EXTRACTING EVENT DATA FROM MEMORY CHIPS WITHIN A DETROIT DIESEL DDEC V

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SAE INTERNATIONAL

THE UNIVERSITY *of* TULSA

Department of Mechanical Engineering

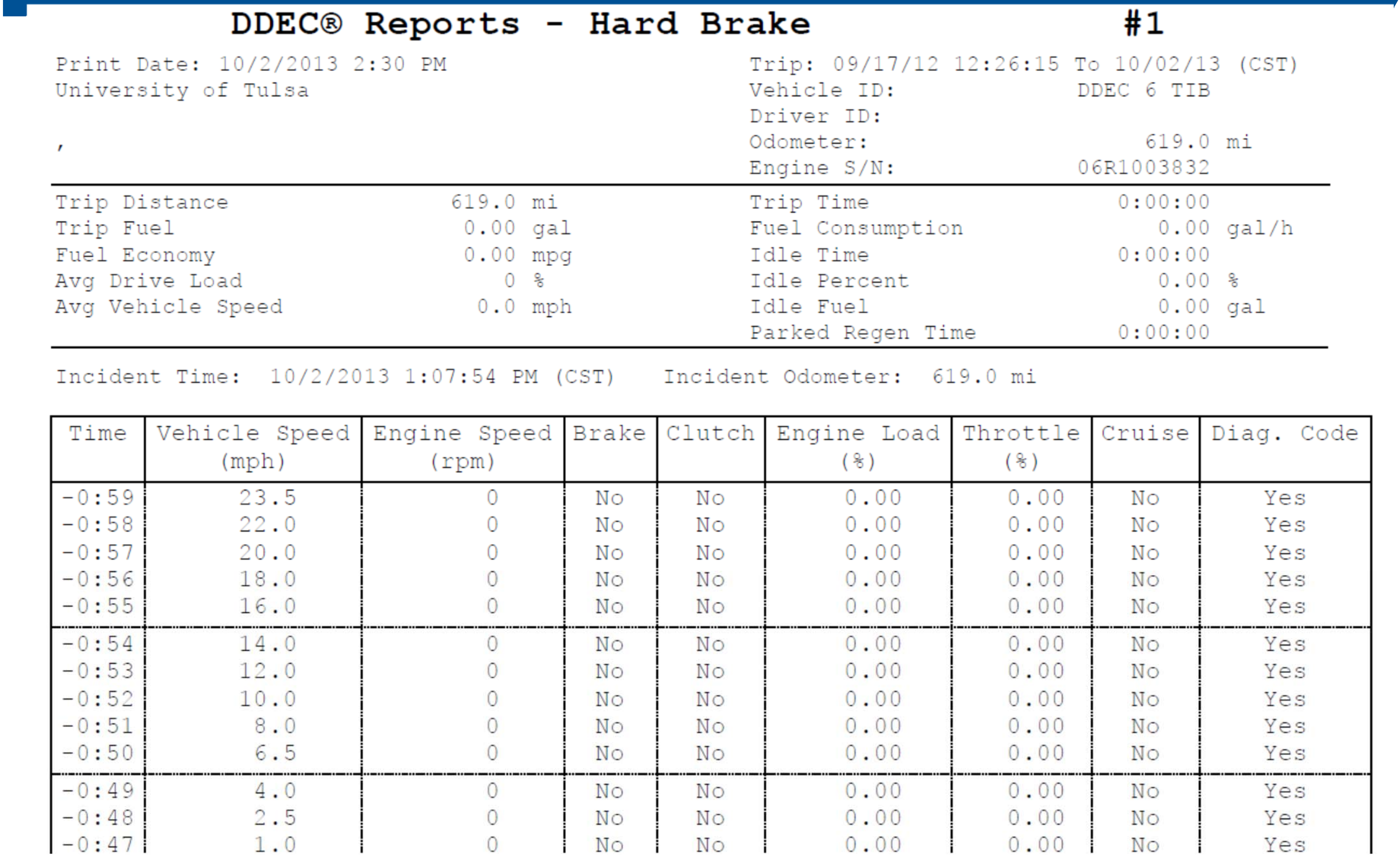
Overview

1. Problem Definition
2. Figuring out what to look for (Produce Known Data)
3. Locating Known data in memory from an Exemplar ECM
4. Finding Data in the Subject ECM (Unknown)
5. Decoding and Presenting the data

Problem Statement

We want to connect to a truck…

…and get data.



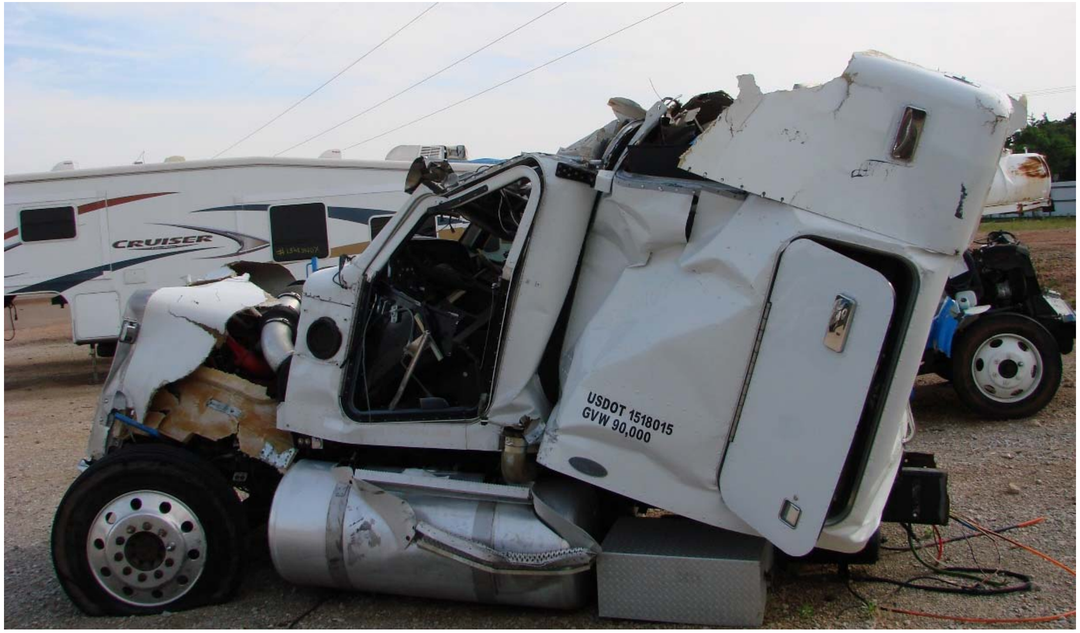
DDEC® Reports - Hard Brake #1

```
Print Date: 10/2/2013 2:30 PM                        Trip: 09/17/12 12:26:15 To 10/02/13 (CST)
University of Tulsa                                  Vehicle ID:               DDEC 6 TIB
                                                     Driver ID:
,                                                    Odometer:                      619.0 mi
                                                     Engine S/N:               06R1003832

Trip Distance                 619.0 mi               Trip Time                  0:00:00
Trip Fuel                      0.00 gal              Fuel Consumption              0.00 gal/h
Fuel Economy                   0.00 mpg              Idle Time                  0:00:00
Avg Drive Load                    0 %                Idle Percent                  0.00 %
Avg Vehicle Speed               0.0 mph              Idle Fuel                     0.00 gal
                                                     Parked Regen Time          0:00:00

Incident Time:  10/2/2013 1:07:54 PM (CST)   Incident Odometer:  619.0 mi
```

Time	Vehicle Speed (mph)	Engine Speed (rpm)	Brake	Clutch	Engine Load (%)	Throttle (%)	Cruise	Diag. Code
-0:59	23.5	0	No	No	0.00	0.00	No	Yes
-0:58	22.0	0	No	No	0.00	0.00	No	Yes
-0:57	20.0	0	No	No	0.00	0.00	No	Yes
-0:56	18.0	0	No	No	0.00	0.00	No	Yes
-0:55	16.0	0	No	No	0.00	0.00	No	Yes
-0:54	14.0	0	No	No	0.00	0.00	No	Yes
-0:53	12.0	0	No	No	0.00	0.00	No	Yes
-0:52	10.0	0	No	No	0.00	0.00	No	Yes
-0:51	8.0	0	No	No	0.00	0.00	No	Yes
-0:50	6.5	0	No	No	0.00	0.00	No	Yes
-0:49	4.0	0	No	No	0.00	0.00	No	Yes
-0:48	2.5	0	No	No	0.00	0.00	No	Yes
-0:47	1.0	0	No	No	0.00	0.00	No	Yes

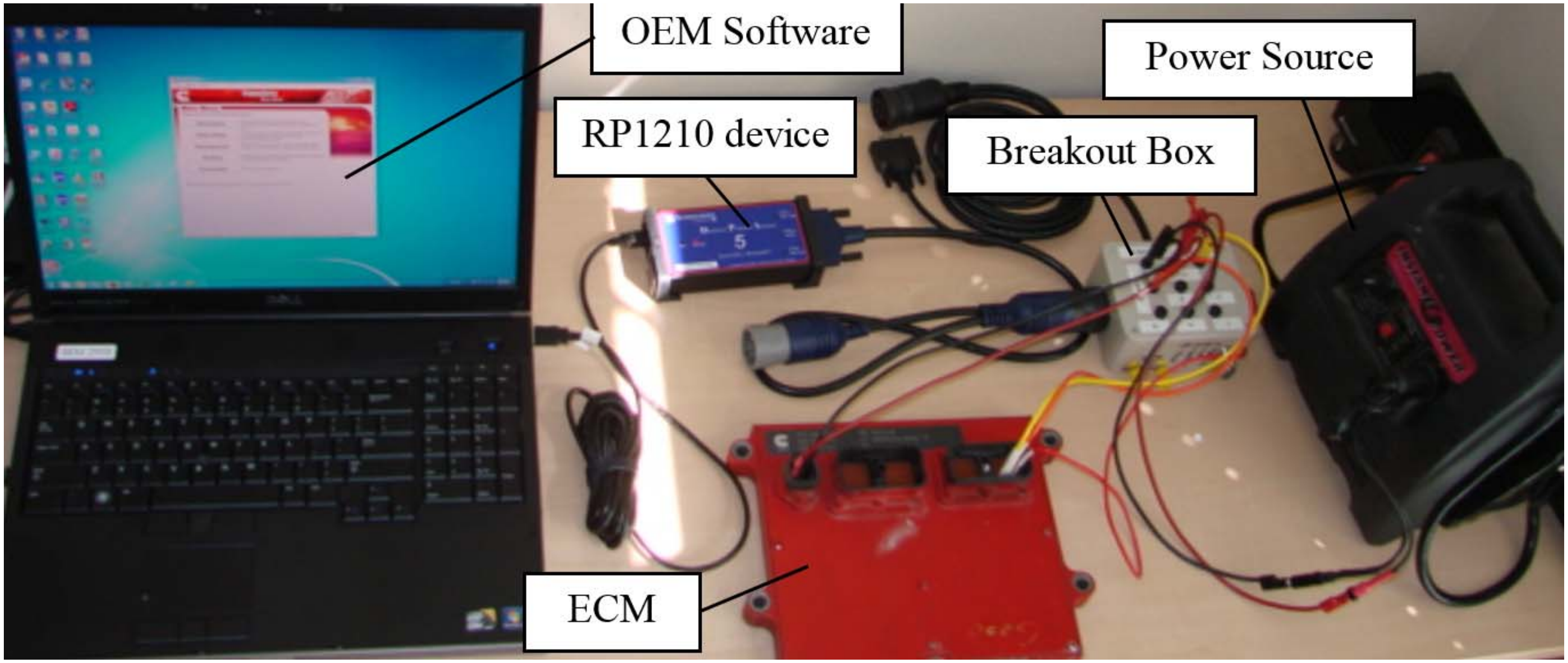
A direct approach may be needed

The electrical system is compromised.

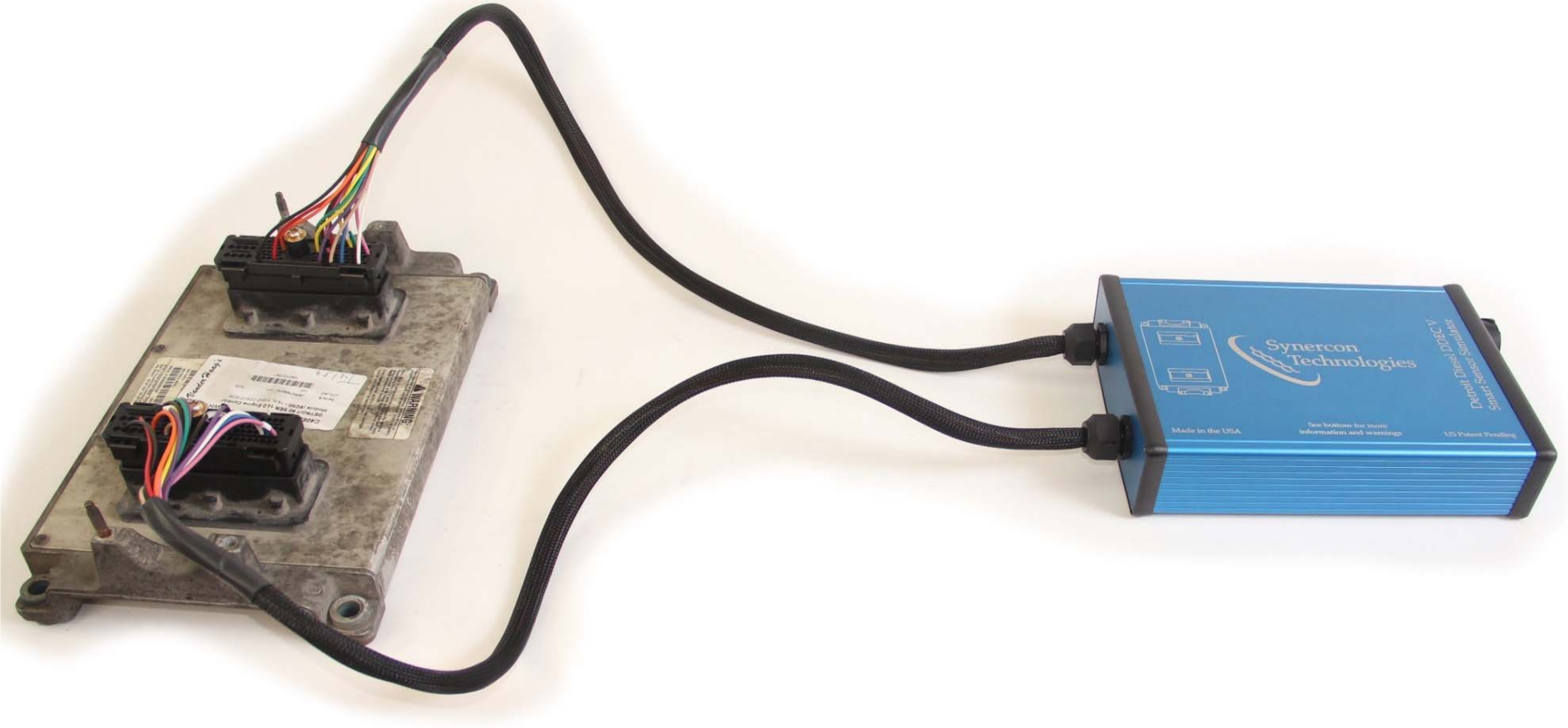


Bench Top Download (or Image?)

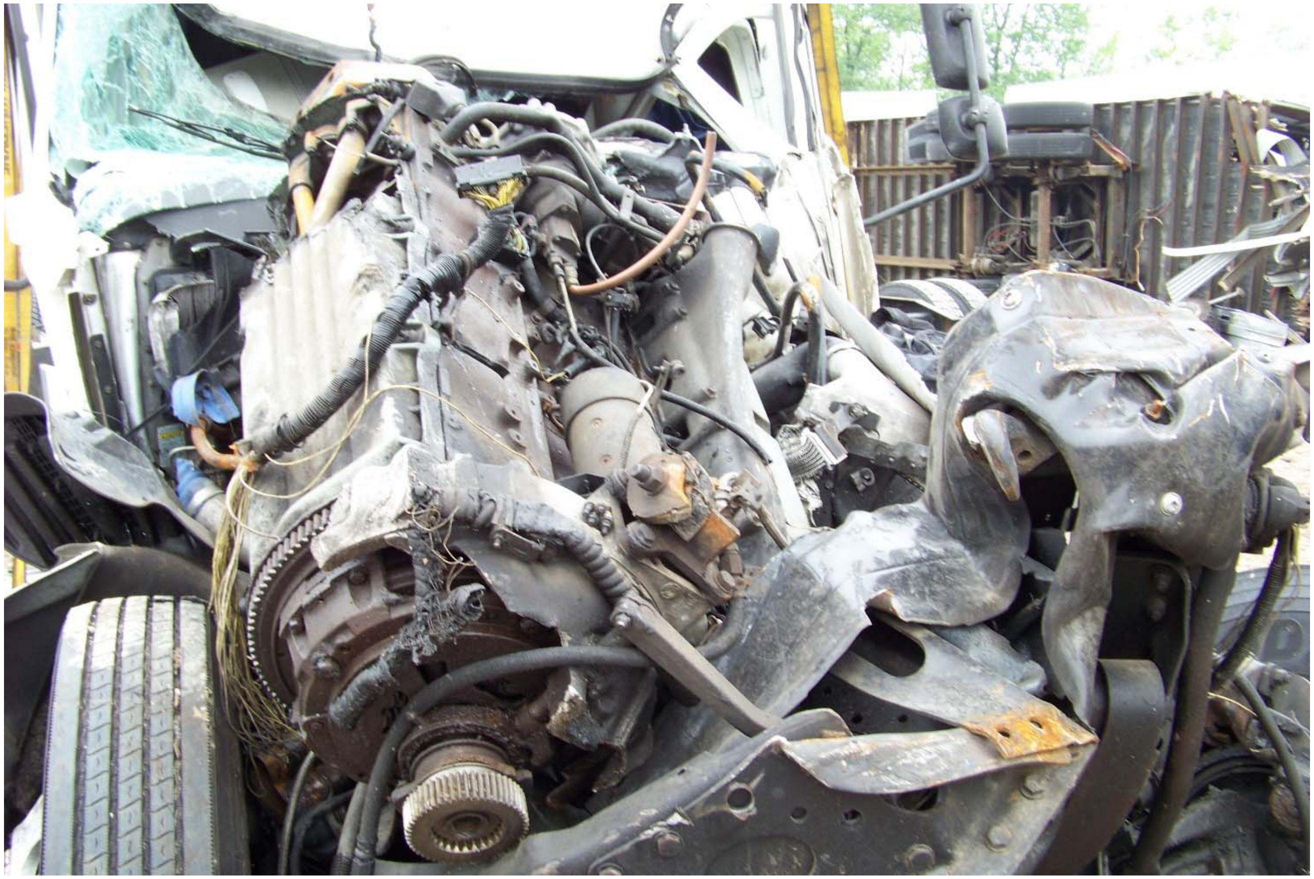
But this sets new faults.



