

Museo dell'Informatica Funzionante



MusIF
Palazzolo Acreide (SR)
ITALY



MIAI
Museo Interattivo di
Archeologia Informatica
Cosenza
ITALY

Presentation at Waag Society, Amsterdam, 3/3/2014



Working computers: "*hands on*"!



Working computers: "*hands on*"!

How we work

Methods

Information gathering

Hardware recovery

Analysis

Museal restoration

Research

Data recovery



Eflags fixing stuff during a recovery

Computer archaeology

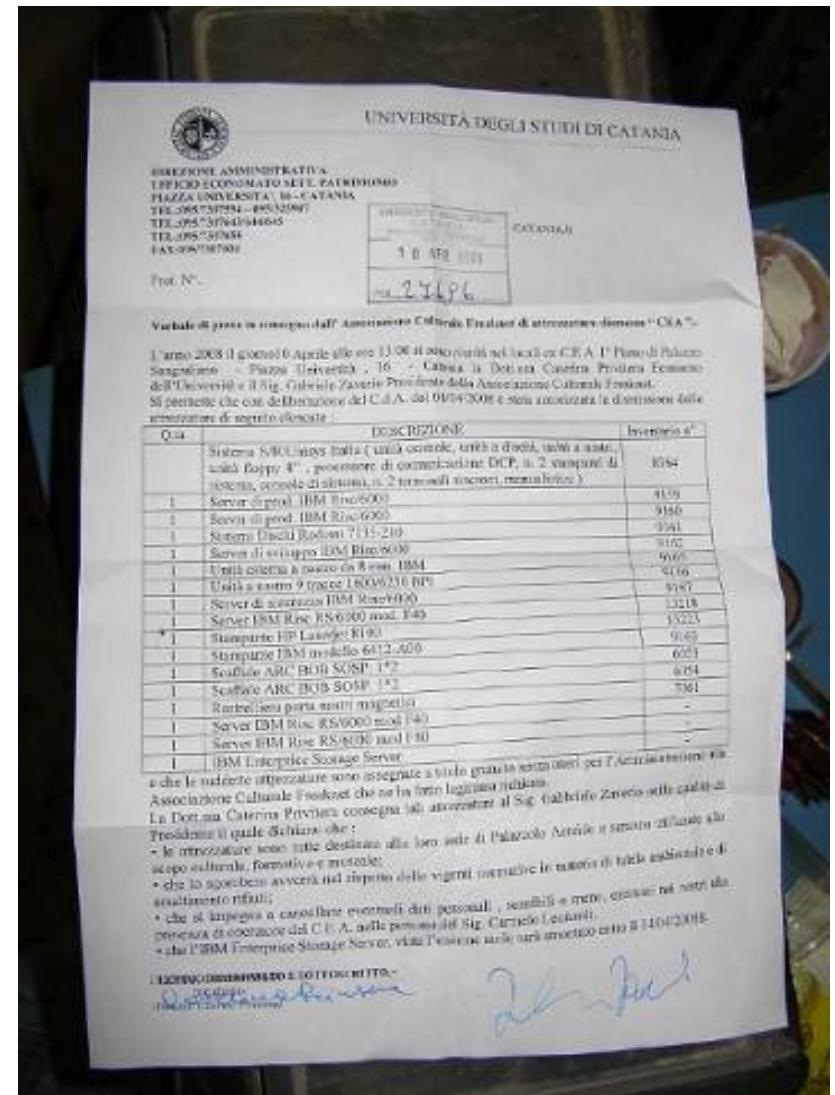
*Where to find
Historical hardware?*



Burocracy

Some institution (especially in Italy) require a lot of paper

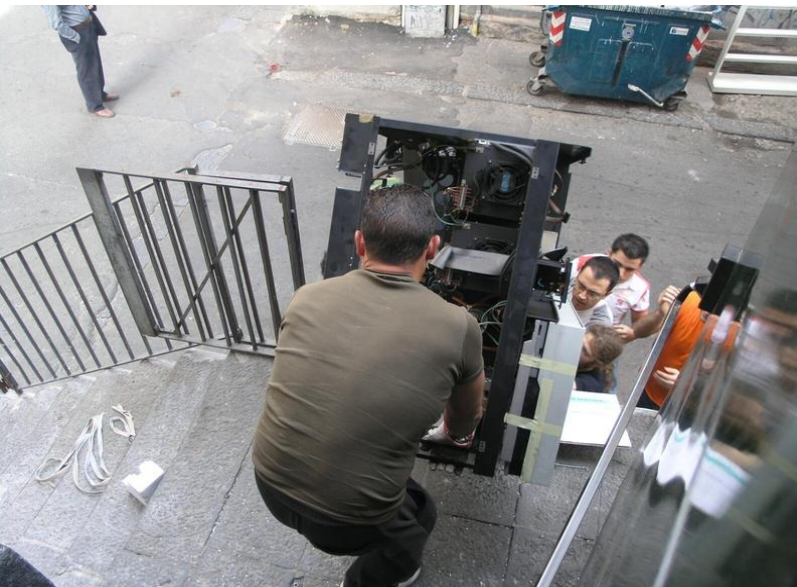
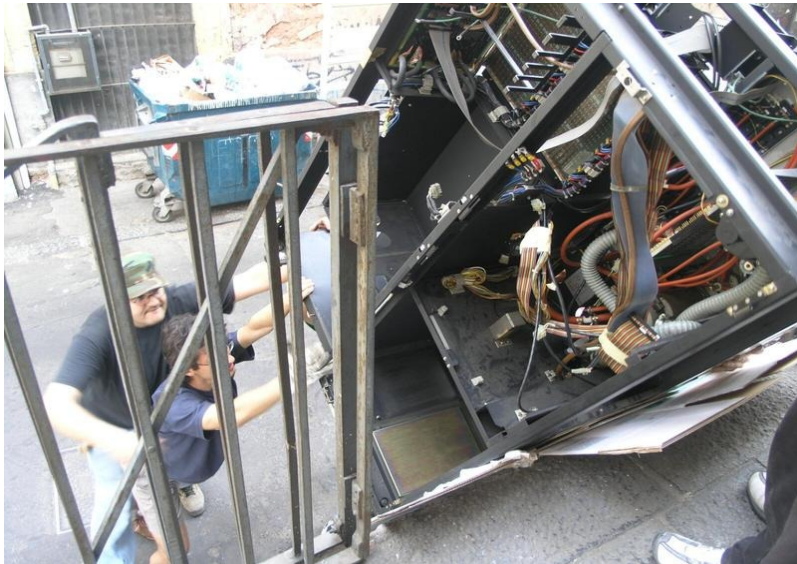
This can be a very time-consuming task!



Very big stuff to move



Logistic must be planned

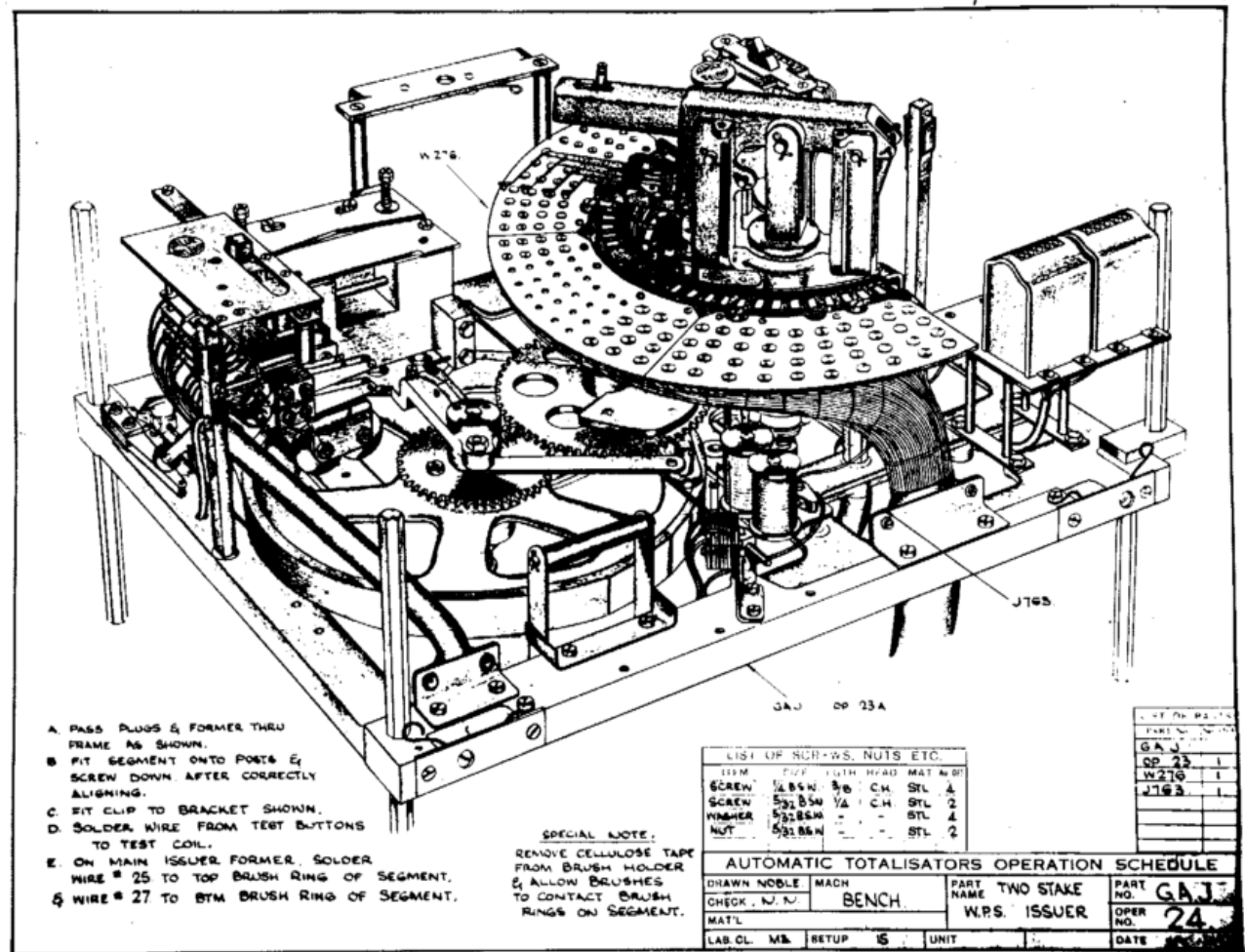


Murphy's law: In Sicily, in full August, it will rain for sure!



Documentation is important

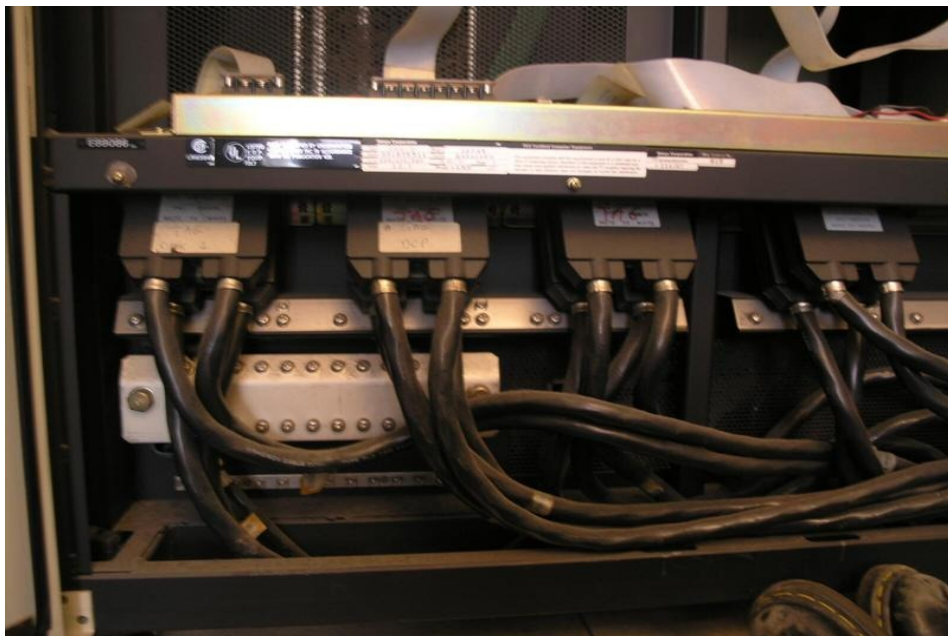
- * Schematics
- * Pictures
- * Spare part list
- * Similar experiences
- * ...



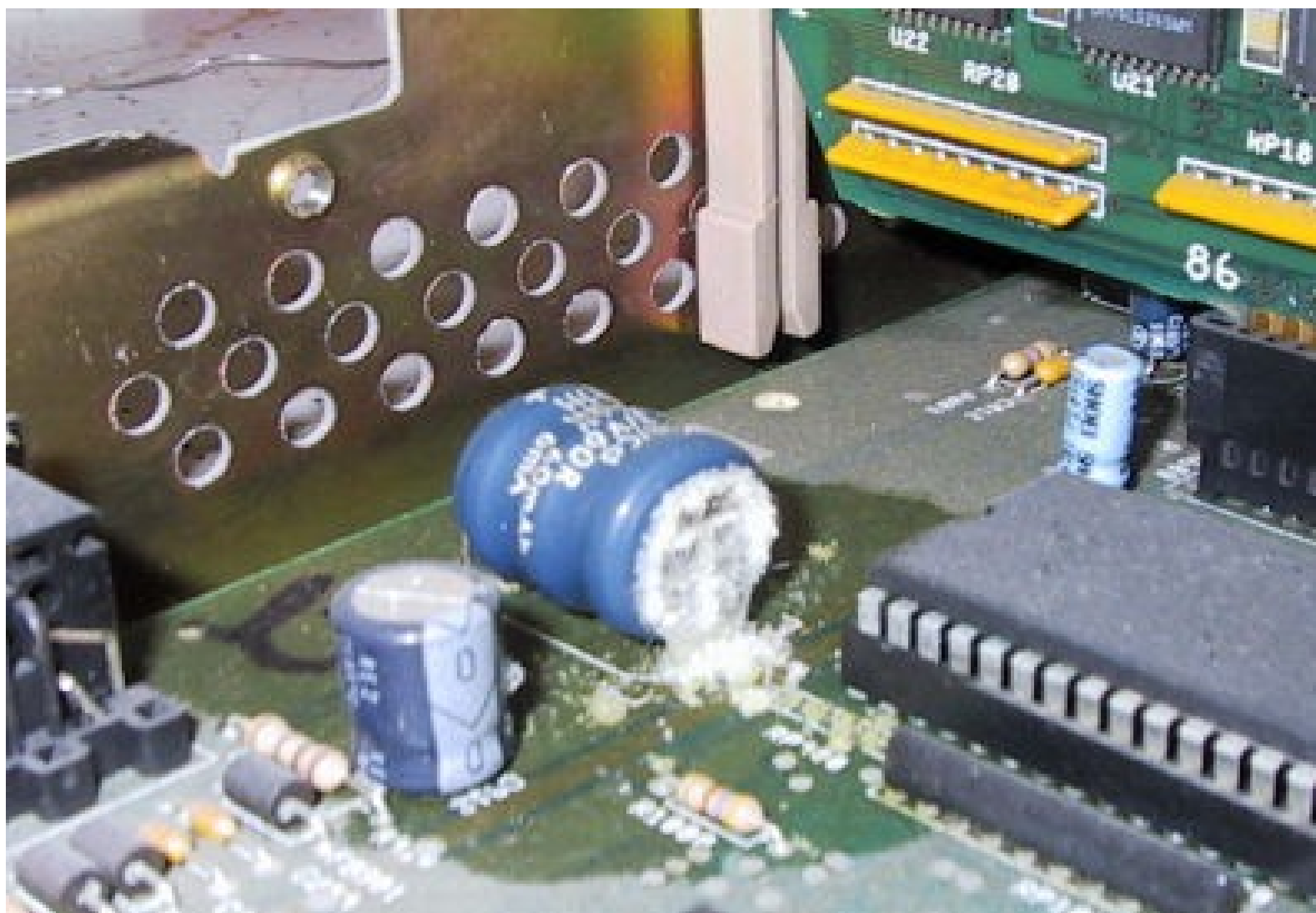
Documentation about everything!

Labels, pictures, diagrams...

Everything is useful for a succesful restoration!



