ELECTRICAL POWER SYSTEM TRAINING

DECEMBER 19, 2000

CONTRACT NO. PPB005884

PRESENTED BY:

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OVERVIEW

Electrical Power System Architecture

Telecommands and Telemetry

Fault Management

PCB Overview

ADB Overview

CCB Overview

ELECTRICAL POWER SYSTEM ARCHITECTURE

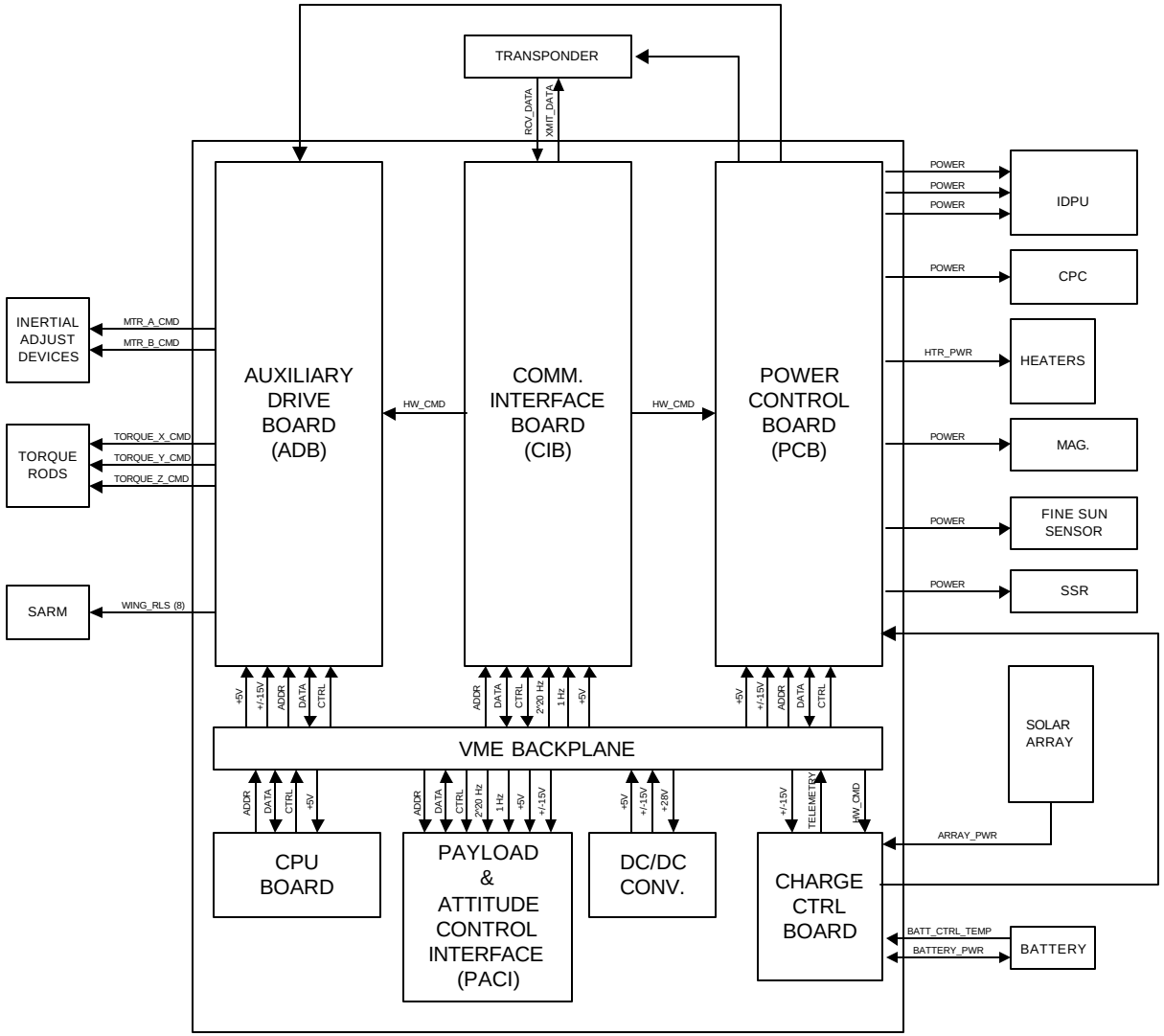
Overview of Subsystem Interaction

- **Charge Control Board (CCB) transfers power from solar arrays to battery or spacecraft as required.**
- **Power Control Board (PCB) distributes power from CCB to spacecraft.**
- **Auxiliary Drive Board (ADB) controls Solar Array release, Torque Rod currents and IAD motor phasing.**