Bench Top Download (Fault Free)

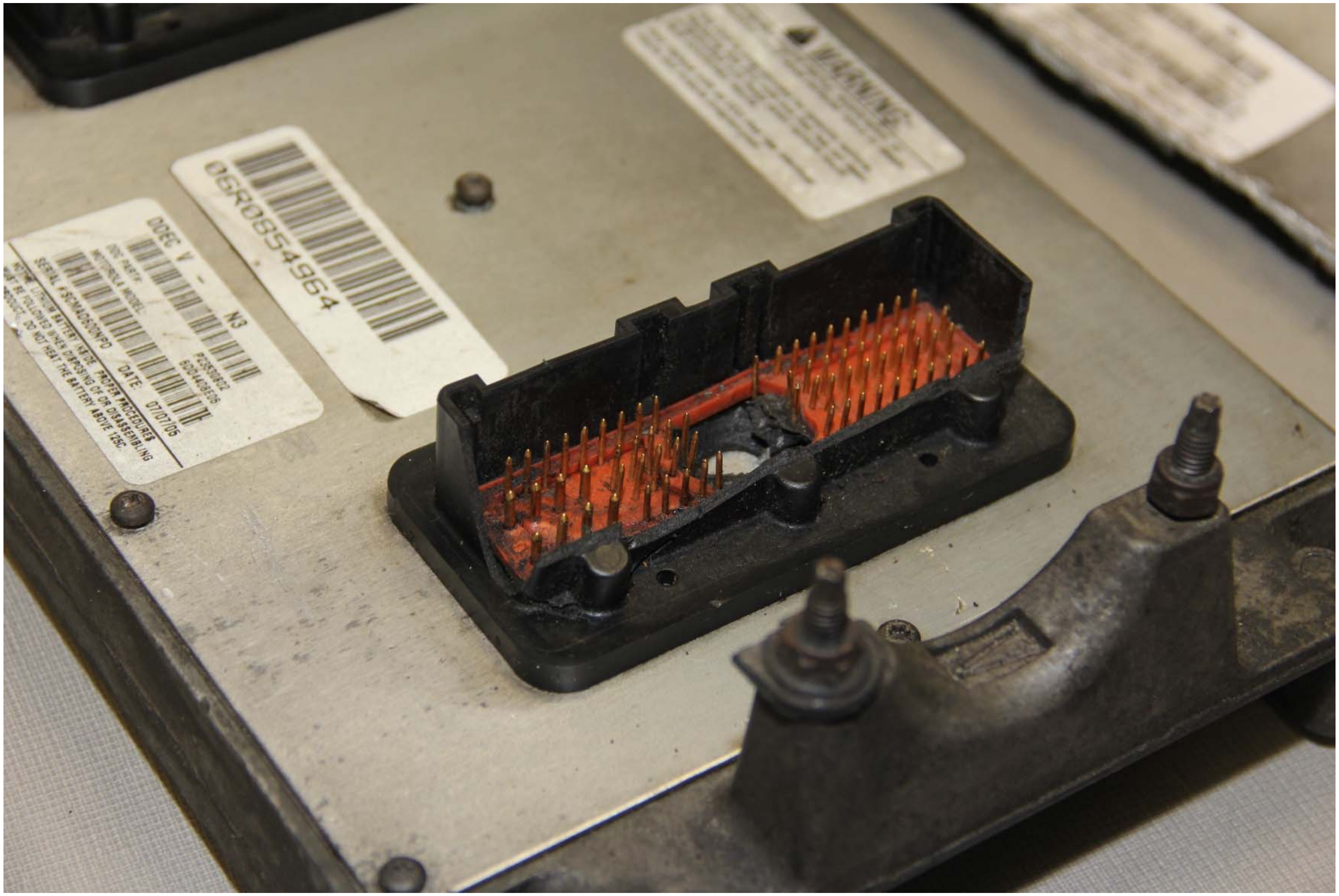


But, sometimes it’s not that easy.



The electrical system is compromised.

Recovered Modules



Attempted Download

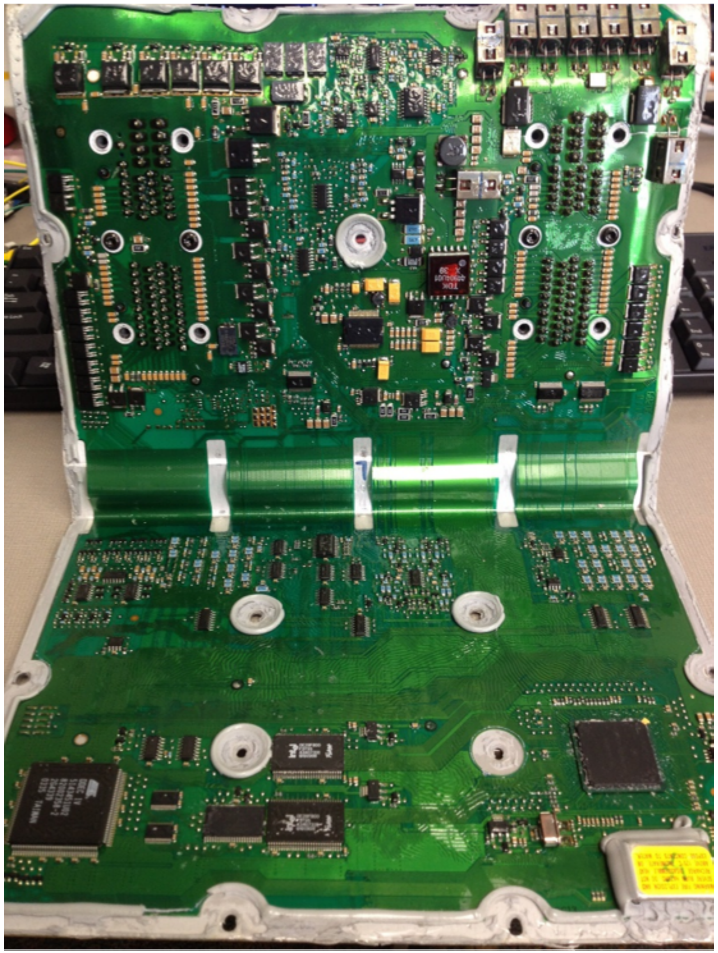
Able to connect, but throws a J1708 Network Error??

This isn’t covered in the manual…

Let’s take a peek inside the module.

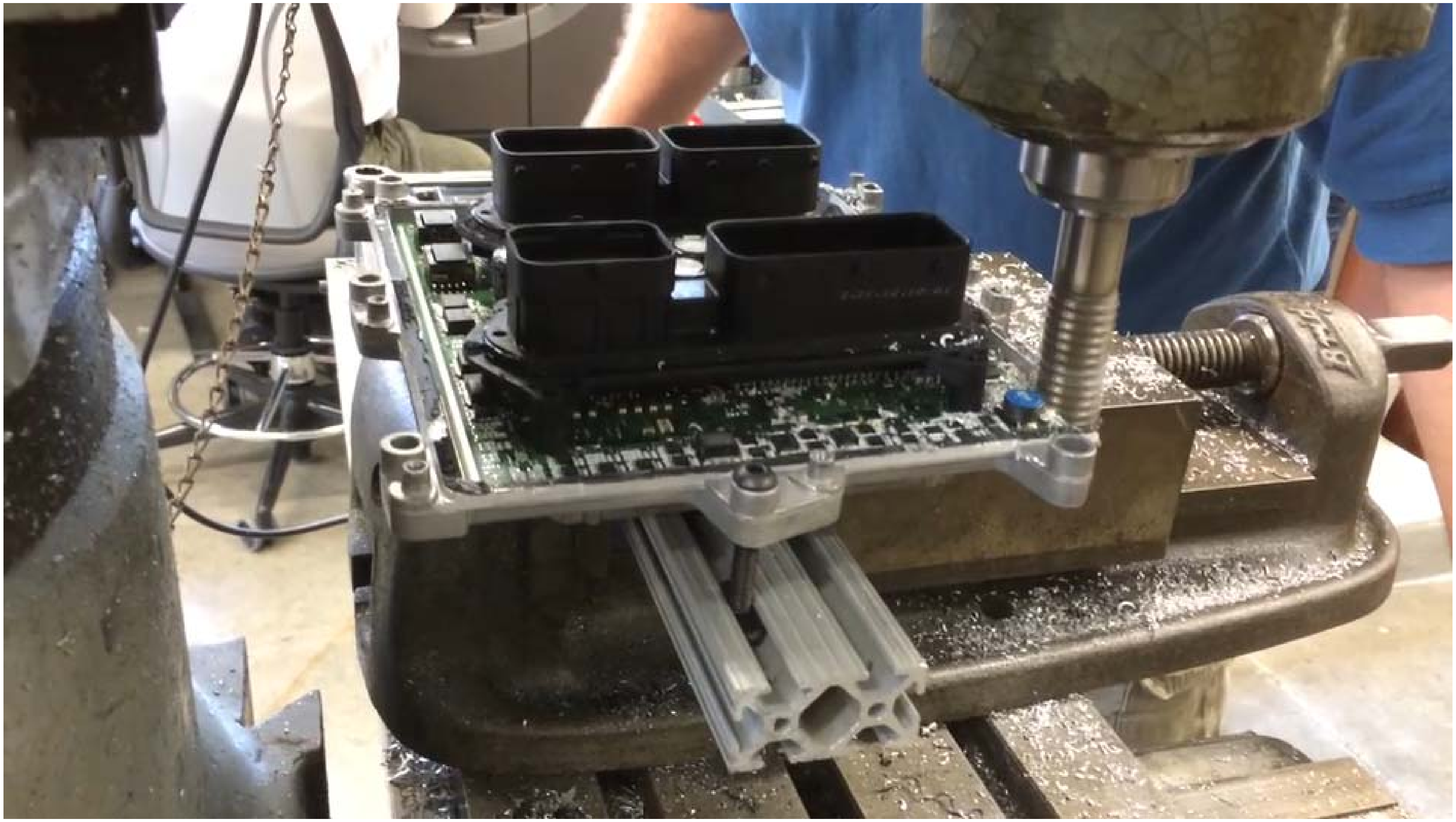
Chip Access

Accessing the chips the mechanical engineering way…



Chip Access

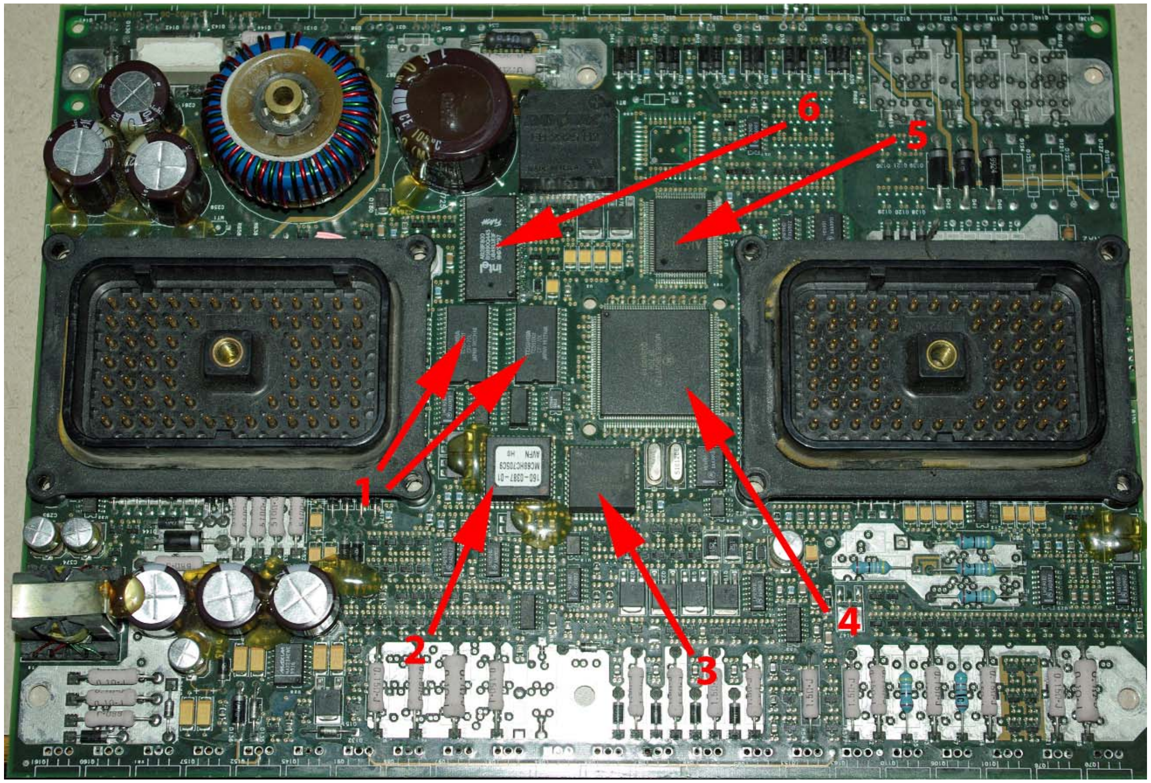
Drastic measures



Chip Identification

CAT ADEM III

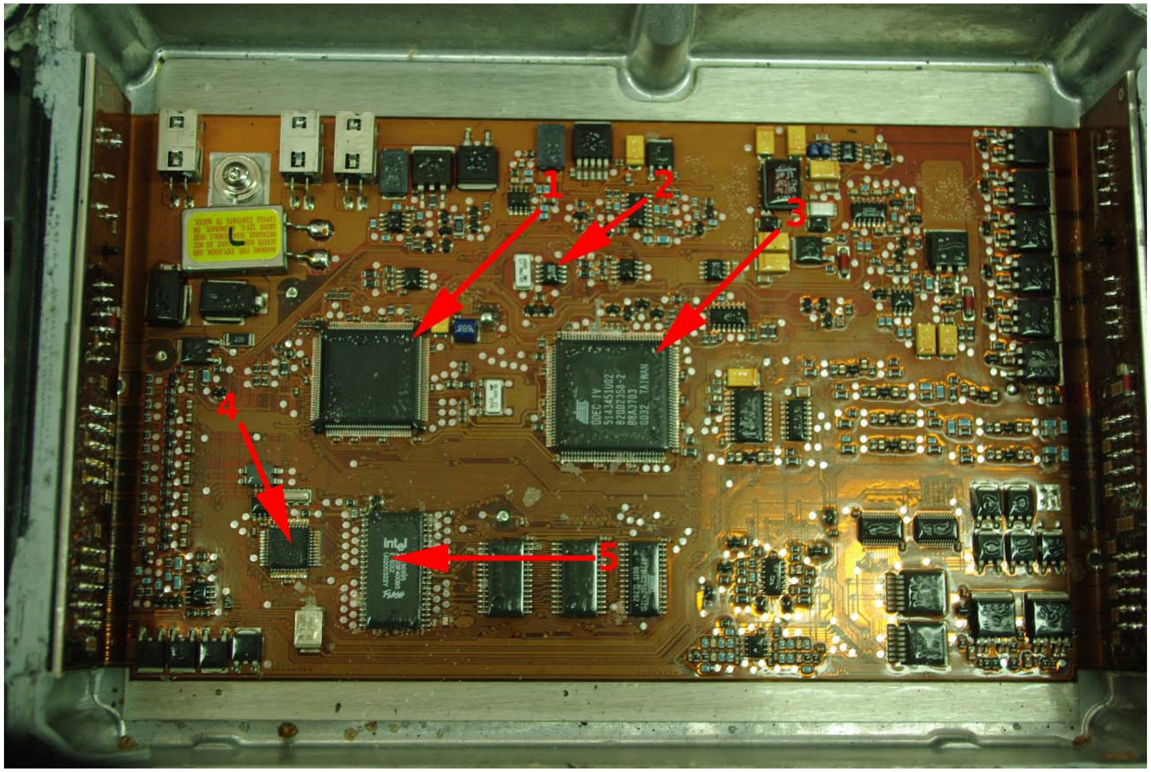
1. Toshiba SRAM
2. MC68HC705C9A 8-bit Microcontroller (EEPROM)
3. Intel CAN 2.0 Controller
4. MC68336 32-bit Microprocessor (note: Mask-Rom + SRAM)
5. AMI IC Branded Caterpillar, Presumed ASIC
6. Intel AB28F800 5V Flash Storage



