

"In the streets of Hau-kai, we wait Night comes, winter descends
The lights of the world grow cold And, in this three-hundredth year
From the ascendancy of Bilat He will come who treads the dawn
Tramples the sun beneath his feet And judges the souls of men
He will stride across the rooftops, And he will fire the engines of God."

- *The Engines of God*, Jack McDevitt

Amateur Digital Archeology

Matt Joyce

<http://pgsc.space/>

Hacker is just another
word for amateur.

“Three young IS militants lie dead on the banks of the
River Tigris.”

What if the story stopped there?



“They left behind personal photos and documents which reveal the extraordinary story of their private lives.”

– Quentin Sommerville, Riam Dalati for BBC News

This is a great example of how digital forensics can help produce valuable primary and secondary sources.

http://www.bbc.co.uk/news/resources/idt-sh/is_fighters



“Documents--diaries, letters, drawings, and memoirs--created by those who participated in or witnessed the events of the past tell us something that even the best-written article or book cannot convey. The use of primary sources exposes students to important historical concepts. First, students become aware that all written history reflects an author's interpretation of past events.

Therefore, as students read a historical account, they can recognize its subjective nature. Second, through primary sources the students directly touch the lives of people in the past. Further, as students use primary sources, they develop important analytical skills.”

– US National Archive / History in the Raw

Adam at NYC Resistor has this to say
about siphoning the brains out of EEPROMs.

“Step zero: Find a board with a brain.”

-phooky

Concerning 'amateur'
archeology...



Part of being an amateur is recognizing
your limitations.

Part of being an amateur
is being dumb enough not to.



Some of you are going to be thinking this during this talk.



This is Def Con.
We are way more Lando Calrissian,
than we are Professor Jones.

The National Air and Space Museum has several GRiD compass computers in its collections, including one that has flown on two Shuttle flights, STS-35 and STS-36. The modifications were minor: the attachment of pieces of Velcro to fasten it to various places on the flight deck, a modification of the power cord to plug into the Shuttle's power supply, and the addition of a small fan to compensate for the lack of convective cooling in zero-G. A lot of custom work went into the development of specialized software, however: to aid Shuttle astronauts in managing their mission and assisting with navigation, and as a back-up to prepare the vehicle for return to Earth. As with every item carried on the Shuttle, the software had to be rigorously tested before it was loaded onto the computer.

reference:

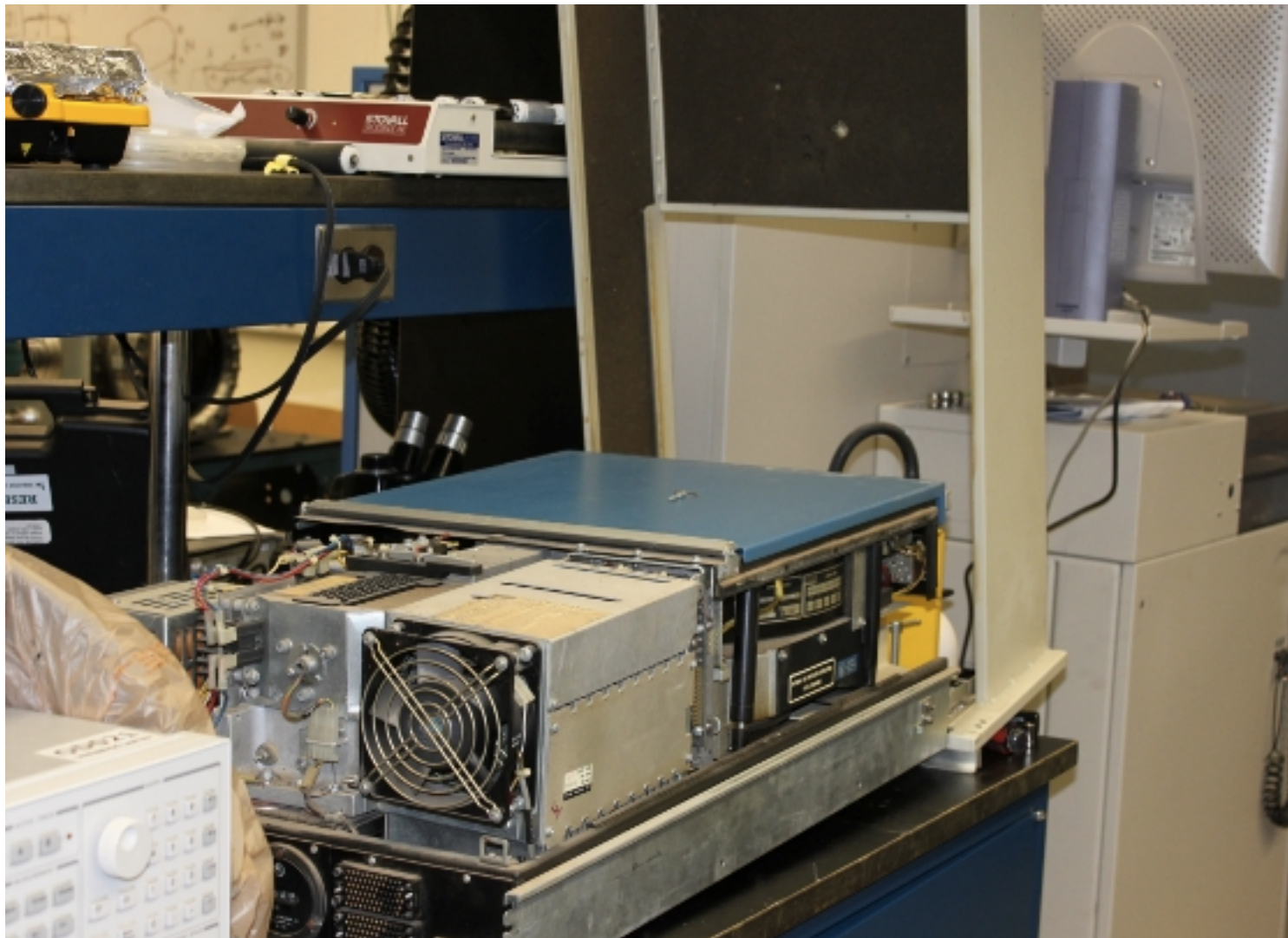
<https://airandspace.si.edu/stories/editorial/laptop-space>



NASA OIG Report
0-00-16-0061-S
The Sad epitaph
to pioneer's data
systems.

Chris Fenton's Cray 1 / XMP project

Possibly the last known early Cray OS data dump.
archive.org was contacted ... at Def Con.



Cray XMP is now..
preserved...
At least, for a while.

<https://archive.org/details/Cos1.17DiskImageForCray-1x-mp>



archive.org
is super important.

If you see this
dude, give him a hug.

but there needs
to be more done.

Who gives a shit about data on a 386?

Seriously, there's not a lot of data you could preserve on
these things... so why care?



Donald J. Trump ✓
@realDonaldTrump

 Follow

Despite the constant negative press covfefe

RETWEETS
56,177

LIKES
68,854



9:06 PM - 30 May 2017

 24K  56K  69K 

There's only 140 chars
in one of these...

And lord knows no one can shut up about em.

The european kids talk about 'right to be forgotten' on the internet...



We have a much larger amount of data being forgotten when it shouldn't be.

The Trump Presidential Library is going to probably be
75% tweets and 25% executive orders...
(made up those stats)

He is one of the first to expose a flaw in the existing
presidential archival process. social networking platforms.

Soundcloud... just announced 40% layoffs.
This spurred a response from archive.org

donate here if you care: <https://archive.org/donate/>



Probably, the first laptop
and first clamshell ever
was the grid compass

<https://www.youtube.com/watch?v=OQgoAQq7bP4>
Computer History Museum - Pioneering the Laptop
Engineering the GRiD Compass

“Here's a NASA story for you - the first shuttle flight that carried a Compass for the first time, it also carried a Texas Instruments laptop. Texas Instruments started crowing about how their computer was the first laptop in space, but we disputed their claim. We finally had to get a verdict from NASA about whose laptop was first - and the GRiD Compass was declared the first, only because it was stored in a more forward storage compartment. So we were first in space by microseconds. *grin*”

- Tim Carlson former GRiD Engineer

GRiD's 'alleged' gov't affair

- NSA used em (scrubbing bubbles)
- NRO used em (some say the football was a grid)
- NASA used em
- SPAWAR and other military forces used em
- Marines fought aliens with em... (Aliens 1986) =P

Gratuitous GRiD laptops fighting aliens shot...



Before we get to the meat of that task,
lets talk potatoes.

how the hell do you get your hands on old NASA gear?



You can pretty much buy most anything at a government auction... or as scrap.

Seriously... pretty much ANYTHING.

““[This man] started selling stuff on eBay and one day got a visit from the FBI wanting to know where he got it, He was able to find the original invoice and showed it to them and they went away. But it scared him and he didn't want to tell anyone else in the USA what he had.””

- Francois Rautenbach

What's an AGC?

If you have to ask.
You have just found a really lovely rabbit hole.



Francois Rautenboch basically bought a test AGC unit off a guy who bought it as scrap.

The Apollo Guidance Computer is the first silicon micro controller ever. The progenitor of the silicon age. All of it.

Francois has several amazing videos
on Youtube.

Including reading data from memory.
Check em out!

[https://www.youtube.com/channel/UC1KeUTUd-
fDv553C3UNr7xQ](https://www.youtube.com/channel/UC1KeUTUd-fDv553C3UNr7xQ)

So, was there software included?

Yes.. sorta. Francois can read data.

But... thanks to an intern and several nerds, the source code is now on GitHub.

L ASSEMBLY AND OPERATION INFORMATION

USER'S PAGE NO. 1

EO

R000001

R000002 *****
R000003 *
R000004 * THIS AGC PROGRAM SHALL ALSO BE REFERRED TO AS:
R000005 *
R000006 *
R000007 * COLOSSUS 2A
R000008 *
R000009 *
R00001 * THIS PROGRAM IS INTENDED FOR USE IN THE CM AS SPECIFIED
R000011 * IN REPORT R-577. THIS PROGRAM WAS PREPARED UNDER DSR
R000012 * PROJECT 55-23870, SPONSORED BY THE MANNED SPACECRAFT
R000013 * CENTER OF THE NATIONAL AERONAUTICS AND SPACE
R000014 * ADMINISTRATION THROUGH CONTRACT NAS 9-4065 WITH THE
R000015 * INSTRUMENTATION LABORATORY, MASSACHUSETTS INSTITUTE OF
R000016 * TECHNOLOGY, CAMBRIDGE, MASS.
R000017 *
R000018 *****

R000019 SUBMITTED: MARGARET H. HAMILTON DATE: 28 MAR 69
R00002 M.H.HAMILTON, COLOSSUS PROGRAMMING LEADER
R000021 APOLLO GUIDANCE AND NAVIGATION

R000022 APPROVED: DANIEL J. LICKLY DATE: 28 MAR 69
R000023 D.J.LICKLY, DIRECTOR, MISSION PROGRAM DEVELOPMENT
R000024 APOLLO GUIDANCE AND NAVIGATION PROGRAM

R000025 APPROVED: FRED H. MARTIN DATE: 28 MAR 69
R000026 FRED H. MARTIN, COLOSSUS PROJECT MANGER
R000027 APOLLO GUIDANCE AND NAVIGATION PROGRAM

R000028 APPROVED: NORMAN E. SEARS DATE: 28 MAR 69
R000029 N.E. SEARS, DIRECTOR, MISSION DEVELOPMENT
R00003 APOLLO GUIDANCE AND NAVIGATION PROGRAM

R000031 APPROVED: RICHARD H. BATTIN DATE: 28 MAR 69
R000032 R.H. BATTIN, DIRECTOR, MISSION DEVELOPMENT
R000033 APOLLO GUIDANCE AND NAVIGATION PROGRAM

R000034 APPROVED: DAVID G. HOAG DATE: 28 MAR 69
R000036 D.G. HOAG, DIRECTOR
R000037 APOLLO GUIDANCE AND NAVIGATION PROGRAM

R000038 APPROVED: RALPH R. RAGAN DATE: 28 MAR 69
R000039 R.R. RAGAN, DEPUTY DIRECTOR
R00004 INSTRUMENTATION LABORATORY
R000041

L ASSEMBLY AND OPERATION INFORMATION

USER'S PAGE NO. 1

EO

R00001 THIS LGC PROGRAM IS INTENDED FOR USE IN THE LM DURING THE MANNED LUNAR LANDING MISSION OR ANY SUBSET THEREOF.
R00002 THE DETAILS OF IMPLEMENTATION ARE SPECIFIED IN REPORT R-567, AS AMENDED.