Automated Features

- **CCB (re-) starts Essential Bus converter when bus voltage exceeds 18V**
- **PCB turns on CPU power, NEB1, and NEB2 when separation is sensed on 2 of 3 separation loopbacks on Umbilical.**
- **ADB runs through solar array releases when separation is sensed on 2 of 3 separation loopbacks on Umbilical.**

HARDWARE ARCHITECTURE



Requirements:

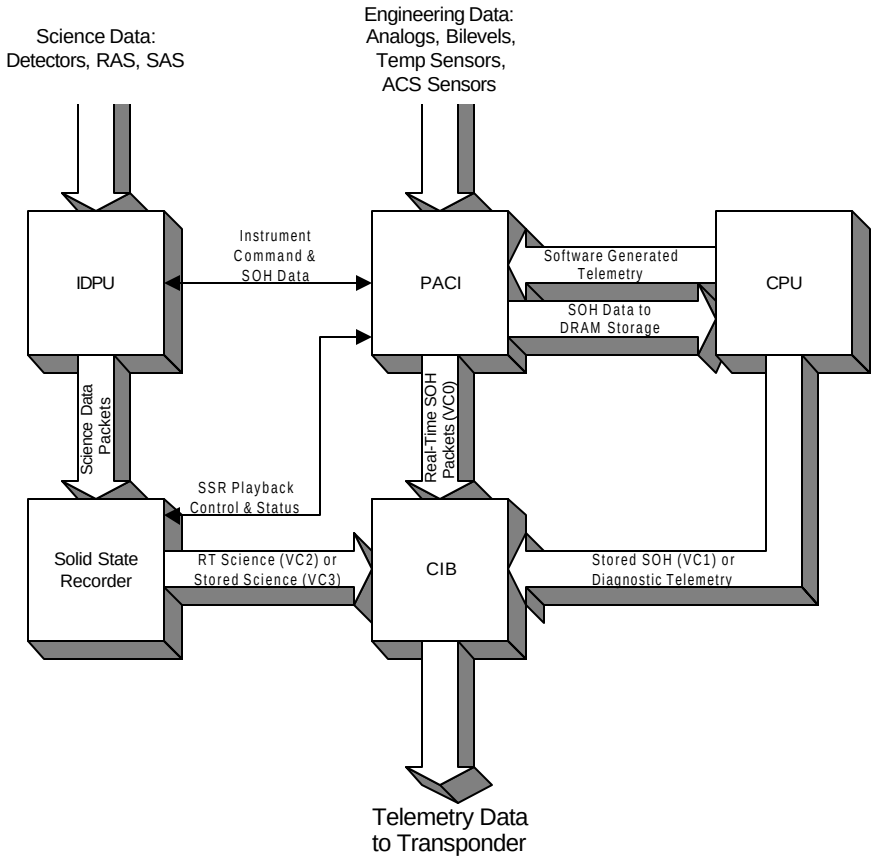
- Power Control & Distribution
- 28 +8/-4V Bus
- Undervoltage/Overcurrent protection
- 12A-Hr Battery Capacity
- 468W Solar Arrays
- Autonomous Battery Charge Control

Features:

- 505W Solar Arrays
- 15 A-Hr Battery
- ADB
  - Stepper Motors
  - Torque Rods
  - Frangibolt Drive
- PCB
  - Power Distribution
- CCB
  - +28 S/C Bus
  - Battery Charging
  - Mission Mode Relays

TELEMETRY ARCHITECTURE

- **Telemetry Data Virtual Channel Definitions:**
  - **VC0: Real-Time SOH**
    - **Data Collected and Assembled by PACI**
    - **Includes FSW Generated Data from CPU and Instrument SOH from IDPU**
    - **Generated at 1 or 8 Hz Rate**
  - **VC1: Stored SOH and Diagnostic Data**
    - **Generated by Flight Software and IDPU Diagnostic Telemetry**
    - **Telemetry is Stored in CPU DRAM**
    - **SOH Data Packets Stored at 0.1 Hz Rate**
- **All Telemetry Data Routed to Transponder Via CIB**
- **CIB Determines Priority for Each Telemetry Type**
- **EPS Data put in telemetry by PACI and CPU**