Chip Identification

DDEC IV

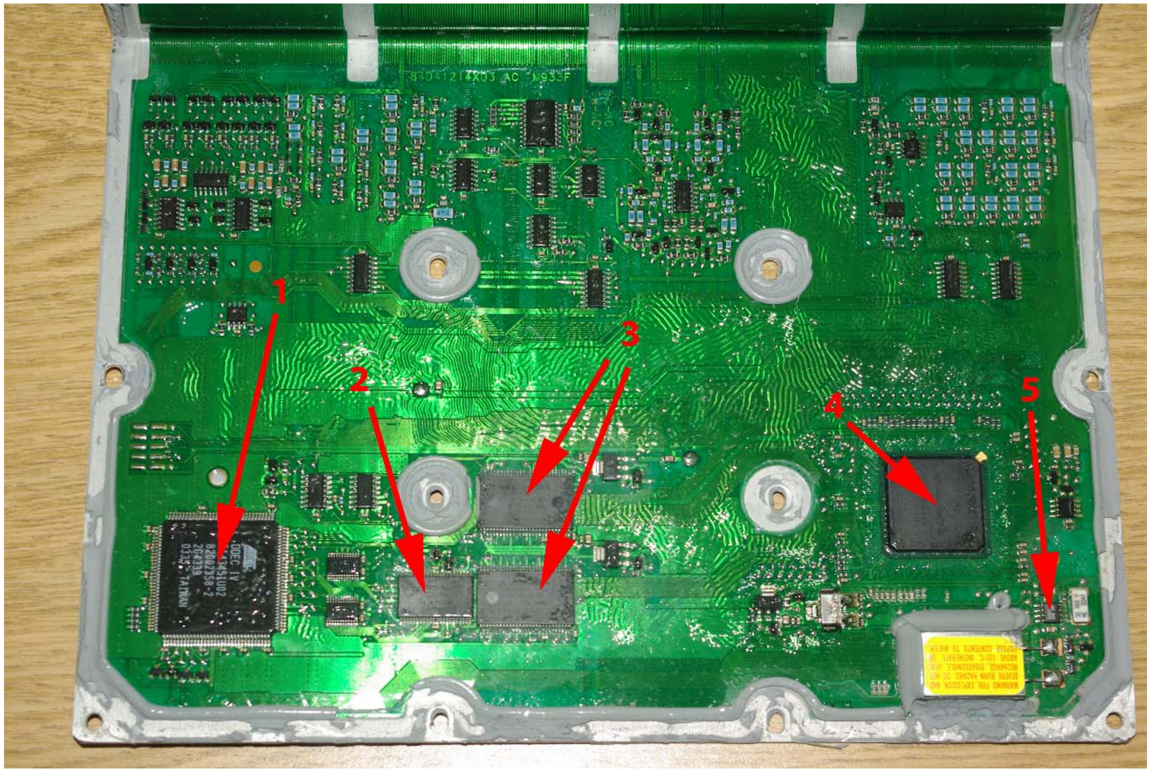
1. **MC68332 – 32-bit CPU**
2. **Real-time Clock controller**
3. **Presumed Custom ASIC controller**
4. **CAN Controller**
5. **Intel Flash Storage IC AB28F400**



Chip Identification

DDEC 5

1. **Custom ASIC – similar to later DDEC4**
2. **Cypress CY62137VLL SRAM**
3. **AMD AM29BL802CB Flash Storage ICs**
4. **MPC555LF8MZP40 32-bit CPU**
5. **Real-time clock IC EM V3020**

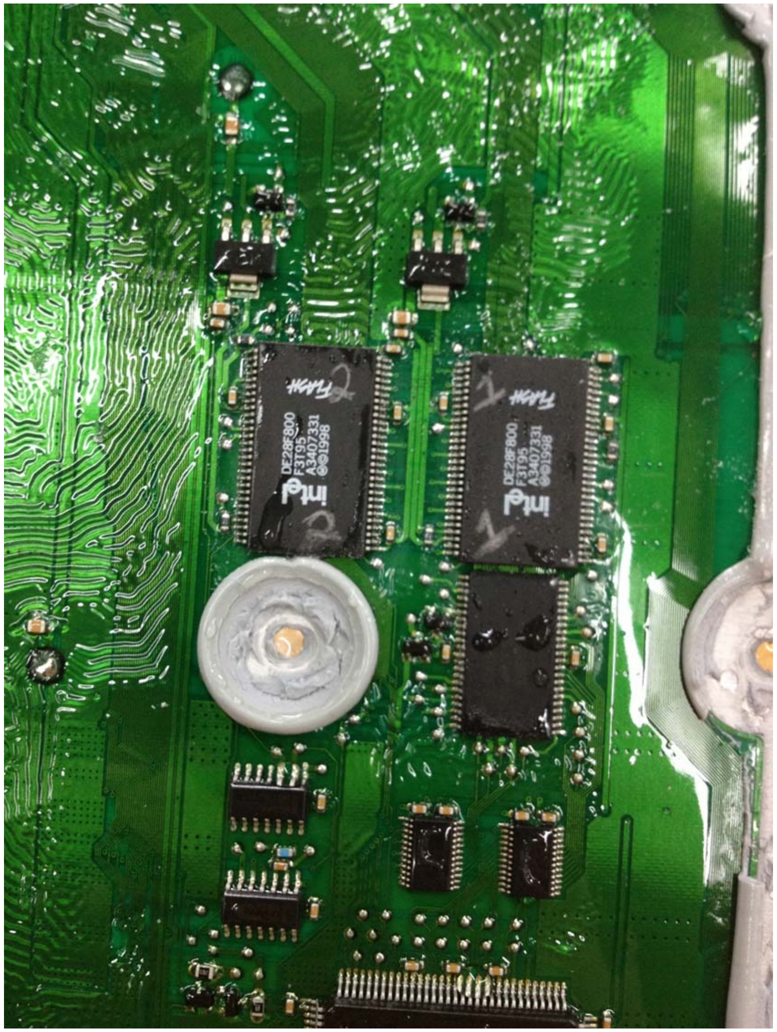


Another DDEC 5

Data is stored on flash memory.

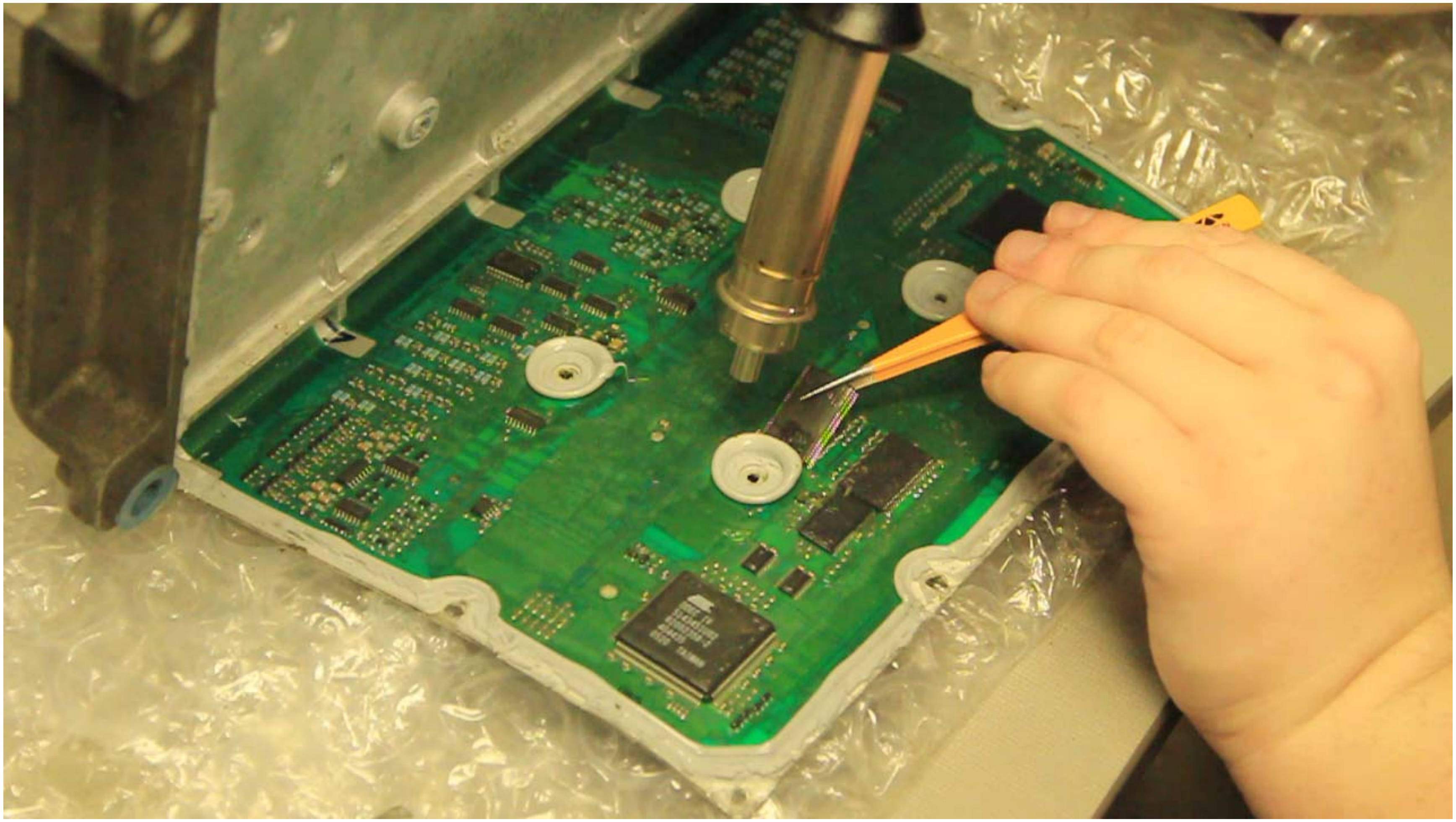
This DDEC5 used an Intel chip.

Each chip stores 1 megabyte



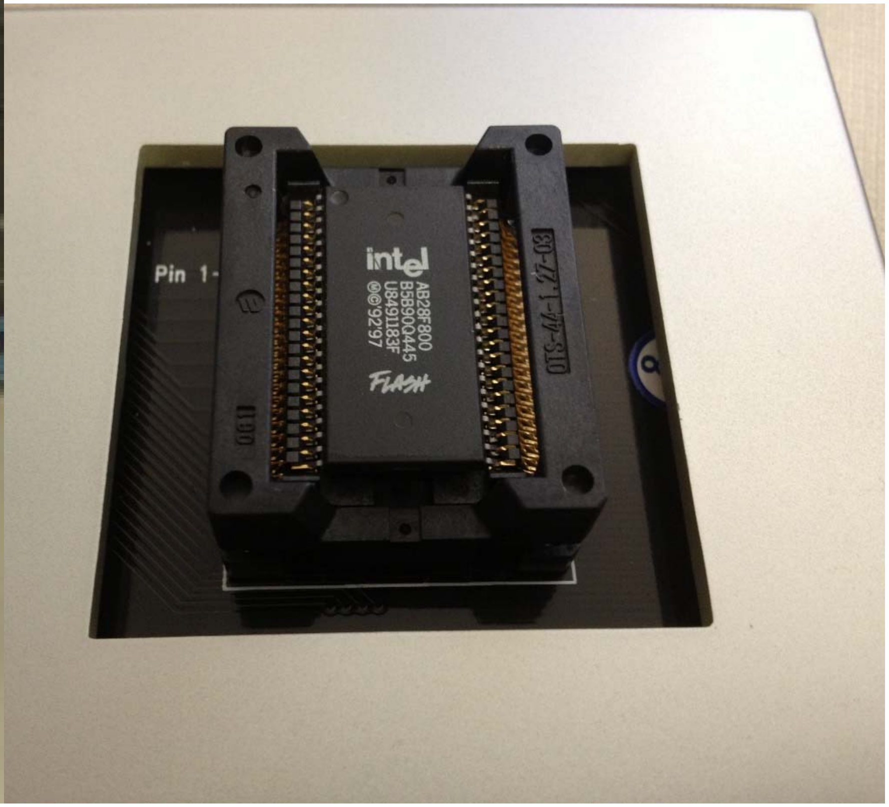
Chip Removal

Hot air rework station to removing the flash memory



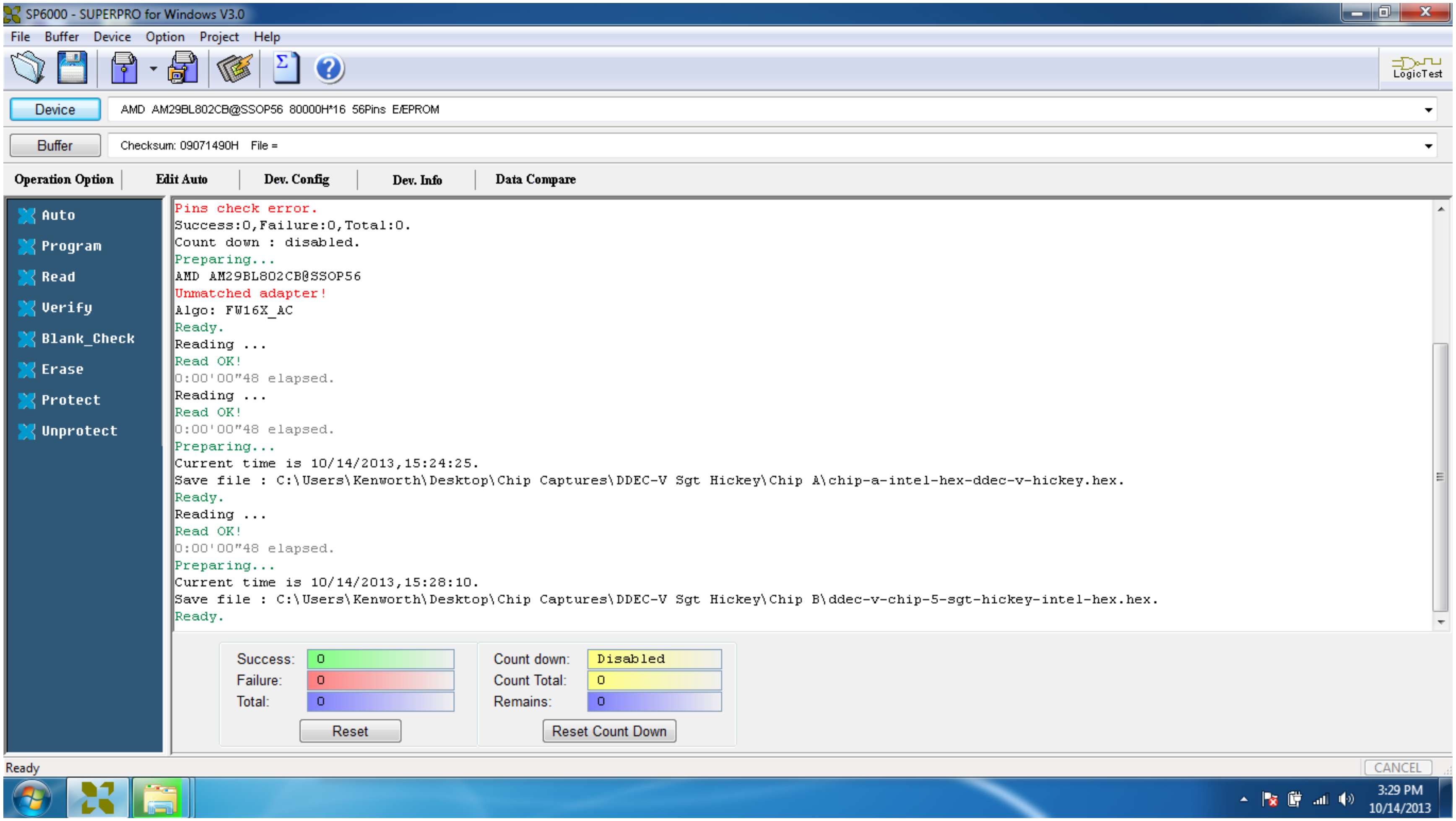
Reading the chip memory

Xeltek Super Pro 6000 Universal Chip Reader



Software to run the Chip Reader

Output is a raw binary file (*.hex)



Device: AMD AM29BL802CB@SSOP56 80000H*16 56Pins E/EPROM

Buffer: Checksum: 09071490H   File =

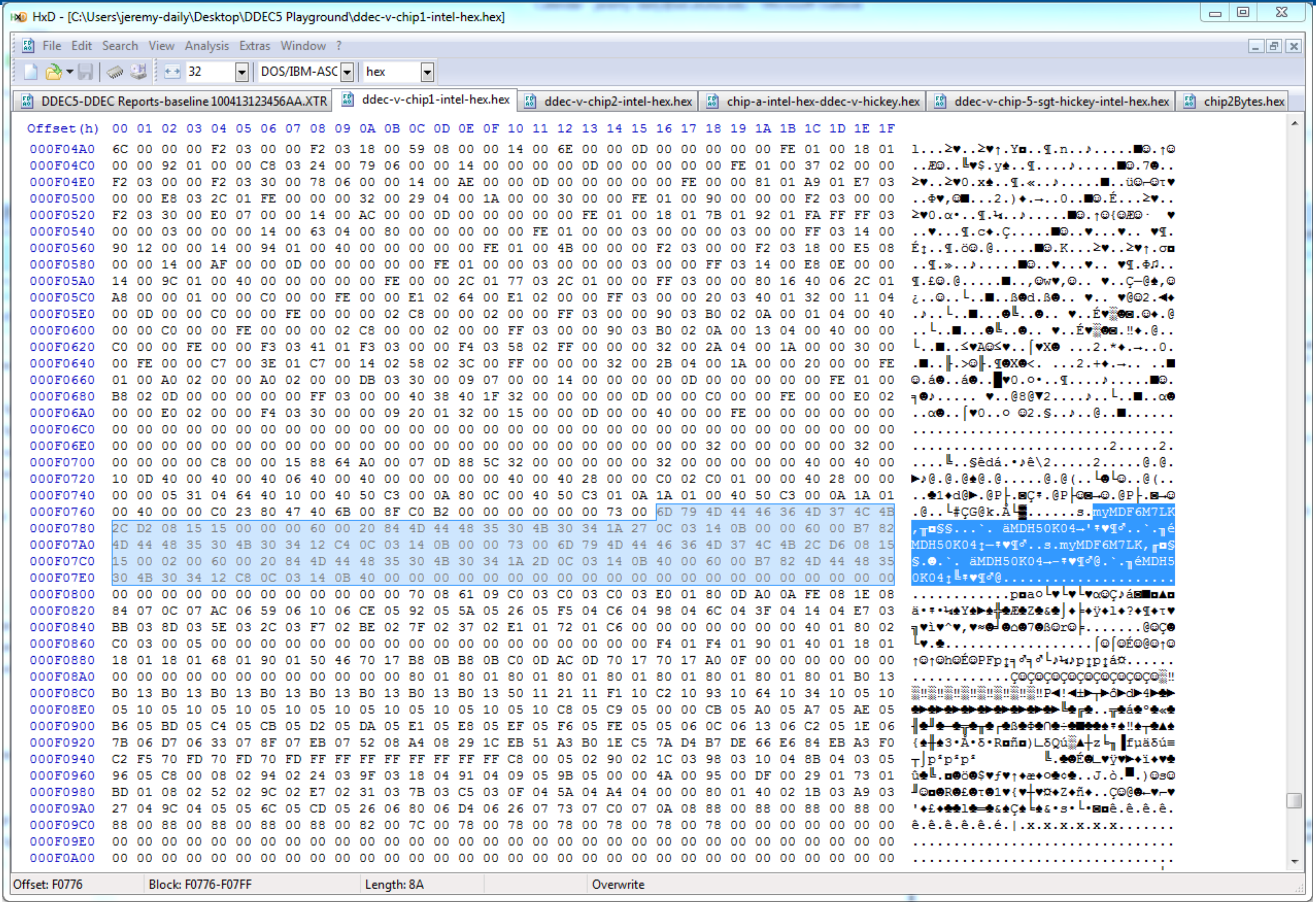
```
Pins check error.
Success:0,Failure:0,Total:0.
Count down : disabled.
Preparing...
AMD AM29BL802CB@SSOP56
Unmatched adapter!
Algo: FW16X_AC
Ready.
Reading ...
Read OK!
0:00'00"48 elapsed.
Reading ...
Read OK!
0:00'00"48 elapsed.
Preparing...
Current time is 10/14/2013,15:24:25.
Save file : C:\Users\Kenworth\Desktop\Chip Captures\DDEC-V Sgt Hickey\Chip A\chip-a-intel-hex-ddec-v-hickey.hex.
Ready.
Reading ...
Read OK!
0:00'00"48 elapsed.
Preparing...
Current time is 10/14/2013,15:28:10.
Save file : C:\Users\Kenworth\Desktop\Chip Captures\DDEC-V Sgt Hickey\Chip B\ddec-v-chip-5-sgt-hickey-intel-hex.hex.
Ready.
```

Success: 0
Failure: 0
Total: 0

Count down: Disabled
Count Total: 0
Remains: 0

Ready

Results in a Hex editor (Now What?)