R000025 GUIDANCE SYSTEM OPERATIONS PLAN
R00003 FOR MANNED LM EARTH ORBITAL AND LUNAR MISSIONS
R000035 USING PROGRAM LUMINARY

R00004 THIS PROGRAM AND R-567 HAVE BEEN PREPARED BY THE INSTRUMENTATION LABORATORY, MASSACHUSETTS INSTITUTE OF
R00005 TECHNOLOGY 75 CAMBRIDGE PARKWAY, CAMBRIDGE, MASSACHUSETTS UNDER PROJECT 55-238-70, SPONSORED BY THE MANNED
R00006 SPACECRAFT CENTER OF THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, CONTRACT NAS 9-4065.

R00007 THIS PROGRAM IS REFERRED TO AS LUMINARY 1A

Much love to Ron Burke, Gary Neff, Chris Garry

<https://github.com/chrislgarry/Apollo-11>

In this case the software
was hiding in a library in
hard copy.

Seriously...
someone printed out the source code...
and bound it.



This whole situation is
really entertaining.

Also really bad.



Finding Primary Source Digital History

WARNING: I have no formalized process for this.



History is everywhere.

It is at Def Con. Right now. Being made by all of you.
Seriously, Hacking at Random 2009 is in the Fifth Estate Movie.
I was there. I got messed up on Grappa thanks to Italian Embassy hackers.

Where did I find NASA flight modified systems?

I found them being auctioned on the internet.
They likely entered the public market via GSA Liquidation auction. Each state as their own. Federal tends to use private liquidation services.

Example of
what shady
looks like...



Disclaimer:

ALL Auctions are
SUPER SHADY

RR AUCTION

Catalog 474, Item 6662
Inventory #3355688

Auction Certificate

STS-41 PGSC

Auction Date: April 2016

Description: A Payload and General Support Computer (PGSC) manufactured by GRID Systems, measuring approximately 11.5 x 9 x 15 when open, stenciled with part numbers on the top, "P/N SED33103332-713, S/N 1044." Includes the associated carrying case. Accompanied by a packet of paperwork dated 1992 regarding tests and possible modifications to the device. Oversized.



Remarkable Results

RR Auction • 5 Rt. 101A, Suite 5 • Amherst NH 03031 • 800.937.3880
Charter Member of the UACC #RDO43, Manuscript Society, NH State Lic #3029, MA/Lic #3214

RR AUCTION

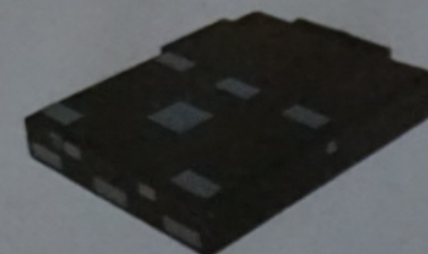
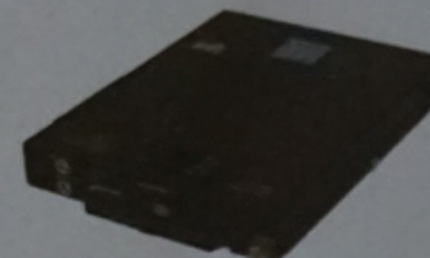
Catalog 498, Item 8485
Inventory #3372537

Auction Certificate

Space Shuttle Payload and General Support Computer

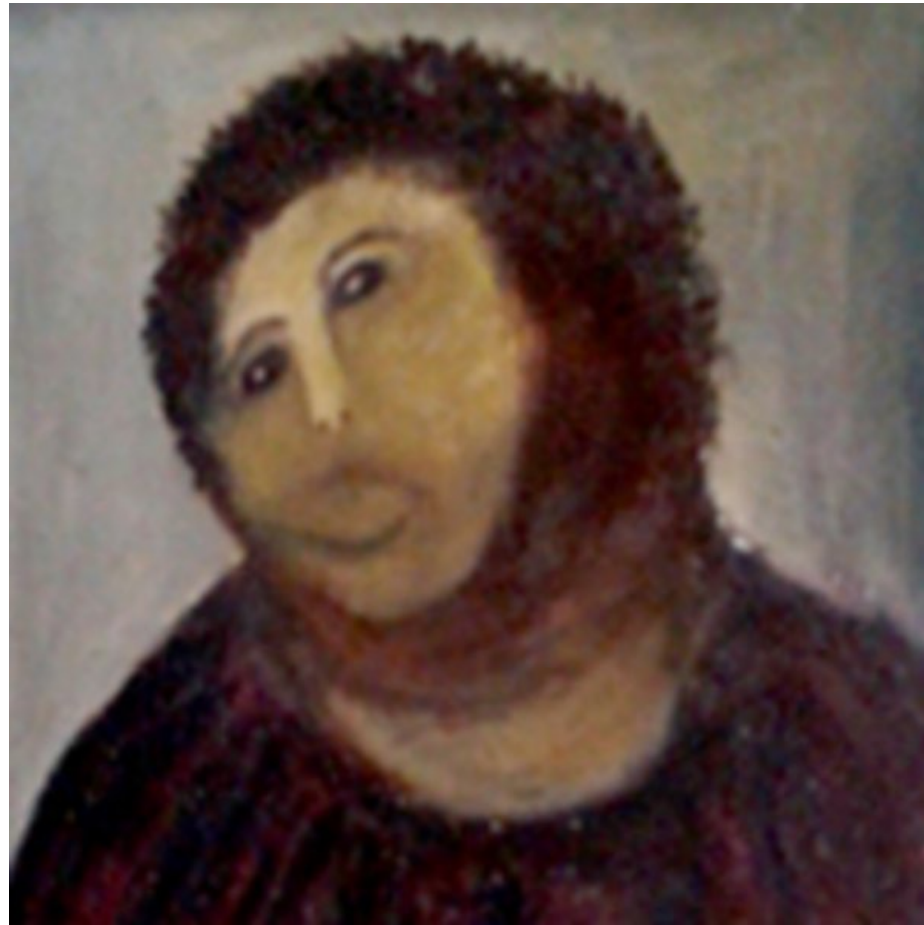
Auction Date: April 2017

Description: A Payload and General Support Computer (PGSC) manufactured by GRID Systems modified for use aboard the Space Shuttle, measuring approximately 11.5 x 9 x 15 when open, stenciled with part numbers on the top, "P/N SED33103332-713, S/N 1045." Ruggedly made with a magnesium case and additional cooling fan. One of the NASA modifications was the substitution of an external power connector (a NASA-spec circular connector) for the commercial one and disconnection of the internal power supply from the standard GRID modular power supply slot (a standard GRID power module will not work in this computer). Includes the associated carrying case. In fine condition. These were among the earliest, if not the first, laptop computers flown on the Shuttle; this particular computer was flight-qualified, but its flight status is unknown.



Remarkable Results

RR Auction • 5 Rt. 101A, Suite 5 • Amherst NH 03031 • 800.937.3880
Charter Member of the UACC #RDO43, Manuscript Society, NH State Lic #3029, MA/Lic #3214

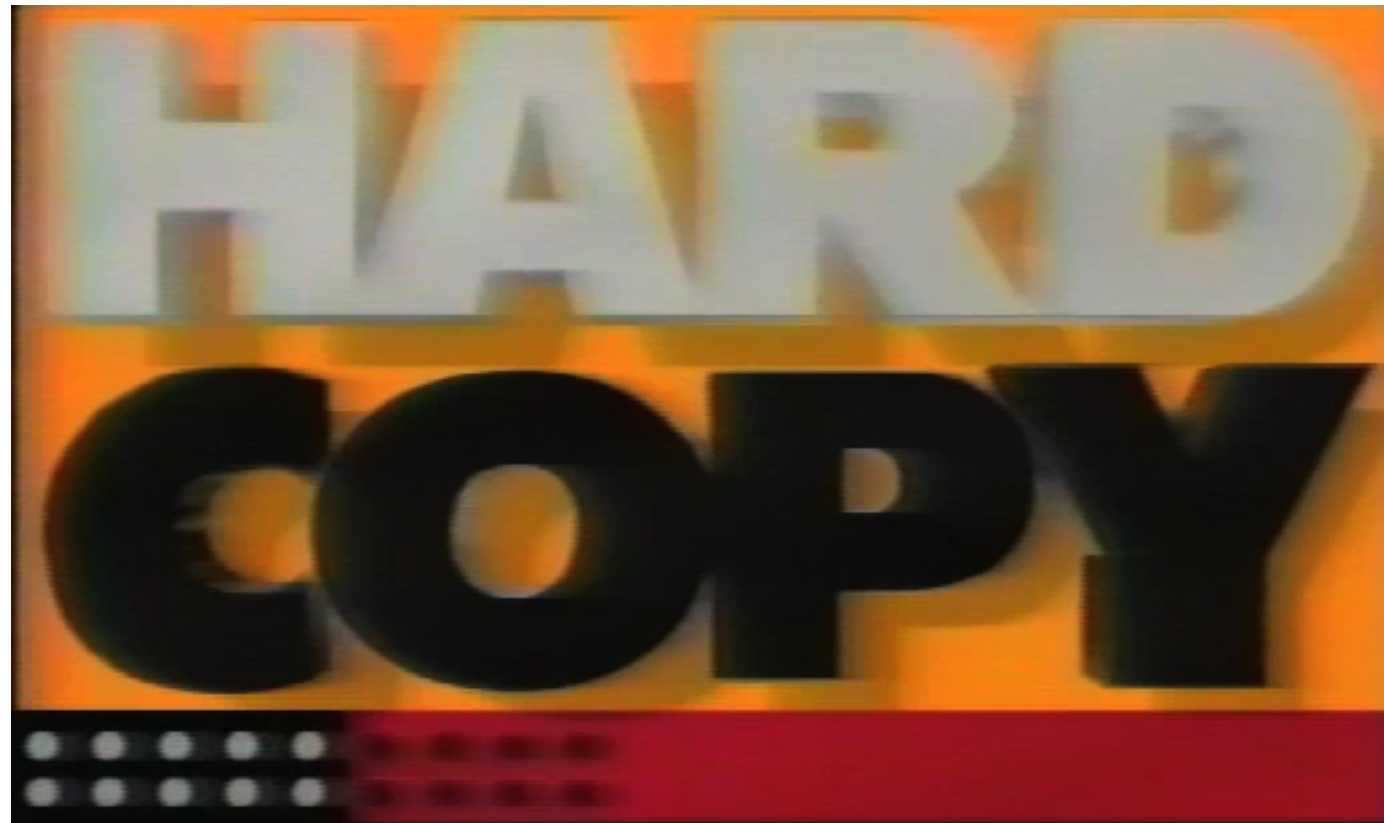


Authenticating the Artifact

“Yo dawg, I heard you like to forge shmoocon badges?”
- my inner demons

The Smithsonian has
a couple of these...
And high quality photos...