SAFETY procedures before long term storage



Restoration & testing

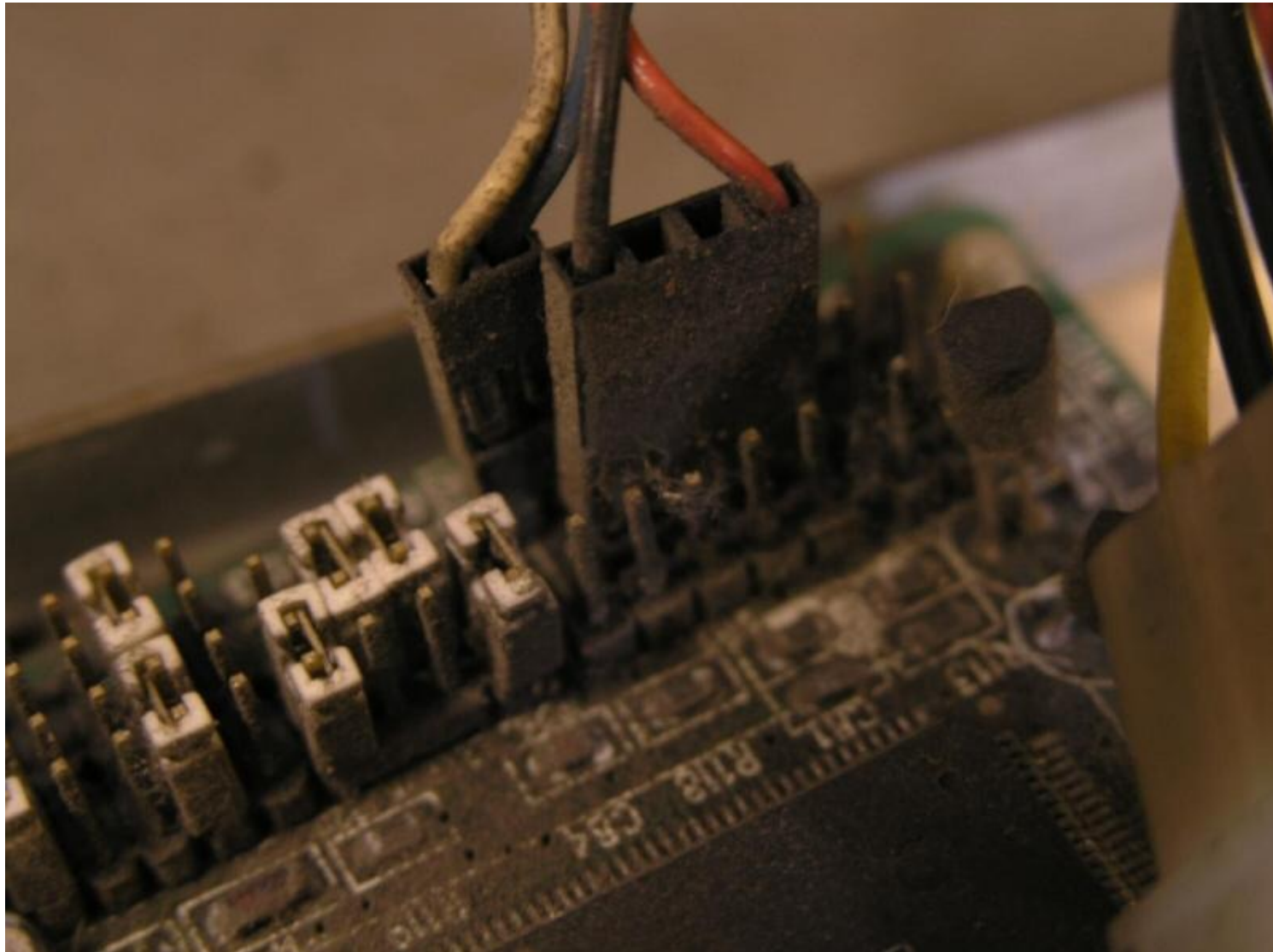
...light on that hardware!



NEVER turn on anything before preventive restoration

NEVER turn on anything if you don't know the correct shutdown procedure

Testing



Visual inspection, information gathering, tools etc.

Data recovery / backup / disk images



Aesthetic restoration

Things should be done according to a museum perspective

If something can't be properly restored, is better to preserve it in the actual condition.

Preliminary documentation about the part

(Plastic? Resin? Metal? Wood?)

Very careful washing

Special detergents

Special solvents

Documentation is important!

Aesthetic restoration



Problems with some detergents (Hewlett Packard HP-64000 and others)



An example of restoration



An example of restoration



An example of restoration



An example of restoration



SAGA FOX LS-1000, Torino, 1980

Yellow plastic



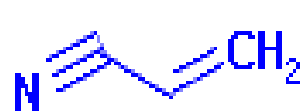
Preservation or restoration?

Chemical treatments?

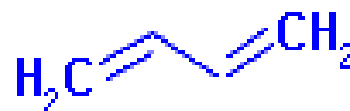


ABS

Thermal/chemical
resistance

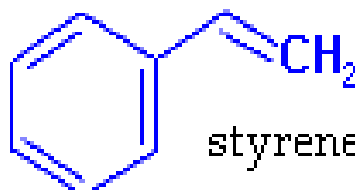
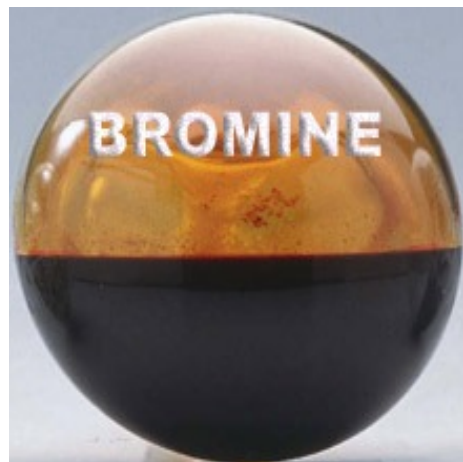


acrylonitrile



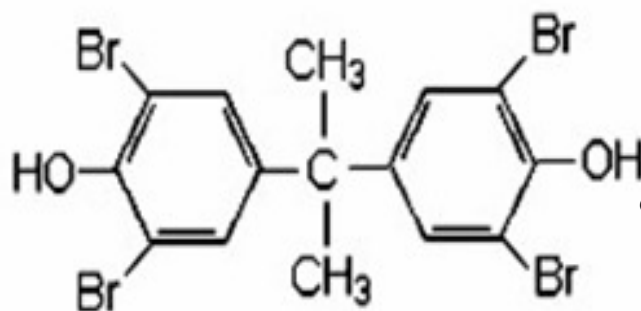
1,3-butadiene

Flexibility, resistance
to impacts

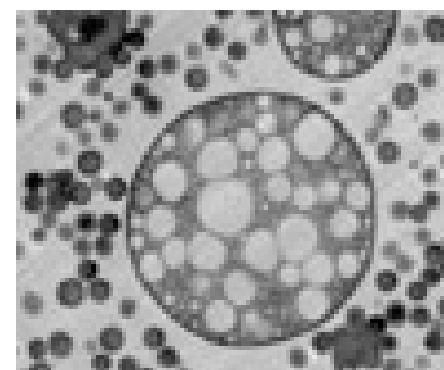
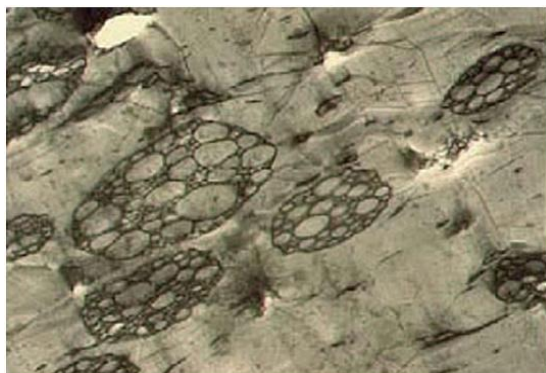


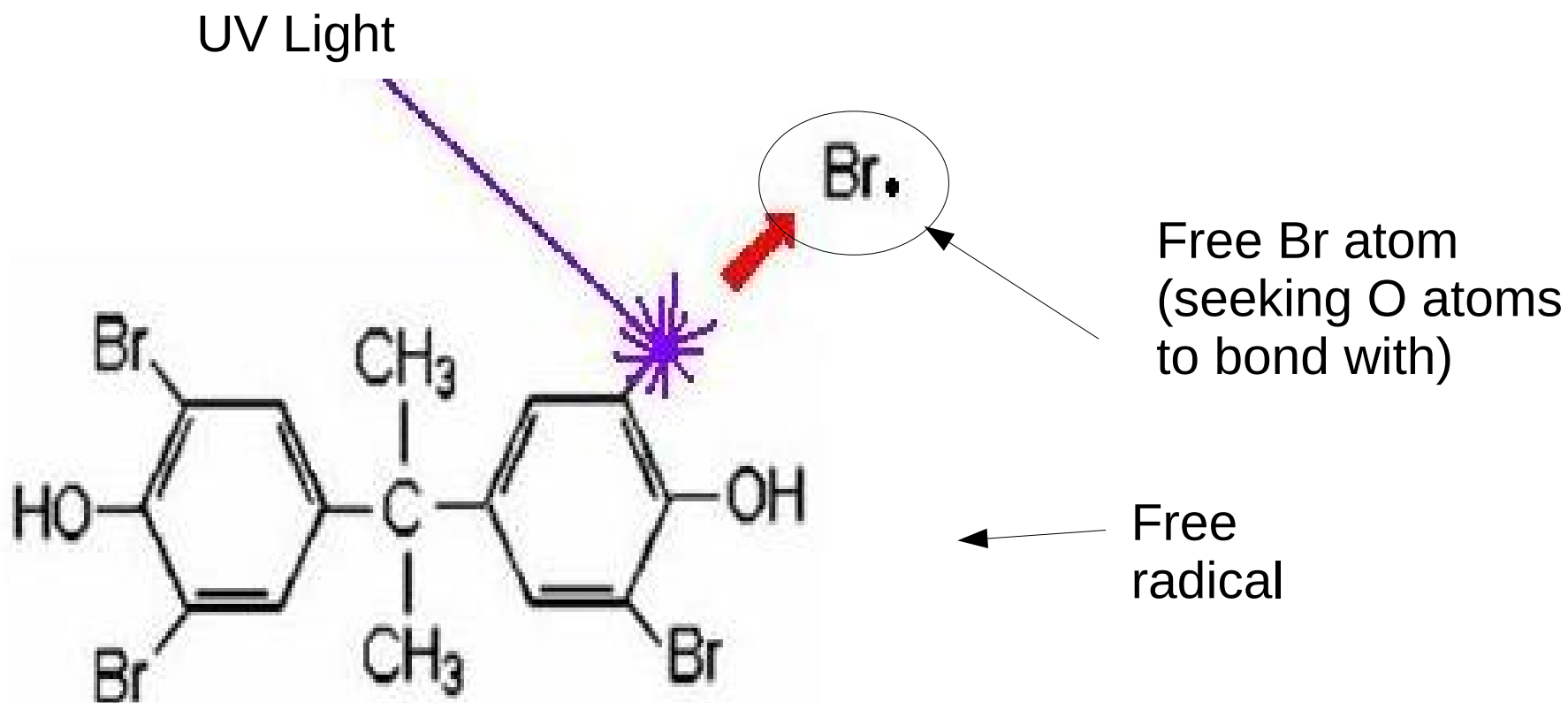
styrene

Surface smoothness,
cost reduction, facilitates
cutting & machining

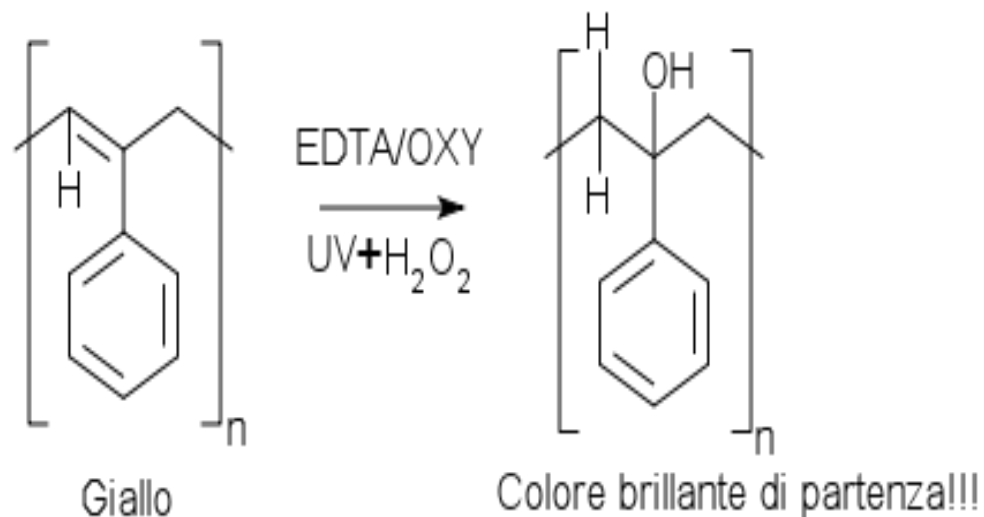


*Tetrabromobisphenol A (TBBPA) used as reactive and additive **flame retardant**. It bound chemically to the polymers.*





**The yellowing process: BrO₂ is YELLOW!
The free radical generates more BrO₂ and
so this is a chain reaction. BrO₂ is also unstable.**



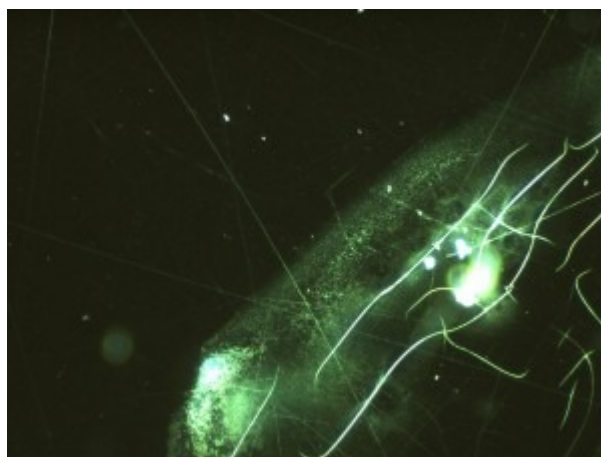
We apply UV light to destabilise the Bromine / Oxygen bond, break it and attach a Hydrogen atom to the Bromine, removing the yellowing. We are breaking apart hydrogen peroxide (H₂O₂) into O, H and water (H₂O). Water dissociates into H and OH naturally. We are taking the oxygen away from the bromine with UV light, then replacing it with a hydrogen. The removed O links up with the O from the broken up peroxide and becomes O₂ and is given off as bubbles.

Why we do not recommend this:

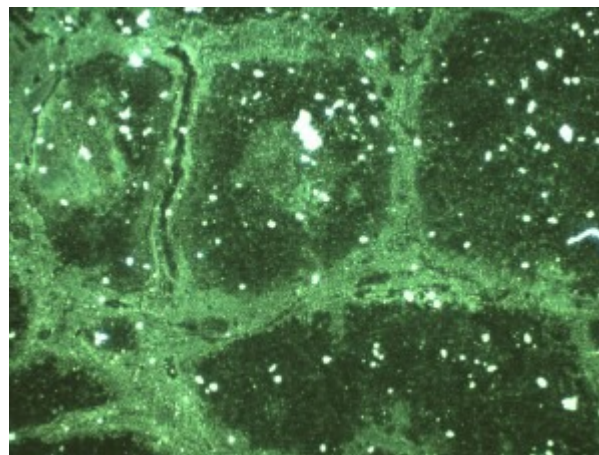
We don't know about the long term effects.

There are *visual changes on the surface*

It is a **non reversible treatment.**



Polymethilmetacrylate



PVC

Etching of the surface, visible with the naked eye. An obvious crack in the area where the solution had been applied. Polyvinyl chloride (PVC), was become dull; the gel has etched a bubble-like pattern in the material surface.