HxD - [C:\Users\jeremy-daily\Desktop\DDEC5 Playground\ddec-v-chip1-intel-hex.hex]
File
Edit
Search
View
Analysis
Extras
Window
?
32
DOS/IBM-ASC
hex
DDEC5-DDEC Reports-baseline 100413123456AA.XTR
ddec-v-chip1-intel-hex.hex
ddec-v-chip2-intel-hex.hex
chip-a-intel-hex-ddec-v-hickey.hex
ddec-v-chip-5-sgt-hickey-intel-hex.hex
chip2Bytes.hex

```
Offset(h) 00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F 10 11 12 13 14 15 16 17 18 19 1A 1B 1C 1D 1E 1F

000F04A0  6C 00 00 00 F2 03 00 00 F2 03 18 00 59 08 00 00 14 00 6E 00 00 0D 00 00 00 00 00 FE 01 00 18 01  l...≥♥..≥♥↑.Y◘..¶.n..♪.....■☺.↑☺
000F04C0  00 00 92 01 00 00 C8 03 24 00 79 06 00 00 14 00 00 00 00 0D 00 00 00 00 00 FE 01 00 37 02 00 00  ..Æ☺..╚♥$.y♠..¶....♪.....■☺.7☻..
000F04E0  F2 03 00 00 F2 03 30 00 78 06 00 00 14 00 AE 00 00 0D 00 00 00 00 00 FE 00 00 81 01 A9 01 E7 03  ≥♥..≥♥0.x♠..¶.«..♪.....■..ü☺⌐☺τ♥
000F0500  00 00 E8 03 2C 01 FE 00 00 00 32 00 29 04 00 1A 00 00 30 00 00 FE 01 00 90 00 00 00 F2 03 00 00  ..Φ♥,☺■...2.)♦.→..0..■☺.É...≥♥..
000F0520  F2 03 30 00 E0 07 00 00 14 00 AC 00 00 0D 00 00 00 00 00 FE 01 00 18 01 7B 01 92 01 FA FF FF 03  ≥♥0.α•..¶.¼..♪.....■☺.↑☺{☺Æ☺·  ♥
000F0540  00 00 03 00 00 00 14 00 63 04 00 80 00 00 00 00 00 FE 01 00 00 03 00 00 00 03 00 00 FF 03 14 00  ..♥...¶.c♦.Ç.....■☺..♥...♥.. ♥¶.
000F0560  90 12 00 00 14 00 94 01 00 40 00 00 00 00 00 FE 01 00 4B 00 00 00 F2 03 00 00 F2 03 18 00 E5 08  É↕..¶.ö☺.@.....■☺.K...≥♥..≥♥↑.σ◘
000F0580  00 00 14 00 AF 00 00 0D 00 00 00 00 00 FE 01 00 00 03 00 00 00 03 00 00 FF 03 14 00 E8 0E 00 00  ..¶.»..♪.....■☺..♥...♥.. ♥¶.Φ♫..
000F05A0  14 00 9C 01 00 40 00 00 00 00 00 FE 00 00 2C 01 77 03 2C 01 00 00 FF 03 00 00 80 16 40 06 2C 01  ¶.£☺.@.....■..,☺w♥,☺.. ♥..Ç▬@♠,☺
000F05C0  A8 00 00 01 00 00 C0 00 00 FE 00 00 E1 02 64 00 E1 02 00 00 FF 03 00 00 20 03 40 01 32 00 11 04  ¿..☺..└..■..ß☻d.ß☻.. ♥.. ♥@☺2.◄♦
000F05E0  00 0D 00 00 C0 00 00 FE 00 00 00 02 C8 00 00 02 00 00 FF 03 00 00 90 03 B0 02 0A 00 01 04 00 40  .♪..└..■...☻╚..☻.. ♥..É♥░☻◙.☺♦.@
000F0600  00 00 C0 00 00 FE 00 00 00 02 C8 00 00 02 00 00 FF 03 00 00 90 03 B0 02 0A 00 13 04 00 40 00 00  ..└..■...☻╚..☻.. ♥..É♥░☻◙.‼♦.@..
000F0620  C0 00 00 FE 00 00 F3 03 41 01 F3 03 00 00 F4 03 58 02 FF 00 00 00 32 00 2A 04 00 1A 00 00 30 00  └..■..≤♥A☺≤♥..⌠♥X☻ ...2.*♦.→..0.
000F0640  00 FE 00 00 C7 00 3E 01 C7 00 14 02 58 02 3C 00 FF 00 00 00 32 00 2B 04 00 1A 00 00 20 00 00 FE  .■..╟.>☺╟.¶☻X☻<. ...2.+♦.→.. ..■
000F0660  01 00 A0 02 00 00 A0 02 00 00 DB 03 30 00 09 07 00 00 14 00 00 00 00 0D 00 00 00 00 00 FE 01 00  ☺.á☻..á☻..█♥0.○•..¶....♪.....■☺.
000F0680  B8 02 0D 00 00 00 00 00 FF 03 00 00 40 38 40 1F 32 00 00 00 00 0D 00 00 C0 00 00 FE 00 00 E0 02  ╕☻♪..... ♥..@8@▼2....♪..└..■..α☻
000F06A0  00 00 E0 02 00 00 F4 03 30 00 00 09 20 01 32 00 15 00 00 0D 00 00 40 00 00 FE 00 00 00 00 00 00  ..α☻..⌠♥0..○ ☺2.§..♪..@..■......
000F06C0  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ................................
000F06E0  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 32 00 00 00 00 00 32 00  ........................2.....2.
000F0700  00 00 00 00 C8 00 00 15 88 64 A0 00 07 0D 88 5C 32 00 00 00 00 00 32 00 00 00 00 00 40 00 40 00  ....╚..§êdá.•♪ê\2.....2.....@.@.
000F0720  10 0D 40 00 40 00 40 06 40 00 40 00 00 00 00 00 40 00 40 28 00 00 C0 02 C0 01 00 00 40 28 00 00  ►♪@.@.@♠@.@.....@.@(..└☻└☺..@(..
000F0740  00 00 05 31 04 64 40 10 00 40 50 C3 00 0A 80 0C 00 40 50 C3 01 0A 1A 01 00 40 50 C3 00 0A 1A 01  ..♣1♦d@►.@P├.◙Ç♀.@P├☺◙→☺.@P├.◙→☺
000F0760  00 40 00 00 C0 23 80 47 40 6B 00 8F C0 B2 00 00 00 00 00 00 73 00 6D 79 4D 44 46 36 4D 37 4C 4B  .@..└#ÇG@k.Å└▓......s.myMDF6M7LK
000F0780  2C D2 08 15 15 00 00 00 60 00 20 84 4D 44 48 35 30 4B 30 34 1A 27 0C 03 14 0B 00 00 60 00 B7 82  ,╥◘§§...`. äMDH50K04→'♀♥¶♂..`.╖é
000F07A0  4D 44 48 35 30 4B 30 34 12 C4 0C 03 14 0B 00 00 73 00 6D 79 4D 44 46 36 4D 37 4C 4B 2C D6 08 15  MDH50K04↕─♀♥¶♂..s.myMDF6M7LK,╓◘§
000F07C0  15 00 02 00 60 00 20 84 4D 44 48 35 30 4B 30 34 1A 2D 0C 03 14 0B 40 00 60 00 B7 82 4D 44 48 35  §.☻.`. äMDH50K04→-♀♥¶♂@.`.╖éMDH5
000F07E0  30 4B 30 34 12 C8 0C 03 14 0B 40 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  0K04↕╚♀♥¶♂@.....................
000F0800  00 00 00 00 00 00 00 00 00 00 00 00 70 08 61 09 C0 03 C0 03 C0 03 E0 01 80 0D A0 0A FE 08 1E 08  ............p◘a○└♥└♥└♥α☺Ç♪á◙■◘▲◘
000F0820  84 07 0C 07 AC 06 59 06 10 06 CE 05 92 05 5A 05 26 05 F5 04 C6 04 98 04 6C 04 3F 04 14 04 E7 03  ä•♀•¼♠Y♠►♠╬♣Æ♣Z♣&♣⌡♦╞♦ÿ♦l♦?♦¶♦τ♥
000F0840  BB 03 8D 03 5E 03 2C 03 F7 02 BE 02 7F 02 37 02 E1 01 72 01 C6 00 00 00 00 00 00 00 40 01 80 02  ╗♥ì♥^♥,♥≈☻╛☻⌂☻7☻ß☺r☺╞.......@☺Ç☻
000F0860  C0 03 00 05 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 F4 01 F4 01 90 01 40 01 18 01  └♥.♣..................⌠☺⌠☺É☺@☺↑☺
000F0880  18 01 18 01 68 01 90 01 50 46 70 17 B8 0B B8 0B C0 0D AC 0D 70 17 70 17 A0 0F 00 00 00 00 00 00  ↑☺↑☺h☺É☺PFp↨╕♂╕♂└♪¼♪p↨p↨á☼......
000F08A0  00 00 00 00 00 00 00 00 00 00 00 00 80 01 80 01 80 01 80 01 80 01 80 01 80 01 80 01 80 01 B0 13  ............Ç☺Ç☺Ç☺Ç☺Ç☺Ç☺Ç☺Ç☺Ç☺░‼
000F08C0  B0 13 B0 13 B0 13 B0 13 B0 13 B0 13 B0 13 B0 13 50 11 21 11 F1 10 C2 10 93 10 64 10 34 10 05 10  ░‼░‼░‼░‼░‼░‼░‼░‼P◄!◄±►┬►ô►d►4►♣►
000F08E0  05 10 05 10 05 10 05 10 05 10 05 10 05 10 05 10 05 10 C8 05 C9 05 00 00 CB 05 A0 05 A7 05 AE 05  ♣►♣►♣►♣►♣►♣►♣►♣►♣►╚♣╔♣..╦♣á♣º♣«♣
000F0900  B6 05 BD 05 C4 05 CB 05 D2 05 DA 05 E1 05 E8 05 EF 05 F6 05 FE 05 05 06 0C 06 13 06 C2 05 1E 06  ╢♣╜♣─♣╦♣╥♣┌♣ß♣Φ♣∩♣÷♣■♣♣♠♀♠‼♠┬♣▲♠
000F0920  7B 06 D7 06 33 07 8F 07 EB 07 52 08 A4 08 29 1C EB 51 A3 B0 1E C5 7A D4 B7 DE 66 E6 84 EB A3 F0  {♠╫♠3•Å•δ•R◘ñ◘)∟δQú░▲┼z╘╖▐fµäδú≡
000F0940  C2 F5 70 FD 70 FD 70 FD FF FF FF FF FF FF FF FF C8 00 05 02 90 02 1C 03 98 03 10 04 8B 04 03 05  ┬⌡p²p²p²        ╚.♣☻É☻∟♥ÿ♥►♦ï♦♥♣
000F0960  96 05 C8 00 08 02 94 02 24 03 9F 03 18 04 91 04 09 05 9B 05 00 00 4A 00 95 00 DF 00 29 01 73 01  û♣╚.◘☻ö☻$♥ƒ♥↑♦æ♦○♣¢♣..J.ò.▀.)☺s☺
000F0980  BD 01 08 02 52 02 9C 02 E7 02 31 03 7B 03 C5 03 0F 04 5A 04 A4 04 00 00 80 01 40 02 1B 03 A9 03  ╜☺◘☻R☻£☻τ☻1♥{♥┼♥☼♦Z♦ñ♦..Ç☺@☻←♥⌐♥
000F09A0  27 04 9C 04 05 05 6C 05 CD 05 26 06 80 06 D4 06 26 07 73 07 C0 07 0A 08 88 00 88 00 88 00 88 00  '♦£♦♣♣l♣═♣&♠Ç♠╘♠&•s•└•◙◘ê.ê.ê.ê.
000F09C0  88 00 88 00 88 00 88 00 88 00 82 00 7C 00 78 00 78 00 78 00 78 00 78 00 78 00 00 00 00 00 00 00  ê.ê.ê.ê.ê.é.|.x.x.x.x.x.x.......
000F09E0  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ................................
000F0A00  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ................................
```

Offset: F0776 | Block: F0776-F07FF | Length: 8A | Overwrite

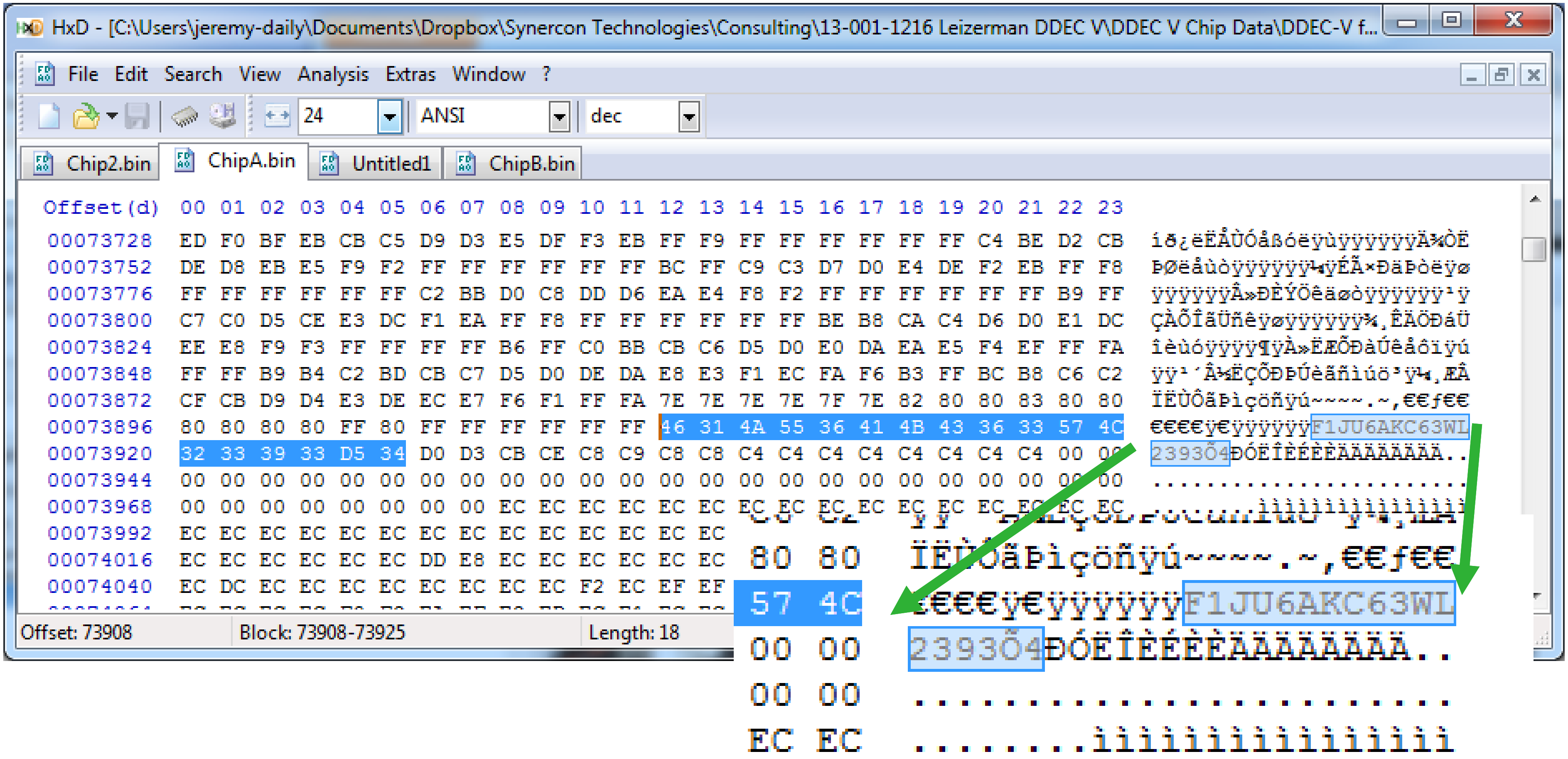
NEED TO DECODE AND INTERPRET SOME DATA

ITS ALL BINARY (HEX)!!