The Paper Trail

Trust your eyes and ears... but verify with hard copy.

PGSC
SED33103332
1044
NAS 9-17900/055-60-330
Lockheed

PART NAME	
PART NUMBER	
SERIAL NUMBER	
CONTRACT NUMBER	
CONTRACTOR/SUPPLIER	

Acceptance Data Package

NASA

National Aeronautics and
Space Administration

Lyndon B. Johnson Space Center
Houston, Texas 77058

NSTS-21000-IDD-PSC									
DOCUMENT CENTER	DOCUMENT TITLE	DOCUMENT REVISION	DOCUMENT DATE	DOCUMENT REFERENCE	DOCUMENT UNDER CONFIGURATION MANAGEMENT Yes/No	AVAILABLE ON-LINE FULL TEXT Yes/No	DOCUMENT SOURCE	DOCUMENT OWNER	DOCUMENT OWNER PHONE
JSC	Shuttle/Payload ICD for the Payload and General Support Computer	Rev. A	2-19-93	NSTS 07700, VOL. XIV NSTS-21000-IDD-MDK	Yes	No	Document Distribution Complete JSC Form 614 and mail or Fax to JM335 713-483-6165 Fax 483-5383	Stan Blackmer	713-483-1221

APPLICABLE AND REFERENCE DOCUMENTS						
NSTS-21000-IDD-PSC						
HQ	JSC	KSC	GSFC	MSFC	DOD	INDUSTRY
FED STD 1020A	JSC 22448 JSC 23378 NSTS 07700, VOL. XIV NSTS 1700.7B NSTS 18468 NSTS 21000-IDD-MDK SED33103332-7xx* SED33103334-3xx* SED39122875-3xx* SED33103382-303 SED33103335-3xx* SED33103348-3xx* SED33103336-3xx* SED33103357-3xx* SED33103364-3xx* SED33103363-3xx* SED33103344-7xx* SED33103347-3xx* SED33104027-3xx* SED33104173-3xx*					EIA STD RS232C EIA STD RS422A GRiD 1500.40

*NOTE: The suffix "-3xx" or "-7xx" indicates the latest version of drawing. For clarity, the suffix is not used in this document.



Okay... looks legit...

But uhm... early 90s space missions... did DoD work occasionally... I mean... shouldn't the memory have been pulled?



A warning, concerning classified materials

Also ITAR, isn't it cool that data can be a munition?



A gentle reminder that I am an amateur. Much like the guy above.

Nothing in this presentation is marked classified.

Nothing is ITAR covered, as far as I know it to be.

Nothing is at all sensitive, as far as I know it to be.

Nothing is marked UNCLASSIFIED//FOUO.

If it were, I would not release it to you.

Storing the Artifact

In technology, we see things as ephemeral.
In reality, all things are.

Electronics, like beer temperatures.

So do some critters.... who nominally dislike electronics.

- Cool env. Chilly not Cold.
- Dark. Protect media, displays, signs, housing...
- Not damp, not humid. Dehumidifier if necessary.
But not so dry you ruin gaskets.
- Clean. Clutter attracts critters.
- Treat it like EVIDENCE.

- Photograph how you found it. Never stop taking photos and recording information.
- Keep logs. Paperwork / chain of custody. Good auction houses help with this. They love a good documented chain of custody.
- When working with the unit, try to do it with someone else in the room. Peer review / Witnesses.
- Log everything you do, and when.
- Plan every action. Follow the plan. Don't get fancy.

Bit Rot

Every bit is sacred.

Every bit is bound by thermodynamics.

Life span of Magnetic Media

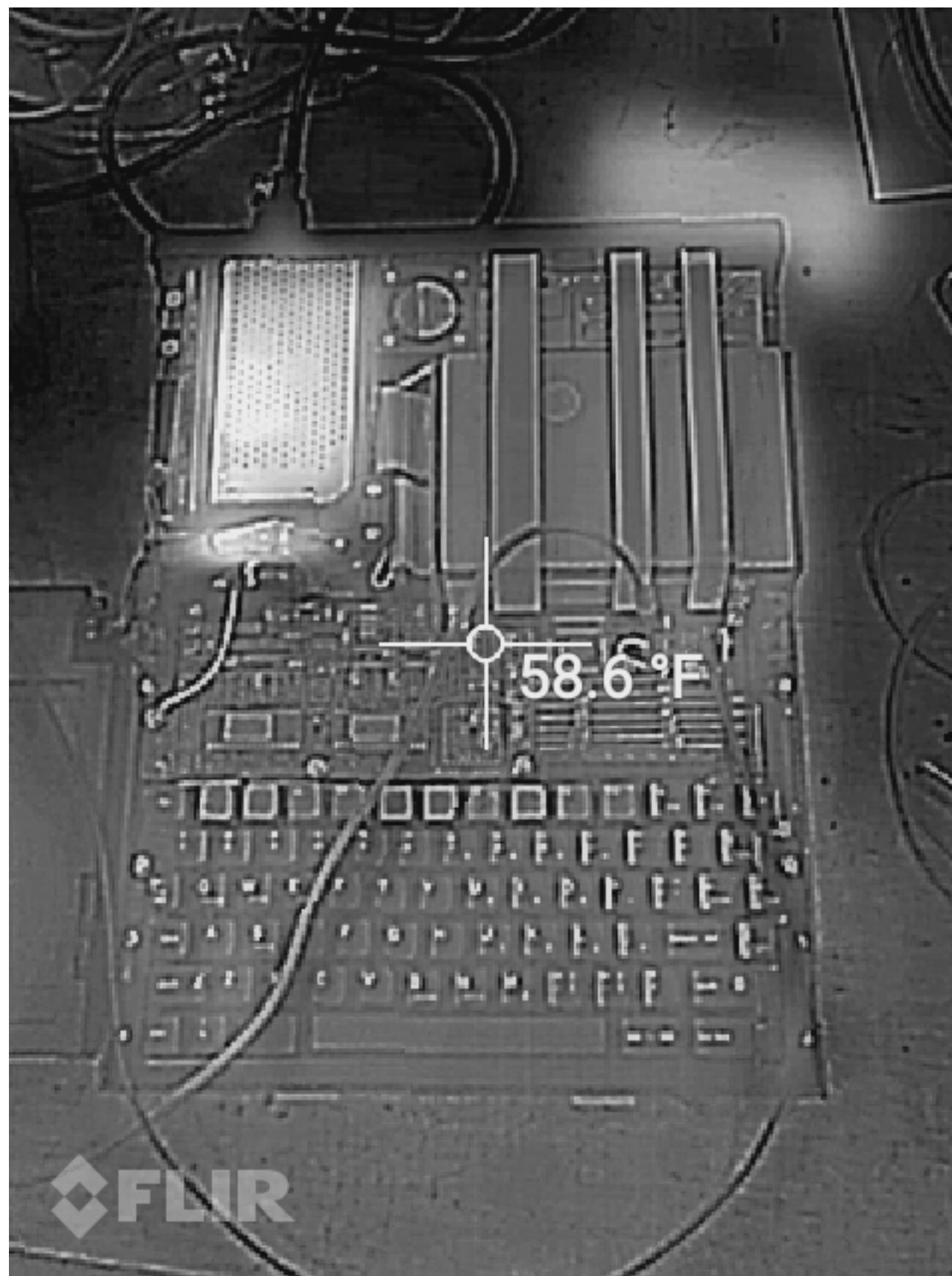
- 5 - 10 years
- Maybe as long as 50. But don't count on it.
- Cool environments will prolong life.
- Too dry and you might reduce lifespan of gaskets / rubbers.
- Much like a car, occasionally spinning up the system will keep the mechanical components from locking up.

Lifespan of EEPROM / Flash

- Floating Gate will bit rot it in probably under a century.
- You can expect 10 years safely.
- Some ROMs are UV sensitive.
- Extreme heat or cold is bad for them.
- Nuclear furnaces should be avoided.
- Do not store in anything that takes skin off of people.
- Always wear your grounding bracelet when handling.
- No Rugs

Capacitors and other gooey components...

- Caps die. Anything older than 50 years... Swap caps before you attempt a power on.
- Anything new ... that number is even lower. Some caps have shown lifetime failures in under 3 years. So... oddly, older electronics are easier to work with than newer stuff. More tolerant to bad voltage / current situations etc.
- When powering on, thermal imaging can be really nice.



Initial Inspection of Device...

The just stand there and look at it method.



Huh... that's not stock...





Hi there... what's your name...

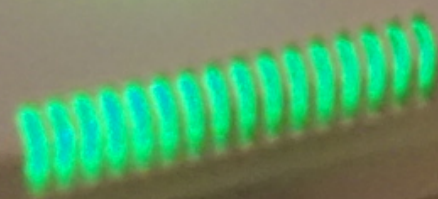


Alright.. App ROMs.

HINT: someone didn't pull data from the unit.

GQ-4x4
TrueUSBUniversalProgrammer

VCC ON VPP



Strings... well hah!
Dump worked. Who is 'slick'?

```
[01M$
[01L$
[2J$
[0K$
[7m$
[0m$
Copyright (C) 1988 GRiD Systems Corporation Copyright (C) 1988 Timothy (-Slick-) Carlson 0123456789ABCDEF0123456789ABCDEFabcdef
Version
88.0718-1214Timothy Shayne Carlson
[]J~
4 nnuummbbeerr
nnuummbbeerr GRiDCASE GRiDCASE PLUS GRiDCASE TEMPEST GRiDLITE GRiDCASE MINUS GRiD-EXP GRiDLITE PLUS
PYTHON (286) COBRA (386) UNKNOWN TYPE FILENAME
ASAFakeFAILNO 8087 PRESENT IN THIS SYSTEMPress Any Key When Ready8087 PRESENT8087 PROCESSOR HAS FAILED CALCULATION TEST!!Press Any Key When ReadyZIPPYUNIT FAILURE - TESTING HAS BEEN HALTED!F1 - REST
T TEST F10 - MONITOR
8087/80287/80387 Test NO 80287 PRESENT IN THIS SYSTEMNO 80387 PRESENT IN THIS SYSTEM80287 PRESENT80387 PRESENT N! N 1/N!
---- 80287 PROCESSOR HAS FAILED CALCULATION TEST!!80387 PROCESSOR HAS FAILED CALCULATION TEST!!
BGFE
PSQRVWU
[] ^ZY[X.
[3;3z$U
[3;4z$
QSQP
QPQRSVW
[] ^[ZYX
>
Yt
#n$#%c%
>h
:t
h4#5\5D6P6Y6
l7{7
8 8/8>8M8
9$939B9Q9`9o9
>">1>@>0>^>m>
2%2426282~2e2
```




Timothy 'Slick' Carlson responded to emails Was also cool with sharing that with you all.

