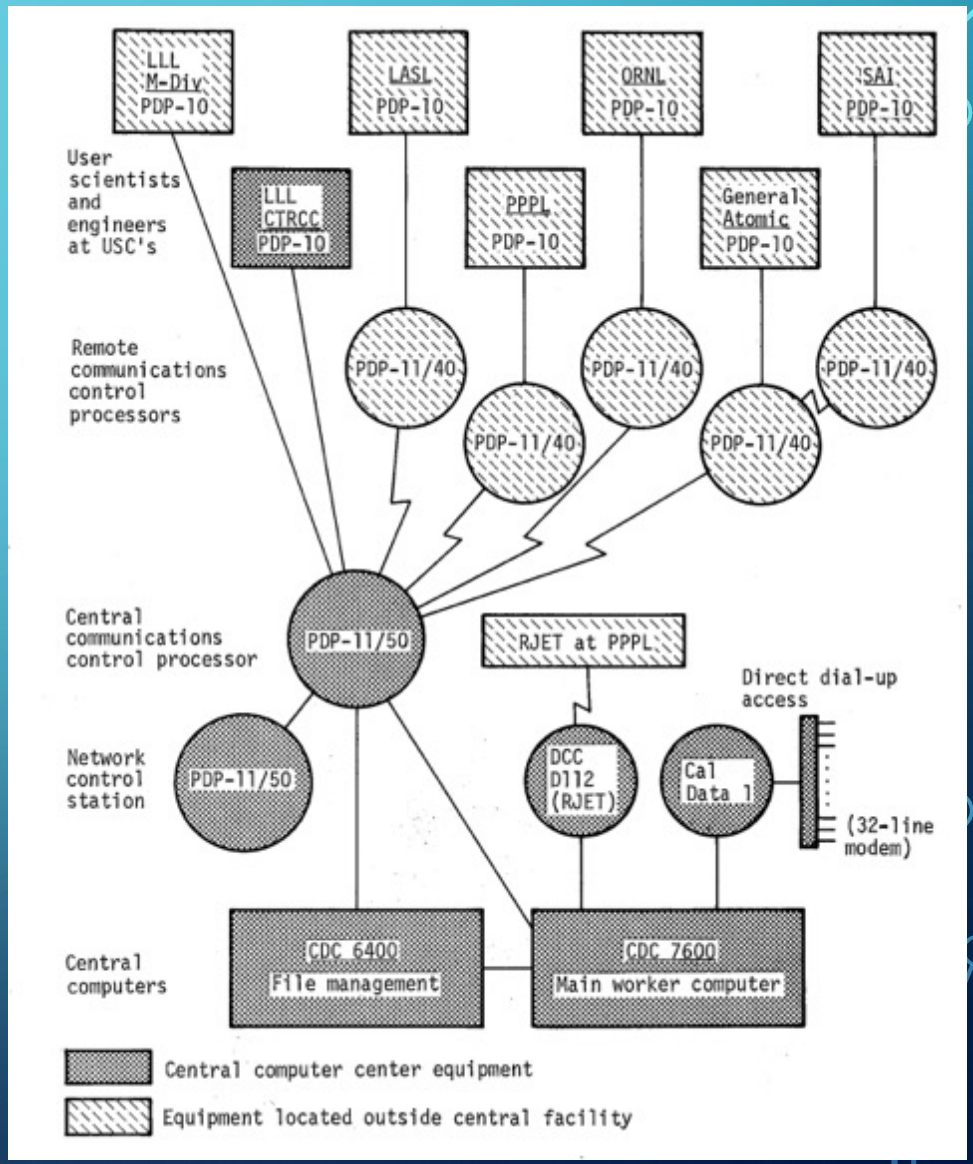
Unless the overloaded condition is relieved by voluntary destruction of unwanted files, a PACKRAT file purge will be necessary. Files that have not been accessed for a period of 45 days will be destroyed. If you have files that are valuable but rarely used, you should store them on tape and delete them from PACKRAT.

Jean Shuler, Ext. 3286
CTR Computer Center

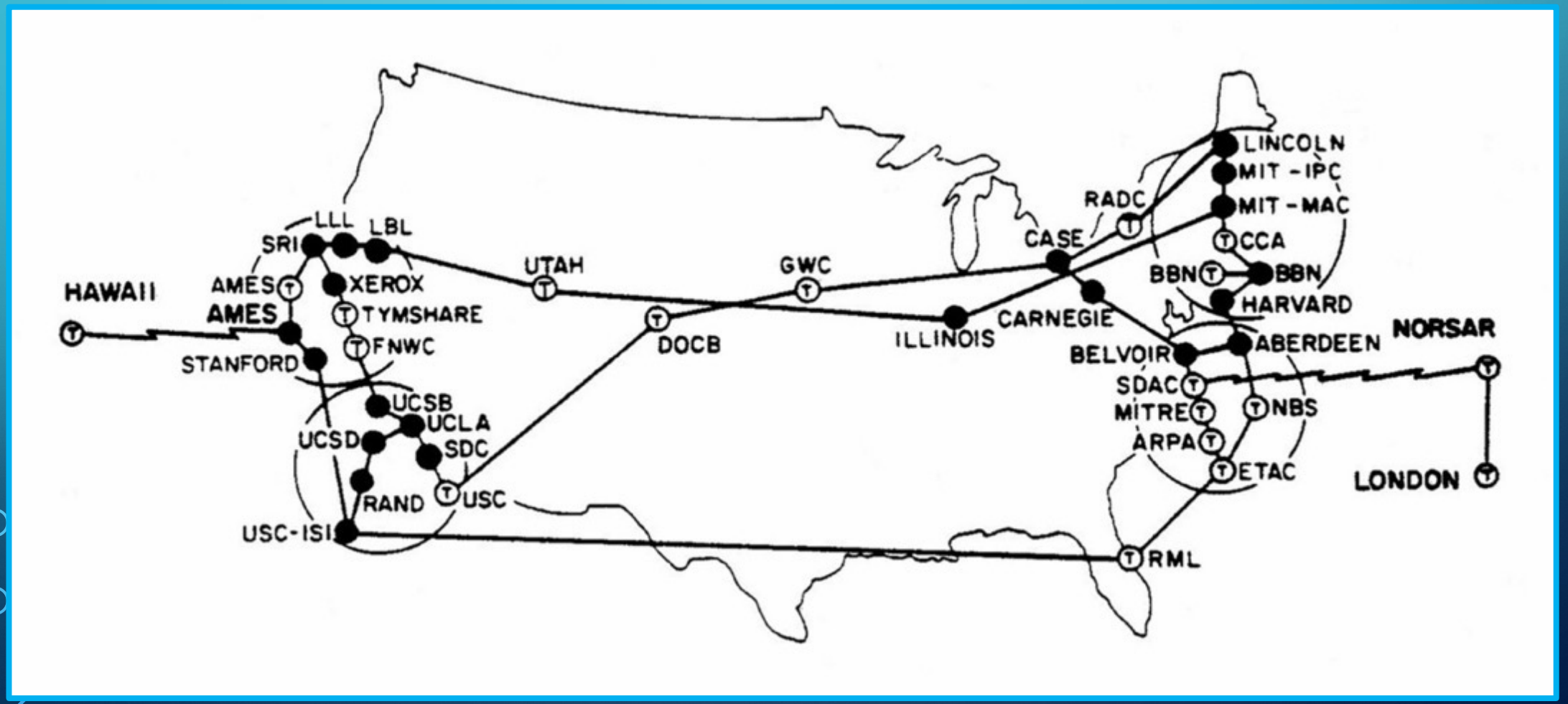
GPL/qed

BEGINNINGS OF MFENET





BEGINNINGS OF ARPANET




Jean
Shuler


LRL "Roadrunners"