Reference: Aktuel Bevaring - Følg med hos konservatorerne på Nationalmuseets Bevaringsafdeling -National Museum of Denmark, Anja Liss Petersen, Yvonne Shashoua

<http://aktuelbevaring.natmus.dk/afrensning-af-plast-med-retrobright.html>

<http://aktuelbevaring.natmus.dk/miljoevenlige-alternativer-til-plastmaterialer-brugt-i-konservering-af-museumsgenstande.html>

Electronic restoration

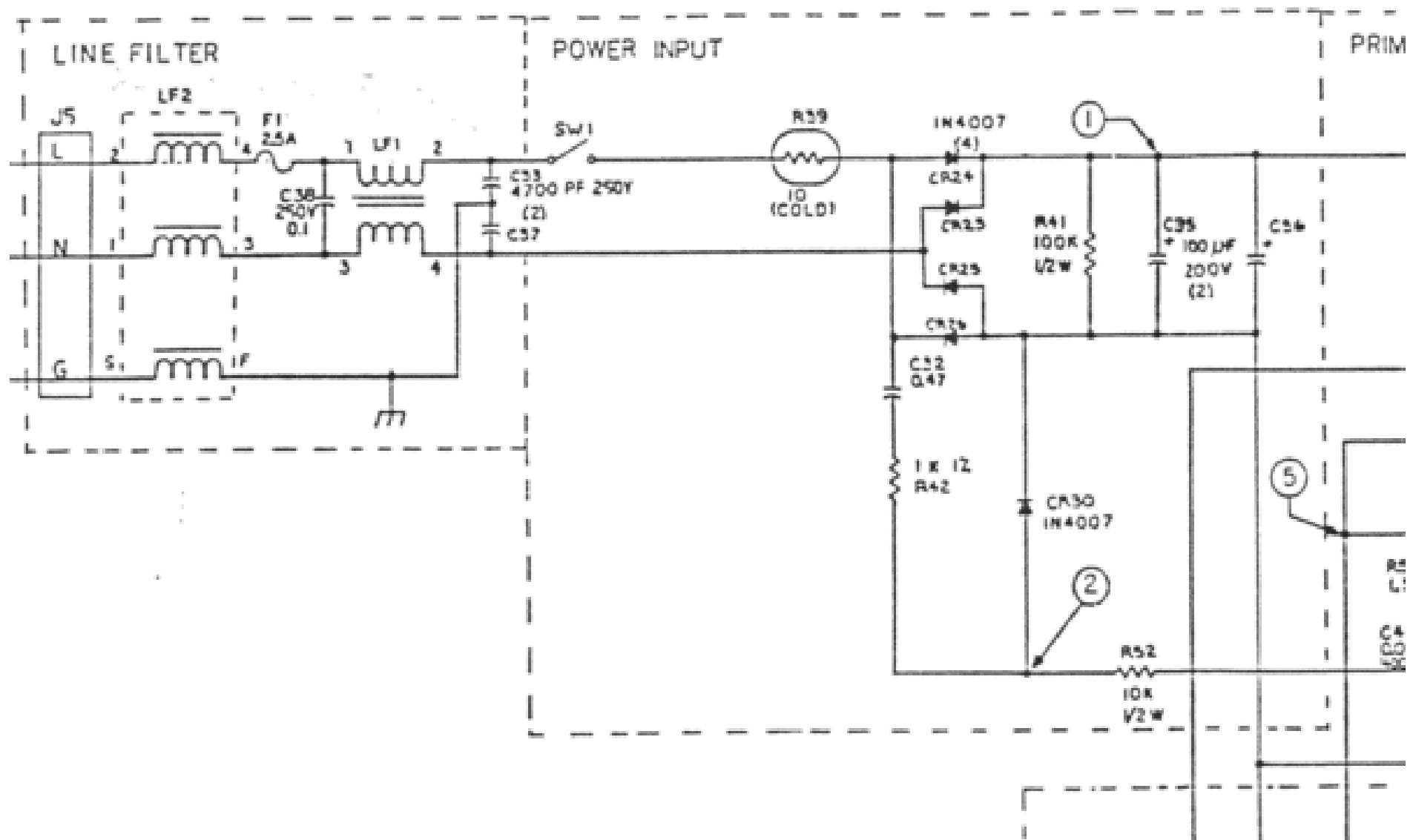
Having schematics or reverse-engineering the circuit...

- Connections between boards etc.
- Voltage levels
- Aged components

If required:

- A new power supply?

Apple Macintosh: a case study

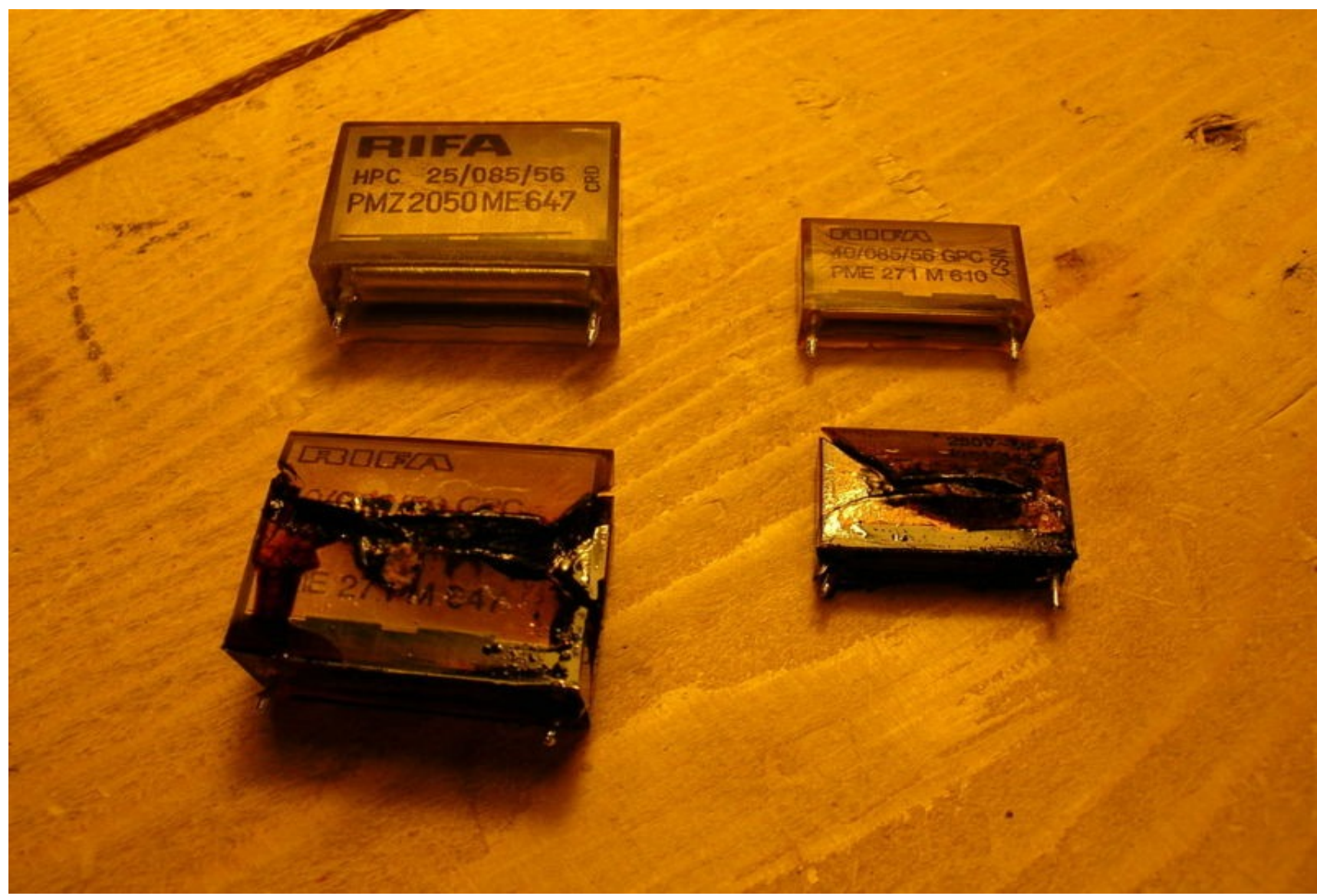


Apple Macintosh: a case study

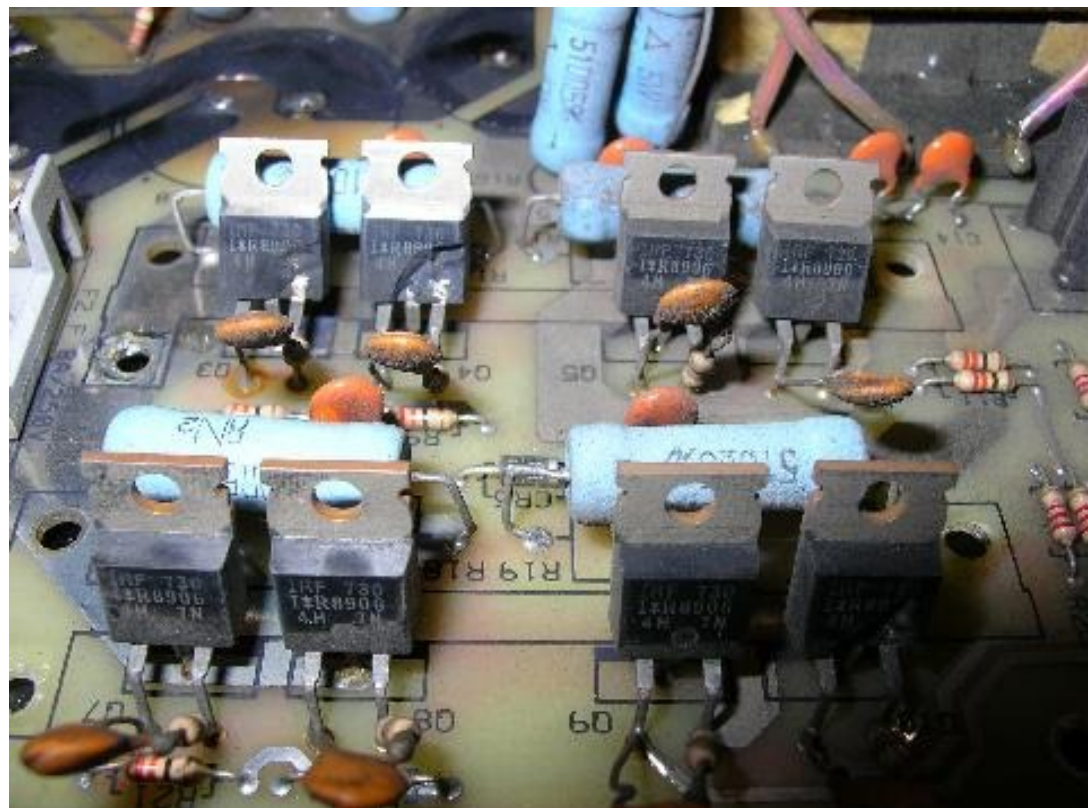
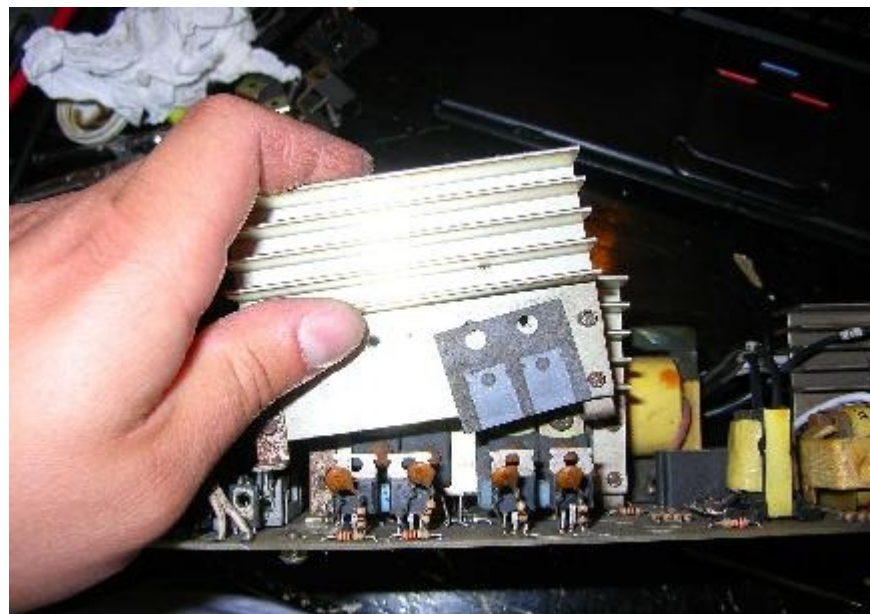