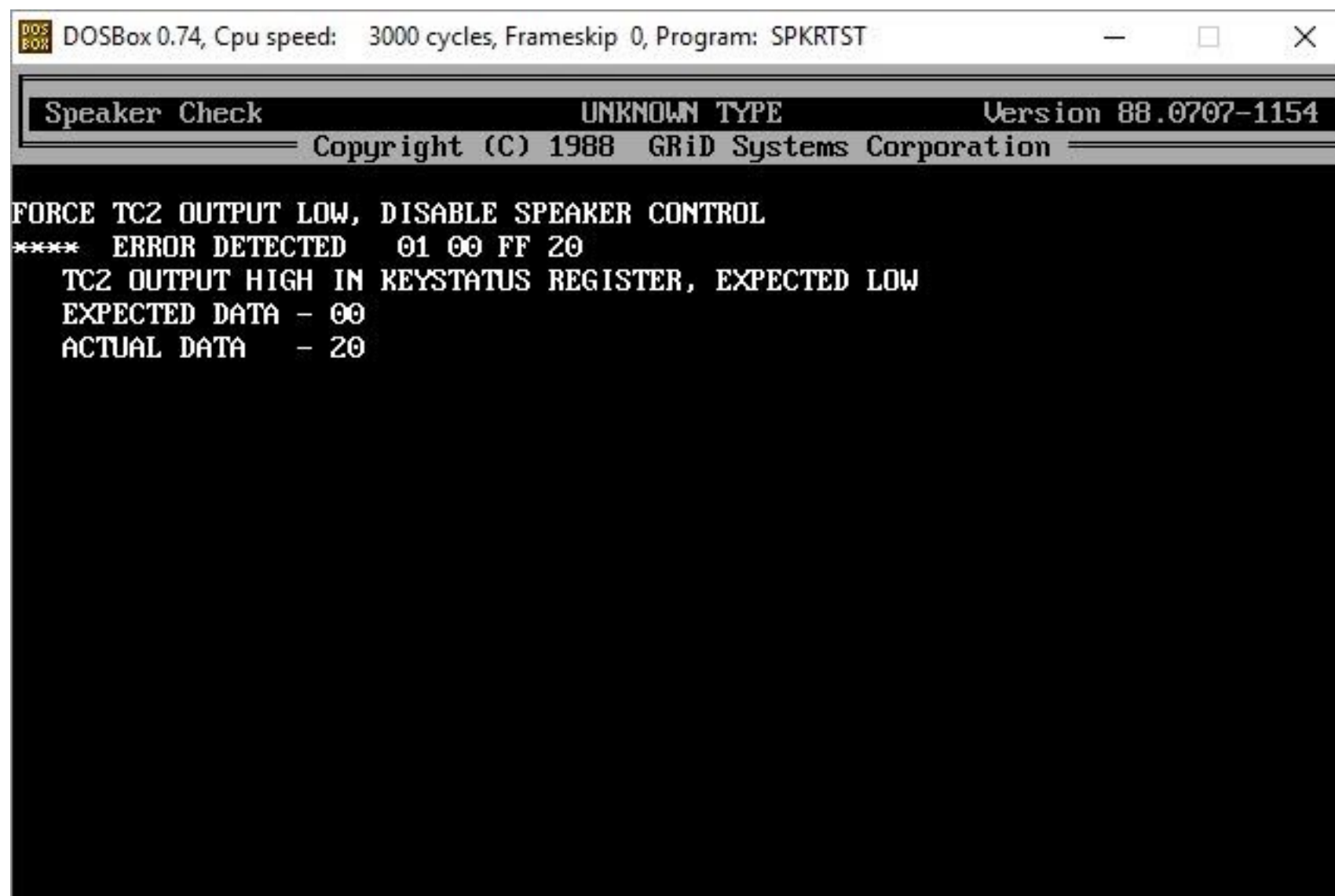
"Hi Matt,

Yeah, that's me. Wow, I haven't seen those binary images in 29 years.

I don't know how much I will be able to help you with that system. If it flew in 1994, that was 6 years after I left GRiD (in June 1988). The ROM images are production diagnostic/test ROMs, and those were produced in April of 1988. Each diagnostic was its own MSDOS executable, thus the multiple iterations of my name within the ROMs (that was a standard header file / title screen I used for each diagnostic). Maybe NASA wanted diagnostic capability for the computer that wasn't on the hard drive. I am surprised that there were 6 year old images on that system, but -- I don't know what GRiD did for diagnostics after I left.

As far as the fan/power/interface modifications - we found out using the magnesium case for cooling doesn't work well in space (0G), so the units had to be modified. I think the power connector was so the power supply unit, which normally slid inside the system, could stay outside - that would keep the heat the power supply generated outside of the system. But, like I said, this system was 6 years after I left GRiD, I don't know who did the mods or exactly why.

The mods may have been done internally, or an outside source could have received the unit from GRiD and performed the mods then pass the unit on to NASA. I really don't know."...



ROM running in dos box

Courtesy Tim Carlson, Author

“I hexedited the binaries you sent and pulled out one of the DOS executables - which happened to be the speaker test. Then I pulled it up in a DOS box and got the picture, above.

BTW: all of the GRiD diagnostics were written in PL/M86, except for parts of the coprocessor test which were done in FORTRAN86 for the floating point math.

These ROMs appear to be something that were glommed together after I left. Besides the GRiD diagnostics, they have some of the old Norton Utilities included in the images.

Anyway - just thought I'd share. And thanks for sending the ROM images - they have been making me smile all morning!”

– Timothy Carlson

2 - MS-DOS

GRiD

XrbP

XYZr

BOOT ERROR: No system file. Press a key to reboot.

BOOT ERROR: Disk error

io sys

APROM BAT

BE EXE

CHK8087 EXE

CLOCKSTEXE

DISPLAY EXE

DT EXE

EXTENDEDEXE

KEYTEST EXE

RAMTEST EXE

ROMCHECKEXE

SPKRCHK EXE

VIDEORAMEXE

echo off

:begin

be rowcol 2,0 ""

ECHO

PGSC Application ROM Diagnostic Utilities

be rowcol 5,0

ECHO

(A) Keyboard

ECHO

(B) ROM

ECHO

(C) Math Coprocessor

ECHO

(D) Display

ECHO

(E) Video Ram

ECHO

(F) Speaker

ECHO

(G) Clock

ECHO

(H) Floppy Disk Test

ECHO

(I) Hard Disk Drive

ECHO

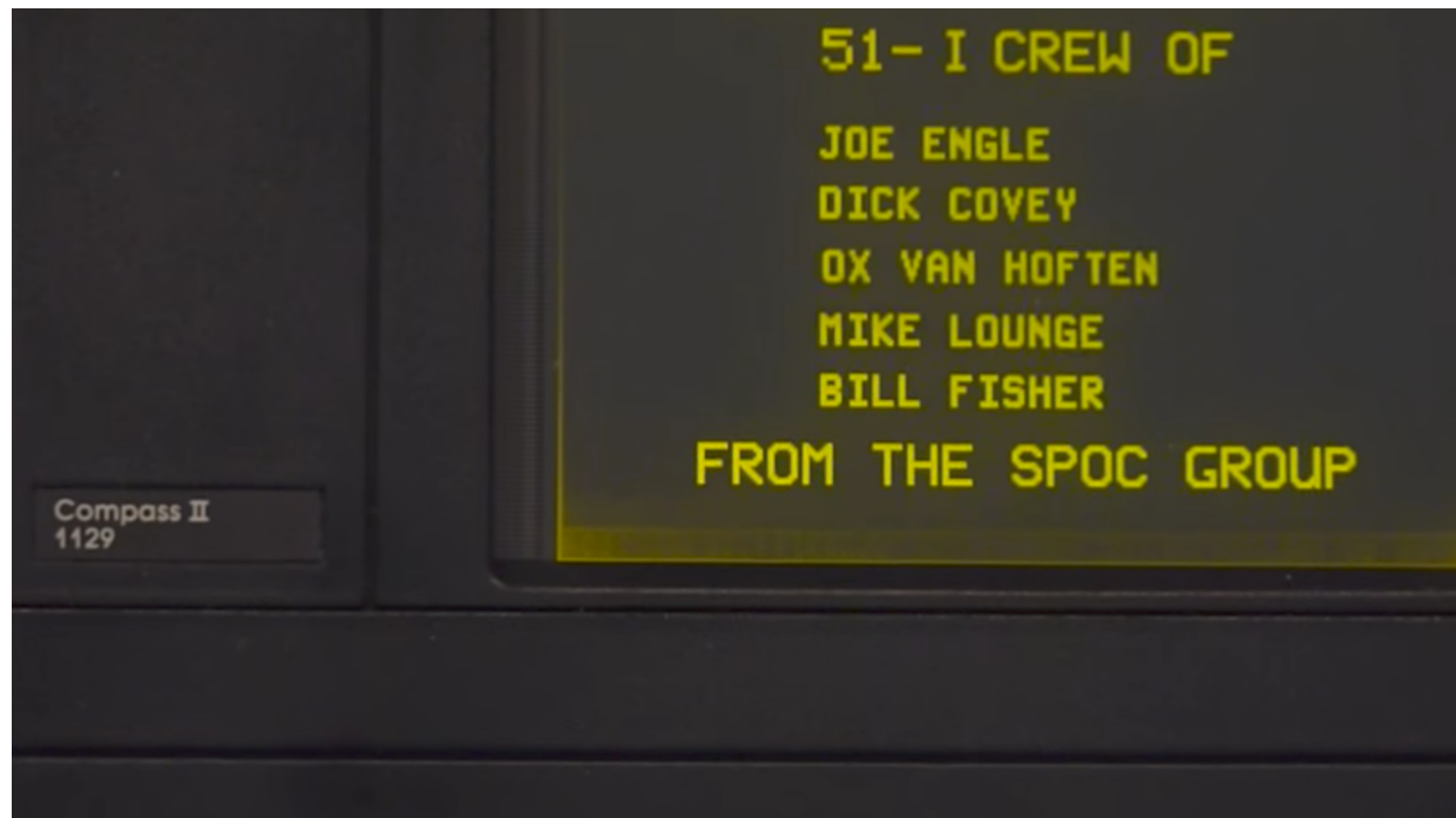
(J) Conventional Memory

ECHO

(K) Extended Memory

SPOC vs PGSC

GRiD Compass vs GRiD Case



GRiD Compass 1129

SPOC

“The GRiD Compass was first used on the Space Shuttle mission launched from Kennedy Space Center on November 28, 1983. The computer, code-named SPOC (Shuttle Portable On-Board Computer) by NASA was slightly modified for operation in a weightless environment...” (Neither this press release nor any from NASA notes the similarity between the acronym and the better-known character from the television series Star Trek.)

The Smithsonian has this to say about the SPOC



The SPOC in a 'forward compartment' of the orbiter.

Challenger Disaster

SPOC systems on challenger are believed to have survived the crash. — See Computer History Museum Video

The PGSC took over for the SPOC in 1988

The GRiD Case 1530 was the
standard PGSC from 1988 until 1997.

SPOC / PGSC Apps

No App Store sadly... though GRiD did have their own
1980s version of cloud storage =P.