Human Readable Hex

Letters and numbers are encoded using ASCII.

Strategy: Look for known ASCII, like VIN and Serial Number.


HxD - [C:\Users\jeremy-daily\Documents\Dropbox\Synercon Technologies\Consulting\13-001-1216 Leizerman DDEC V\DDEC V Chip Data\DDEC-V f...
File Edit Search View Analysis Extras Window ?
Chip2.bin
ChipA.bin
Untitled1
ChipB.bin

24 | ANSI | dec

```
Offset(d) 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23

00073728  ED F0 BF EB CB C5 D9 D3 E5 DF F3 EB FF F9 FF FF FF FF FF FF C4 BE D2 CB  íð¿ëËÅÙÓåßóëÿùÿÿÿÿÿÿÄ¾ÒË
00073752  DE D8 EB E5 F9 F2 FF FF FF FF FF FF BC FF C9 C3 D7 D0 E4 DE F2 EB FF F8  ÞØëåùòÿÿÿÿÿÿ¼ÿÉÃ×ÐäÞòëÿø
00073776  FF FF FF FF FF FF C2 BB D0 C8 DD D6 EA E4 F8 F2 FF FF FF FF FF FF B9 FF  ÿÿÿÿÿÿÂ»ÐÈÝÖêäøòÿÿÿÿÿÿ¹ÿ
00073800  C7 C0 D5 CE E3 DC F1 EA FF F8 FF FF FF FF FF FF BE B8 CA C4 D6 D0 E1 DC  ÇÀÕÎãÜñêÿøÿÿÿÿÿÿ¾¸ÊÄÖÐáÜ
00073824  EE E8 F9 F3 FF FF FF FF B6 FF C0 BB CB C6 D5 D0 E0 DA EA E5 F4 EF FF FA  îèùóÿÿÿÿ¶ÿÀ»ËÆÕÐàÚêåôïÿú
00073848  FF FF B9 B4 C2 BD CB C7 D5 D0 DE DA E8 E3 F1 EC FA F6 B3 FF BC B8 C6 C2  ÿÿ¹´Â½ËÇÕÐÞÚèãñìúö³ÿ¼¸ÆÂ
00073872  CF CB D9 D4 E3 DE EC E7 F6 F1 FF FA 7E 7E 7E 7E 7F 7E 82 80 80 83 80 80  ÏËÙÔãÞìçöñÿú~~~~.~‚€€ƒ€€
00073896  80 80 80 80 FF 80 FF FF FF FF FF FF 46 31 4A 55 36 41 4B 43 36 33 57 4C  €€€€ÿ€ÿÿÿÿÿÿF1JU6AKC63WL
00073920  32 33 39 33 D5 34 D0 D3 CB CE C8 C9 C8 C8 C4 C4 C4 C4 C4 C4 C4 C4 00 00  2393Õ4ÐÓËÎÈÉÈÈÄÄÄÄÄÄÄÄ..
00073944  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ........................
00073968  00 00 00 00 00 00 00 00 EC EC EC EC EC EC EC EC EC EC EC EC EC EC EC EC  ........ìììììììììììììììì
00073992  EC EC EC EC EC EC EC EC EC EC EC EC EC EC
00074016  EC EC EC EC EC EC DD E8 EC EC EC EC EC EC
00074040  EC DC EC EC EC EC EC EC EC EC F2 EC EF EF
```

Offset: 73908 | Block: 73908-73925 | Length: 18

```
80 80   ÏËÙÔãÞìçöñÿú~~~~.~‚€€ƒ€€
57 4C   €€€€ÿ€ÿÿÿÿÿÿF1JU6AKC63WL
00 00   2393Õ4ÐÓËÎÈÉÈÈÄÄÄÄÄÄÄÄ..
00 00   ........................
EC EC   ........ìììììììììììììììì
```

2 Byte Reversals

The flash memory is used such that the bytes are stored with bytes that are reversed.

The VIN from the raw memory says:

F1 JU 6A KC 63 WL 23 93 ◊4

After swapping every 2 bytes, it becomes:

1FUJA6CK36LW32394

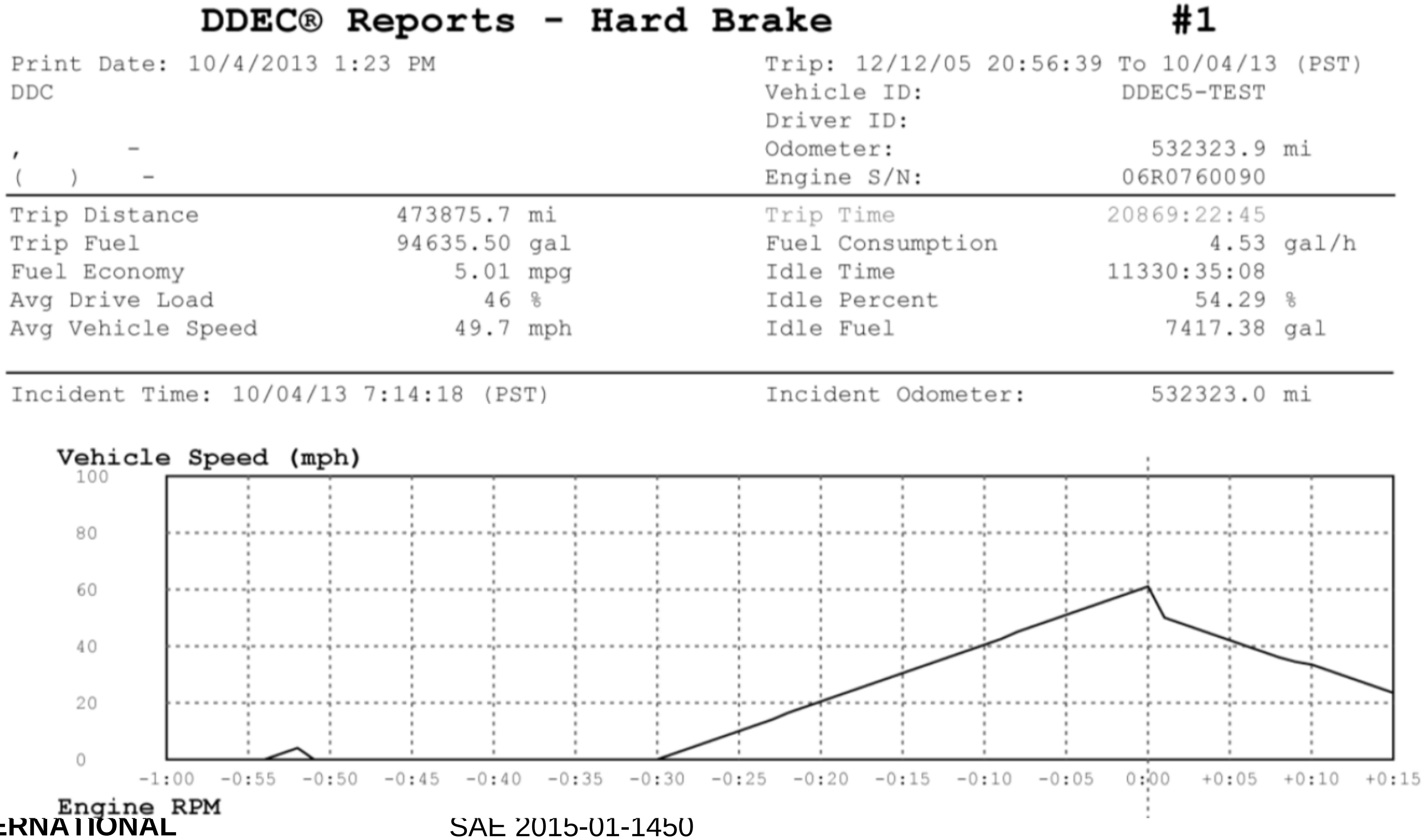
This is 18 bytes, but VINs are 17 characters

We can also find serial numbers (search for “R6”)

Simulated Data

Issue: Still need to decode the data…

Strategy: Get an exemplar ECM and put a known speed record on it to find the Hard Brake and Last Stop Events.



DDEC® Reports - Hard Brake #1

```
Print Date: 10/4/2013 1:23 PM              Trip: 12/12/05 20:56:39 To 10/04/13 (PST)
DDC                                        Vehicle ID:              DDEC5-TEST
                                           Driver ID:
,          -                               Odometer:                 532323.9 mi
(    )     -                               Engine S/N:              06R0760090
--------------------------------------------------------------------------------
Trip Distance          473875.7 mi         Trip Time               20869:22:45
Trip Fuel              94635.50 gal        Fuel Consumption               4.53 gal/h
Fuel Economy               5.01 mpg        Idle Time               11330:35:08
Avg Drive Load               46 %          Idle Percent                  54.29 %
Avg Vehicle Speed          49.7 mph        Idle Fuel                   7417.38 gal
--------------------------------------------------------------------------------
Incident Time: 10/04/13 7:14:18 (PST)      Incident Odometer:        532323.0 mi
```

Get help from the Network logs

DDEC Reports downloads data in 9 groups called data pages.

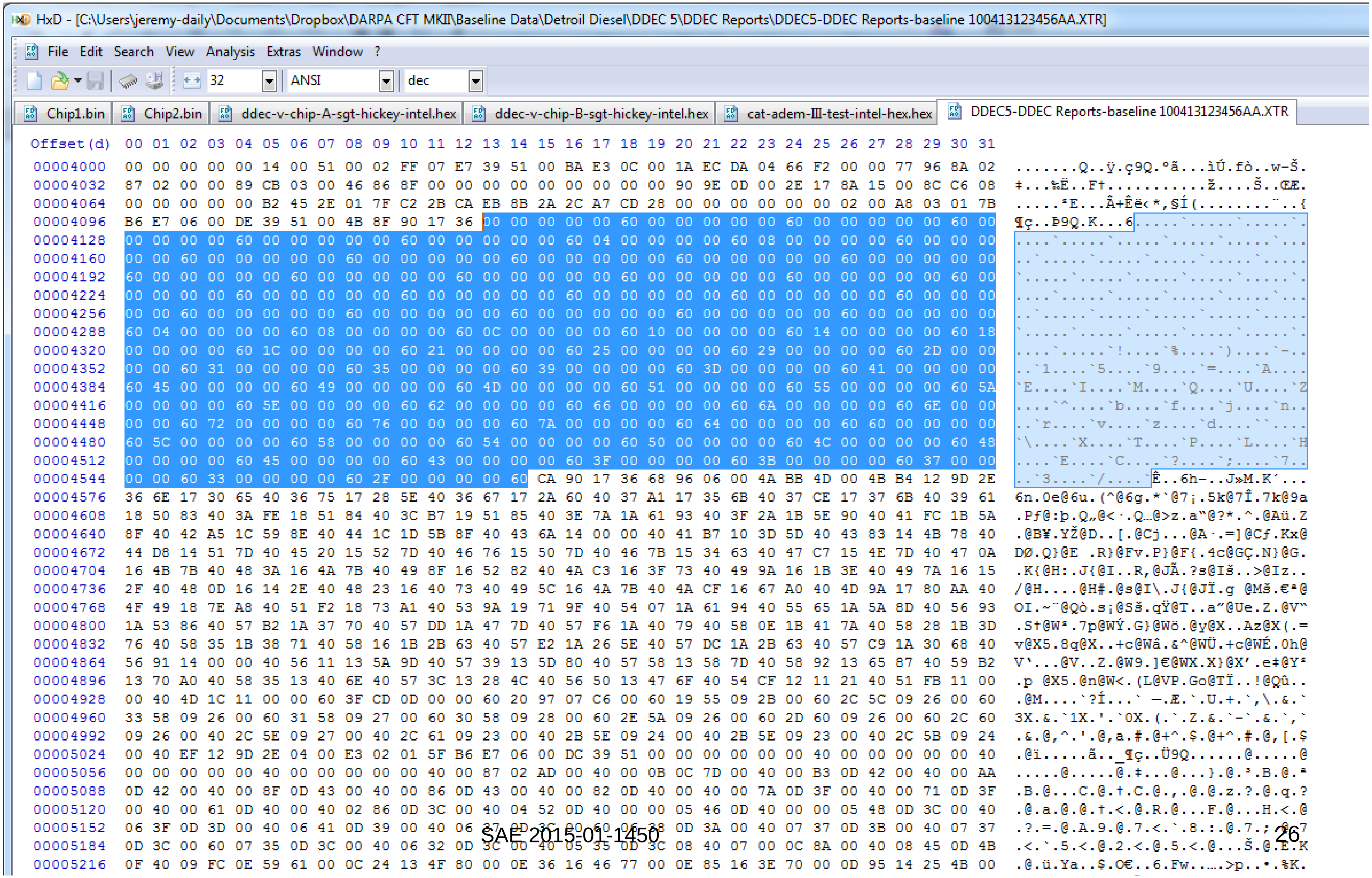
Use J1587 Transport layer to reconstruct the network traffic.

*.XTR file is close to a network log.

Borrowing from last year, we can map the XTR file contents to DDEC Reports elements. (2014-01-0495)

Enables pattern matching for data elements like Mileage and Times.

Find the Data pattern (Hard Brake)

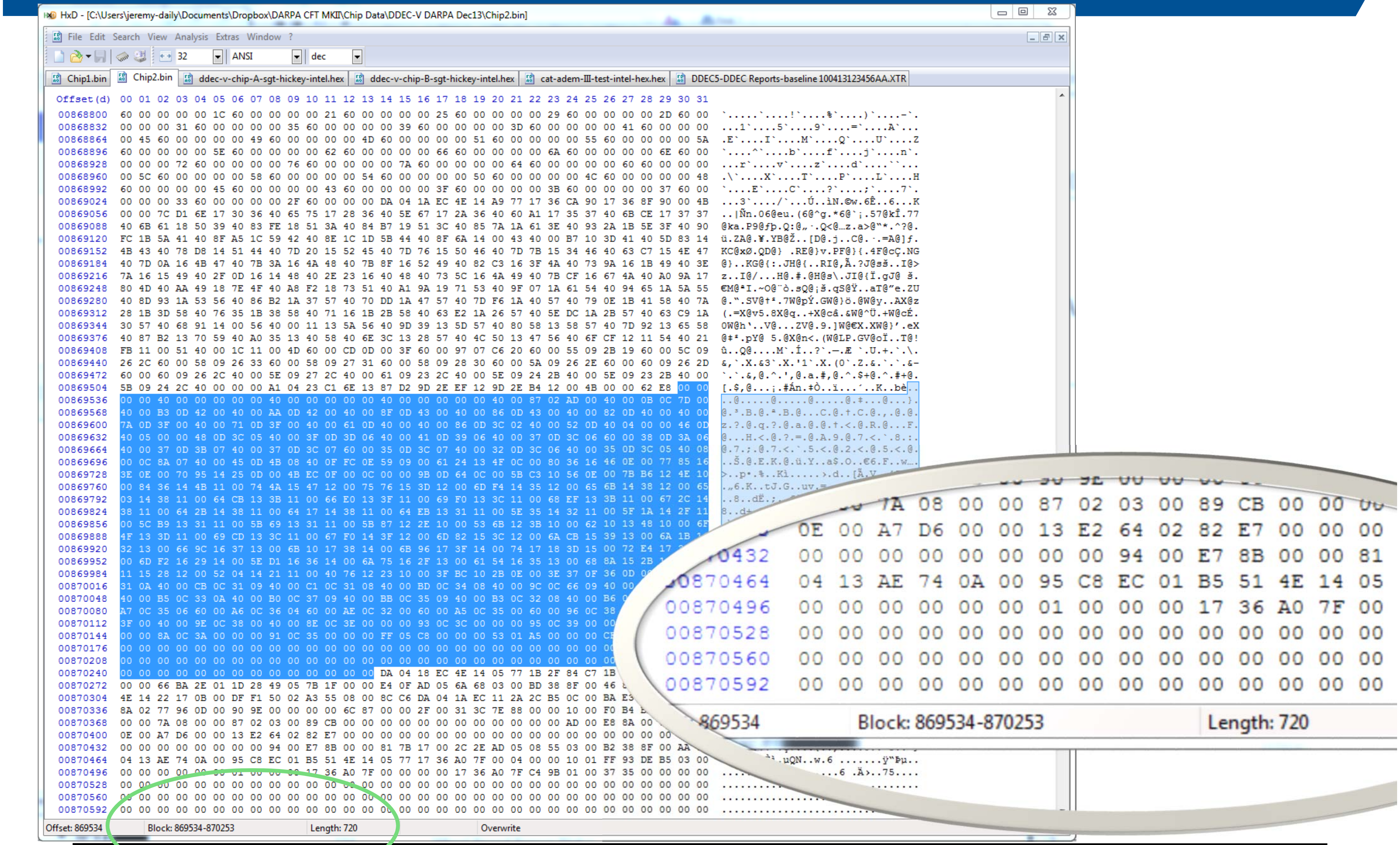

File
Edit
Search
View
Analysis
Extras
Window
?
Chip1.bin
Chip2.bin
ddec-v-chip-A-sgt-hickey-intel.hex
ddec-v-chip-B-sgt-hickey-intel.hex
cat-adem-III-test-intel-hex.hex
DDEC5-DDEC Reports-baseline 100413123456AA.XTR

HxD - [C:\Users\jeremy-daily\Documents\Dropbox\DARPA CFT MKII\Baseline Data\Detroil Diesel\DDEC 5\DDEC Reports\DDEC5-DDEC Reports-baseline 100413123456AA.XTR]