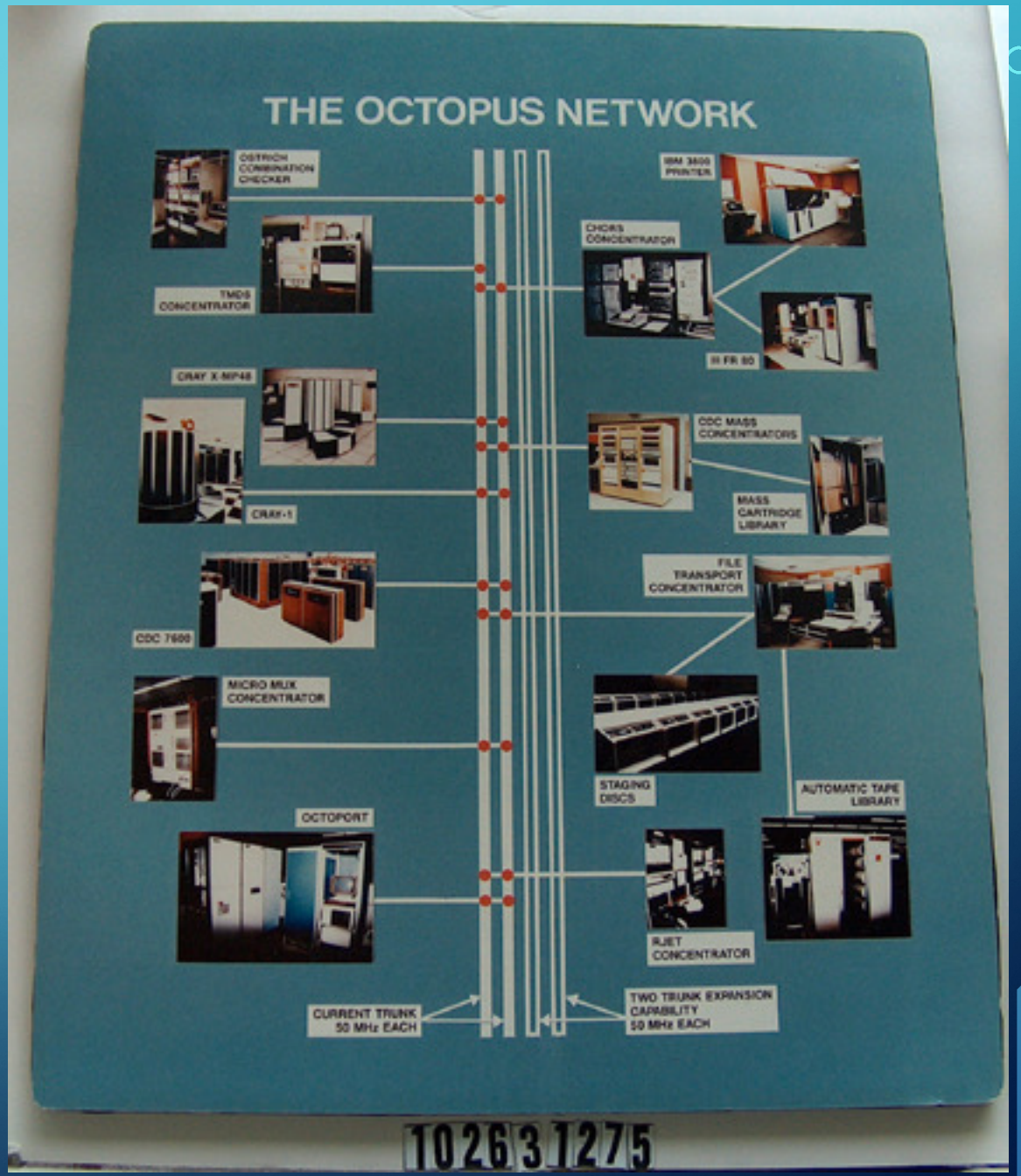
1976-1980

- Biggest bug: Vancouver SE index truncation
- Best movie: Star Trek Motion Pictute (Vger)
- Digits of Pi: 2,000,036
- Fastest: Cray 1 (160 MFLOPS)

TENTACLE

SEPTEMBER 1981 Volume 1 Number 2

CONTENTS



EXCERPTS FROM TENTACLE

Systems and Software News

Arrays

Both Vax Fortran and LRLTRAN have the array-processing capabilities of the 1978 Fortran standard. Each permits you to declare arrays of any of its data types, including its structures. This means that although Vax Fortran permits 8-bit byte arrays, it does not permit arbitrarily sized byte arrays; nor does it permit bit arrays.

Initial values

In Vax Fortran, initial values may be specified for data objects in the object declaration statement. LRLTRAN does not provide this. Both languages provide a separate `DATA` statement for specifying initial values.

Strong typing

Both languages support the `IMPLICIT NONE` statement. This statement is used to force an error message whenever a variable is encountered that is not explicitly typed.

Is portable code possible?

The nonstandard features that are available in the same way in both Vax Fortran and LRLTRAN are few:

- Long names with underscores permitted
- Use of ! for comments
- `IMPLICIT NONE`

Features that are similar but require some translation are:

- `DO ..... END DO`
- `NAMELIST`
- `INCLUDE` / `USE` without arguments
- Minimal dynamic storage
- Bit manipulation
- Octal / hexadecimal data
- Structures

The closer a code is to standard Fortran, the better chance it has for acceptability in more than one environment.