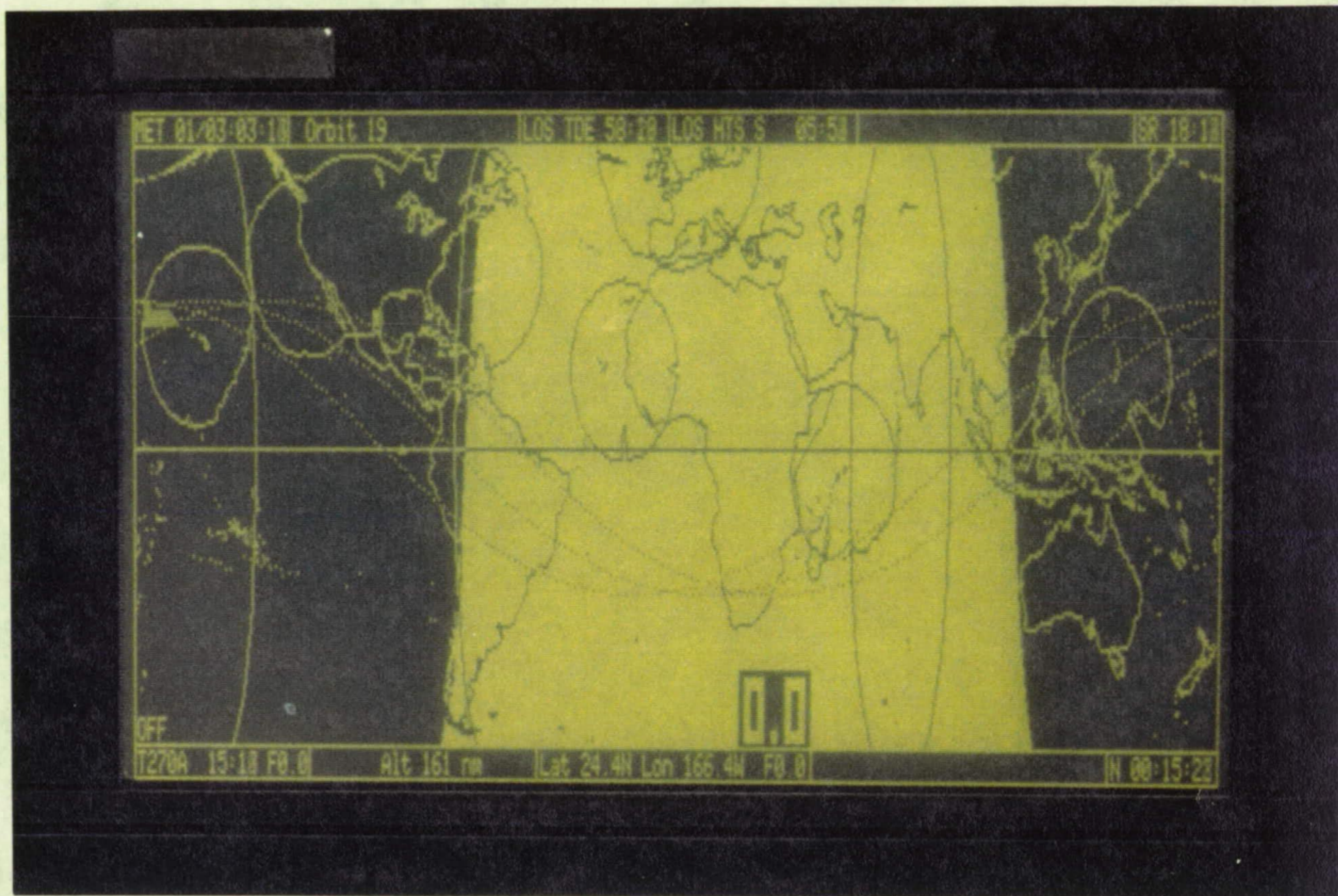


Figure 5. EL Display

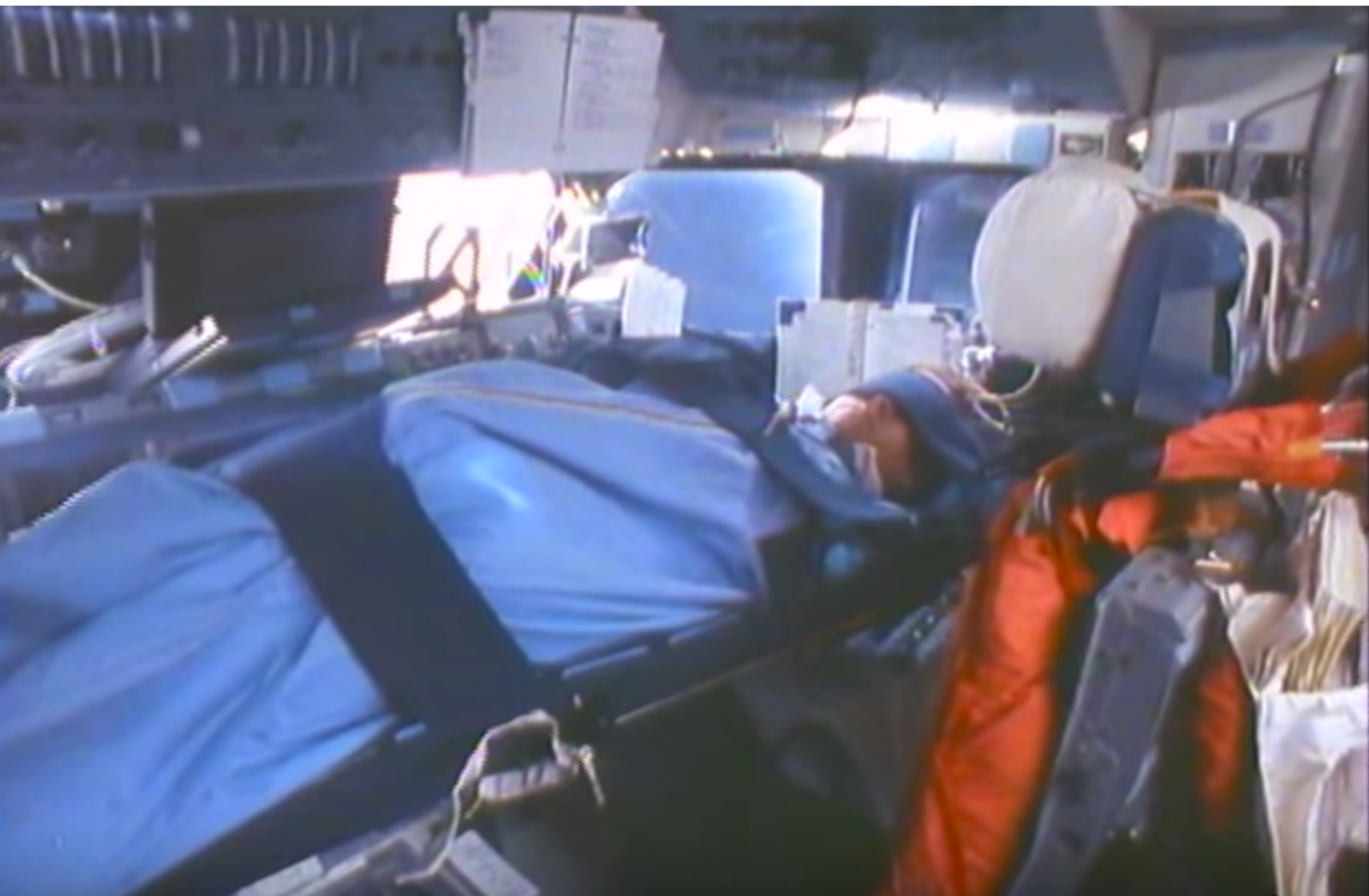
You can download a copy
of the Orbiter Tracking
app from the SPOC.

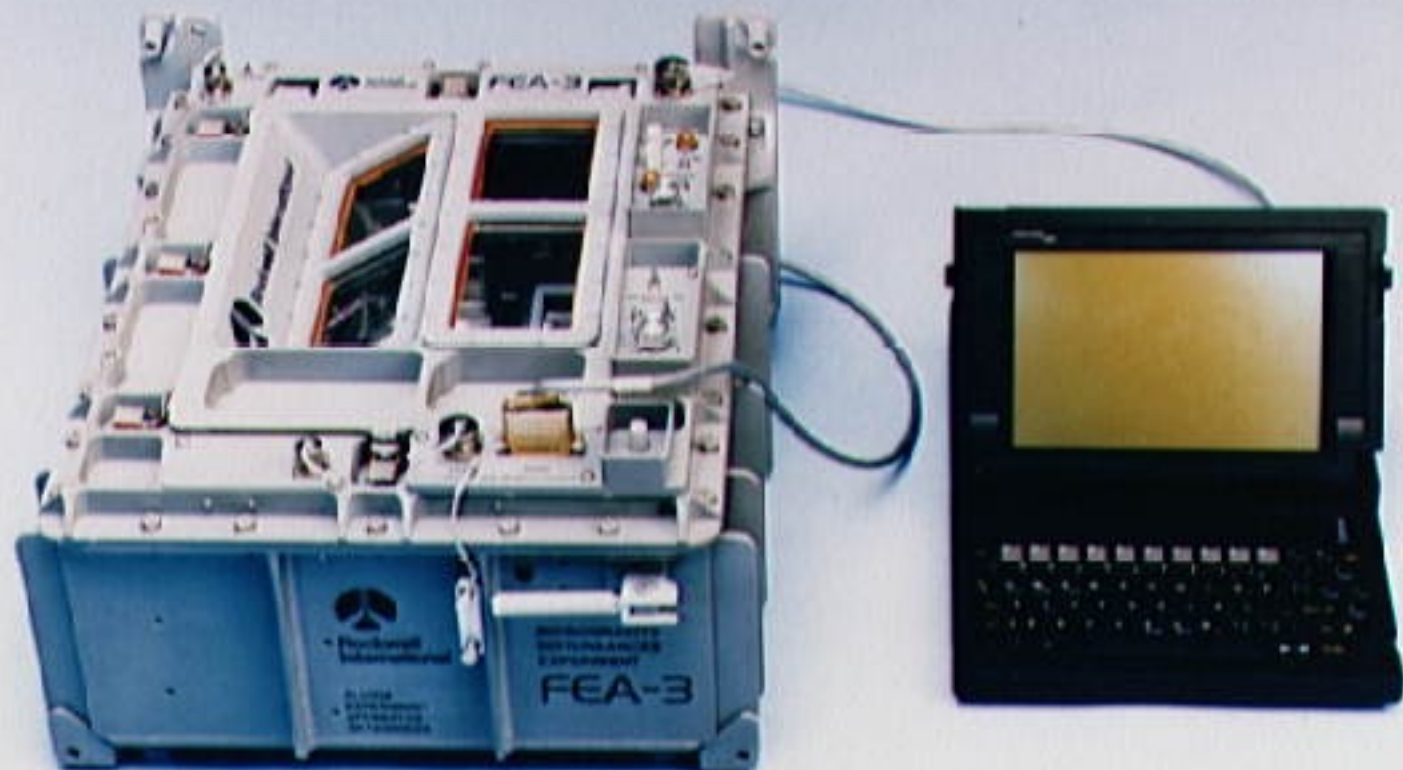
It also ran on the PGSC systems.

So now that we have
'visually' inspected.

And syphoned the brains out of a couple App ROMs...

STS-41 shot





The PGSC does not directly have a link to the orbiter communication system which limits ground control of experiments. This, in turn, potentially limits scientific return from payloads and also places a greater burden on the flightcrew (training and timeline impact). In some applications, such as TSS, this is overcome by use of the STS smart flexible multiplexer/demultiplexer (SFMDM) which is connected to both the orbiter communications system, as well the PGSC.

Hold on a tic.. 1... that's a floppy... 2.. those are KEY CAPS!



STS-94

STS-64 ... clearly you can see... no key caps.





STS-47 Plain as day... Key caps. Also no SAIC logo.



STS-65 Key Caps... two laptops(and casios)
where is that?



80 95 E1 21

E2 95 E1 21

Space Lab
Microgravity Science Laboratory
All of the flights correspond to these missions.

Visually all of these laptops who I could find legible
serial numbers for... are S/N 1073 or 106x

These systems sn 1044 / 1045... probably did not fly.

Analysis of the hard copy that came with SN 1044

REQUISITION AND INVOICE / SHIPPING DOCUMENT

Form Approved
OMB No. 0704-0188
Expires Oct 31, 1994

Public reporting burden for this collection of information is estimated to average 15 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0246), Washington, DC 20503.