CIB HCD/CRC COMMAND TELEMETRY

CIB HCD/CRC Hardware Command and Status Display Page

- **cib_hcd_cmds.page**

TCBCRCBIT0 to TCBCRCBIT23

TCBEFCBIT0 to TCBEFCBIT23

```
                                    CIB HCD CONTROL
CRC BITS     EFC BITS                          CRC BITS     EFC BITS
 0OFFON  OFF OFFSET CLR SYS RESET              12OFFON  OFF OFFSET CLR CCB VT0
 1OFFON  OFF OFFSET CLR CPU ON                 13OFFON  OFF OFFSET CLR CCB VT1
 2OFFON  OFF OFFSET CLR Tx On                  14OFFON  OFF OFFSET CLR CCB VT2
 3FWDAFT FWD OFFSET CLR Tx ANTENNA SELECT      15OFFON  OFF OFFSET CLR CCB VT3
 4OFFON  OFF OFFSET CLR SARM UPPER PRI REL     16OFFON  OFF OFFSET CLR CCB TEMP SEL
 5OFFON  OFF OFFSET CLR SARM LOWER PRI REL     178HZ1HZ 8HZ OFFSET CLR PACI SOH RATE
 6OFFON  OFF OFFSET CLR SARM UPPER RED REL     18LO HI  LO  OFFSET CLR DOWNLINK RATE
 7OFFON  OFF OFFSET CLR SARM LOWER RED REL     19ENADIS ENA OFFSET CLR CIB WATCHDOG
 8OFFON  OFF OFFSET CLR SARM X ENABLE          20OFFON  OFF OFFSET CLR CRC 20
 9OFFON  OFF OFFSET CLR SARM Y ENABLE          21DISENA DIS OFFSET CLR EEPROM WRITES
10OFFON  OFF OFFSET CLR UV TRIP ENABLE         22PRISEC PRI OFFSET CLR BOOT IMAGE
11OFFON  OFF OFFSET CLR OC TRIP ENABLE         23OFFON  OFF OFFSET CLR CRC 23
```

HARDWARE FAULT MANAGEMENT

Under-voltage trip levels

- **UV1 Level is 26.85V nominal and 24.86V degraded mode.**
- **UV2 Level is 26.33V nominal and 24.15V degraded mode.**
- **UV3 Level is 25.70V nominal and 23.54V degraded mode.**

Under-voltage trip action

- **UV1 causes IDPU safemode signal to be sent.**
- **UV2 turns off NEB1 loads, magnetometer and CPU.**
- **UV3 turns off all switches. Transmitter and Receiver will still work.**

HARDWARE FAULT MANAGEMENT

Under-voltage event response

- **If UV1 was reached, but UV2 was not, send /PCBCLRLATCH command. This will clear the UV1 indication.**
- **If UV2 or UV3 was reached, turn off HCD bit 10 (Under-voltage trip enable). This accomplishes the same thing as sending the /PCBCLRLATCH command. At this point the CPU and other power services can be re-started. The latched UV statuses will have been reset at this point, so all telemetry will show normal status. HCD bit 10 (Under-Voltage trip enable) may be re-enabled at any time after the bus voltage has increased above the trip points. The transmitter must be controlled by HCD bit 3 until the CPU is running again. To restart the CPU or transmitter, their HCD bits must be brought low, then high.**