32 | ANSI | dec

```
Offset(d) 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

00004000  00 00 00 00 00 14 00 51 00 02 FF 07 E7 39 51 00 BA E3 0C 00 1A EC DA 04 66 F2 00 00 77 96 8A 02  ......Q..ÿ.ç9Q.ºã...ìÚ.fò..w–Š.
00004032  87 02 00 00 89 CB 03 00 46 86 8F 00 00 00 00 00 00 00 00 00 90 9E 0D 00 2E 17 8A 15 00 8C C6 08  ‡...‰Ë..F†..........ž....Š..ŒÆ.
00004064  00 00 00 00 00 B2 45 2E 01 7F C2 2B CA EB 8B 2A 2C A7 CD 28 00 00 00 00 00 00 02 00 A8 03 01 7B  .....²E...Â+Êë‹*,§Í(........¨..{
00004096  B6 E7 06 00 DE 39 51 00 4B 8F 90 17 36 00 00 00 00 00 60 00 00 00 00 00 60 00 00 00 00 00 60 00  ¶ç..Þ9Q.K...6.....`.....`.....`.
00004128  00 00 00 00 60 00 00 00 00 00 60 00 00 00 00 00 60 04 00 00 00 00 60 08 00 00 00 00 60 00 00 00  ....`.....`.....`.....`.....`...
00004160  00 00 60 00 00 00 00 00 60 00 00 00 00 00 60 00 00 00 00 00 60 00 00 00 00 00 60 00 00 00 00 00  ..`.....`.....`.....`.....`.....
00004192  60 00 00 00 00 00 60 00 00 00 00 00 60 00 00 00 00 00 60 00 00 00 00 00 60 00 00 00 00 00 60 00  `.....`.....`.....`.....`.....`.
00004224  00 00 00 00 60 00 00 00 00 00 60 00 00 00 00 00 60 00 00 00 00 00 60 00 00 00 00 00 60 00 00 00  ....`.....`.....`.....`.....`...
00004256  00 00 60 00 00 00 00 00 60 00 00 00 00 00 60 00 00 00 00 00 60 00 00 00 00 00 60 00 00 00 00 00  ..`.....`.....`.....`.....`.....
00004288  60 04 00 00 00 00 60 08 00 00 00 00 60 0C 00 00 00 00 60 10 00 00 00 00 60 14 00 00 00 00 60 18  `.....`.....`.....`.....`.....`.
00004320  00 00 00 00 60 1C 00 00 00 00 60 21 00 00 00 00 60 25 00 00 00 00 60 29 00 00 00 00 60 2D 00 00  ....`.....`!....`%....`)....`-..
00004352  00 00 60 31 00 00 00 00 60 35 00 00 00 00 60 39 00 00 00 00 60 3D 00 00 00 00 60 41 00 00 00 00  ..`1....`5....`9....`=....`A....
00004384  60 45 00 00 00 00 60 49 00 00 00 00 60 4D 00 00 00 00 60 51 00 00 00 00 60 55 00 00 00 00 60 5A  `E....`I....`M....`Q....`U....`Z
00004416  00 00 00 00 60 5E 00 00 00 00 60 62 00 00 00 00 60 66 00 00 00 00 60 6A 00 00 00 00 60 6E 00 00  ....`^....`b....`f....`j....`n..
00004448  00 00 60 72 00 00 00 00 60 76 00 00 00 00 60 7A 00 00 00 00 60 64 00 00 00 00 60 60 00 00 00 00  ..`r....`v....`z....`d....``....
00004480  60 5C 00 00 00 00 60 58 00 00 00 00 60 54 00 00 00 00 60 50 00 00 00 00 60 4C 00 00 00 00 60 48  `\....`X....`T....`P....`L....`H
00004512  00 00 00 00 60 45 00 00 00 00 60 43 00 00 00 00 60 3F 00 00 00 00 60 3B 00 00 00 00 60 37 00 00  ....`E....`C....`?....`;....`7..
00004544  00 00 60 33 00 00 00 00 60 2F 00 00 00 00 60 CA 90 17 36 68 96 06 00 4A BB 4D 00 4B B4 12 9D 2E  ..`3....`/....`Ê..6h–..J»M.K´...
00004576  36 6E 17 30 65 40 36 75 17 28 5E 40 36 67 17 2A 60 40 37 A1 17 35 6B 40 37 CE 17 37 6B 40 39 61  6n.0e@6u.(^@6g.*`@7¡.5k@7Î.7k@9a
00004608  18 50 83 40 3A FE 18 51 84 40 3C B7 19 51 85 40 3E 7A 1A 61 93 40 3F 2A 1B 5E 90 40 41 FC 1B 5A  .Pƒ@:þ.Q„@<·.Q…@>z.a“@?*.^.@Aü.Z
00004640  8F 40 42 A5 1C 59 8E 40 44 1C 1D 5B 8F 40 43 6A 14 00 00 40 41 B7 10 3D 5D 40 43 83 14 4B 78 40  .@B¥.YŽ@D..[.@Cj...@A·.=]@Cƒ.Kx@
00004672  44 D8 14 51 7D 40 45 20 15 52 7D 40 46 76 15 50 7D 40 46 7B 15 34 63 40 47 C7 15 4E 7D 40 47 0A  DØ.Q}@E .R}@Fv.P}@F{.4c@GÇ.N}@G.
00004704  16 4B 7B 40 48 3A 16 4A 7B 40 49 8F 16 52 82 40 4A C3 16 3F 73 40 49 9A 16 1B 3E 40 49 7A 16 15  .K{@H:.J{@I..R‚@JÃ.?s@Iš..>@Iz..
00004736  2F 40 48 0D 16 14 2E 40 48 23 16 40 73 40 49 5C 16 4A 7B 40 4A CF 16 67 A0 40 4D 9A 17 80 AA 40  /@H....@H#.@s@I\.J{@JÏ.g @Mš.€ª@
00004768  4F 49 18 7E A8 40 51 F2 18 73 A1 40 53 9A 19 71 9F 40 54 07 1A 61 94 40 55 65 1A 5A 8D 40 56 93  OI.~¨@Qò.s¡@Sš.qŸ@T..a”@Ue.Z.@V“
00004800  1A 53 86 40 57 B2 1A 37 70 40 57 DD 1A 47 7D 40 57 F6 1A 40 79 40 58 0E 1B 41 7A 40 58 28 1B 3D  .S†@W².7p@WÝ.G}@Wö.@y@X..Az@X(.=
00004832  76 40 58 35 1B 38 71 40 58 16 1B 2B 63 40 57 E2 1A 26 5E 40 57 DC 1A 2B 63 40 57 C9 1A 30 68 40  v@X5.8q@X..+c@Wâ.&^@WÜ.+c@WÉ.0h@
00004864  56 91 14 00 00 40 56 11 13 5A 9D 40 57 39 13 5D 80 40 57 58 13 58 7D 40 58 92 13 65 87 40 59 B2  V‘...@V..Z.@W9.]€@WX.X}@X’.e‡@Y²
00004896  13 70 A0 40 58 35 13 40 6E 40 57 3C 13 28 4C 40 56 50 13 47 6F 40 54 CF 12 11 21 40 51 FB 11 00  .p @X5.@n@W<.(L@VP.Go@TÏ..!@Qû..
00004928  00 40 4D 1C 11 00 00 60 3F CD 0D 00 00 60 20 97 07 C6 00 60 19 55 09 2B 00 60 2C 5C 09 26 00 60  .@M....`?Í...` —.Æ.`.U.+.`,\.&.`
00004960  33 58 09 26 00 60 31 58 09 27 00 60 30 58 09 28 00 60 2E 5A 09 26 00 60 2D 60 09 26 00 60 2C 60  3X.&.`1X.'.`0X.(.`.Z.&.`-`.&.`,`
00004992  09 26 00 40 2C 5E 09 27 00 40 2C 61 09 23 00 40 2B 5E 09 24 00 40 2B 5E 09 23 00 40 2C 5B 09 24  .&.@,^.'.@,a.#.@+^.$.@+^.#.@,[.$
00005024  00 40 EF 12 9D 2E 04 00 E3 02 01 5F B6 E7 06 00 DC 39 51 00 00 00 00 00 00 40 00 00 00 00 00 40  .@ï.....ã.._¶ç..Ü9Q......@.....@
00005056  00 00 00 00 00 40 00 00 00 00 00 40 00 87 02 AD 00 40 00 0B 0C 7D 00 40 00 B3 0D 42 00 40 00 AA  .....@.....@.‡...@...}.@.³.B.@.ª
00005088  0D 42 00 40 00 8F 0D 43 00 40 00 86 0D 43 00 40 00 82 0D 40 00 40 00 7A 0D 3F 00 40 00 71 0D 3F  .B.@...C.@.†.C.@.‚.@.@.z.?.@.q.?
00005120  00 40 00 61 0D 40 00 40 02 86 0D 3C 00 40 04 52 0D 40 00 00 05 46 0D 40 00 00 05 48 0D 3C 00 40  .@.a.@.@.†.<.@.R.@...F.@...H.<.@
00005152  06 3F 0D 3D 00 40 06 41 0D 39 00 40 06 37 0D 3C 00 60 06 38 0D 3A 00 40 07 37 0D 3B 00 40 07 37  .?.=.@.A.9.@.7.<.`.8.:.@.7.;.@.7
00005184  0D 3C 00 60 07 35 0D 3C 00 40 06 32 0D 3C 00 40 05 35 0D 3C 08 40 07 00 0C 8A 00 40 08 45 0D 4B  .<.`.5.<.@.2.<.@.5.<.@...Š.@.E.K
00005216  0F 40 09 FC 0E 59 61 00 0C 24 13 4F 80 00 0E 36 16 46 77 00 0E 85 16 3E 70 00 0D 95 14 25 4B 00  .@.ü.Ya..$.O€..6.Fw...….>p..•.%K.
```

Last Stop Data



HxD - [C:\Users\jeremy-daily\Documents\Dropbox\DARPA CFT MKII\Chip Data\DDEC-V DARPA Dec13\Chip2.bin]
File Edit Search View Analysis Extras Window ?
32
ANSI
dec
Chip1.bin
Chip2.bin
ddec-v-chip-A-sgt-hickey-intel.hex
ddec-v-chip-B-sgt-hickey-intel.hex
cat-adem-III-test-intel-hex.hex
DDEC5-DDEC Reports-baseline 100413123456AA.XTR

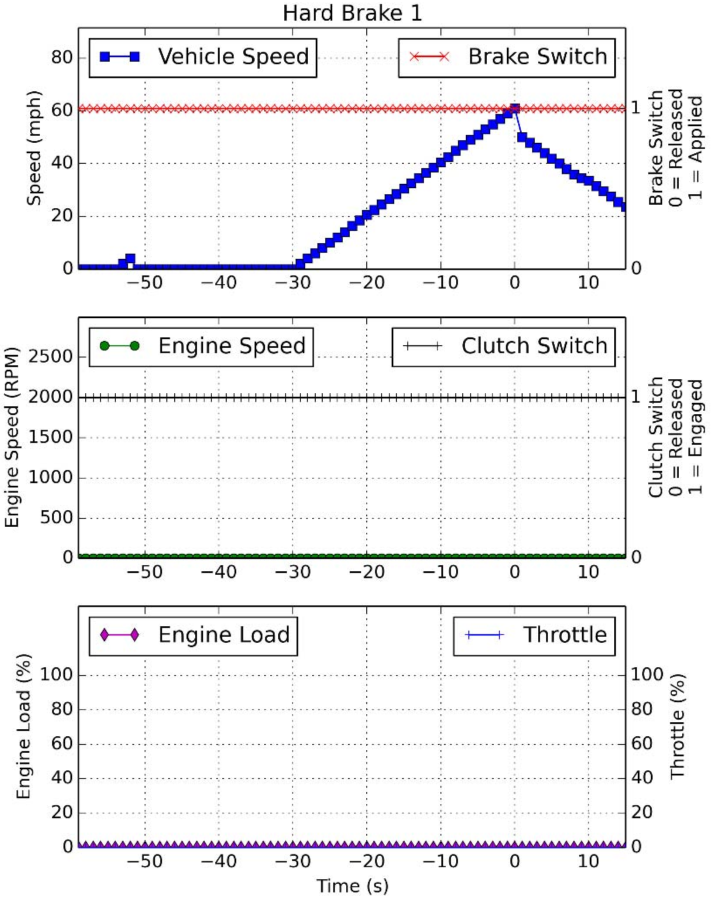
```
Offset(d) 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
00868800  60 00 00 00 00 1C 60 00 00 00 00 21 60 00 00 00 00 25 60 00 00 00 00 29 60 00 00 00 00 2D 60 00  `.....`....!`....%`....)`....-`.
00868832  00 00 00 31 60 00 00 00 00 35 60 00 00 00 00 39 60 00 00 00 00 3D 60 00 00 00 00 41 60 00 00 00  ...1`....5`....9`....=`....A`...
00868864  00 45 60 00 00 00 00 49 60 00 00 00 00 4D 60 00 00 00 00 51 60 00 00 00 00 55 60 00 00 00 00 5A  .E`....I`....M`....Q`....U`....Z
00868896  60 00 00 00 00 5E 60 00 00 00 00 62 60 00 00 00 00 66 60 00 00 00 00 6A 60 00 00 00 00 6E 60 00  `....^`....b`....f`....j`....n`.
00868928  00 00 00 72 60 00 00 00 00 76 60 00 00 00 00 7A 60 00 00 00 00 64 60 00 00 00 00 60 60 00 00 00  ...r`....v`....z`....d`....``...
00868960  00 5C 60 00 00 00 00 58 60 00 00 00 00 54 60 00 00 00 00 50 60 00 00 00 00 4C 60 00 00 00 00 48  .\`....X`....T`....P`....L`....H
00868992  60 00 00 00 00 45 60 00 00 00 00 43 60 00 00 00 00 3F 60 00 00 00 00 3B 60 00 00 00 00 37 60 00  `....E`....C`....?`....;`....7`.
00869024  00 00 00 33 60 00 00 00 00 2F 60 00 00 00 DA 04 1A EC 4E 14 A9 77 17 36 CA 90 17 36 8F 90 00 4B  ...3`..../`...Ú..ìN.©w.6Ê..6...K
00869056  00 00 7C D1 6E 17 30 36 40 65 75 17 28 36 40 5E 67 17 2A 36 40 60 A1 17 35 37 40 6B CE 17 37 37  ..|Ñn.06@eu.(6@^g.*6@`¡.57@kÎ.77
00869088  40 6B 61 18 50 39 40 83 FE 18 51 3A 40 84 B7 19 51 3C 40 85 7A 1A 61 3E 40 93 2A 1B 5E 3F 40 90  @ka.P9@ƒþ.Q:@„·.Q<@…z.a>@“*.^?@.
00869120  FC 1B 5A 41 40 8F A5 1C 59 42 40 8E 1C 1D 5B 44 40 8F 6A 14 00 43 40 00 B7 10 3D 41 40 5D 83 14  ü.ZA@.¥.YB@Ž..[D@.j..C@.·.=A@]ƒ.
00869152  4B 43 40 78 D8 14 51 44 40 7D 20 15 52 45 40 7D 76 15 50 46 40 7D 7B 15 34 46 40 63 C7 15 4E 47  KC@xØ.QD@} .RE@}v.PF@}{.4F@cÇ.NG
00869184  40 7D 0A 16 4B 47 40 7B 3A 16 4A 48 40 7B 8F 16 52 49 40 82 C3 16 3F 4A 40 73 9A 16 1B 49 40 3E  @}..KG@{:.JH@{..RI@‚Ã.?J@sš..I@>
00869216  7A 16 15 49 40 2F 0D 16 14 48 40 2E 23 16 40 48 40 73 5C 16 4A 49 40 7B CF 16 67 4A 40 A0 9A 17  z..I@/...H@.#.@H@s\.JI@{Ï.gJ@ š.
00869248  80 4D 40 AA 49 18 7E 4F 40 A8 F2 18 73 51 40 A1 9A 19 71 53 40 9F 07 1A 61 54 40 94 65 1A 5A 55  €M@ªI.~O@¨ò.sQ@¡š.qS@Ÿ..aT@”e.ZU
00869280  40 8D 93 1A 53 56 40 86 B2 1A 37 57 40 70 DD 1A 47 57 40 7D F6 1A 40 57 40 79 0E 1B 41 58 40 7A  @.“.SV@†².7W@pÝ.GW@}ö.@W@y..AX@z
00869312  28 1B 3D 58 40 76 35 1B 38 58 40 71 16 1B 2B 58 40 63 E2 1A 26 57 40 5E DC 1A 2B 57 40 63 C9 1A  (.=X@v5.8X@q..+X@câ.&W@^Ü.+W@cÉ.
00869344  30 57 40 68 91 14 00 56 40 00 11 13 5A 56 40 9D 39 13 5D 57 40 80 58 13 58 57 40 7D 92 13 65 58  0W@h‘..V@...ZV@.9.]W@€X.XW@}’.eX
00869376  40 87 B2 13 70 59 40 A0 35 13 40 58 40 6E 3C 13 28 57 40 4C 50 13 47 56 40 6F CF 12 11 54 40 21  @‡².pY@ 5.@X@n<.(W@LP.GV@oÏ..T@!
00869408  FB 11 00 51 40 00 1C 11 00 4D 60 00 CD 0D 00 3F 60 00 97 07 C6 20 60 00 55 09 2B 19 60 00 5C 09  û..Q@....M`.Í..?`.—.Æ `.U.+.`.\.
00869440  26 2C 60 00 58 09 26 33 60 00 58 09 27 31 60 00 58 09 28 30 60 00 5A 09 26 2E 60 00 60 09 26 2D  &,`.X.&3`.X.'1`.X.(0`.Z.&.`.`.&-
00869472  60 00 60 09 26 2C 40 00 5E 09 27 2C 40 00 61 09 23 2C 40 00 5E 09 24 2B 40 00 5E 09 23 2B 40 00  `.`.&,@.^.',@.a.#,@.^.$+@.^.#+@.
00869504  5B 09 24 2C 40 00 00 00 A1 04 23 C1 6E 13 87 D2 9D 2E EF 12 9D 2E B4 12 00 4B 00 00 62 E8 00 00  [.$,@...¡.#Án.‡Ò..ï...´..K..bè..
00869536  00 00 40 00 00 00 00 00 40 00 00 00 00 00 40 00 00 00 00 00 40 00 87 02 AD 00 40 00 0B 0C 7D 00  ..@.....@.....@.....@.‡...@...}.
00869568  40 00 B3 0D 42 00 40 00 AA 0D 42 00 40 00 8F 0D 43 00 40 00 86 0D 43 00 40 00 82 0D 40 00 40 00  @.³.B.@.ª.B.@...C.@.†.C.@.‚.@.@.
00869600  7A 0D 3F 00 40 00 71 0D 3F 00 40 00 61 0D 40 00 40 00 86 0D 3C 02 40 00 52 0D 40 04 00 00 46 0D  z.?.@.q.?.@.a.@.@.†.<.@.R.@...F.
00869632  40 05 00 00 48 0D 3C 05 40 00 3F 0D 3D 06 40 00 41 0D 39 06 40 00 37 0D 3C 06 60 00 38 0D 3A 06  @...H.<.@.?.=.@.A.9.@.7.<.`.8.:.
00869664  40 00 37 0D 3B 07 40 00 37 0D 3C 07 60 00 35 0D 3C 07 40 00 32 0D 3C 06 40 00 35 0D 3C 05 40 08  @.7.;.@.7.<.`.5.<.@.2.<.@.5.<.@.
00869696  00 0C 8A 07 40 00 45 0D 4B 08 40 0F FC 0E 59 09 00 61 24 13 4F 0C 00 80 36 16 46 0E 00 77 85 16  ..Š.@.E.K.@.ü.Y..a$.O..€6.F..w...
00869728  3E 0E 00 70 95 14 25 0D 00 4B EC 0F 00 0C 00 00 9B 0D 64 0C 00 5B C3 10 56 0E 00 7B B6 12 4E 10  >..p•.%..Kì.....›.d..[Ã.V
00869760  00 84 36 14 4B 11 00 74 4A 15 47 12 00 75 76 15 3D 12 00 6D F4 14 35 12 00 65 6B 14 38 12 00 65  .„6.K..tJ.G..uv.=
00869792  03 14 38 11 00 64 CB 13 3B 11 00 66 E0 13 3F 11 00 69 F0 13 3C 11 00 68 EF 13 3B 11 00 67 2C 14  ..8..dË.;.
00869824  38 11 00 64 2B 14 38 11 00 64 17 14 38 11 00 64 EB 13 31 11 00 5E 35 14 32 11 00 5F 1A 14 2F 11  8..d+
00869856  00 5C B9 13 31 11 00 5B 69 13 31 11 00 5B 87 12 2E 10 00 53 6B 12 3B 10 00 62 10 13 48 10 00 6F
00869888  4F 13 3D 11 00 69 CD 13 3C 11 00 67 F0 14 3F 12 00 6D 82 15 3C 12 00 6A CB 15 39 13 00 6A 1B
00869920  32 13 00 66 9C 16 37 13 00 6B 10 17 38 14 00 6B 96 17 3F 14 00 74 17 18 3D 15 00 72 E4 17
00869952  00 6D F2 16 29 14 00 5E D1 16 36 14 00 6A 75 16 2F 13 00 61 54 16 35 13 00 68 8A 15 2B
00869984  11 15 28 12 00 52 04 14 21 11 00 40 76 12 23 10 00 3F BC 10 2B 0E 00 3E 37 0F 36 0D
00870016  31 0A 40 00 CB 0C 31 09 40 00 C1 0C 31 08 40 00 BD 0C 34 08 40 00 9C 0C 66 09 40 00
00870048  40 00 B5 0C 33 0A 40 00 B0 0C 37 09 40 00 BB 0C 35 09 40 00 B3 0C 32 08 40 00 B6
00870080  A7 0C 35 06 60 00 A6 0C 36 04 60 00 AE 0C 32 00 60 00 A5 0C 35 00 60 00 96 0C 38
00870112  3F 00 40 00 9E 0C 38 00 40 00 8E 0C 3E 00 00 00 93 0C 3C 00 00 00 95 0C 39 00 00
00870144  00 00 8A 0C 3A 00 00 00 91 0C 35 00 00 00 FF 05 C8 00 00 00 53 01 A5 00 00 00
00870176  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00870208  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00870240  00 00 00 00 00 00 00 00 00 00 00 00 00 00 DA 04 18 EC 4E 14 05 77 1B 2F 84 C7 1B
00870272  00 00 66 BA 2E 01 1D 28 49 05 7B 1F 00 00 E4 0F AD 05 6A 68 03 00 BD 38 8F 00 46
00870304  4E 14 22 17 0B 00 DF F1 50 02 A3 55 08 00 8C C6 DA 04 1A EC 11 2A 2C B5 0C 00 BA E3
00870336  8A 02 77 96 0D 00 90 9E 00 00 00 00 6C 87 00 00 2F 00 31 3C 7E 88 00 00 10 00 F0 B4
00870368  00 00 7A 08 00 00 87 02 03 00 89 CB 00 00 00 00 00 00 00 00 00 00 00 00 AD 00 E8 8A 00
00870400  0E 00 A7 D6 00 00 13 E2 64 02 82 E7 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00870432  00 00 00 00 00 00 00 00 94 00 E7 8B 00 00 81 7B 17 00 2C 2E AD 05 08 55 03 00 B2 38 8F 00 AA
00870464  04 13 AE 74 0A 00 95 C8 EC 01 B5 51 4E 14 05 77 17 36 A0 7F 00 04 00 00 10 01 FF 93 DE B5 03 00  .uQN..w.6 .......ÿ“Þµ..
00870496  00 00 00 00 00 00 01 00 00 00 17 36 A0 7F 00 00 00 00 17 36 A0 7F C4 9B 01 00 37 35 00 00 00 00  ....6 .Ä›..75....
00870528  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ................................
00870560  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ................................
00870592  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ................................
```