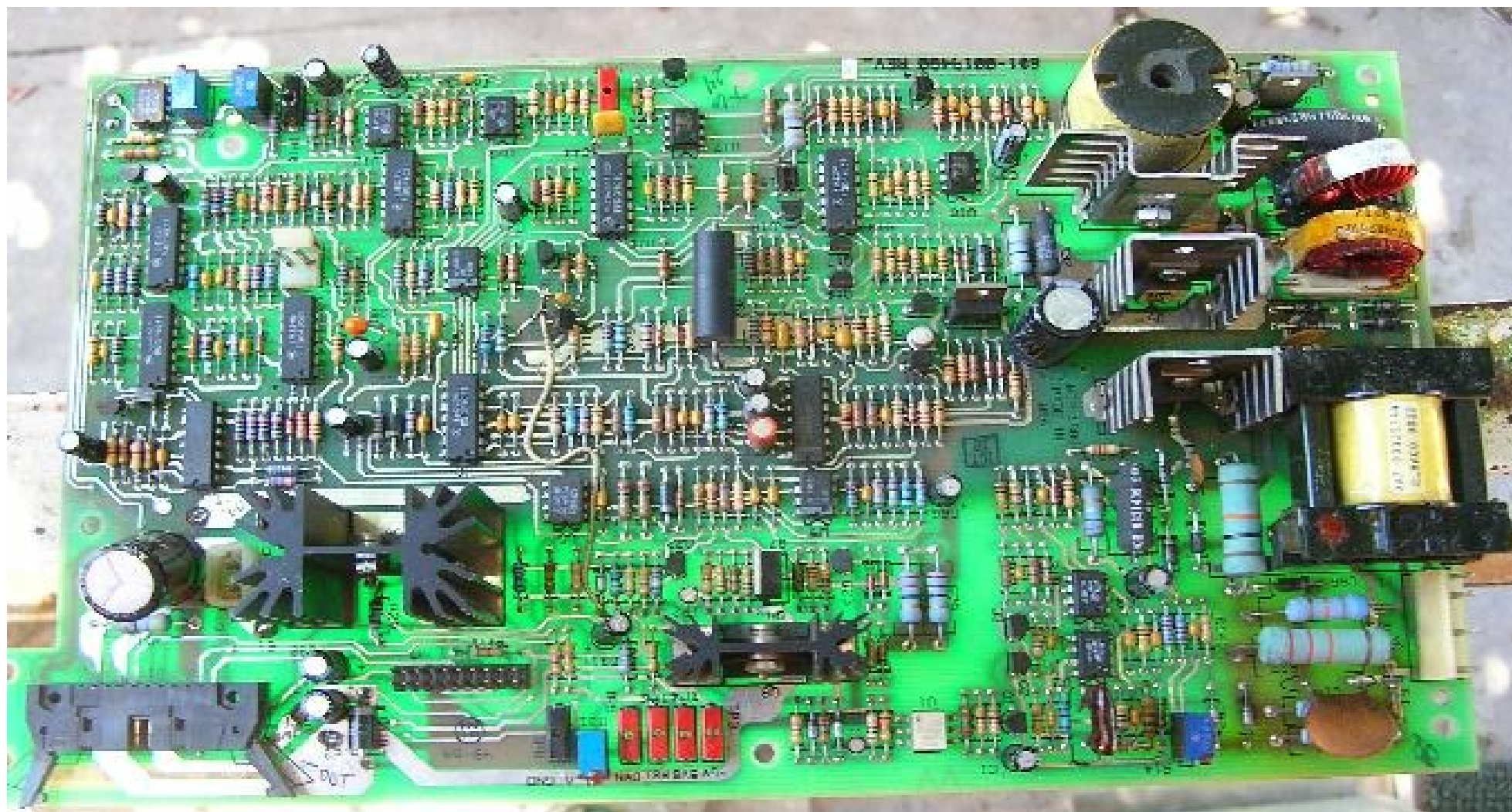


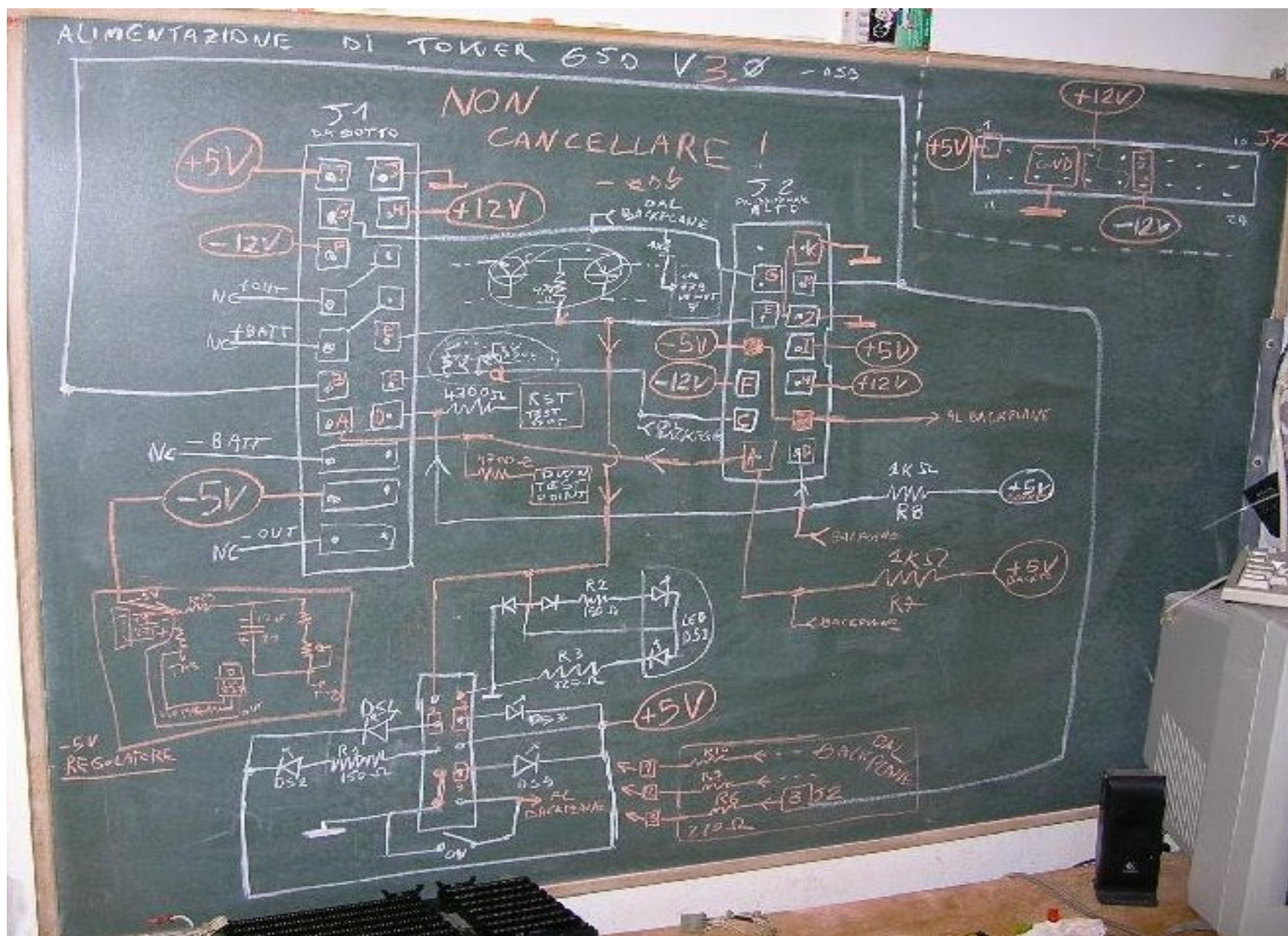


NCR Tower32/650: a case study

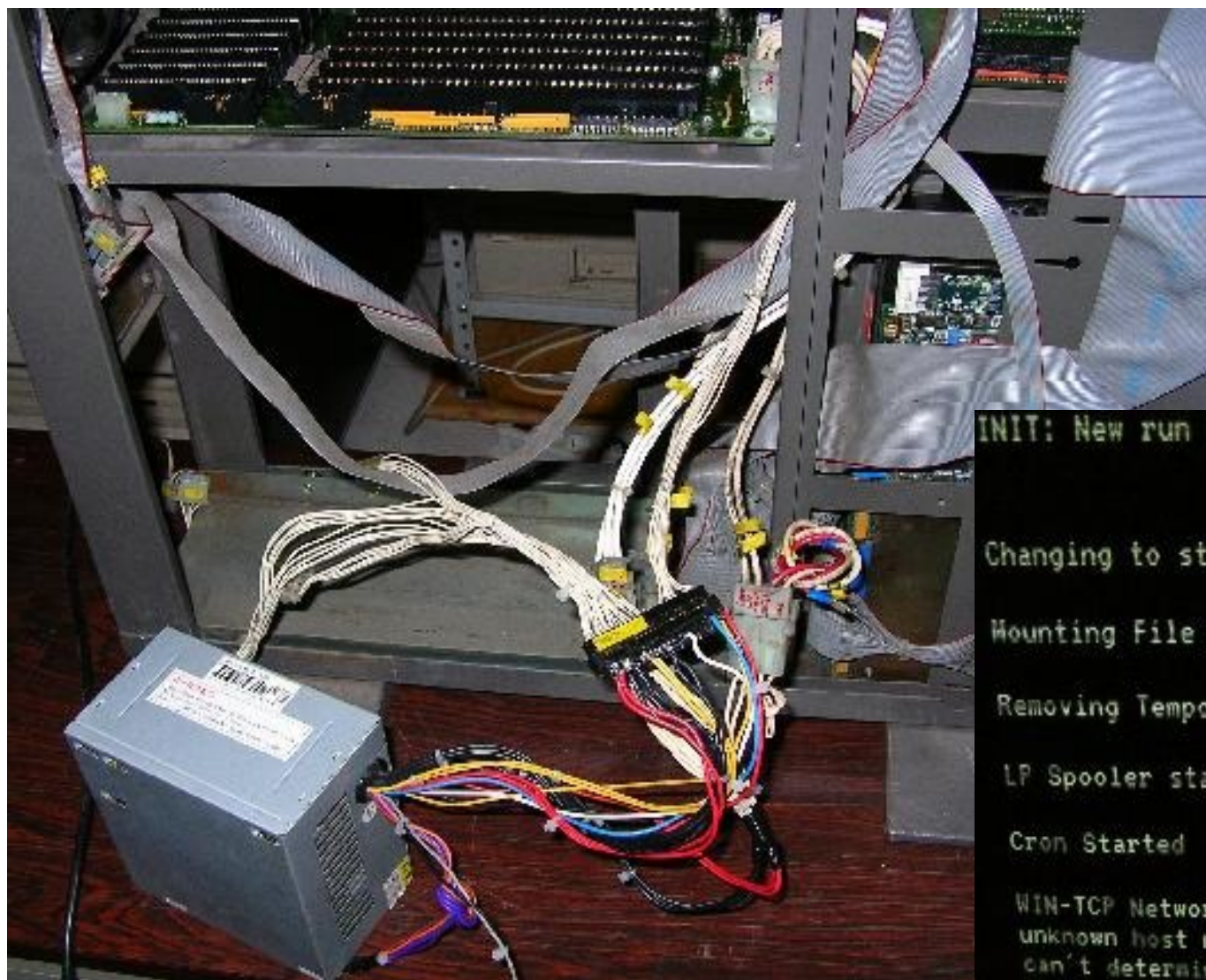


NCR Tower32/650: a case study





NCR Tower32/650: a case study



```
INIT: New run level: 1
```

```
Changing to state 1.
```

```
Mounting File Systems
```

```
Removing Temporary Files
```

```
LP Spooler started
```

```
Cron Started
```

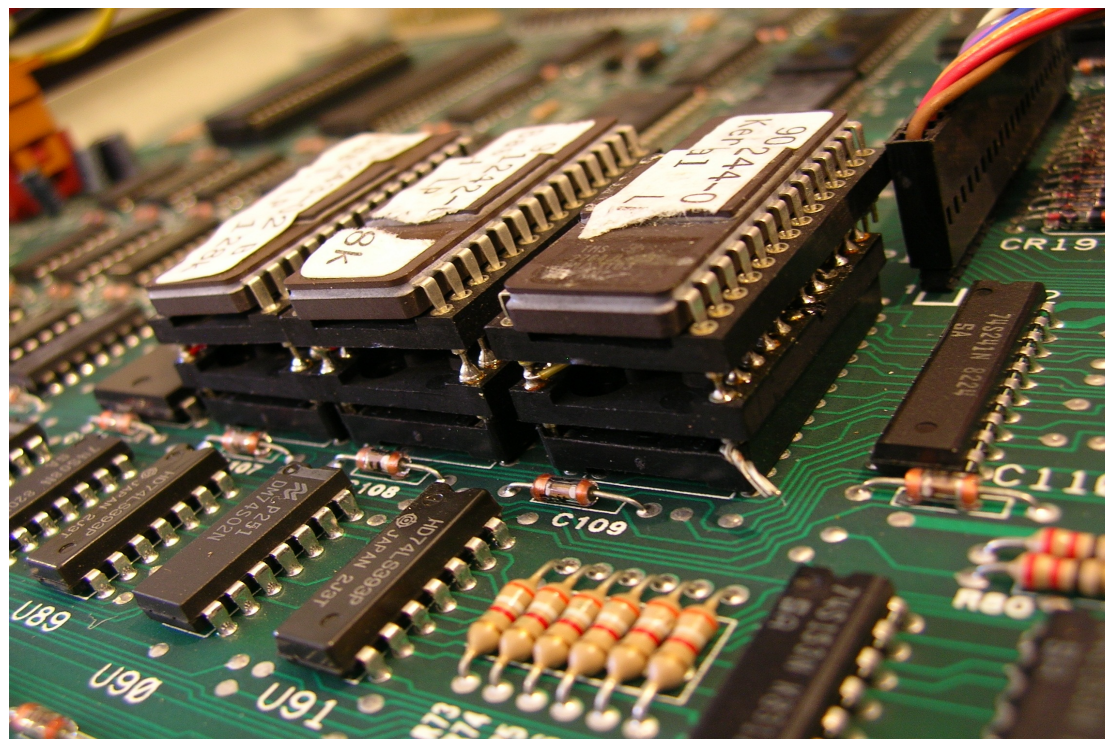
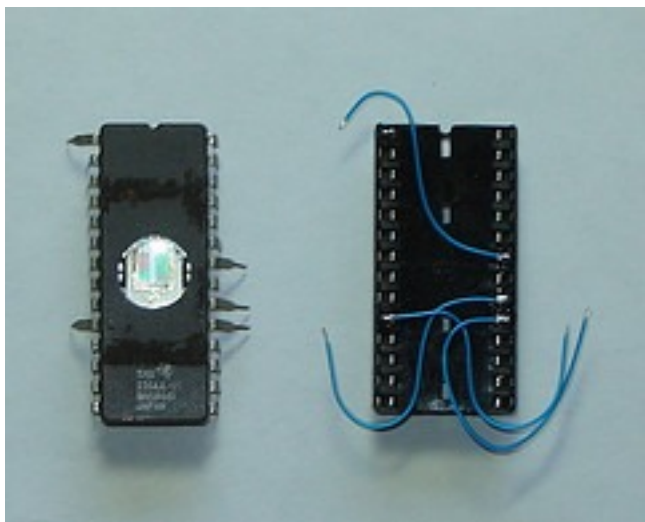
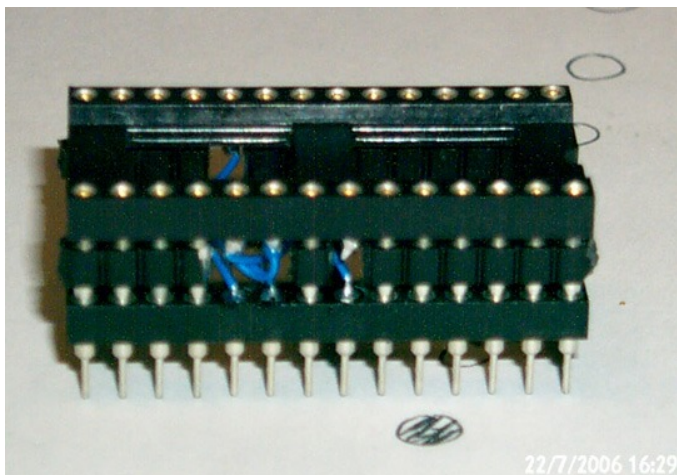
```
WIN-TCP Network Initializing.
```

```
unknown host ne
```

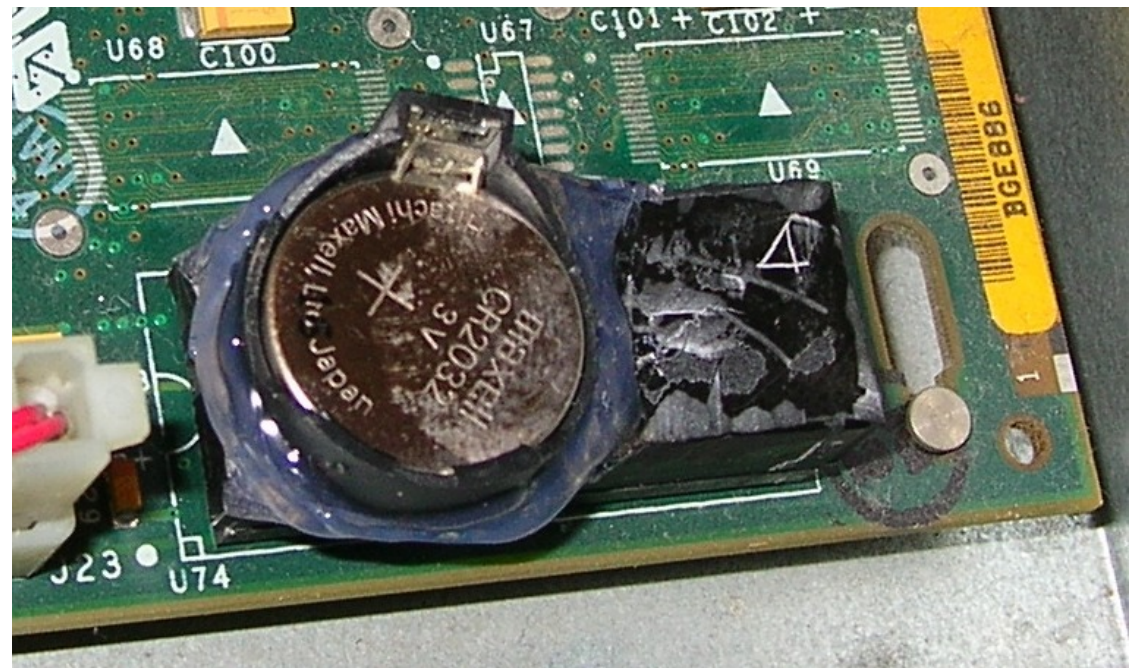
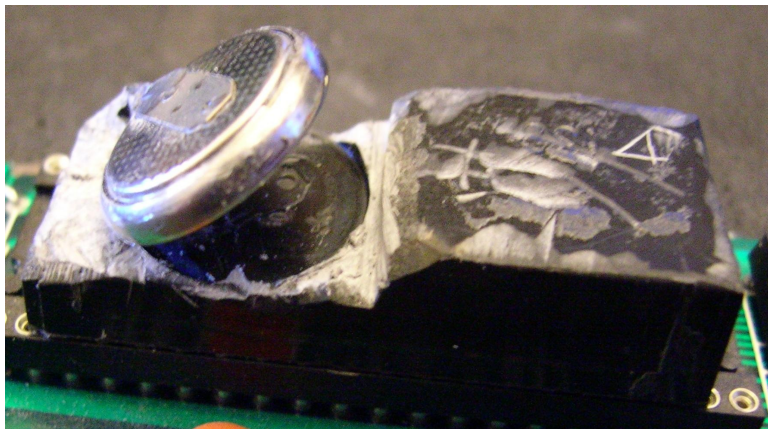
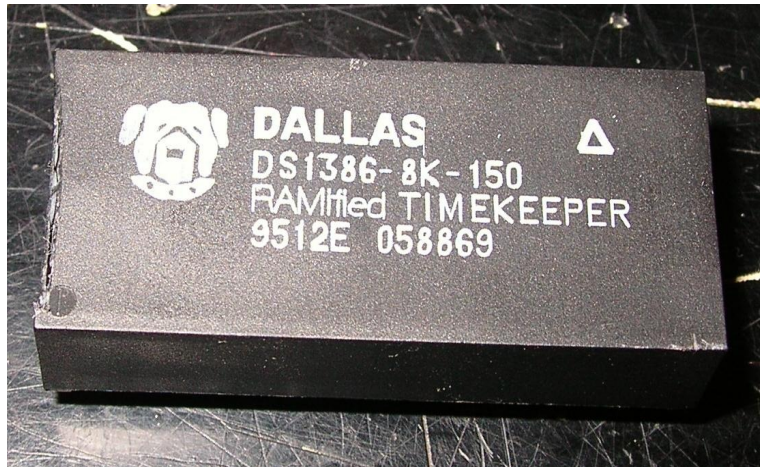
```
can't determine my internet address/usr/etc/inetinit: config
```

```
Press the <Return> key to continue: 
```