Screenshot

EARLY GRAPHICS SYSTEMS

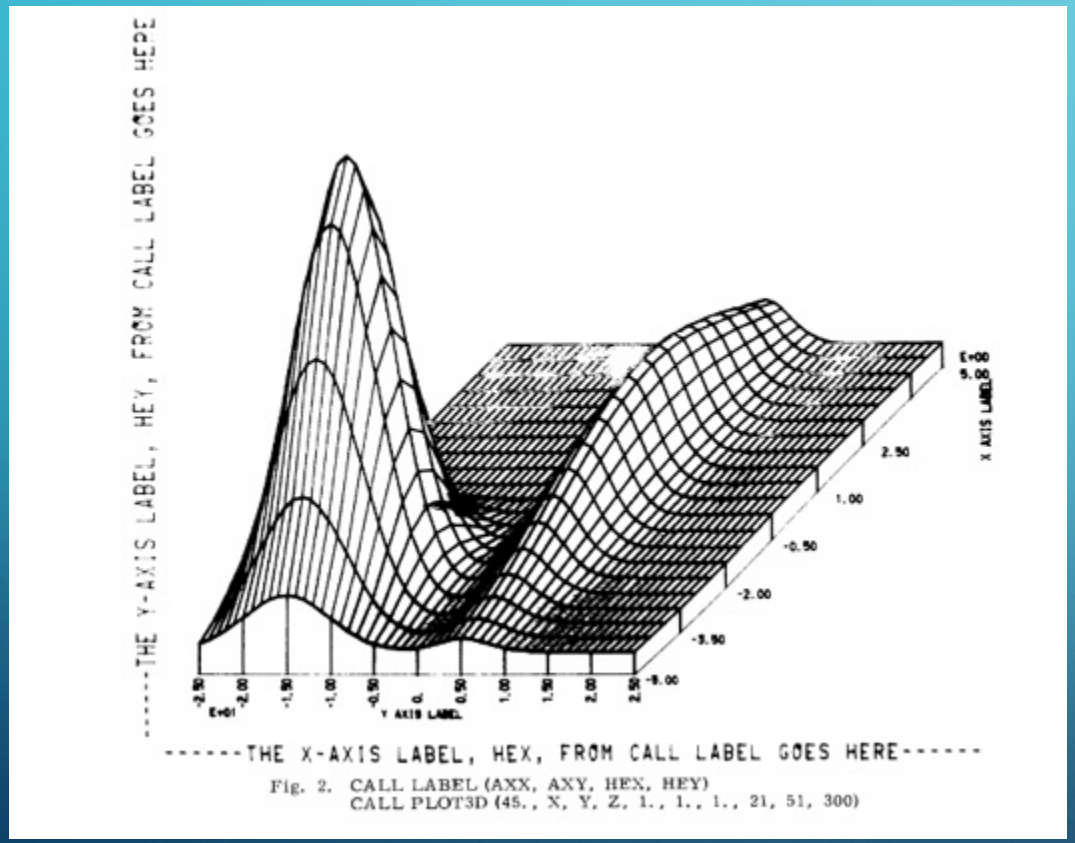
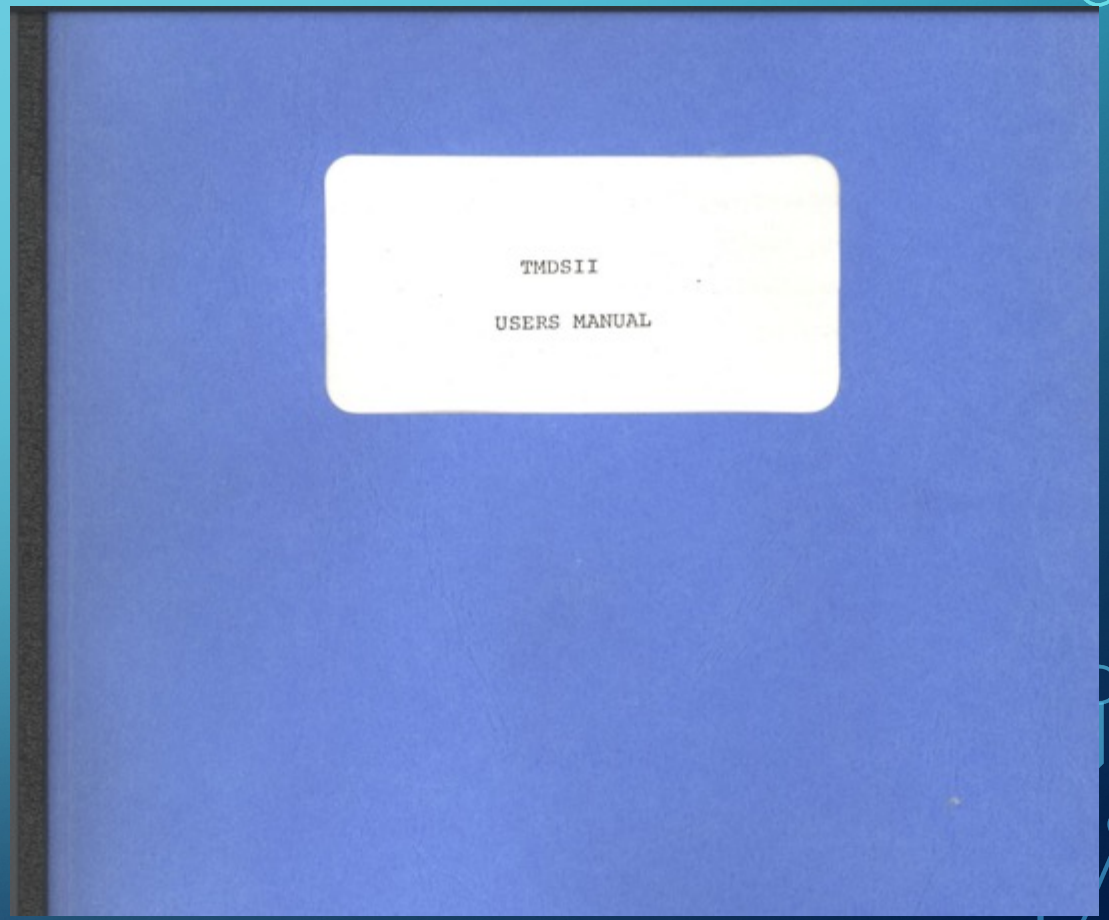


Fig. 2. CALL LABEL (AXX, AXY, HEX, HEY)
CALL PLOT3D (45., X, Y, Z, 1., 1., 1., 21, 51, 300)



TMDS AND TEK4014


```
R  43C                +CHRSOUTC  SYS  4      User ONE      .10 13 P1   RAM 12   PP:73 IDL: 6 SYS:21
                        Z-MAN    SYS  1      User ONE      SB 44 HC    MEM  8
15:01:27              LILY PAD  1.66  5 CO   Pitts AJ      SB 32 IR    DCW 15
969 Files               CAP20*A 1.00 19 DO   Vincent RT    FS 20 P1    SBS 47
39 TTYs                 SORT/A/ 1.00  3 C1   Kirchner C    FS 16 P7    IDB  0
108 DBs               +BMQD2CA  1.00 10 C1   Carlson RE    FS 16 P7    PRP  5
Half Core               +SANDYL  .15 11 D    Kruger HW       16 P7    TPE  1
RW 8 RO  8              +RPRODB   FS  6 P7   Alder BJ                 CDW 18   DISK  6-819   8-844
8 Kfac                  +LIBA  3.00  3 CO   Operations               IDL 41   MBLE 11,054k  3,276k
                      +COSMRBO 1.33  8 L    Stinson SP               BAT  0   LEFT 71,437k 13,107k
                        +SANDYL 1.10 12 A    Goldberg E
                           TRIX 1.06  4 A    Adiv MINI
                         ZATRIX 1.00  0 NC   Nuckolls R

S  43C                  +LIBA  3.00  3 CO   Operations       RAM  8   PP:74 IDL: 7 SYS:19
                        +XE0B  1.20  5 A    Estabrook        MEM  3
15:01:41              +NRL269G 1.10 29 A    Pollaine S       DCW  8
450 Files             +VECTORB 1.10 12 A    Nilsen J         SBS 83
14 TTYs                 +SANDYL 1.10 12 A    Goldberg E       IDB  0
141 DBs                 +OPTCON 1.00  1 D    Patenaude        PRP  2
Full Core               +SANDYL  .20 11 D    Kruger HW        TPE  0
RW 8 RO 18              +SPRODB   FS  5 P7   Alder BJ          CDW  2   DISK  6-819   8-844
16 Kfac                 M1028A+ 1.00 49 A    Dalhed HE        IDL  4   MBLE 13,999k  6,766k
                          +HCT    FS 20 P1   Westbrook        BAT  0   LEFT 69,794k  8,661k
                        +SPRODC   FS 16 P7   Alder BJ

U  43C                  +LIBA  3.00  6 CO   Operations     3.00 24 IR   RAM 15   PP:79 IDL: 6 SYS:15
                      +HUY12BCA  .33 15 C1   MacQueen D     1.40 34 NC   MEM 13
15:01:35                +SANDYL  .30 11 D    Kruger HW       .11 13 P2   DCW 13
456 Files               +OPTCON   SB  1 A    Pollaine S      SB 28 A     SBS 75
26 TTYs                 +OPTCON   SB  1 A    Munro DH        SB 44 HC    IDB  0
90 DBs                  +OPTCON   SB  1 A    Moulden JM      SB 12 A     PRP  6
Full Core               +OPTCON   SB  1 A    Minner LD       SB  1 A     TPE  1   DISK  6-819   8-844
RW 8 RO  8              +OPTCON   SB  1 A    Mikaelian       SB  0 HM    CDW 14   MBLE 16,051k  4,610k
16 Kfac                 +OPTCON   SB  1 A    Meeker DJ       SB  1 A     IDL 24   LEFT 66,534k 21,348k
                        +OPTCON   SB  1 A    Kim DR          FS 20 P1    BAT  0
                        +OPTCON   SB  1 A    Kiernan GP      FS  9 P7
                        +OPTCON   SB  1 A    Haan SW         FS  5 P7
                        +OPTCON   SB  1 A    Giallanza       FS  9 P7

03/20/86 U 15:01:01
135 of 240 TMDS channels are free  105

ENTERPRISE IS UP.                                   03/20/86 15:01:33

JOB MIX   CART  TEMP   ATL     C    D    E  NLTSS   G    H    P    R    S    U
FROM         0     0    13    10    0    0      0   0    5    0    0    0    0
TO           1     0     4     4   16    0      0   0    1    0    3    0    0
TOT TODAY 5447    87  3826  3397 2798 1406      0 706 2069   95 2201  961 1375

ACTIVE JOBS:      29      JOBS COMPLETED TODAY:     9853

MASS expiring files recorded FEB  3
```