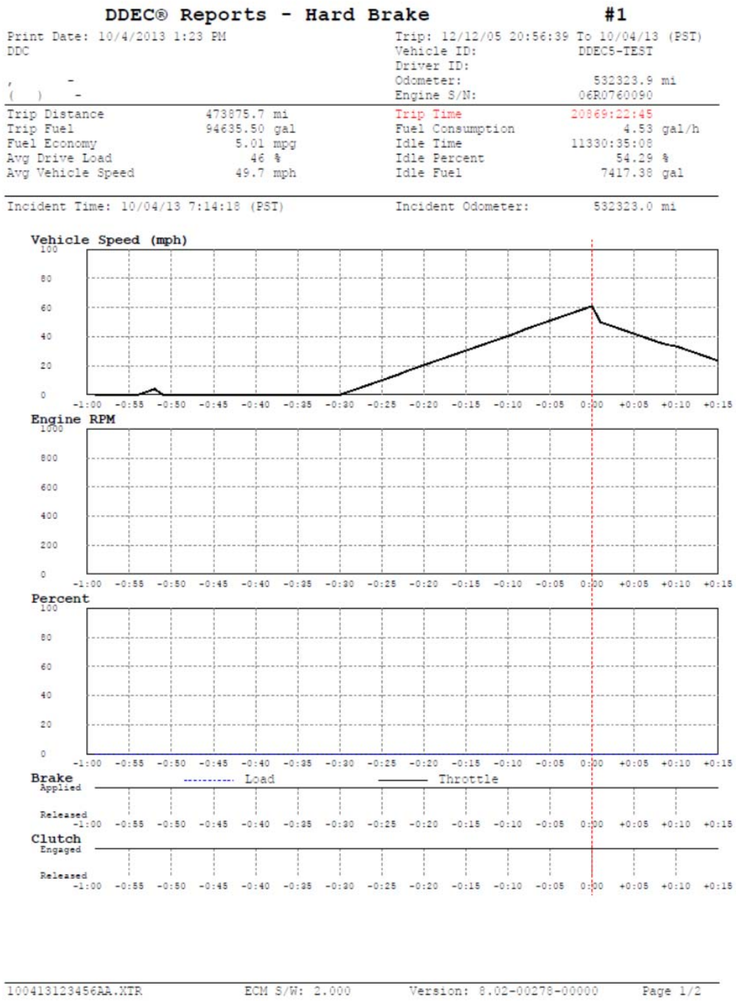
Offset: 869534 | Block: 869534-870253 | Length: 720 | Overwrite

```
          7A 08 00 00 87 02 03 00 89 CB 00 00
          0E 00 A7 D6 00 00 13 E2 64 02 82 E7 00 00 00
  0432    00 00 00 00 00 00 00 00 94 00 E7 8B 00 00 81
00870464  04 13 AE 74 0A 00 95 C8 EC 01 B5 51 4E 14 05
00870496  00 00 00 00 00 00 01 00 00 00 17 36 A0 7F 00
00870528  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00870560  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00870592  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
```

869534 | Block: 869534-870253 | Length: 720

Hard Brake 1 Comparison

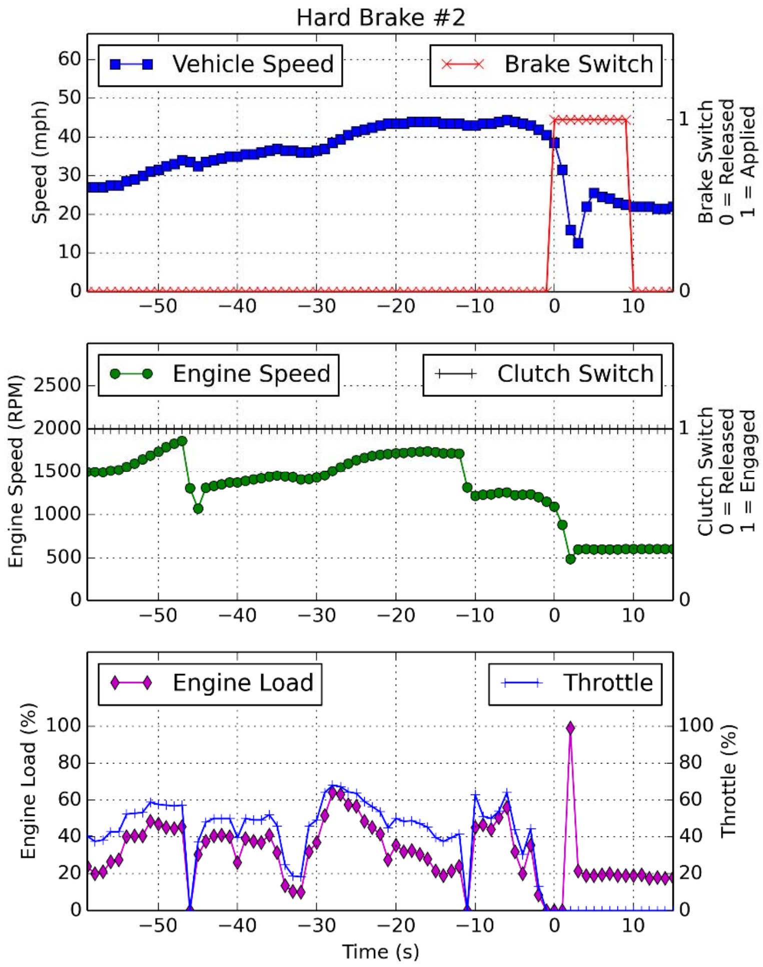


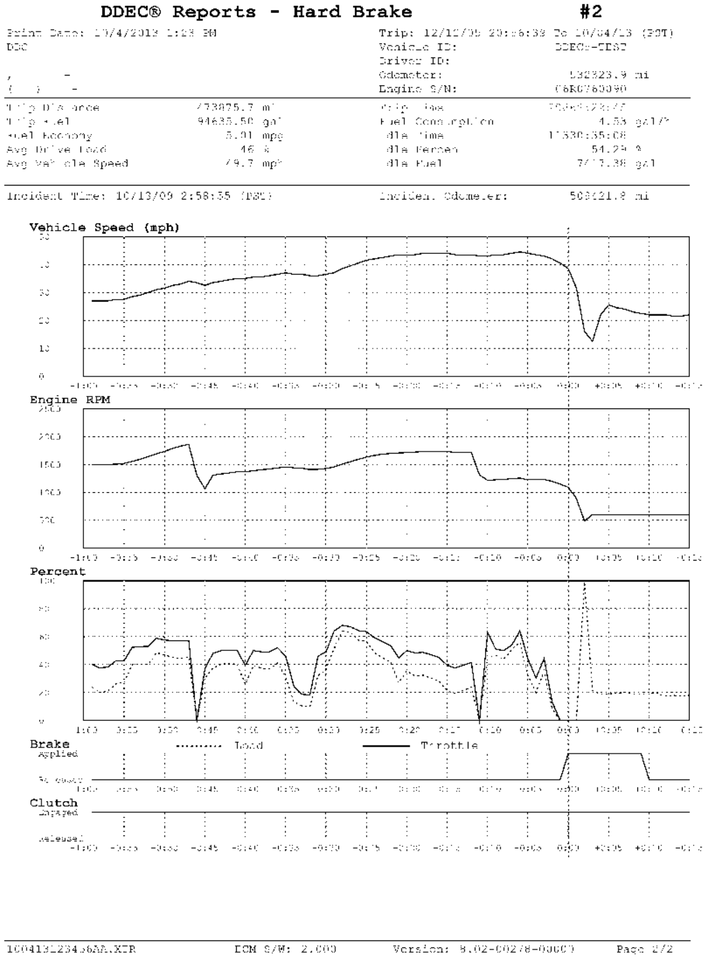


```
DDEC® Reports - Hard Brake                    #1
Print Date: 10/4/2013 1:23 PM          Trip: 12/12/05 20:56:39 To 10/04/13 (PST)
DDC                                    Vehicle ID:              DDEC5-TEST
                                       Driver ID:
,      -                               Odometer:                 532323.9 mi
(   )     -                            Engine S/N:              06R0760090
Trip Distance          473875.7 mi     Trip Time               20869:22:45
Trip Fuel              94635.50 gal    Fuel Consumption               4.53 gal/h
Fuel Economy               5.01 mpg    Idle Time               11330:35:08
Avg Drive Load               46 %      Idle Percent                  54.29 %
Avg Vehicle Speed          49.7 mph    Idle Fuel                   7417.38 gal

Incident Time: 10/04/13 7:14:18 (PST)  Incident Odometer:         532323.0 mi
```

```
100413123456AA.XTR      ECM S/W: 2.000      Version: 8.02-00278-00000      Page 1/2
```

Hard Brake 2 Comparison





DDEC® Reports - Hard Brake #2

Print Date: 10/4/2013 1:23 PM
DDC

Trip: 12/12/05 20:?6:39 To 10/04/13 (PST)
Vehicle ID: DDEC?-TEST
Driver ID:
Odometer: 532323.9 mi
Engine S/N: 06R0760090

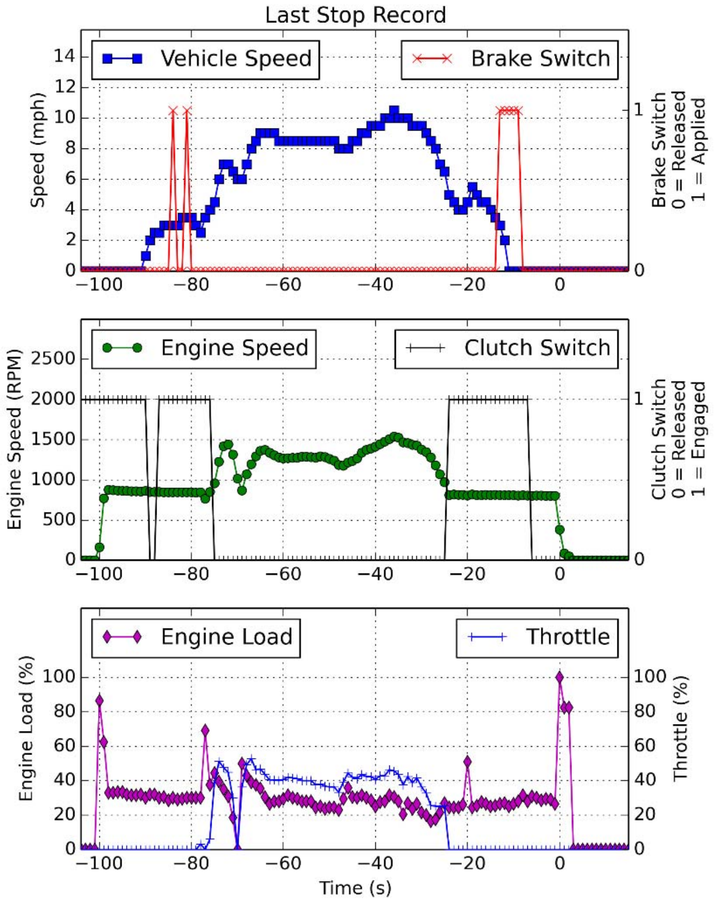
Trip Distance 473875.7 mi
Trip Fuel 94635.50 gal
Fuel Economy 5.01 mpg
Avg Drive Load 46 %
Avg Vehicle Speed 49.7 mph