EPROM Backup



Hidden batteries

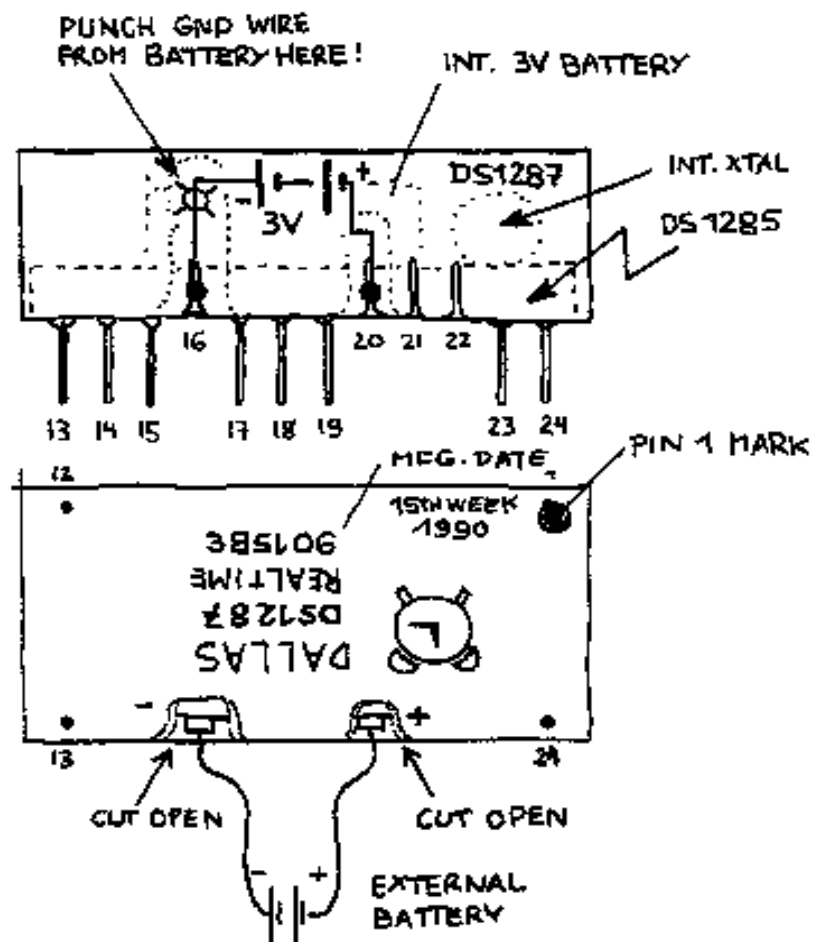


Hidden batteries

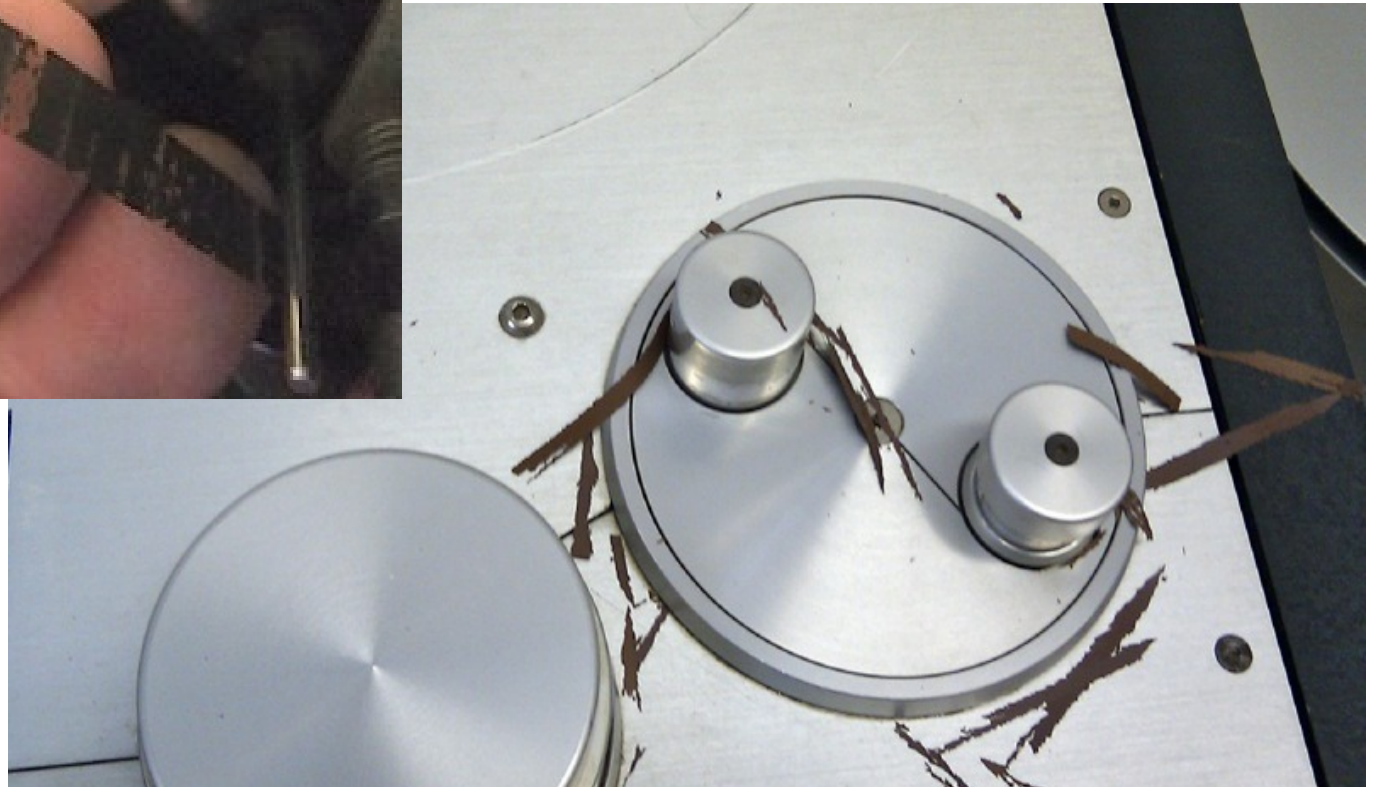


HOW-TO RETROFIT W. EXT. BATTERY

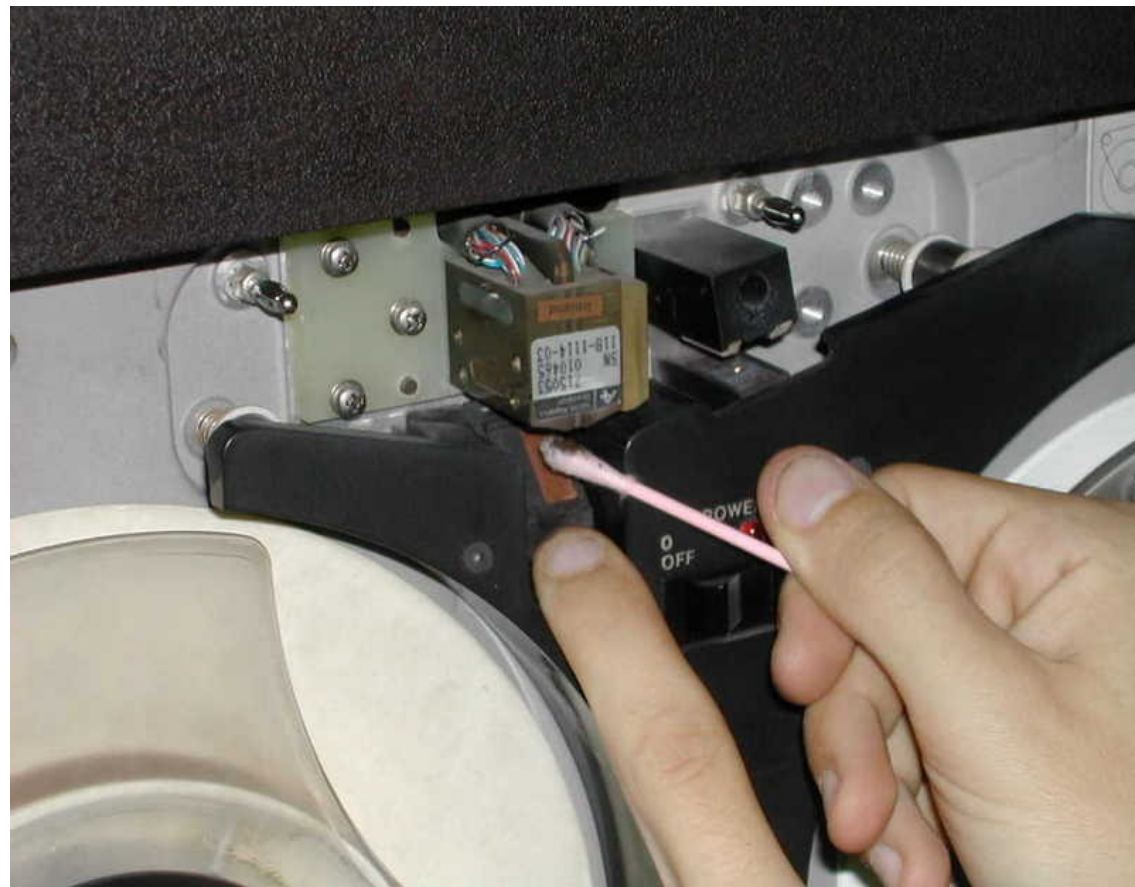
DALLAS DS1287(A)
REWORK



MEDIA recovery: sticky tapes



MEDIA recovery: sticky tapes



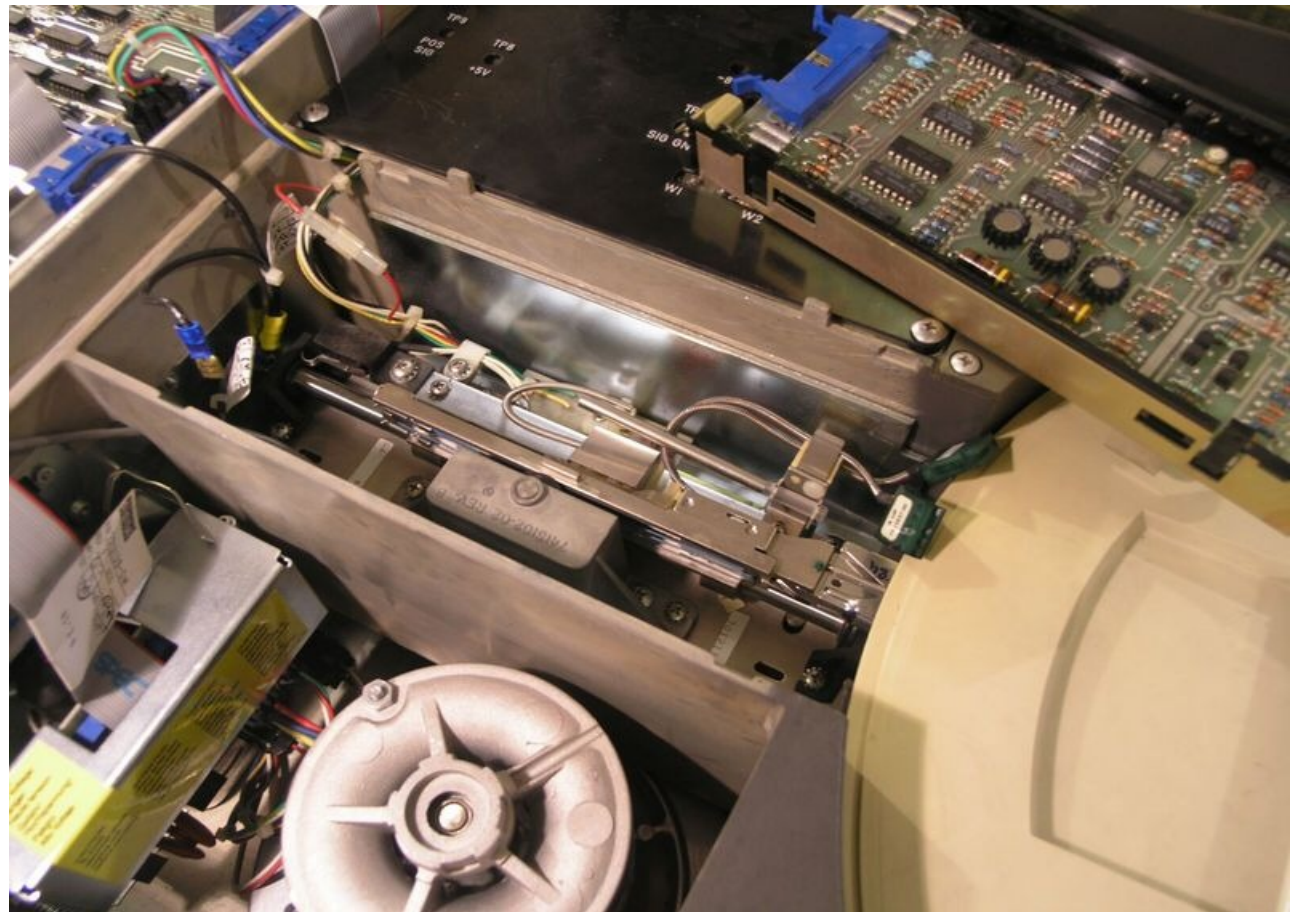
MEDIA recovery: sticky tapes



Weird problems...



Weird problems...



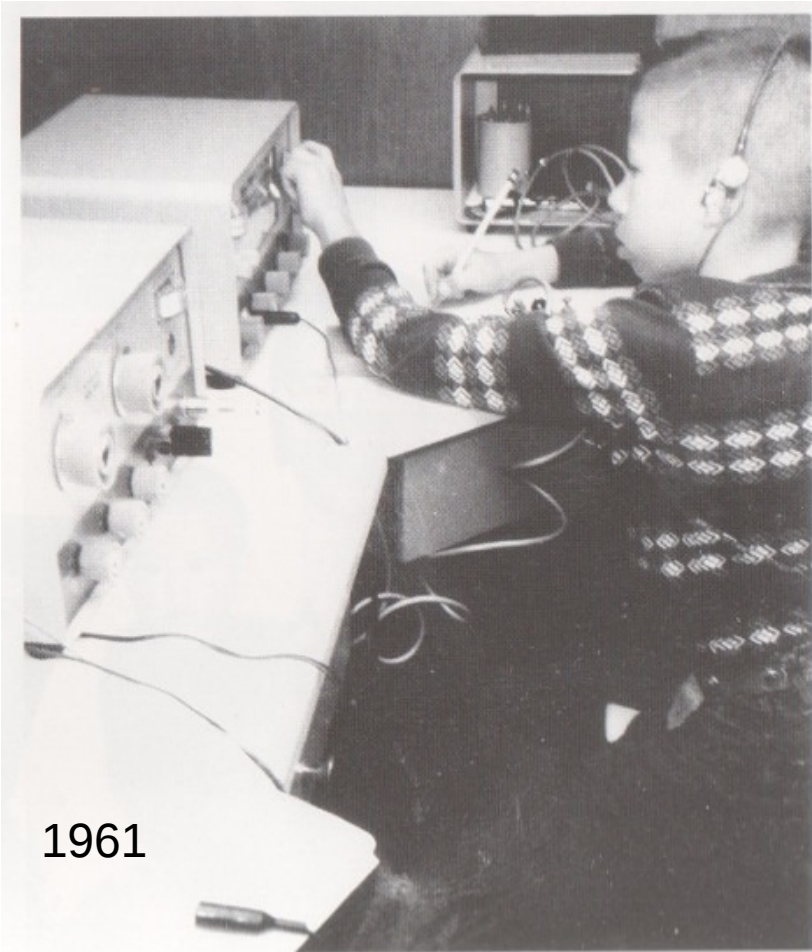
Weird problems...



How Apple Computers was born?