1980 5.5 EARTHQUAKE

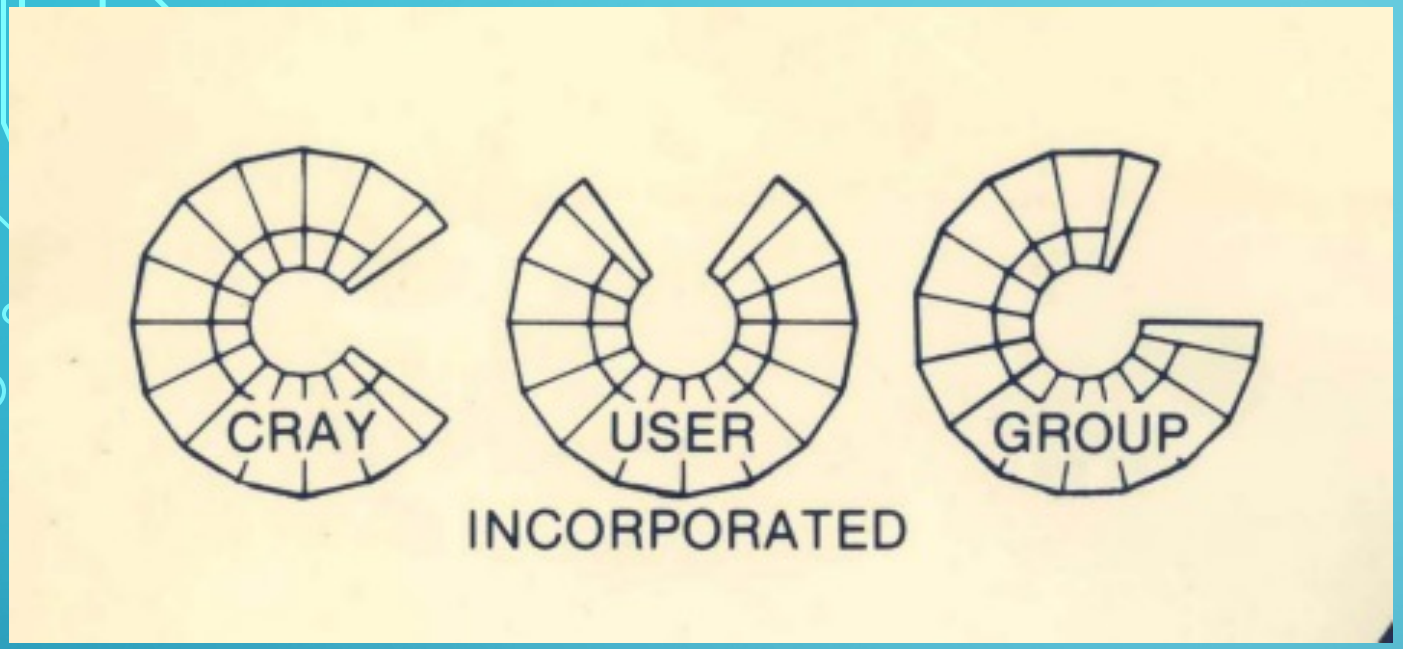
1981-1985

- Biggest bug: Super Mario Minus World
- Best movie: Tron (filmed @ LLNL)
- Digits of Pi: 17,526,200
- Fastest: Cray 2 (1.5 GFLOPS)

SUPERKIDS…AN EARLY STEAM EFFORT

I was just 18 and I missed my high school graduation to come here, and it set my whole career in motion - Mike Collette

USER SUPPORT SERVICES


CRAY
USER
GROUP
INCORPORATED


CUG
Cray User Group

1986-1990

- Biggest bug: USSR Phobos 1
- Best movie: Terminator (Skynet)
- Digits of Pi: 1,073,740,799
- Fastest: Fujitsu VP2600/10 (4 GFLOPS)

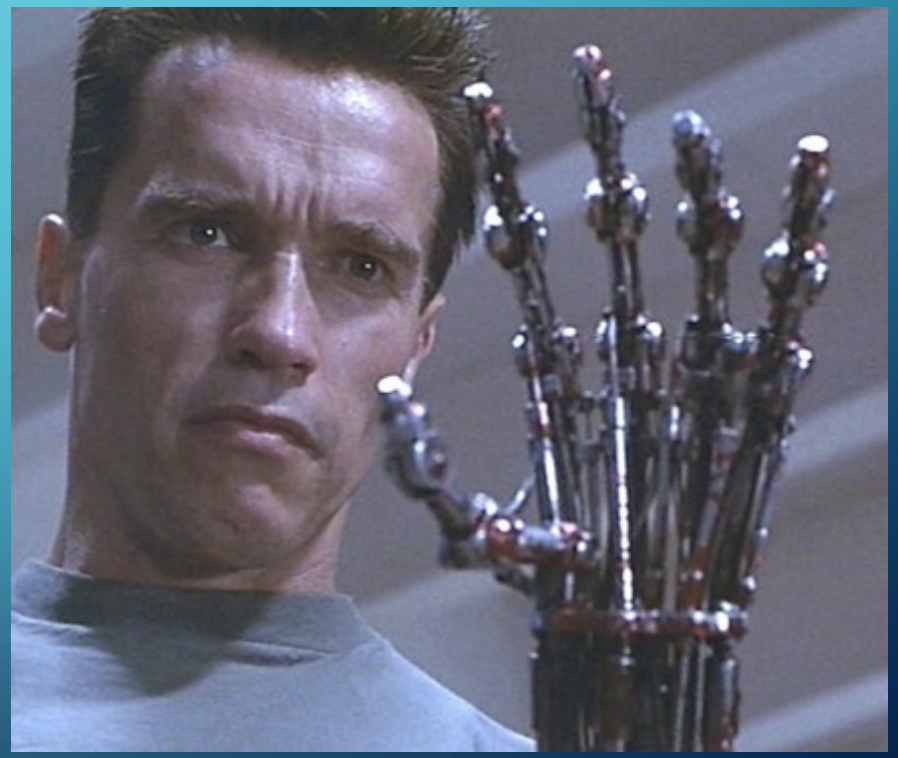
1990

FIRST MASSIVELY PARALLEL RESOURCE

LLNL acquired its first substantial onsite massively parallel resource from the MCPI: a 64-node BBN-ACI TC-2000 machine (later upgraded to 128 node). By 1992, positive results were being achieved in diverse areas, such as particle physics simulation.