1. FROM: (Include ZIP Code) MCDONNELL DOUGLAS SPACE SYSTEMS PGOC WHSE., BLDG. M6-698 KENNEDY SPACE CENTER, FLORIDA 32899		MDSS - KSC NAS10-11400		SHEET NO. 1	NO. OF SHEETS 15	5. REQUISITION DATE 14-Mar	6. REQUISITION NUMBER 4073-5400			
				7. DATE MATERIAL REQUIRED (YYMMDD) 3-15-94		8. PRIORITY 1				
2. TO: (Include ZIP Code) MDAC - HSV - DIV. 6767 OLD MADISON PIKE, SUITE 320 HUNTSVILLE, AL 35806				9. AUTHORITY OR PURPOSE RES# 9209843						
				10. SIGNATURE S. ROARK		11a. VOUCHER NUMBER & DATE (YYMMDD)				
3. SHIP TO - MARK FOR ATTN: JIM BROOMFIELD/JOHN SMITH PH: (204)922-7303 EXT. 4509				12. DATE SHIPPED (YYMMDD) 3-16-94		bPC94-4073-5400C/3-14-94				
				13. MODE OF SHIPMENT AIR		14. BILL OF LADING NUMBER				
				15. AIR MOVEMENT DESIGNATOR OR PORT REFERENCE NO.						
4. APPROPRIATIONS SYMBOL AND SUBHEAD VB931000 NAS10-11400 VB931000				OBJECT CLASS	EXPENDITURE ACCOUNT (From) (To)	CHARGEABLE ACTIVITY	BUREAU CONTROL ACTIVITY NO.	BUREAU CONTROL NO.	AMOUNT	
ITEM NO.	FEDERAL STOCK NUMBER, DESCRIPTION, AND CODING OF MATERIEL AND/OR SERVICES				UNIT OF ISSUE	QUANTITY REQUESTED	SUPPLY ACTION	TYPE CONTAINER NOS.	UNIT PRICE	TOTAL COST
(a)	(b)				(c)	(d)	(e)	(f)	(g)	
1	9007509-501C PGSC GRID S/N MD004, NASA TAG# 1172427				EA	1	1		\$40,000.00	\$40,000.00
2	9007509-501C PGSC GRID S/N MD005, NASA TAG# 1172425				EA	1	1		\$40,000.00	\$40,000.00
3	DUMMY BATTERY PACK				EA	2	2		\$5.00	\$10.00
4	CARRY CASE, GRID S/N 1043 & 1046				EA	2	2		\$200.00	\$400.00
5	DATA PACK (FOR PGSC'S)				EA	2	2		\$20.00	\$40.00
6	REUSABLE CONTAINER CONTROL # 148				EA	1	1		\$300.00	\$300.00
LAST ITEM										
O PACKING REQUIRED. O NO KSC QA REQUIRED.										
O NON-FLIGHT HARDWARE. O JSC FOR 290 VOUCHER NO. C4-061-021 (INCLUDED)										
O SHIPMENT WILL NOT RETURN TO MDSS-KSC.										
O SHIPPED TO KSC IN ERROR.										
DIST: N. L. JONES, F846; THOMAS; SMITH; MACKEY; REC; FILE										

16. TRANSPORTATION VIA MATS OR MSTs CHARGEABLE TO

17. SPECIAL HANDLING

RECEIVED SHIPMENT DATE 1994 192250 J. L. Jones ACKED BY	ISSUED BY	TOTAL CONTAINERS	TYPE CONTAINER	DESCRIPTION	TOTAL WEIGHT	TOTAL CUBE	19. CONTAINERS RECEIVED EXCEPT AS NOTED	DATE (YYMMDD)	BY	SHEET TOTAL
										\$80,750.00
							QUANTITIES RECEIVED EXCEPT AS NOTED	DATE (YYMMDD)	BY	GRAND TOTAL
								3-16-94	19227	\$80,750.00
							POSTED	DATE (YYMMDD)	BY	20. RECEIVER'S VOUCHER NO.
				TOTAL						

DD Form 1149, MAR 89

306/080

51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

Previous editions are obsolete.

DOD 3-15-94

RT NO: 9007509-501 REV: A S/N: MD005 DATE: 7-31-92
 ACCEPTANCE DATA PACKAGE NO.: MDSSC-ASO-GSC-9007509-5
 GE CHG. STATUS: N/A

LIFE HISTORY LOG

EVENT	ORGANIZATION	DATE	SUMMARY OF CHRONOLOGICAL EVENTS MODIFICATION/REPAIRS/TESTING SHIPMENTS/RECEIPTS etc.	RUN TIME/CYCLES HOURS & MINUTES		
SUBJECT	LOCATION			START TIME	STOP TIME	TOTAL
RECEIPT	MDSSC-HSV	07/17/92	MDSSC-HSV RECEIVED P/N SED33103332-713 S/N 1044 FROM MSPC-REF MSPC FORM 57 DCN 2-2-36-25026 DTD 7/16/92	N/A	N/A	N/A
MODIFY	MDSSC-HSV	8/21/92	THIS UNIT HAS BEEN DOWNGRADED TO A GRADE UNIT (CONFIRMATION) MODIFIED TO P/N 9007509-501 REV A S/N MD005 Q13442 9/21/92	N/A	N/A	N/A
SHIP	MDSSC-HSV	9/15/92	MDSSC-HSV SHIPPED TO MDSSC-KSC V# 929809	N/A	N/A	N/A
Receipt	MDA-HSV	1/31/94	V# 940098	—	—	—
SHIP	JSC	1/31/94	V# 945074	—	—	—
SHIP	JSC	3/7/94	Data Pack only	—	—	—
Receipt	KSC	3/16/94	Receive from KSC on V# 940249	—	—	—

QARC ADP FUNCTIONAL EQUIPMENT HISTORICAL RECORD
DATE/TIME RUN: 03/03/94 AT 13.44.09



PART NAME: COMPUTER
PART NUMBER: 9007509-501C
SERIAL NUMBER: MD005
SYSTEM: PGSC
SPECIAL INSTR: N/A
LIFE LIMITS: N/A

MANUFACTURER: GRID
ACCEPTED: 1
CLASS: 1
ACTIVE: Y
MFG DATE:

IN DATE	DOCUMENT NUMBER TITLE/TEXT	TYPE	MRB	QA STAMP	CLOSED
09/08/92	D88G9230076 LOOSE OBJECT IN DISPLAY UNCONNECTED NUT WAS FOUNDED.	3	N	F41	09/10/92
09/10/92	1149#02-265-523 RECEIVED IN J-17 BONDED STORAGE FROM MCDONNELL DOUGLAS, KENNEDY SPACE CENTER.			F16	09/10/92
09/18/92	TPS8G9220510 MOVE MARSHALL PGSC TO J-17 BOND.	B		F41	09/18/92
09/21/92	290#C2-265-001 OK TO SHIP TO MDSSC-KSC-DIV, PER VOUCHER NUMBER C2-265-001			F57	09/21/92
01/24/94	1149#04-027-573 RECEIVE IN J-17 BONDED STORAGE FROM KSC.			F15	01/31/94
02/03/94	TPS8G9420041 RELEASE COMPUTERS FROM J-17 BOND.	B		F44	02/03/94
02/15/94	1149#04-039-502 RECEIVED IN BUILDING 17 BONDED STORAGE.			F15	02/15/94
	TPS8G9420057 VIBRATITE TO DISPLAY MOUNTING SCREWS.	A		F15	02/18/94
03/02/94	290#C4-061-021 OK TO SHIP PER 290 VOUCHER NUMBER C4-061-021.			F16	03/02/94

Released Bldg 17 Bonded Storage Per 290/c4-061-021 3/9/94



TYPE
F4

TO: Pat

SUBJECT: PAYLOAD & GENERAL SUPPORT COMPUTER (PGSC)
SED33103332-713

After reviewing the improvements and modifications incorporated into PGSC, P/N SED33103332-713, eg,

- o Add 4MB RAM for total of 8 MB.
- o Add diagnostic proms.
- o Add ETI meter.
- o Add Epoxi backshell to RS-422 connectors.
- o Add part number/serial number to bottom of units.
- o Add improved power "ON" indication circuit (green LED).
- o Replace 20 MB hard drive with 40 MB hard drive.
- o Remove temperature strips from unit.
- o Replace existing chain connector tether with cable type.
- o Replace power supply PC board mounting screws with shorter screws and locknuts,

and evaluating the EMI engineering data, this office has determined that the changes would not warrant EMI recertification relative to the SED33103332-709 PGSC.

If you need further assistance in coordinating this with Quality Engineering or with the Project/Program Offices, please contact me.