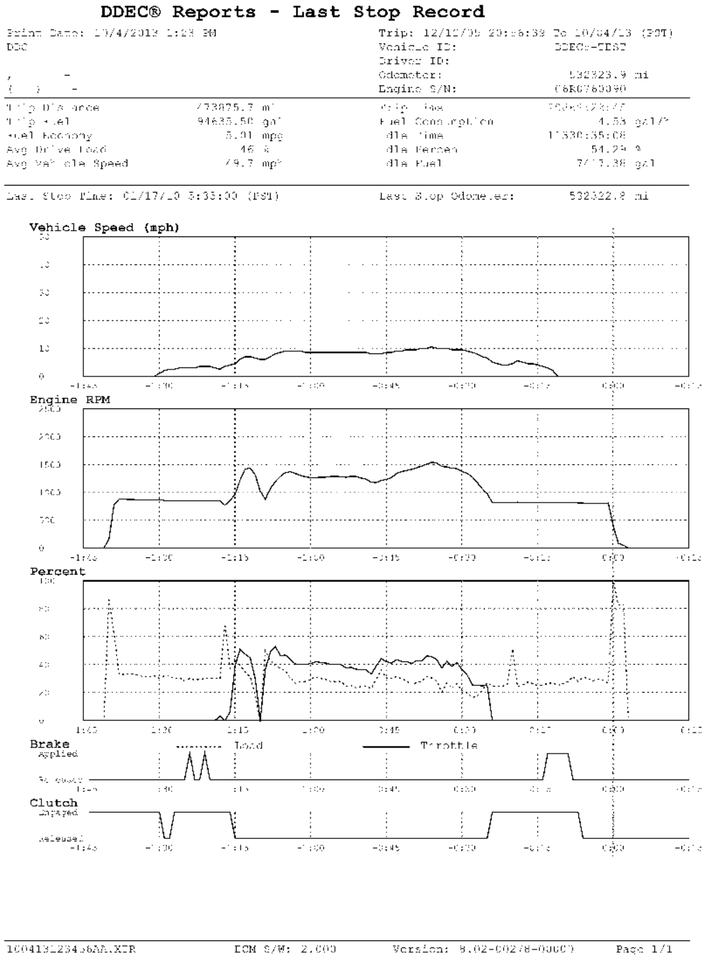
Trip Time [illegible]
Fuel Consumption 4.53 gal/h
Idle Time 11530:35:08
Idle Percent 54.29 %
Idle Fuel 7?17.38 gal

Incident Time: 10/13/09 2:58:35 (PST)
Incident Odometer: 503421.8 mi

1004131234 56AA.XTR ECM S/W: 2.000 Version: 8.02-0027 8-00000 Page 2/2

Last Stop Comparison

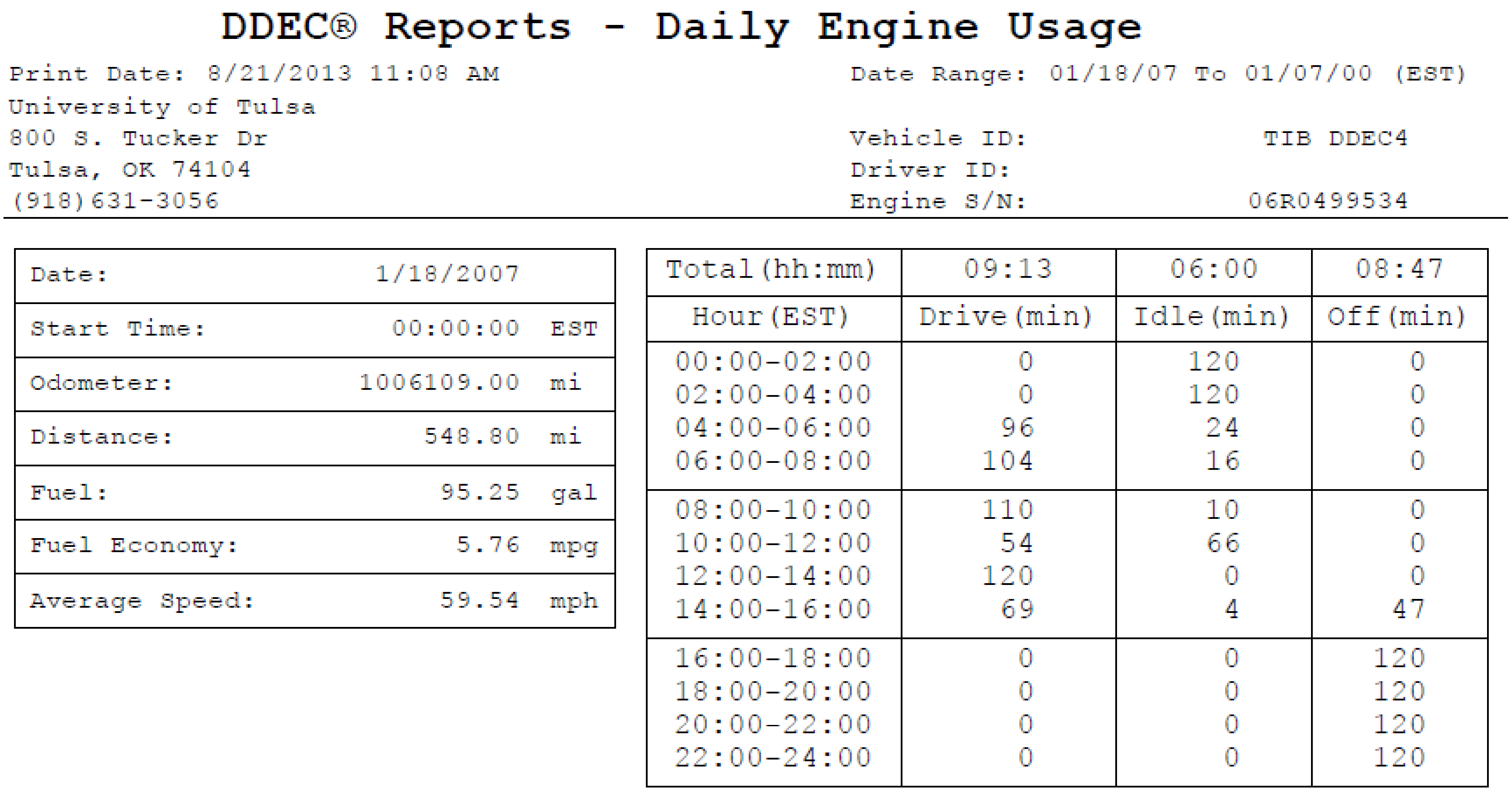




```
DDEC® Reports - Last Stop Record
Print Date: 10/4/2013 1:23 PM                  Trip: 12/12/05 20:56:39 To 10/04/13 (PST)
DDC                                            Vehicle ID:           DDECx-TEST
                                               Driver ID:
,      -                                       Odometer:              532323.9 mi
(   )   -                                      Engine S/N:           06R0760090
Trip Distance           473875.7 mi            Trip Time             [illegible]
Trip Fuel               94635.50 gal           Fuel Consumption          4.53 gal/h
Fuel Economy                5.01 mpg           Idle Time            11530:35:08
Avg Drive Load                46 %             Idle Percent             54.29 %
Avg Vehicle Speed           49.7 mph           Idle Fuel              7417.38 gal

Last Stop Time: 01/17/10 5:33:00 (PST)         Last Stop Odometer:     532322.8 mi
```

```
1004131234 56AA.XTR        ECM S/W: 2.000        Version: 8.02-00278-00000        Page 1/1
```

Daily Engine Usage



DDEC® Reports - Daily Engine Usage

Print Date: 8/21/2013 11:08 AM
University of Tulsa
800 S. Tucker Dr
Tulsa, OK 74104
(918)631-3056

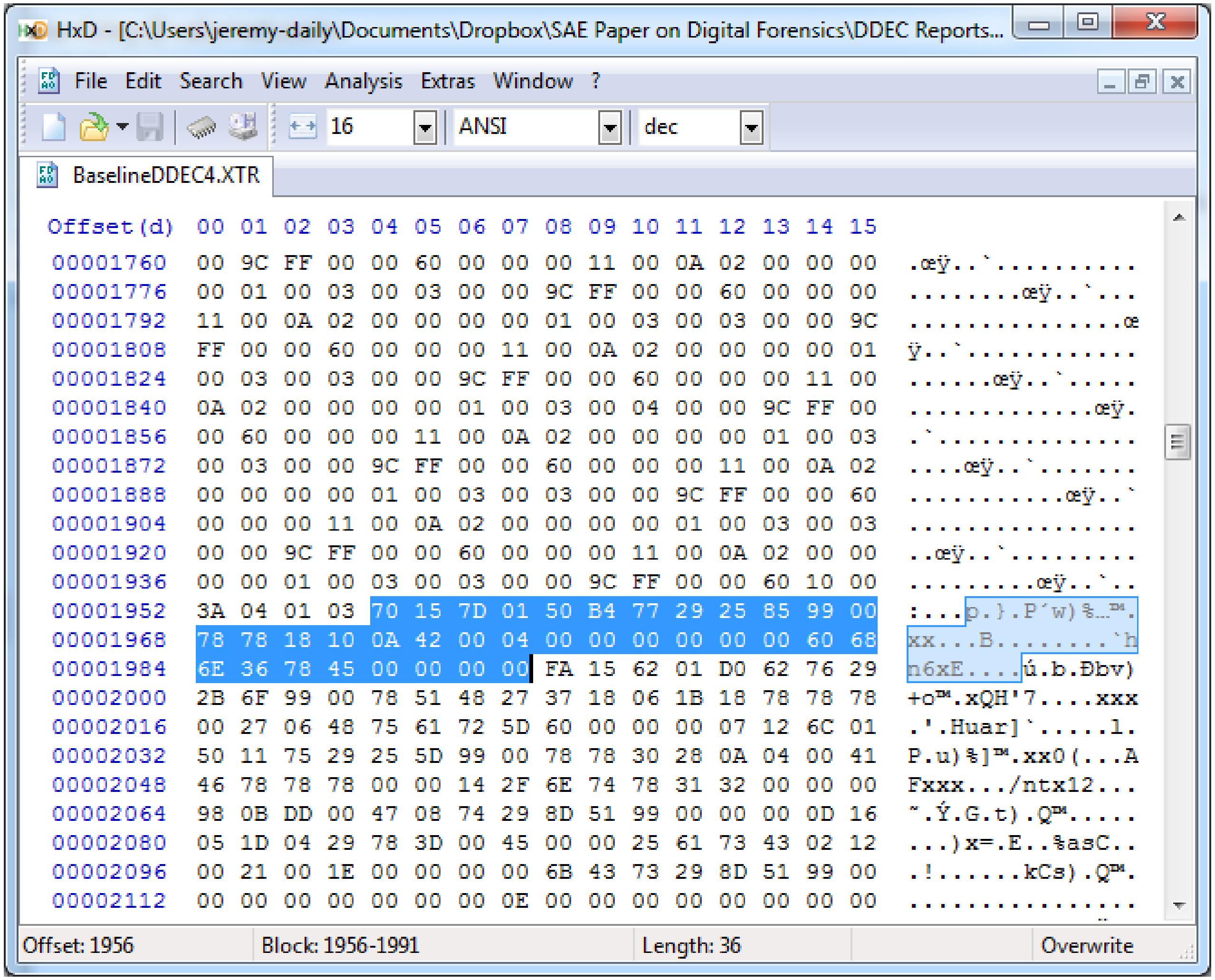
Date Range: 01/18/07 To 01/07/00 (EST)

Vehicle ID: TIB DDEC4
Driver ID:
Engine S/N: 06R0499534

Date:	1/18/2007	
Start Time:	00:00:00	EST
Odometer:	1006109.00	mi
Distance:	548.80	mi
Fuel:	95.25	gal
Fuel Economy:	5.76	mpg
Average Speed:	59.54	mph

Total(hh:mm)	09:13	06:00	08:47
Hour(EST)	Drive(min)	Idle(min)	Off(min)
00:00-02:00	0	120	0
02:00-04:00	0	120	0
04:00-06:00	96	24	0
06:00-08:00	104	16	0
08:00-10:00	110	10	0
10:00-12:00	54	66	0
12:00-14:00	120	0	0
14:00-16:00	69	4	47
16:00-18:00	0	0	120
18:00-20:00	0	0	120
20:00-22:00	0	0	120
22:00-24:00	0	0	120

Daily Engine Usage Log Data - .XTR file



HxD - [C:\Users\jeremy-daily\Documents\Dropbox\SAE Paper on Digital Forensics\DDEC Reports...
File Edit Search View Analysis Extras Window ?
16
ANSI
dec
BaselineDDEC4.XTR

```
Offset(d)  00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15

 00001760  00 9C FF 00 00 60 00 00 00 11 00 0A 02 00 00 00   .œÿ..`..........
 00001776  00 01 00 03 00 03 00 00 9C FF 00 00 60 00 00 00   ........œÿ..`...
 00001792  11 00 0A 02 00 00 00 00 01 00 03 00 03 00 00 9C   ...............œ
 00001808  FF 00 00 60 00 00 00 11 00 0A 02 00 00 00 00 01   ÿ..`............
 00001824  00 03 00 03 00 00 9C FF 00 00 60 00 00 00 11 00   ......œÿ..`.....
 00001840  0A 02 00 00 00 00 01 00 03 00 04 00 00 9C FF 00   .............œÿ.
 00001856  00 60 00 00 00 11 00 0A 02 00 00 00 00 01 00 03   .`..............
 00001872  00 03 00 00 9C FF 00 00 60 00 00 00 11 00 0A 02   ....œÿ..`.......
 00001888  00 00 00 00 01 00 03 00 03 00 00 9C FF 00 00 60   ...........œÿ..`
 00001904  00 00 00 11 00 0A 02 00 00 00 00 01 00 03 00 03   ................
 00001920  00 00 9C FF 00 00 60 00 00 00 11 00 0A 02 00 00   ..œÿ..`.........
 00001936  00 00 01 00 03 00 03 00 00 9C FF 00 00 60 10 00   .........œÿ..`..
 00001952  3A 04 01 03 70 15 7D 01 50 B4 77 29 25 85 99 00   :...p.}.P´w)%…™.
 00001968  78 78 18 10 0A 42 00 04 00 00 00 00 00 00 60 68   xx...B........`h
 00001984  6E 36 78 45 00 00 00 00 FA 15 62 01 D0 62 76 29   n6xE....ú.b.Ðbv)
 00002000  2B 6F 99 00 78 51 48 27 37 18 06 1B 18 78 78 78   +o™.xQH'7....xxx
 00002016  00 27 06 48 75 61 72 5D 60 00 00 00 07 12 6C 01   .'.Huar]`.....l.
 00002032  50 11 75 29 25 5D 99 00 78 78 30 28 0A 04 00 41   P.u)%]™.xx0(...A
 00002048  46 78 78 78 00 00 14 2F 6E 74 78 31 32 00 00 00   Fxxx.../ntx12...
 00002064  98 0B DD 00 47 08 74 29 8D 51 99 00 00 00 0D 16   ˜.Ý.G.t).Q™.....
 00002080  05 1D 04 29 78 3D 00 45 00 00 25 61 73 43 02 12   ...)x=.E..%asC..
 00002096  00 21 00 1E 00 00 00 00 6B 43 73 29 8D 51 99 00   .!......kCs).Q™.
 00002112  00 00 00 00 00 00 00 0E 00 00 00 00 00 00 00 00   ................
```

Offset: 1956 | Block: 1956-1991 | Length: 36 | Overwrite

Determining Data Meaning in the

Interpreted Data

Bytes Sequence	Hex Value (s)	Decimal	LSB Value	Meaning	Value
0-1	70 15	5488	0.1 mile	Distance	548.8 miles
2-3	7D 01	381	0.25 gal	Fuel	95.25 gallons
4-7	50 B4 77 29	695710800	1 sec from epoch	Start Time	17 Jan 2007 at 23:00:00 CST
8-11	25 85 99 00	10061093	0.1 mile	Odometer	1006109.3 miles
12-23	78 78 18 10 0A 42 00 04 00 00 00 00	120 120 24 16 10 66 0 4 0 0 0 0	1 Minute	Idle Time	Same as Decimal
24-35	00 00 60 68 6E 36 78 45 00 00 00 00	0 0 96 104 54 120 69 0 0 0 0	1 Minute	Drive Time	Same as Decimal

All other data are calculated.

Interestingly, the .XTR file contains minutes, but the chip memory contains seconds.

Chip Memory Contents

XTR file has 36 Bytes for 1 day in the Daily Engine Usage Log.

However… The memory record containing the Daily Engine Usage data is contained in a circular 30-day buffer with each day holding 66 bytes.

This was determined by locating the odometer readings since the MSB's were the same. There were 66 bytes from one 4-byte odometer reading to another.

Data Description	Unit	Location and sequence	Word Size (LSB last)	LSB Value	Example
Start Time Stamp	Seconds	1, 0, 3, 2	U32	1	Figure 16
Odometer	Miles	5, 4, 7, 6	U32	1/640	Figure 17
Distance Traveled	Miles	9, 8, 11, 10	U32	1/640	Figure 18
Fuel Used	Gallons	12, 13	U16	0.125	Figure 19

Daily Engine Usage Time

XTR file = 24 bytes

Memory Chips = 48 bytes, so there twice the bytes that are in memory but not transmitted on the network.

XTR file has minutes coded as single bytes (0-255)

Memory stores times in seconds as 2 bytes (16 bit) (0-65536)

Only Drive time and Idle time in each 2 hour block are recorded in memory.

Drive + Idle seconds in memory contents did not always sum to 7200 seconds (2 hours)

Decoded Daily Engine Usage Log

Start Date	Start Time	Odometer	Distance	Fuel	Total Daily Time		00:00-02:00		02:00-04:00		04:00-06:00		06:00-08:00		08:00-10	
Central Standard Time		Miles	Miles	Gallons	Idle (HH:MM)	Drive (HH:MM)	Idle	Drive	Idle	Drive	Idle	Drive	Idle	Drive	Idle	D
Thu, 07 Jan 2010	02:00:00AM	530196.8	346.5	76.750	15:23	08:04	82:33	26:49	65:43	54:17	20:38	99:22	55:49	41:00	00:44	1 1
Fri, 08 Jan 2010	02:00:00AM	530543.3	470.0	111.625	13:60	09:58	120:00	00:00	108:47	11:12	00:00	120:00	05:12	114:48	00:00	1 1
Sat, 09 Jan 2010	02:00:00AM	531013.3	506.1	111.750	13:57	09:43	120:00	00:00	120:00	00:00	49:13	49:57	03:28	116:33	116:25	0