1991-1995

- Biggest bug: ESA Ariane 5 Truncation ($1B)
- Best movie: Terminator 2 (Skynet)
- Digits of Pi: 6,442,450,000
- Fastest: Paragon XP/S-40 (143 GFLOPS)



MEIKO CS-2

1996-2000

- Biggest bug: USS Yorktown div-by-0
- Best movie: The Matrix
- Digits of Pi: 206,158,430,000
- Fastest: ASCI Red (1.06 TFLOPS)

POWERWALL GRAPHICS

2001-2005

- Biggest bug: GE XA/21 Blackout
- Best movie: I, Robot
- Digits of Pi: 1,241,100,000,000
- Fastest: IBM BG/L (280 TFLOPS)

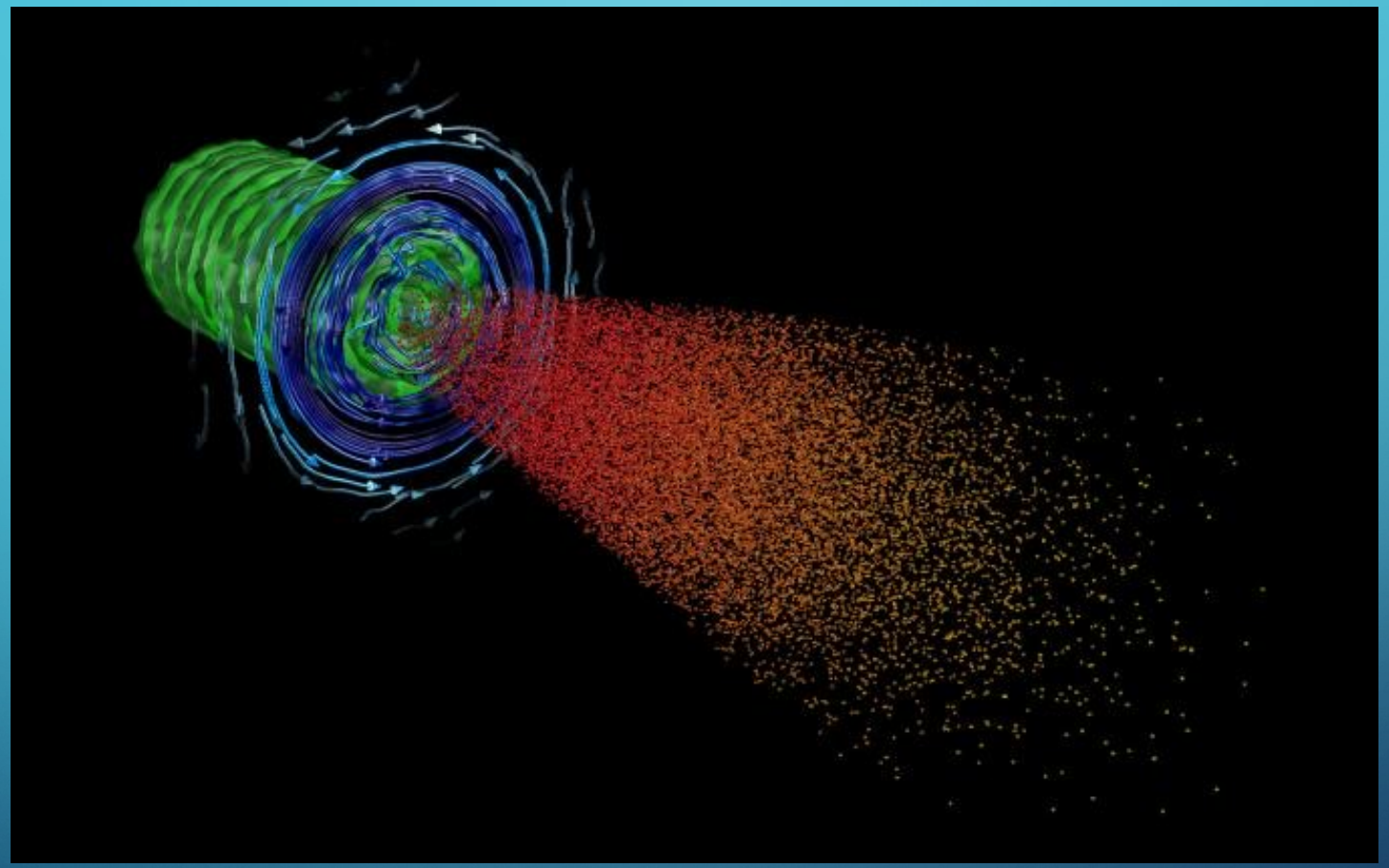

TOUCH! CONTENTS MAY/EXPLODE!

2006-2010

- Biggest bug: Google's Mal-Site Warning
- Best movie: Wall-E
- Digits of Pi: 5,000,000,000,000
- Fastest: Tianhe-1A (2.57 PFLOPS, China)

2011-2015

- Biggest bug: HeartBleed
- Best movie: Imitation Game
- Digits of Pi: 13,300,000,000,000
- Fastest: Tianhe-2 (33 PFLOPS, China)



2016-PRESENT

- Biggest bug: Boeing 737-Max MCAS
- Best movie: Hidden Figures
- Digits of Pi: 62,831,853,071,796
- Fastest: IBM AC922 (146 PFLOPS, Summit)

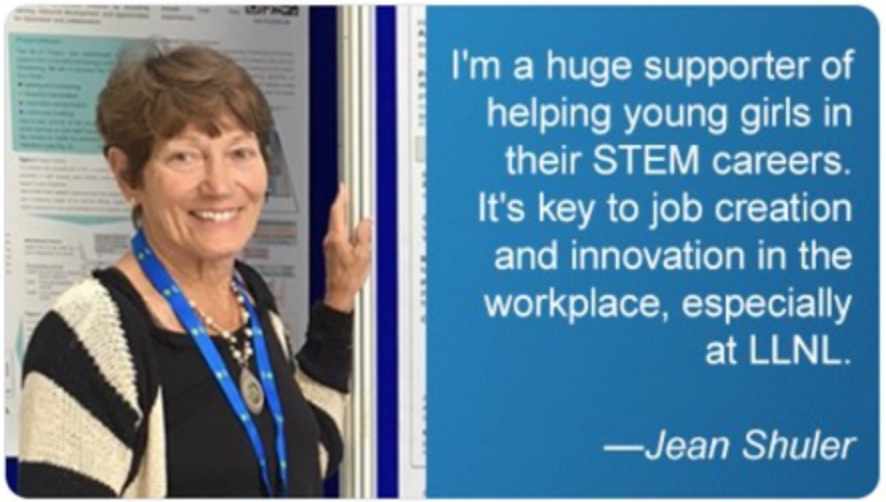
EXPANDING YOUR HORIZONS

SUPERCOMPUTING PRESENCE

← **Tweet**

LLNL Computing
@Livermore_Comp

Workforce Mgr & #HPC Tech Consultant @JeanShuler staffs the LC Hotline, sets up training on our machines, & schedules presentations for staff/users. At LLNL since 1972, she also works with our Cluster Engineering Academy interns. #WomenInHPC #WeAreHPC careers-llnl.ttcportals.com/jobs/search?q=...