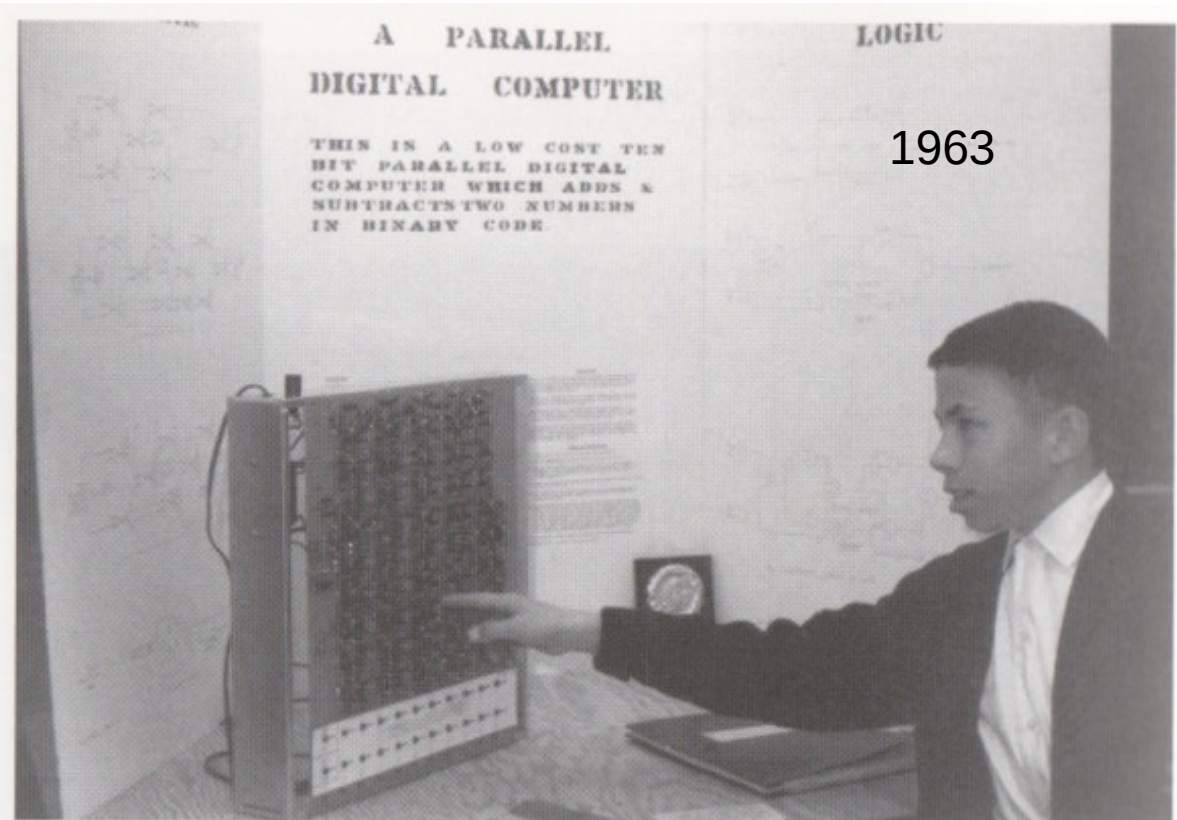


Woz, who is this guy?



1961

At eleven, I was one of the youngest ham radio operators in the world. But I got bored. No one my age to talk to! (Photograph courtesy of Margaret Wozniak)

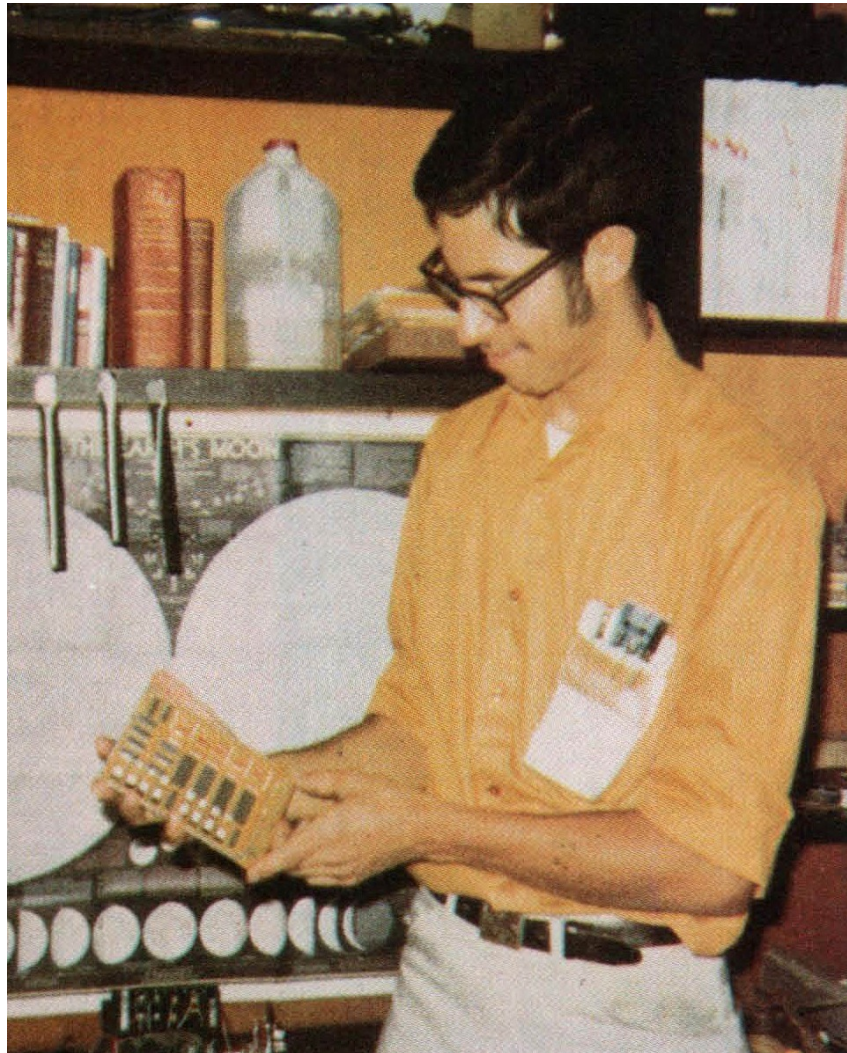


1963

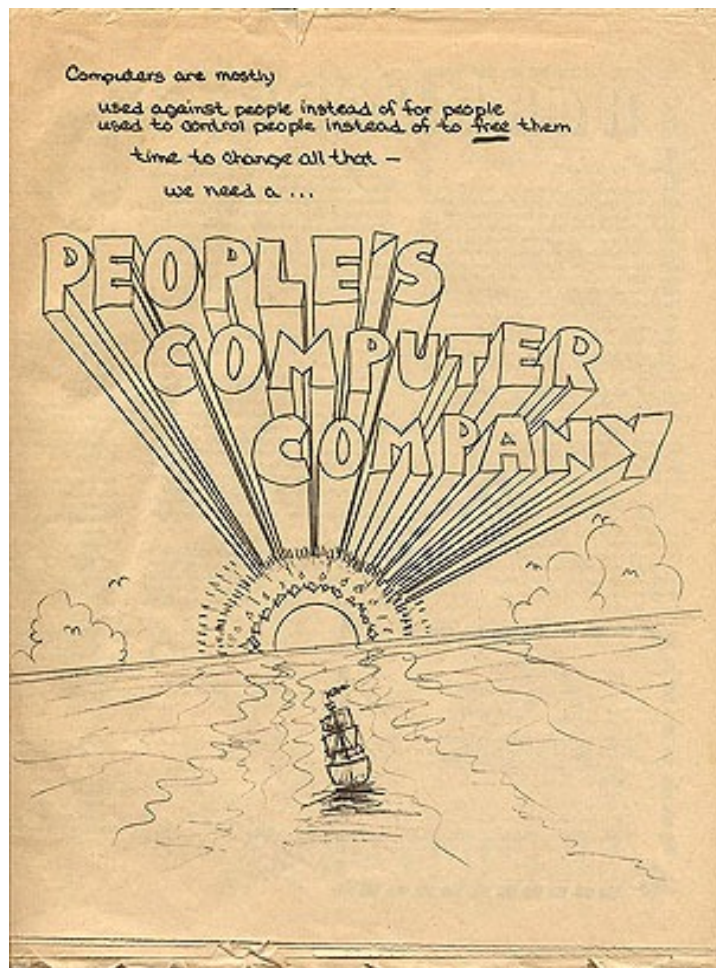
Here I am at thirteen showing off my science-fair-winning Adder/Subtractor. (Photograph courtesy of Margaret Wozniak)

Apple 1 Project

Cream soda computer, 1971: Steve Wozniak & Bill Fernandez



1972: People's Computer Company



Send check or money order to: **PEOPLE'S COMPUTER COMPANY**
 c/o DYMAX
 P.O. Box 310
 Menlo Park, Ca. 94025

NAME _____

ADDRESS _____

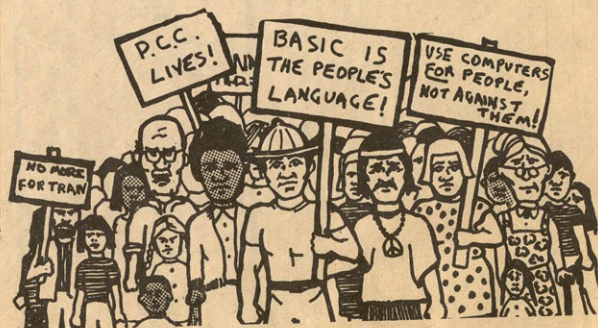
ZIP _____

\$4 for 5 issues
 each school year

\$5 overseas price

What kind of computer do you use (if you do)? _____

A subscription starts with the 1st issue of the school year.



Sample Copy
 Please consider subscribing

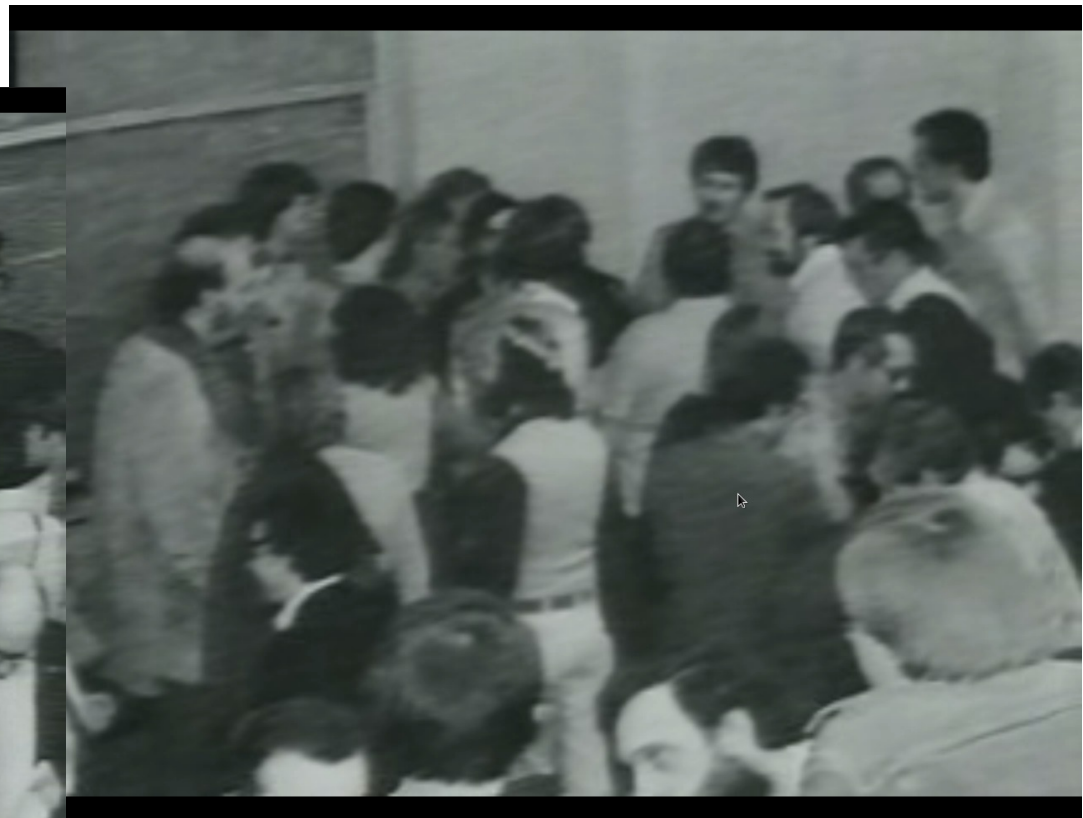
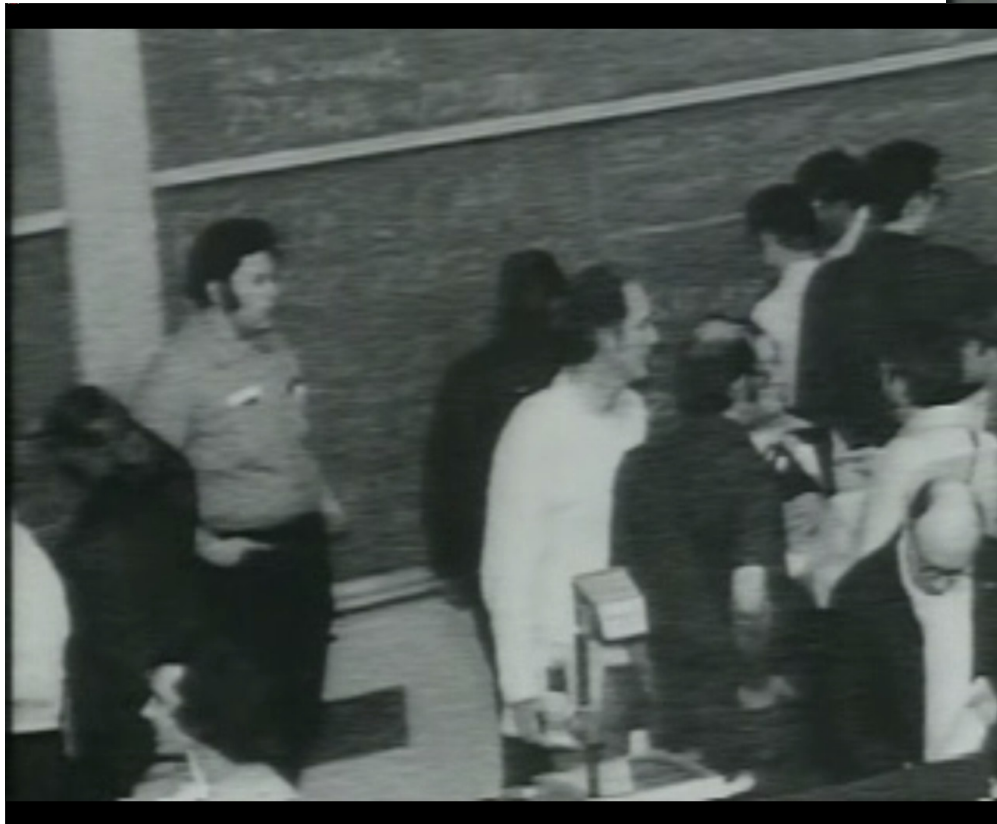
Community Memory, Berkeley 1973



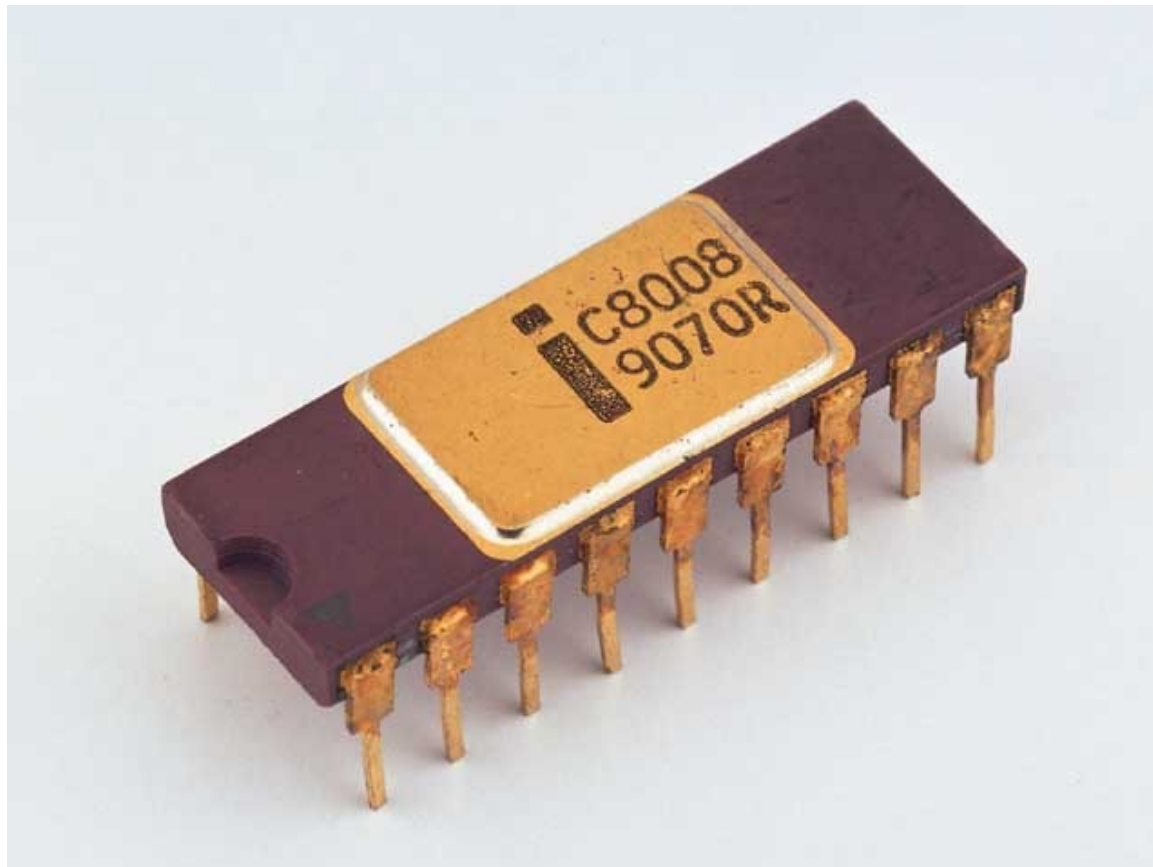
Community Memory was the first public computerized [bulletin board system](#). Established in 1973 in [Berkeley, California](#), it used an [SDS 940 timesharing](#) system in [San Francisco](#) connected via a 110 [baud](#) link to a [teleprinter](#) at a record store in Berkeley to let users enter and retrieve messages. Individuals could place messages in the computer and then look through the memory for a specific notice.