M.D. Harris
M. D. HARRIS 302/92

cc: Kit Chow/B26

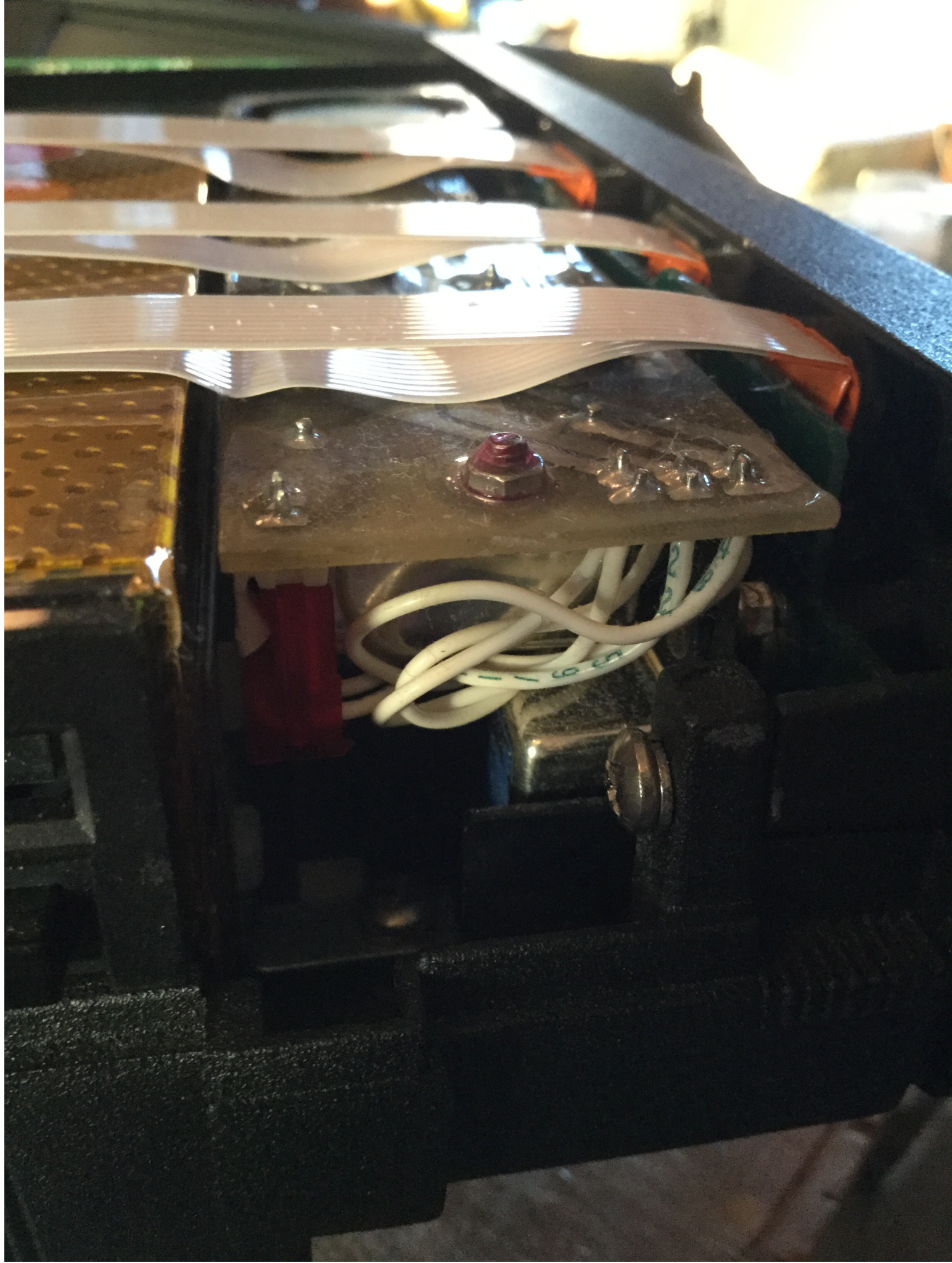
1 Aug 78

DO NOT

AIR

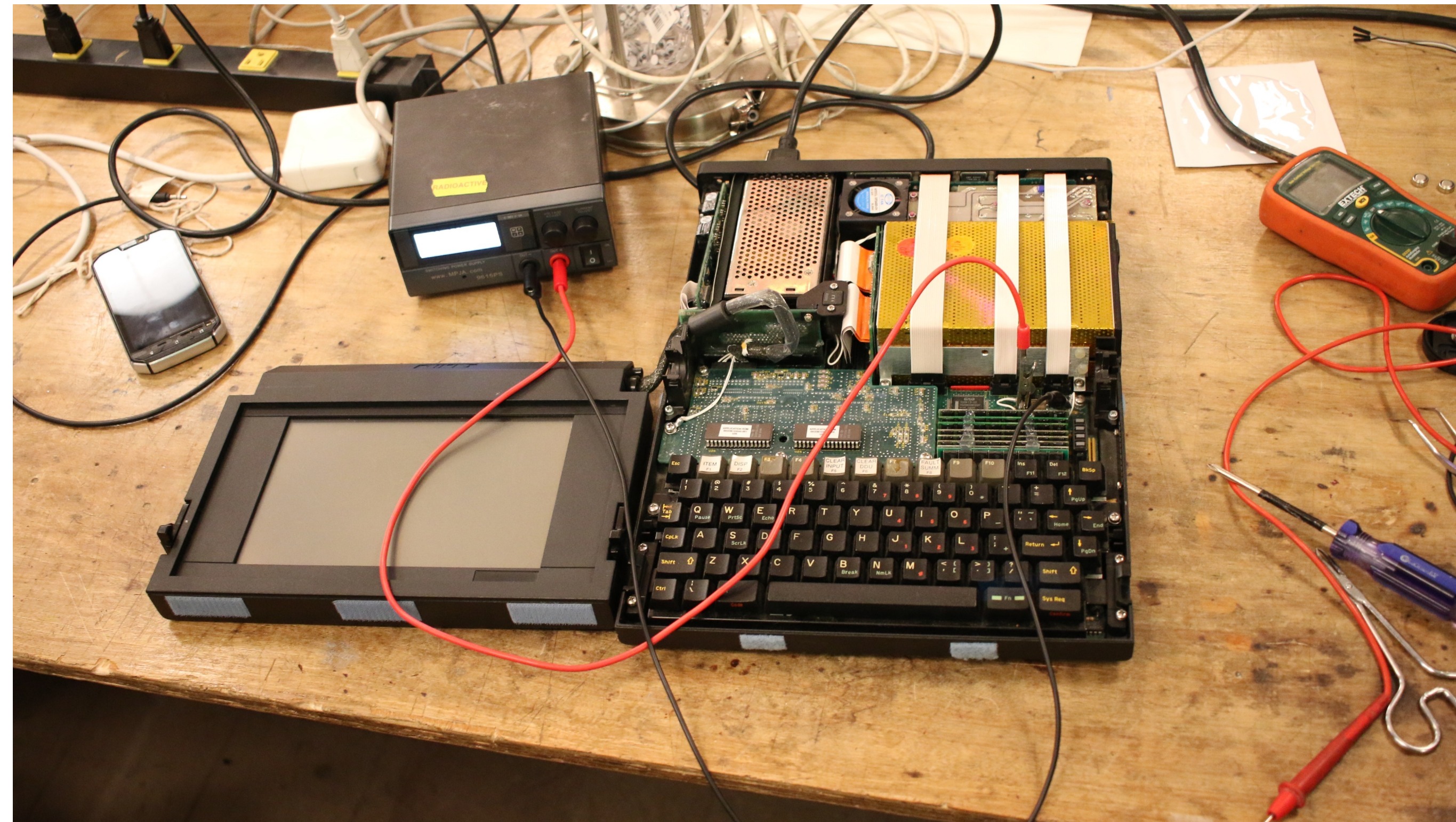
BEFORE UNIT
BATTERY

- 40 MB Hard Disk
- RS-422 Connectors (Rockwell Serial Interface)
- Diagnostic P-ROMs
- Epoxy EVERYWHERE
- Shorter screws
- No EMI recertification
- Remove Temperature Strips



Removal of the Housing.
Small children should leave the room now.
people with weak hearts as well.

Second attempt to power on... doomed to fail.

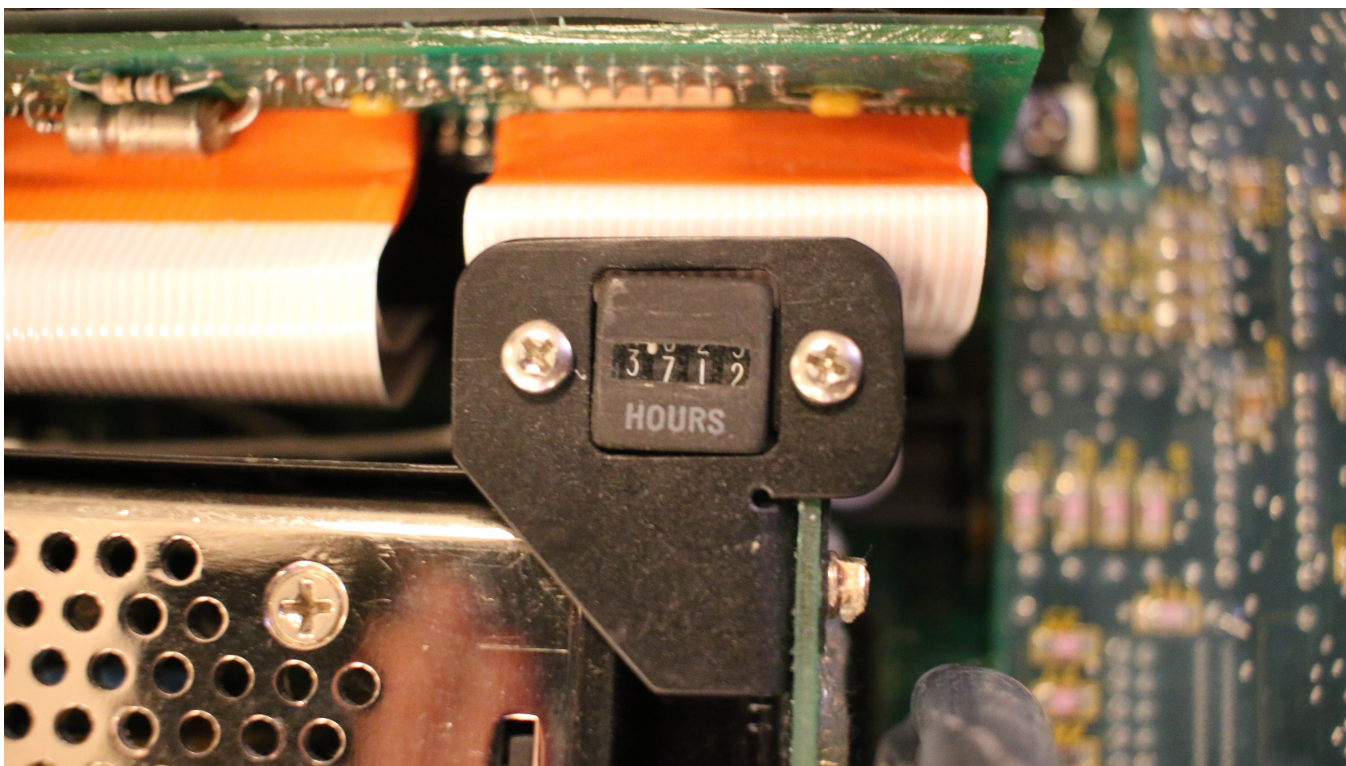




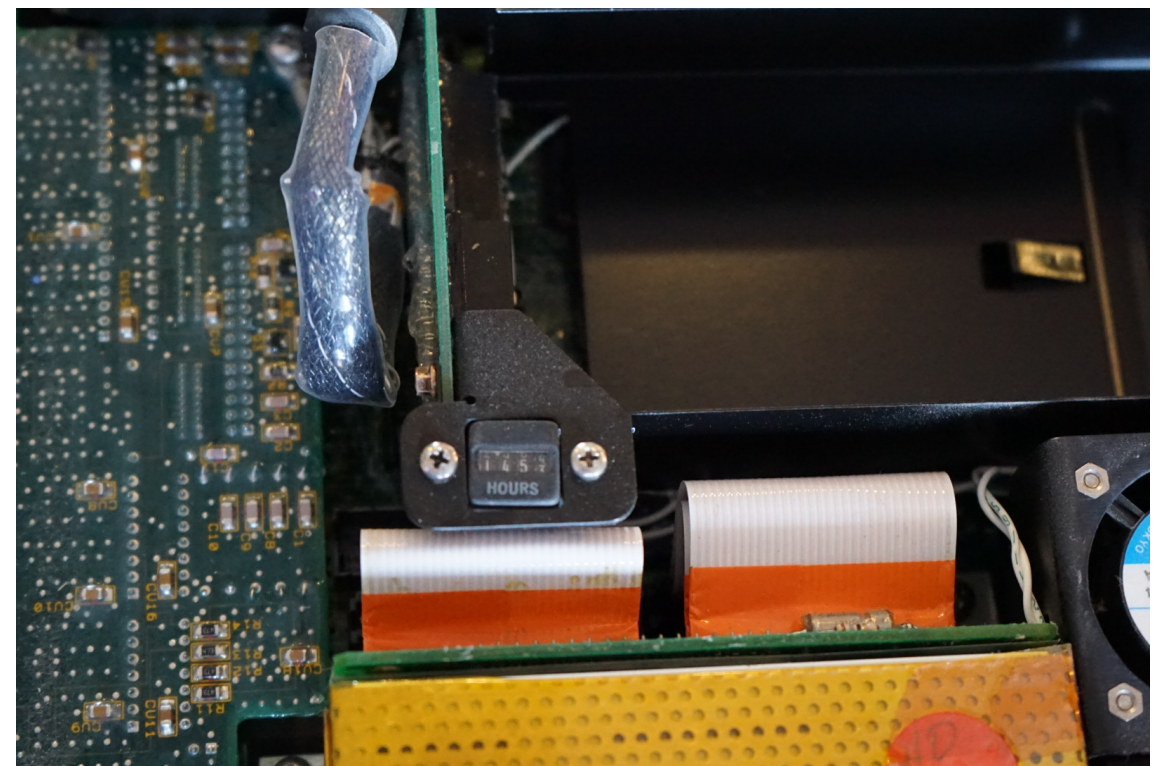
Look at all that silicon.
And that entirely not stock
battery connector / battery.

Hour counters. NASA Added these.