9:03 AM · Sep 21, 2020 · TweetDeck

The winners of last week's HOME Campaign

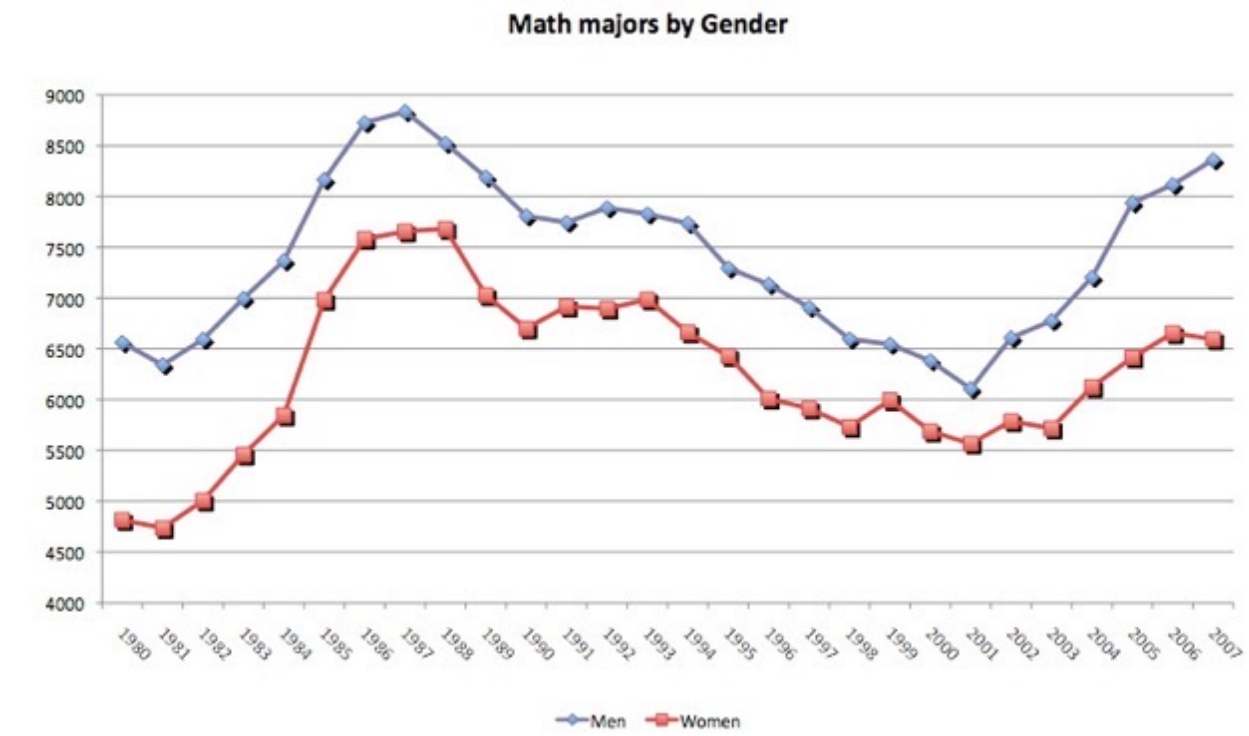
Skaters
1st place male, Patrick Chain, 7:30
1st place female, Tiffany Rose, 8:20
1st place male master , Chuck McGregor, 7:15
1st place female master, (N/A)

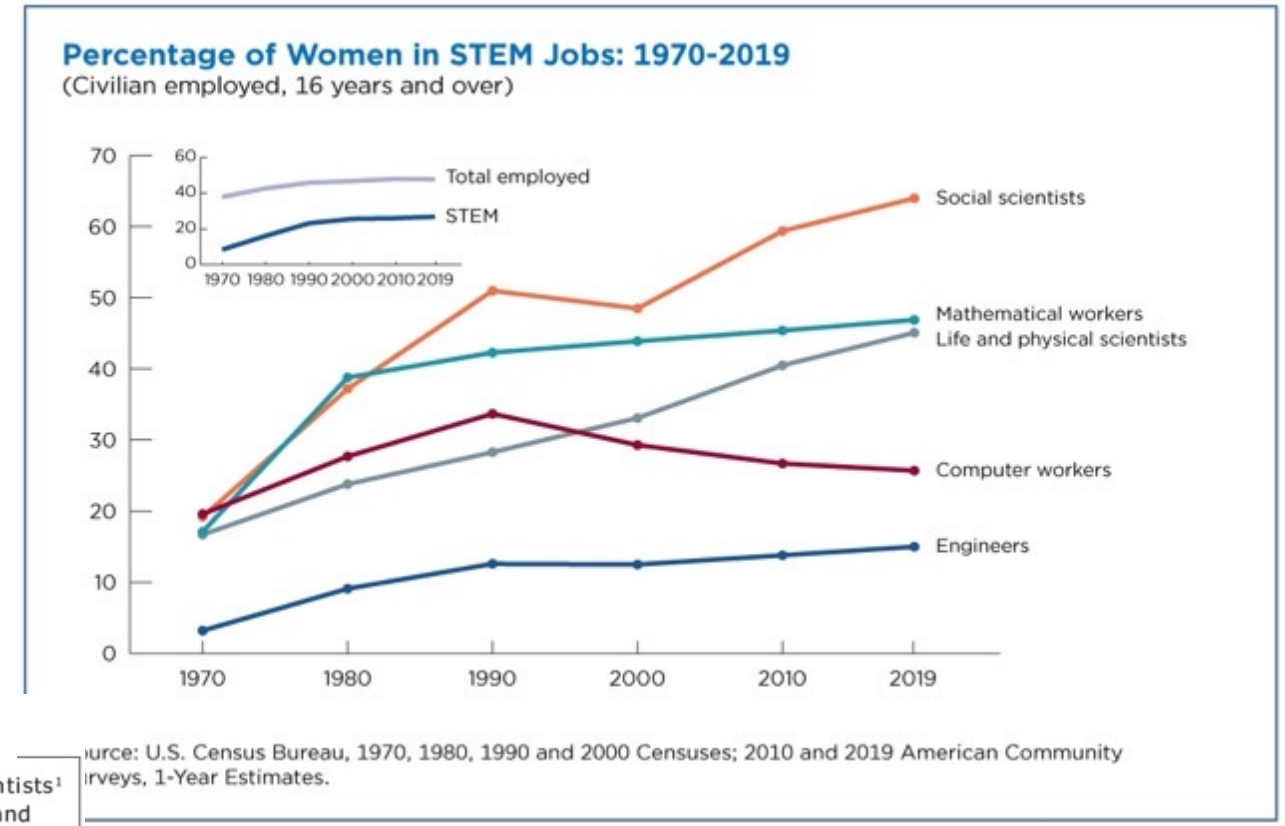
Swimmers
1st place male, Mike Bonner, 10:08
1st place female, Kelly Fedel, 11:45
1st place male master, Alek Shestakov, 10:31
1st place female master, Brynn Bollinger, 16:31

Runners
1st place male, Trevor Willey, 8:57
1st place female, Tara Carreira, 11:29
1st place male master, Fred Mahler, 10:04
1st place female master, Jean Shuler, 14:09