Homebrew Computer Club, 1975

Computer designer Gordon French and community activist Fred Moore met at the People's Computer Center. They invited 35 computer hobbyists to French's Menlo Park garage on March 5, 1975. Homebrew Computer Club was born!



As if to symbolize the concept of free exchange that the group would embody, **Marty Spergel**, the electric parts supplier who would be known as “**the Junk Man**” within the group, held up an **Intel 8008** chip, just as everyone was leaving. “Who wants this?” he asked, and when the first hand went up, he tossed the chip, the fingernail-sized chunk of technology



Apple 1 Project

On **Sunday, June 29th, 1975**, **Steve Wozniak** took a computer he hobbled together out of an old Motorola 6800 CPU and a collection of disjointed parts that he had soldered onto a motherboard and showed at the Homebrew Computer Club.



Apple 1 Project

The APPLE 1 startup

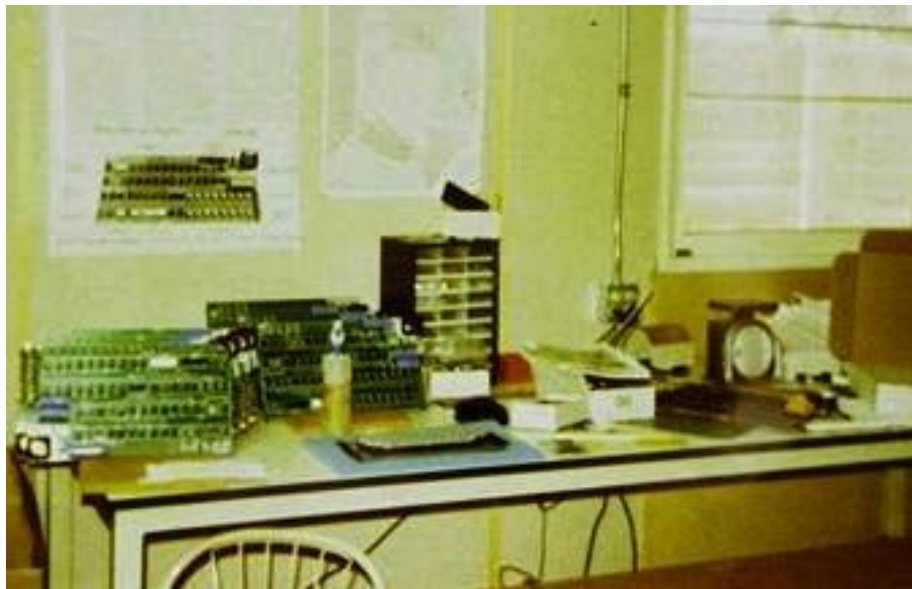


HP-65

The VW Van

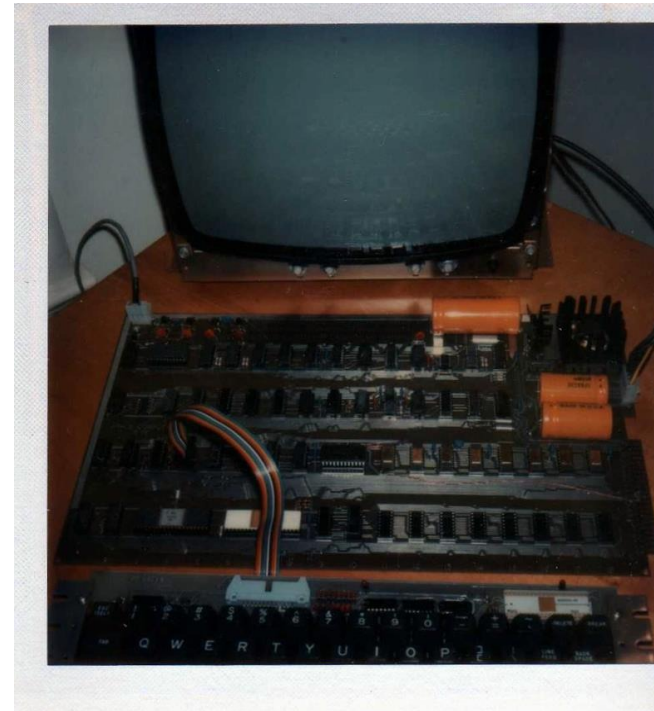


Job's Garage



Apple 1 Project

First boards were sold at BYTE SHOP,
Mountain View (CA) - April 1976

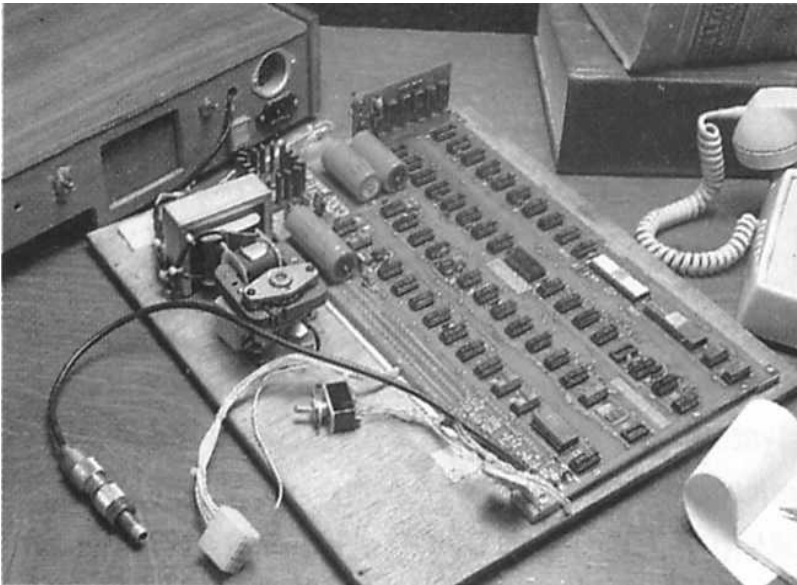


Apple 1 Project

First participations at computer faires
1976



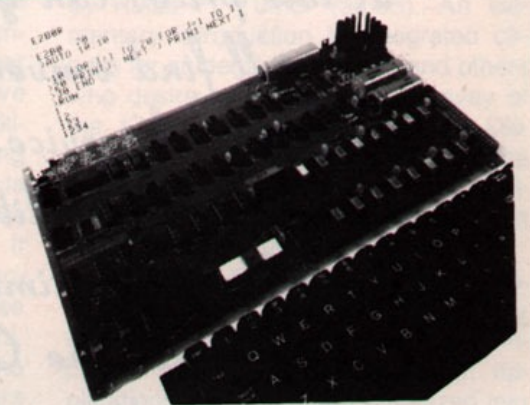
Why Apple 1 was a revolution?



A BALANCE OF FEATURES

The APPLE-1 SYSTEM is a **fully assembled, tested & burned-in** microprocessor board using the 6502 microprocessor. The board contains processor & support hardware; **complete video electronics** for a 40 character/line, 24 line video display; **on-board RAM capacity of 8K BYTES**; software system monitor in PROM; and fully regulated power supplies. The Apple attaches directly to an ASCII encoded keyboard and a video monitor, allowing the efficient entry and examination of programs in hexadecimal notation. The use of the new **16-pin 4K RAM chips** results in low power and high density memory, which can be upgraded to the 16K chips when they become available (32K bytes on-board RAM!!)

A fast (1 kilobaud) cassette interface is available and includes a tape of **Apple Basic**. And ... Yes, Folks. **Apple Basic is Free!**



APPLE-1 **\$666.66**
*includes 4K bytes RAM

- | | |
|------------------------|---|
| Micro Interface | <ul style="list-style-type: none"> • 6502 Microprocessor • Full video display electronics - 40 char/line, 24 line. Outputs composite video. • Has ASCII keyboard interface on-board. • Cassette interface board available. FAST - 1 Kilobaud. |
| Memory | <ul style="list-style-type: none"> • Uses 16-pin 4K Dynamic RAMS. • 8K BYTE RAM capacity on-board! • Upgradable to 16K RAM chips. • Software system monitor in PROM |
| Basic | <ul style="list-style-type: none"> • Apple Basic ... pseudo-compiled, FAST, FREE. |
| Power | <ul style="list-style-type: none"> • Fully regulated power supplies on-board. |

DEALER INQUIRIES INVITED

APPLE COMPUTER COMPANY

770 Welch Road, Suite 154
Palo Alto, California 94304

Phone: (415) 326-4248

CIRCLE NO. 42 ON INQUIRY CARD

JULY 1976

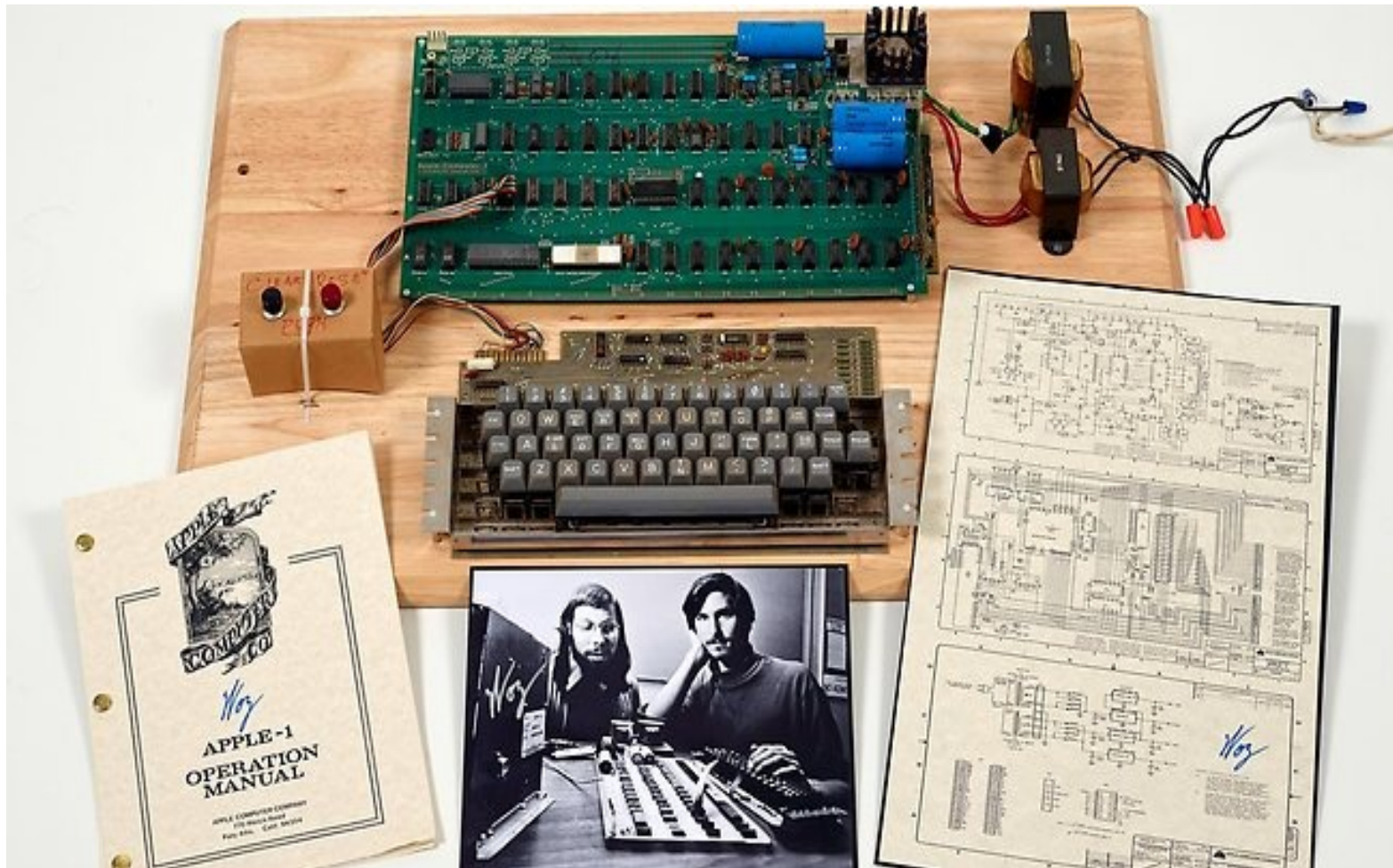
Computers BEFORE the APPLE 1



APPLE 1



Why rebuild an Apple 1?