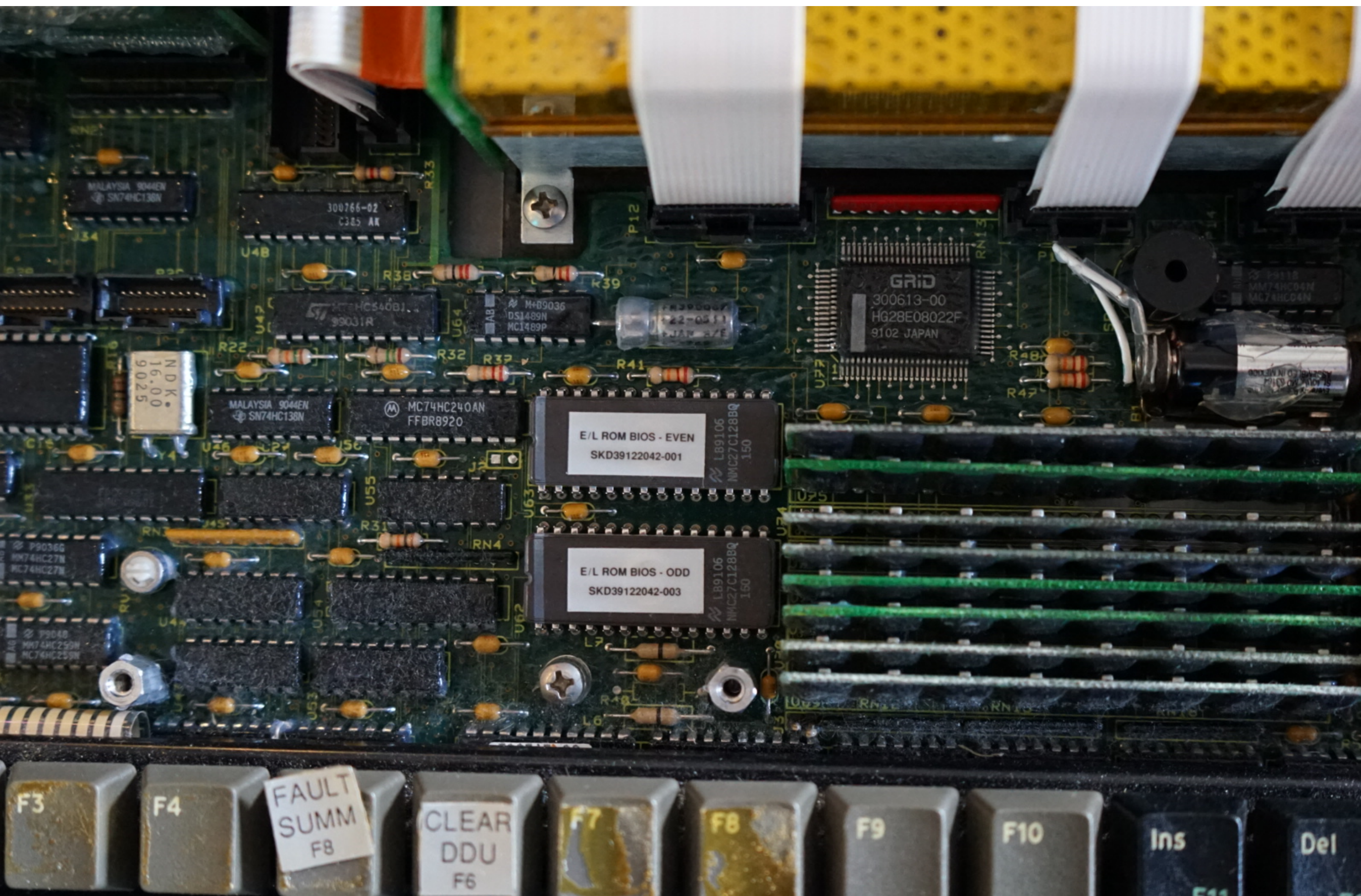
SN 1044 - 3712 Hours



SN 1045 - 1453 Hours



More brains for the brain sucking gods...



This really doesn't work if you want to not cut pins.



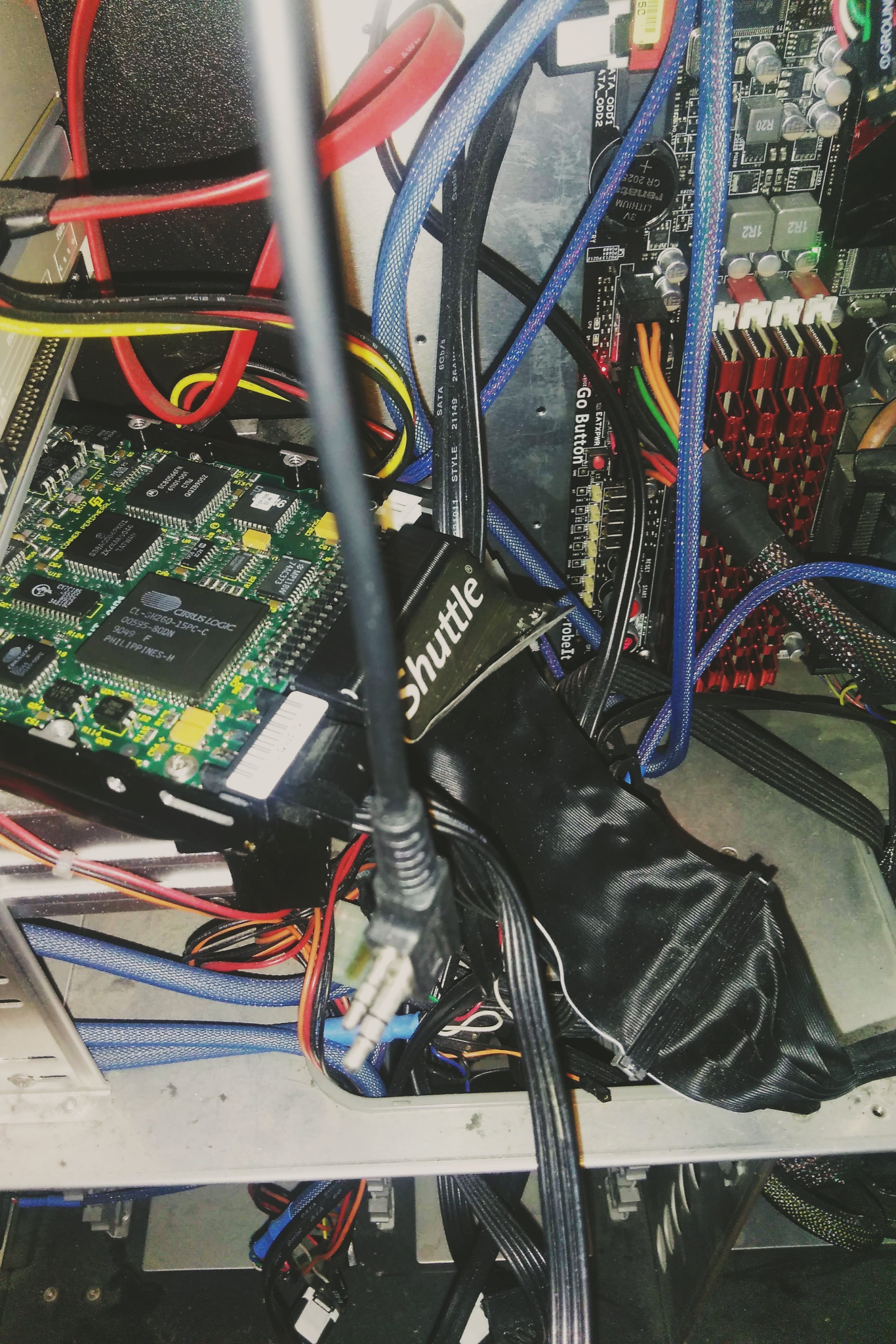
BIOS was pulled.
and is a custom build.
the hard disk geometry is in bios.

Dear Scotland. WTF? Seriously guys.



“Also - when I saw the picture of the hard drive, the first thing I thought was "Oh, no - Conner Peripherals". We used to have a problem with those drives that we called "stiction" - the heads would 'stick' to the platters and stop the platters from spinning. If the drive doesn't spin up for you, that might be the problem. How did we fix it? Well, the techs on the line would rap the case with their knuckles, and sometimes it would free the heads. But we found that would damage the platters (duh!) when the heads skipped across them, if they broke loose from the stiction - not to mention the damage to the original stiction point. We ended up sending a lot of drives back to Conner.”

– Timothy Carlson



Pulling the disks....

- Amazed they spun
- Very Corrupted
- Needed Physical ATA Card
- GNU ddrescue (love u)
- MS DOS
- Diagnostic ROM Software
- DDSE Flight Mode?


```
ECHO
ECHO      DDSE is being loaded in FLIGHT MODE
ECHO
ECHO      PRINTING is supported.
ECHO
ECHO      SCREEN CAPTURE is supported.
ECHO
ECHO      RETURNING TO OS is supported.
ECHO
ECHO
```

DDSE .. flight mode...
That's NASA.

```
..
ASTR02
ASTR02  BAT
ONFIG   SYS
DDSE    EXE
DDSEICP DOC
DDU01   FNT
DDU10   FNT
DDUP01  FNT
DDUP10  FNT
DOUBLE  FNT
FLIGHT  BAT
GSE     BAT
UTOEXECOLD
APROM   BAT
E       EXE
HK8087  EXE
LOCKTSTEXE
ISPLAY  EXE
T       EXE
XTENDEDEXE
EYTEST  EXE
AMTEST  EXE
OMCHECKEXE
PKRCHK  EXE
IDEORAMEXE
```

And there's some clues...
Check the .bat file names

Tim Carlson's Diagnostic Apps.. on disk too.

```

[0m$
Copyright (C) 1988  GRiD Systems Corporation  Copyright (C) 1988 Timothy (-Slick-) Carlson 0123456789ABCDEF0123456789ABCDEFa
cdef
Version
V  nnuummbbeerr
nnuummbbeerrT3100          GRiDCASE          GRiDCASE PLUS          GRiDCASE TEMPEST          GRiDLITE
      GRiD-286          GRiDCASE MINUS          GRiD-EXP          GRiDLITE PLUS          PYTHON (286)
      COBRA (386)          UNKNOWN TYPE          88.0707-1154Timothy Shayne Carlson
DD""
nnuummbbeerr
nnuummbbeerr          GRiDCASE          GRiDCASE PLUS          GRiDCASE TEMPEST          GRiDLITE          G
iDCASE MINUS          GRiD-EXP          GRiDLITE PLUS          PYTHON (286)          COBRA (386)
UNKNOWN TYPE          FILENAME          PLEASE NOTE IF THE FOLLOWING LINES ARE CORRECT:
      THIS LINE SHOULD BLINK          THIS LINE SHOULD BE UNDERLINED
          THIS LINE SHOULD BE REVERSE VIDEO
ERROR IN TEST ACCESS AT 000:FFFF - 000:FFFF - 000:FFFF - 000:FFFF - 000:FFFF - WALKING ONE/ZERO  (B) (OW) (EW)RANDOM PATTERN
      (B) (OW) (EW)QUICKSHORT
SEND MESSAGE ERROR
RECEIVE MESSAGE ERROR
HOSTExtended RamTest ErrorLogExtended RamTest Monitor 286/386 Extended Ramtest UNIT DOES NOT SUPPORT EXTENDED MEMORYNO EXTEND
D RAM IS INSTALLED! Copyright (C) 1988  GRiD Systems Corporation  Copyright (C) 1988 Timothy (-Slick-) Carlson 0123456789ABCD
F0123456789ABCDEFabcdef
Version
```


What binaries I have are on

<http://pgsc.space/>

Feel free to rip into em =P

Look the presentation is not interactive... or something

- Working now on restoring a stock grid case 1520
- Has bad display
- Has dead (locked disk)
- Needs new Bios
- Needs CMOS chip hot-wired
- Will hopefully run some of the software we've pulled.

Lessons learned...

- My weak ass methodology yielded results.
- Authentication of artifact revealed that Auction had info wrong.
- Corroboration of the systems existence while weak was possible.
- Weird added module was an RS-422 interface (probably)
- Original use of systems was likely in a long life testing role.
- Disks showed significant signs of bit rot.
- Flash memory was intact.

The easiest way to do recovery work on NASA gear is... to work there.

You should consider a career with them... it's highly rewarding.

McMoon's The LOIRP project.



https://loirp.arc.nasa.gov/loirp_gallery/



<https://2017.spaceappschallenge.org/>
The Space Apps Challenge helps NASA
to make use of their data. Anyone can help.

<http://pgsc.space/> will contain archival data roms / research

Thank You

- NASA
- NYC Resistor
- Tim 'Slick' Carlson
- The Computer History Museum
- Def Con Goons / CFP Team / Organizers / You all
- All those mentioned within and any I forgot

matt@nycresistor.com