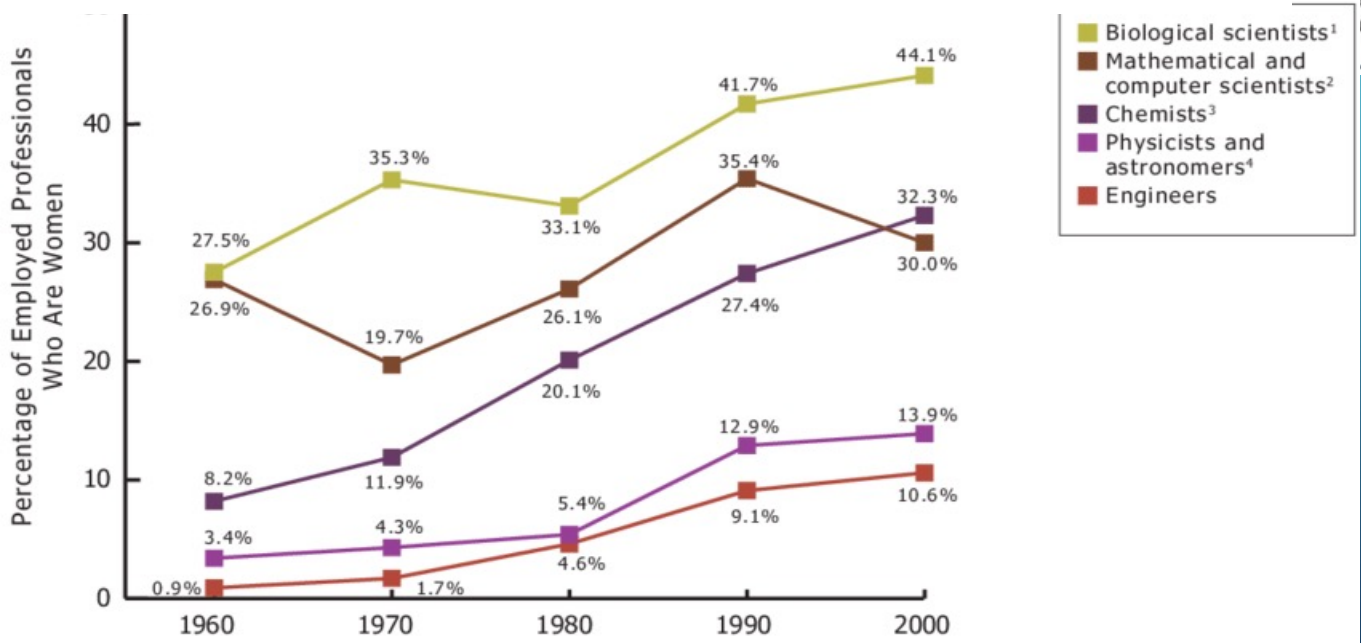
Site300 Runners
1st place male, Stevan Mays, 12:51

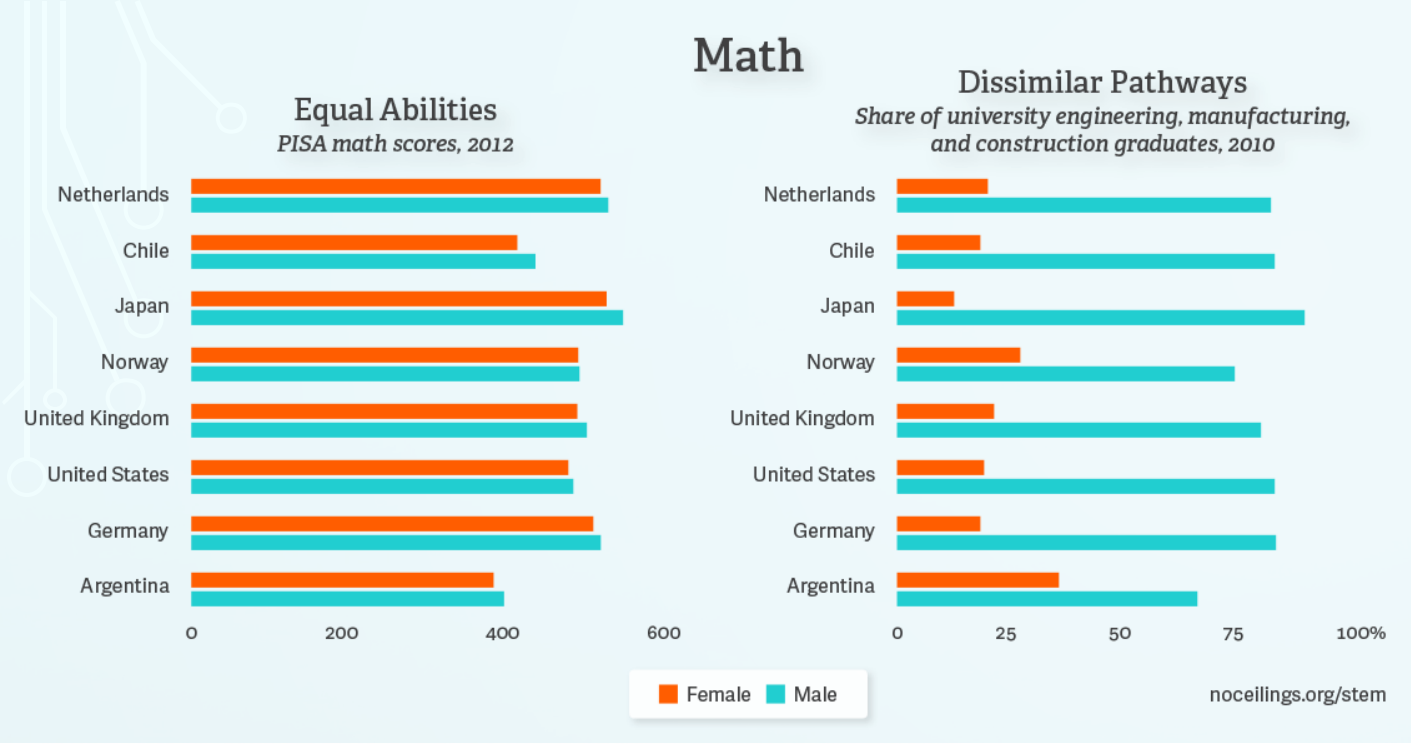
Costumes
Most Humorous: Deviled Egg: Stacey Roberts-Ohr, Math/Science Network
Most Colorful: Uncle Sam: Tom Altenbach
Most Creative: Rosie the Riveters:
Michele Bianchini-Gunn
Kelly Braswell
Janet Conrad
Ginny Dance-Rios
Bonnie Pitrowski
Most Patriotic: Betsy Ross: Sue Steelman
Best-Multi-person: American Flag:
Margie Altenbach
Sherry Christensen
Wendy Dossey
Mary Gualco
Chris Johnson
Tencia Leon