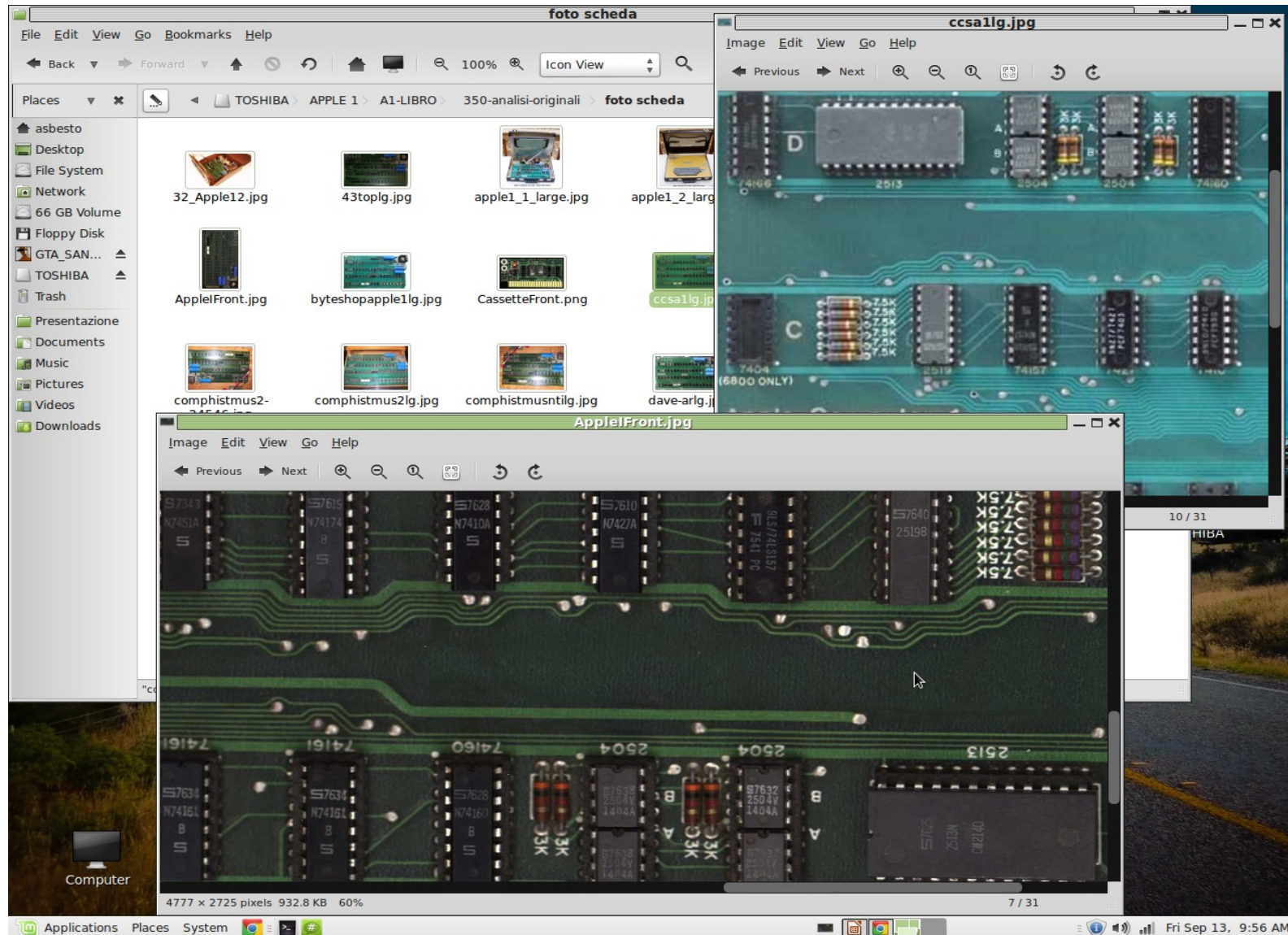
Christie's Auction, 2013: 387.750\$



Apple 1 Project

The part list

Apple 1 Project - Google Chrome														
https://docs.google.com/spreadsheet/ccc?key=0AimV8I32Mp8zdGxxTkxhRFNkbjNNRWs4OUNITkraUE#gid=0														
Apple 1 Project														
File Edit View Insert Format Data Tools Help Last edit was on February 21														
Apple 1 Project														
A B C D E F G H I J K L M														
63	Stancor P-8380 TRIAD F-31X	Trasformatore 110Vac / 10VAc 3A 5+5 presa centrale per +5V e -5V	Online components	1	12.82	12.82	TRIAD F-31X	1.3LBS each						
64	Molex 09-50-1061	Connettore power female	Online components	1	1.06	1.06	6.22 conf. da 10							
65	MP53704	video output transistor	Online components	1	0.289	0.289								
66	47pF	cap video - mica		1	1.12	1.12		10mm						
67	TOTALE PER APPLE					25.189	PER OGNI APPLE 1	totale pagato mouser 68 eur						
68						17.25	compr. sped. / 4							
69														
70														
71		GPEC												
72		http://www.gpecsrl.net/componenti-elettronici/integrato/CD4027J.html?id=24800												
73		http://www.gpecsrl.net/componenti-elettronici/integrato/CD4096BE.html?id=24947												
74	DRAM 4Kx1 4096-11	MK4096 4Kx1 DRAM	Unicorn / GPEC	16	4	64	per ogni apple 1 !!!	Su ebay c'e' quella GOLD ma e' il caso? Su gpec MK4096AJ11 gold a 4€						
75														
76	Motorola 6820	PIA	GPEC	1	4	4	GPEC 4 euro hite MOTOROLA 74H00 TI 30 CENT DATECODE 1974	Abbiamo 1 solo 6820 Signetics!						
77	7400	quad NAND gate		3		2.7	1974	4 in magazzino						
78	7402	quad NOR gate		1		0.18	GPEC TI 1974 ;)	3 in magazzino 1974-76						
79	7408	quad and gate		1		0.4	GPEC Fairchild 1974 SN74H08J	TANTI in magazzino ma 1985 fair - signetics						
80	7410	three input nand		2		0.3	GPEC SW 1974 TI 1976 da .15	8 in magazzino 76-78 !!!						
81	7450	2 input and gate		1		0.2	diversi timecode 1970!	gpec						
82	74160	4 bit counter		1		0.4	SILICON GENERAL 1979	gpec						
83	74166	shift register		1		0.8	166j ceramic texas 1980	gpec						
84	74174	hex flip flop		1		0.24	fairchild SN74LS174 1983	2 in magazzino chiesto su ebay						
85	74S257	2:1 selector		4		2.4	fairchild 1979 .60	gpec						
86	16 pin	socket		42			Alessandro?							
87	14 pin	socket		12			Alessandro?							
88	8 pin	socket		1			Alessandro?							
89	24 pin	socket		2			Alessandro?							
90	40 pin	socket		2			Alessandro?							
91	LM323K +5 volt	regulator	GPEC	1		1.8		gpec						
92	MM5740AAF-N	keyboard encoder		2	4	8	prendere TUTTI?							
93	TOTALE	GPEC				85.42	SPEDIZIONE ESCLUSA							
94														
95		HABEMUS												
96	Mostek 6502	CPU		1	0	0	Bianco SCORDATILLO	Ne abbiamo tante in case plastico						
97	Connettore CINCH 44 pin	non vanno bene!		1	0	0	TROVATI DA GIORGIO	Su ebay 2 per 9€ circa ma forse non e' a pin...						
98	LM340 MP-12 (LM7812)	+12 volt regulator		1			ce l'abbiamo							
99	LM320 MP-12 (LM7912)	-12 volt regulator		1			ce l'abbiamo	LITTLEDIODE TO-202 6.11\$						
100	LM320 MP-5 (LM7905)	-5 volt regulator		1			ce l'abbiamo	chiesto ebay jorgeospina83						
101	.001uF	capacitor 102		1		0	li abbiamo ceramici a disco vintage							
102	.01uF	capacitor 103		4		0	li abbiamo ceramici a disco vintage							
103	.1uF	capacitor 104 decoupling caps		17		0	li abbiamo ceramici a disco vintage							
104	NE555	cursor timer		1		0		ne abbiamo						
105														
106		TOTALE				467.465								
107														
108														
109														
110		http://www.interak.pwp.blueyonder.co.uk/PCToASCII.htm												
111														





Apple 1 Project

Apple 1 Project - Google Chrome

Apple 1 Project

File Edit View Insert Format Data Tools Help All changes saved in Drive

Comments Share

	A	B	C	D	E	F	G	H	I	J	K	L	M
14	MacGeek	White	Black	Black	Black	?	1nF Ceramic	?	?	?	black + ball shape	Yellow	http://www.macgeek.org/museum/appleone/apple_1.jpg
15	Jim McCaig	White	Black	Black	Black	Gold	1nF Ceramic	Black	Blue	2 TO-202 1 TO-220	black + ball shape	Yellow	http://www.willegal.net/appleii/images/a1registry/MCaigsA1front.jpg
16	2002 VCF Auction	White	Black	Black	Black	Gold	1nF Ceramic	Green	Blue	2 TO-202 1 TO-220	black + ball shape	Yellow	http://www.wired.com/news/images/full/apple-1-front.jpg
17	Byte Shop 01-0060	White	Black	Black	Black	Gold	1nF Ceramic	Blue	Blue	2 TO-202 1 TO-220	black + ball shape	Yellow	http://www.willegal.net/appleii/images/a1registry/Larson2lg.jpg
18	John Burch	White	Black	Black	Black	Gold	1nF Ceramic	Black	Blue	2 TO-202 1 TO-220	black + ball shape	Yellow	http://www.willegal.net/appleii/images/a1registry/Larson4lg.jpg
19	Rudie Hoess	Black	Black	Black	Black	Gold	1nF Ceramic	Black	Blue	2 TO-202 1 TO-220	black + ball shape	Yellow	http://www.willegal.net/appleii/images/a1registry/powerhouse1g.jpg
20	Rack Mounted	White	White	Black	Black	?	1nF Ceramic	Black	?	?	black + ball shape	?	http://www.willegal.net/appleii/images/a1registry/rackmountapple1.jpg
21													
22													
23	De Anza College	?	?	?	?	Gold	? Little Blue	Black	Yellow	TO-220	ball shape	Metallic	http://commons.wikimedia.org/wiki/File:Apple1_MLB.jpg
24	Jef Raskin	White	Black	Black	Black	Gold	Little Blue	Black	Blue	TO-220	ball shape	Metallic	http://www.digibarn.com/friends/jef-raskin/apple-1/DSC01712.JPG
25	Larry Nelson	White	Purple	Black	Black	Gold	Little Blue	Black	Blue + Yellow	TO-220	ball shape	Metallic	http://www.rickcrandall.net/images/32_Apple4.jpg
26	#37 2000 VCF auction	White	Black	Black	Black	Gold	Little Blue	Black	Blue + Yellow	TO-220	ball shape + black	Metallic	http://www.vintage.org/2000/apple-1.jpg
27	Fred Louisiana	White	Black	Black	Black	Gold	Little Blue	Black	Blue + Yellow	TO-220	ball shape	Metallic	http://www.willegal.net/appleii/images/a1registry/37withbox.jpg
28	Dave Arizona	White	Black	Black	Black	Gold	Little Blue	Black	Blue + 1 Yellow	TO-220	ball shape	Metallic	http://www.willegal.net/appleii/images/a1registry/dave-arlg.jpg
29	Computer History Museum	White	Black	Black	Black	Gold	Little Blue	Black	Blue + Yellow	TO-220	ball shape	Metallic	http://www.willegal.net/appleii/images/a1registry/comphistmuseum.jpg
30	LCF Group #3	White	Black	Black	Black	Gold	Little Blue	Blue	Yellow + 1 Blue	TO-220	ball shape	Metallic	http://www.willegal.net/appleii/images/a1registry/Larson3lg.jpg
31	Ebay Auction 2010	White	Black	Black	Black	Gold	Little Blue	Black	Yellow	TO-220	ball shape	Metallic	http://www.willegal.net/appleii/images/a1registry/910Apple1lg.jpg
32	Glen Hoag	Black	Black	Black	Black	Gold	Little Blue	Black	Blue + 1 Yellow	TO-220	ball shape	Metallic	http://www.willegal.net/appleii/images/a1registry/43toplg.jpg

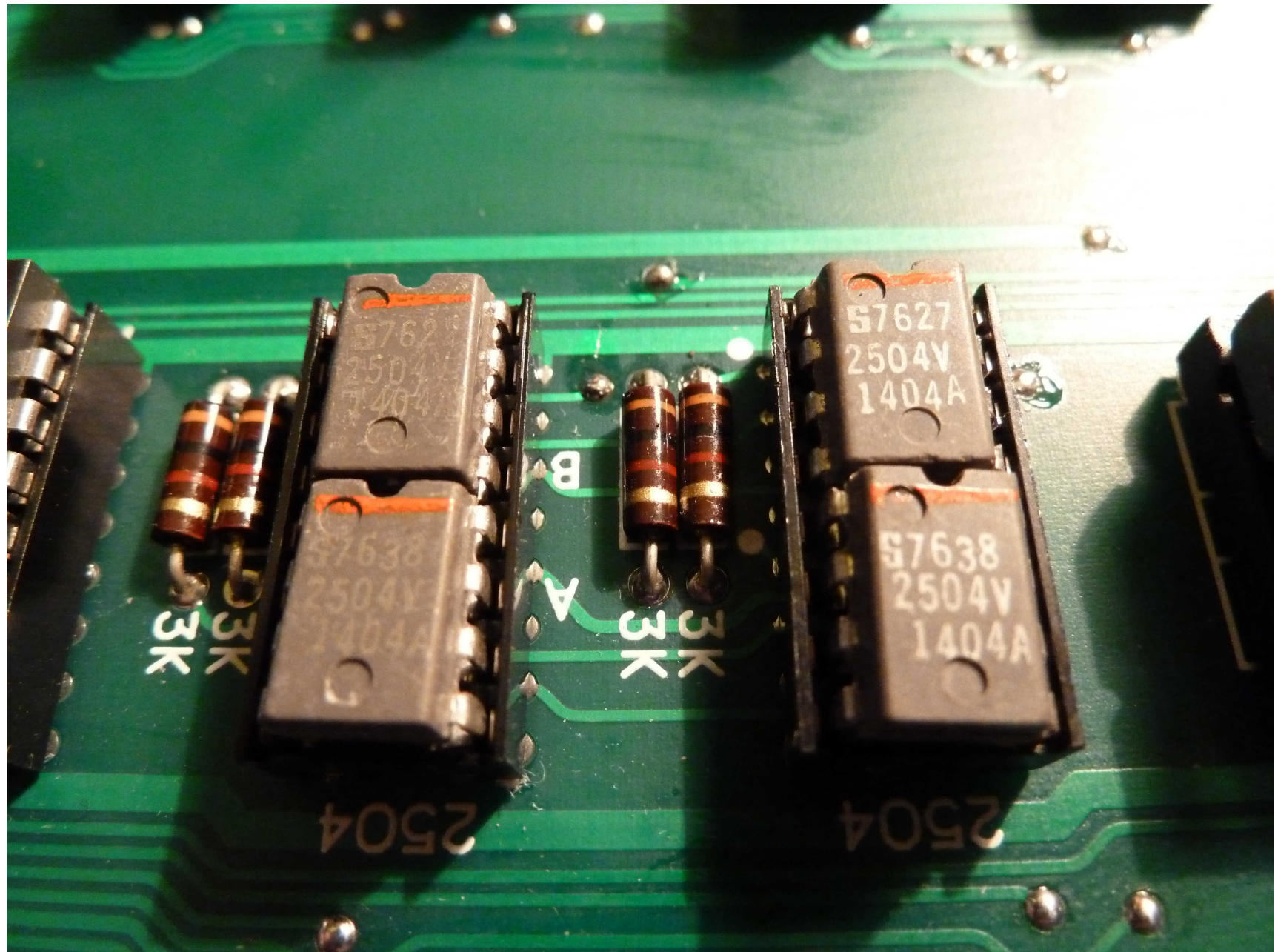
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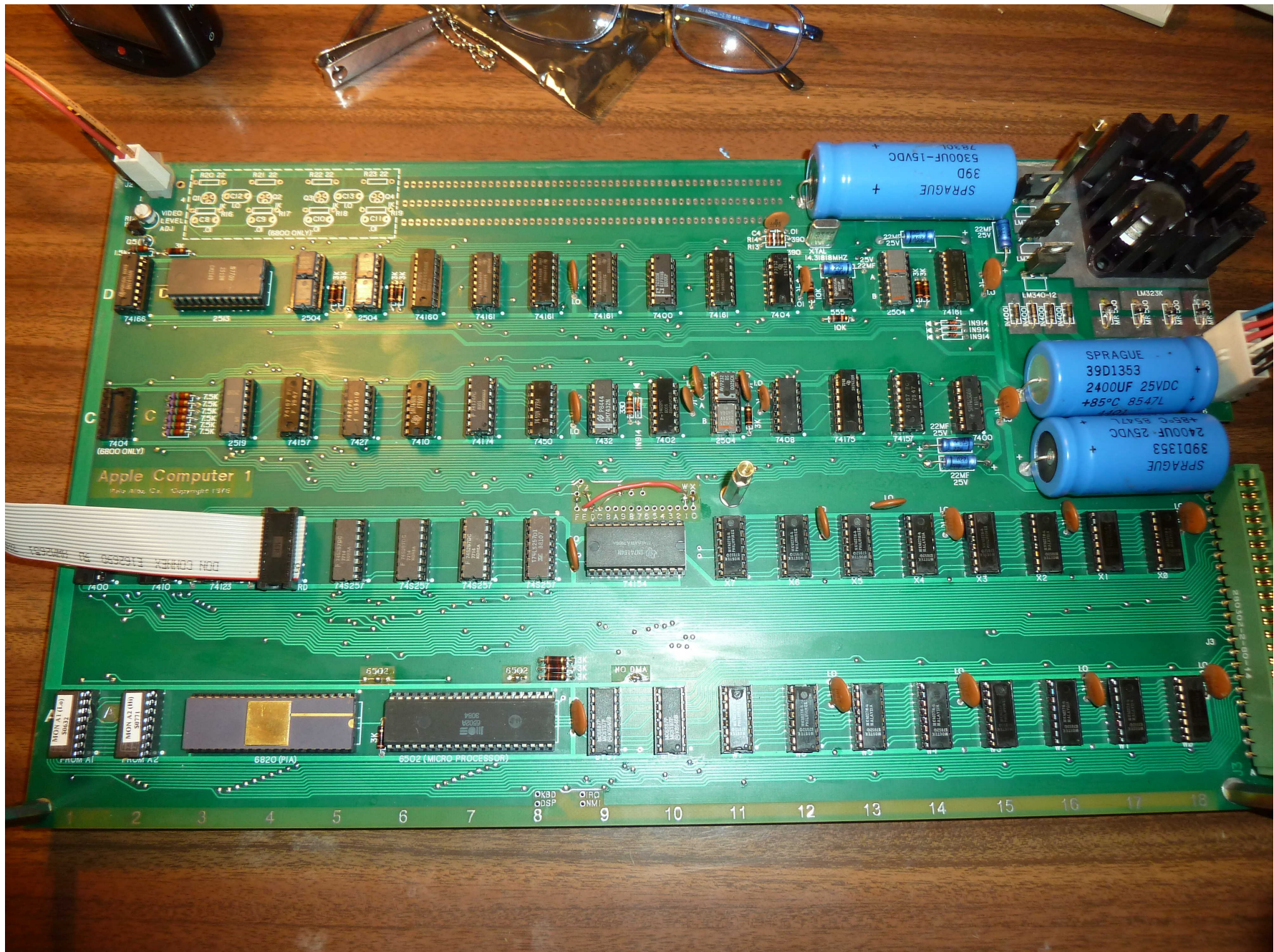
Applications Places System Fri Sep 13, 9:53 AM

Vintage components, but also vintage tools and choiches!



Vintage components, but also vintage tools and choiches!







Come to visit us! ;)





Thanks to...

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...but most of all, thanks Dad for everything you taught me!

<http://dyne.org>

<http://freaknet.org>

<http://museum.dyne.org>

<http://www.verdebinario.org>

<http://hinezumi.org>

<http://dyne.org/museum>

<http://decnet.ipv7.net>

<http://www.unsupported.info>