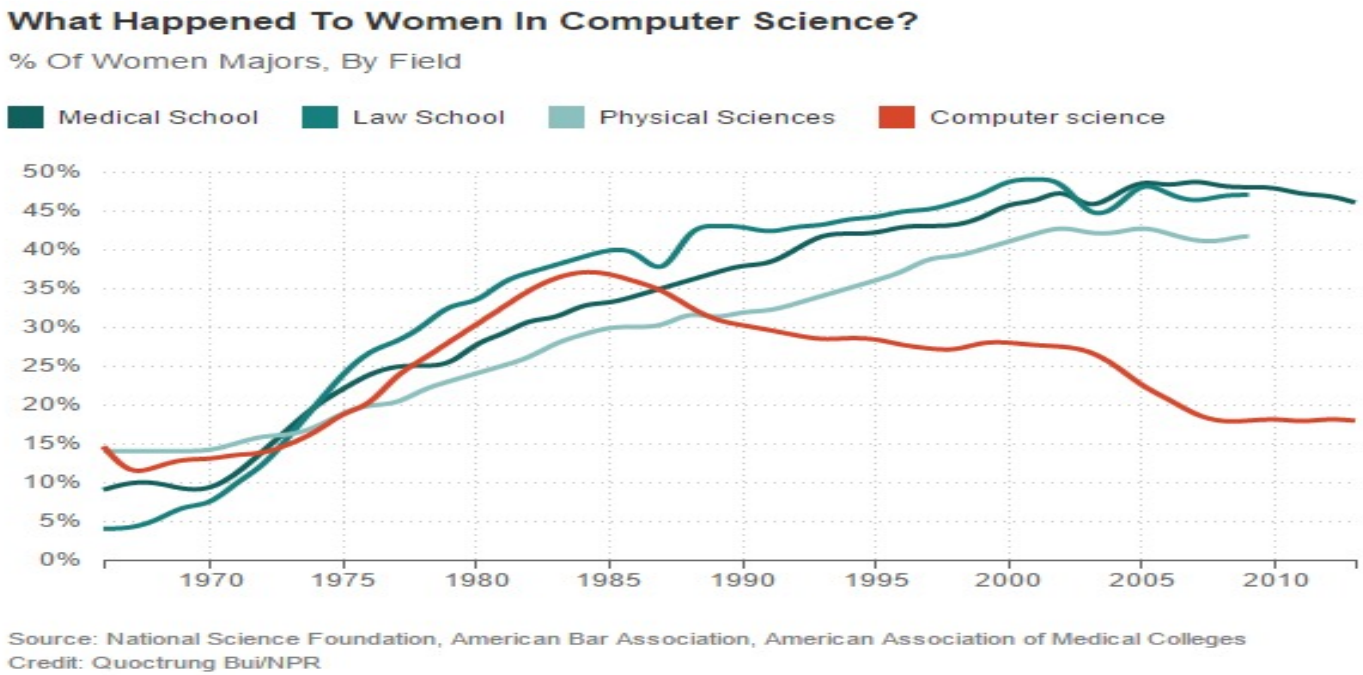


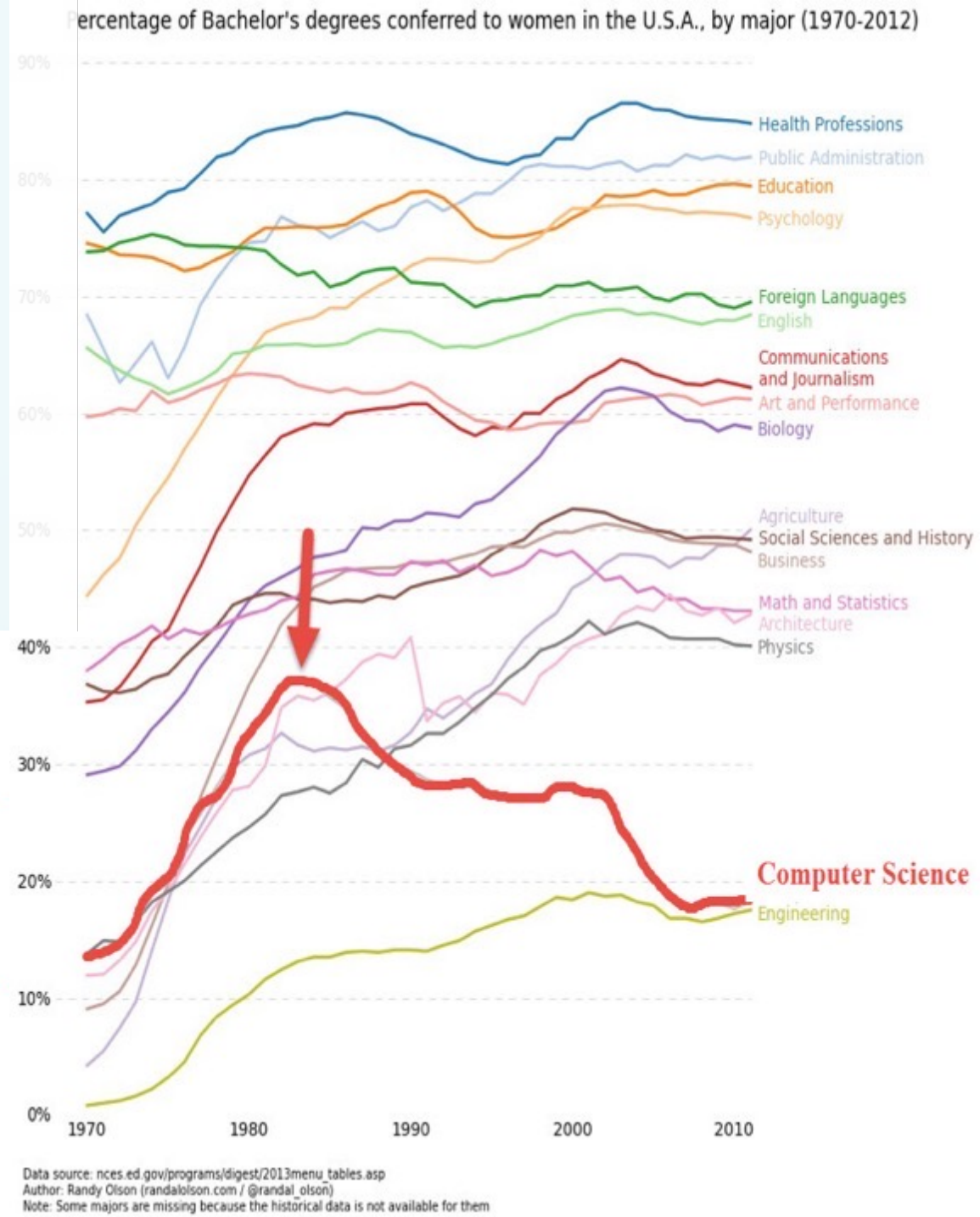


urce: U.S. Census Bureau, 1970, 1980, 1990 and 2000 Censuses; 2010 and 2019 American Community
rveys, 1-Year Estimates.




Math
Equal Abilities
PISA math scores, 2012
Netherlands
Chile
Japan
Norway
United Kingdom
United States
Germany
Argentina
0
200
400
600
Dissimilar Pathways
Share of university engineering, manufacturing, and construction graduates, 2010
0
25
50
75
100%
Female
Male
noceilings.org/stem


What Happened To Women In Computer Science?
% Of Women Majors, By Field
Medical School
Law School
Physical Sciences
Computer science
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
1970
1975
1980
1985
1990
1995
2000
2005
2010
Source: National Science Foundation, American Bar Association, American Association of Medical Colleges
Credit: Quoctrung Bui/NPR


ercentage of Bachelor's degrees conferred to women in the U.S.A., by major (1970-2012)
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1970
1980
1990
2000
2010
Health Professions
Public Administration
Education
Psychology
Foreign Languages
English
Communications and Journalism
Art and Performance
Biology
Agriculture
Social Sciences and History
Business
Math and Statistics
Architecture
Physics
Computer Science
Engineering
Data source: nces.ed.gov/programs/digest/2013menu_tables.asp
Author: Randy Olson (randalolson.com / @randal_olson)
Note: Some majors are missing because the historical data is not available for them