HARDWARE FAULT MANAGEMENT

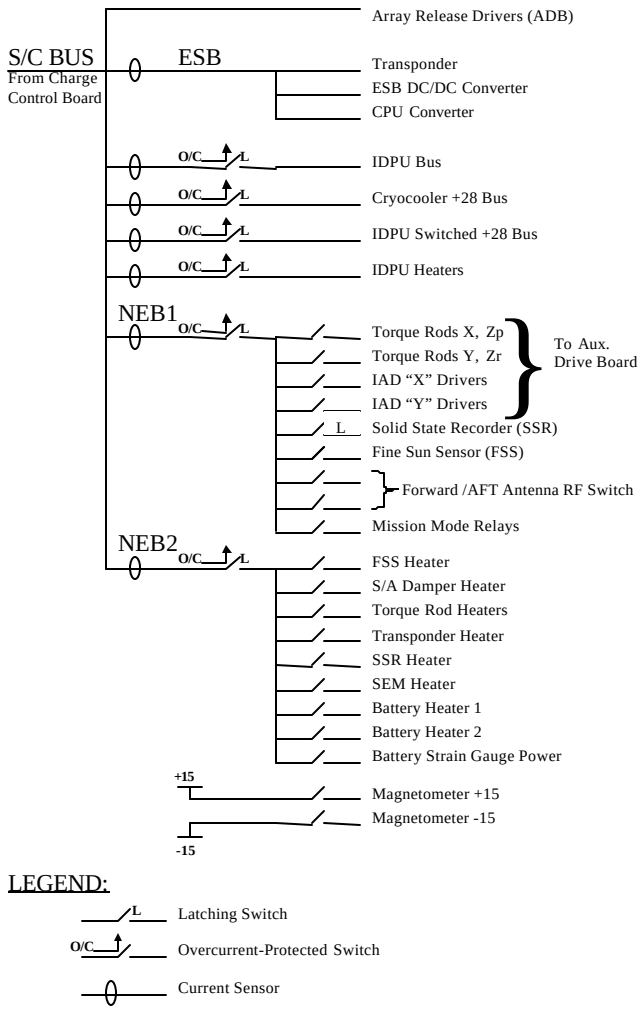
Over-current trips

- Is enabled via HCD BIT 11.
- 20A instantaneous current causes trip.
- 5.0A for greater than 30ms causes IDPU trip.
- 5.0A for greater than 30ms causes IDPU Switched 28 trip.
- 7.5A for greater than 30ms causes IDPU Heater trip.
- 10.5A rms for greater than 30ms causes Cryocooler trip.
- 6.0A for greater than 30ms causes NEB1 trip.
- 10.0A for greater than 30ms causes NEB2 trip.

CPU Watch Dog Timer.

- CIB sends signal to PCB to cycle power on the CPU after the third watchdog timeout.

PCB Power Distribution



PCB COMMAND INTERFACE

One of Four Major Interfaces in the Power Subsystem

- **Power Switches**

PCBSETSWITCH - Set a specific power switch on the Power Converter Board

PCBENABLTXSW - Enable the transmitter power switch to be turned on

PCBCLRLATCH - Clears the PCB latched outputs OC, LUV1, LUV2, and LUV3

PCBFPGARESET - Resets the PCB FPGA Logic. Does not affect switch states.

PCBSETUVLEVL - Sets/clears the degrade bit for under voltage trip levels

HCD BIT 1 - Controls power to the CPU. CPU power is also controlled by the seperation loops and the watchdog timer.

HCD BIT 2 - Turns on or off the transmitter

HCD BIT 3 - Selects the spacecraft's downlink antenna. This bit will be ignored if the transmitter is on.

HCD BIT 10 - Enables Under-voltage trips.

HCD BIT 11 - Enables Over-current trips.

PCB COMMAND INTERFACE

PCBSETSWITCH ARGUMENTS

- **PCBNEB1 - Controls the main bus switch on NEB1**
- **PCBNEB2 - Controls the main bus switch on NEB2**
- **PCBIDPU - Controls the IDPU bus switch**
- **PCBIDPU28 - Controls the IDPU switched bus service**
- **PCBIDPUH - Controls the IDPU Heater bus switch**
- **PCBCRYO - Controls the CPC bus switch**
- **PCBBATHTR - Controls the first battery heater power**
- **PCBBATHTR2 - Controls the second battery heater power**
- **PCBFSS - Controls the Fine Sun Sensor Electronics (FSE) power**
- **PCBFSSHTR - Controls the FSE heater power**
- **PCBIAD1 - Controls the power to the first IAD motor driver**
- **PCBIAD2 - Controls the power to the second IAD motor driver**

PCB COMMAND INTERFACE

PCBSETSWITCH ARGUMENTS

- **PCBMAG - Controls the magnetometer power**
- **PCBRF - Switches the RF antenna between forward and aft. The switch will not change state if the transmitter is turned on.**
- **PCBSADHTR - Controls power to the Solar Array Damper heaters**
- **PCBSEMHTR - Controls power to the SEM heater**
- **PCBSPARE1 - Controls power to the Battery Strain Gauge Amplifiers**
- **PCBSPARE2 - Controls power to the Mission Mode Relays on the CCB**
- **PCBSSR - Controls power to the Solid State Recorder (SSR)**
- **PCBSSRHTR - Controls power to the SSR heater**
- **PCBTQHTR - Controls power to the torque rod heaters**
- **PCBXMIT - Enables the transponder's transmitter**
- **PCBXZTQ - Controls power to the X and Z primary torque rod circuits on the ADB**
- **PCBYZTQ - Controls power to the Y and Z redundant torque rod circuits on the ADB**

PCB INTERLOCKS

PCB Hardware Interlocks

- **The RF switch will not change state (change from forward to aft or vice versa) if the transmitter is on.**
- **Torque rod power will be removed prior to the CPU power converter being commanded to turn off.**

PCB Software Interlocks

- **The transmitter will not turn on using the /PCBSETSWITCH command unless the /PCBENABLTXSW command is sent first. Using HCD bit 2 bypasses this interlock. This interlock is contained in flight software.**

PCB SWITCH TELEMETRY

PCB Switch Command and Status Display Page

- **pcbinterface.page**

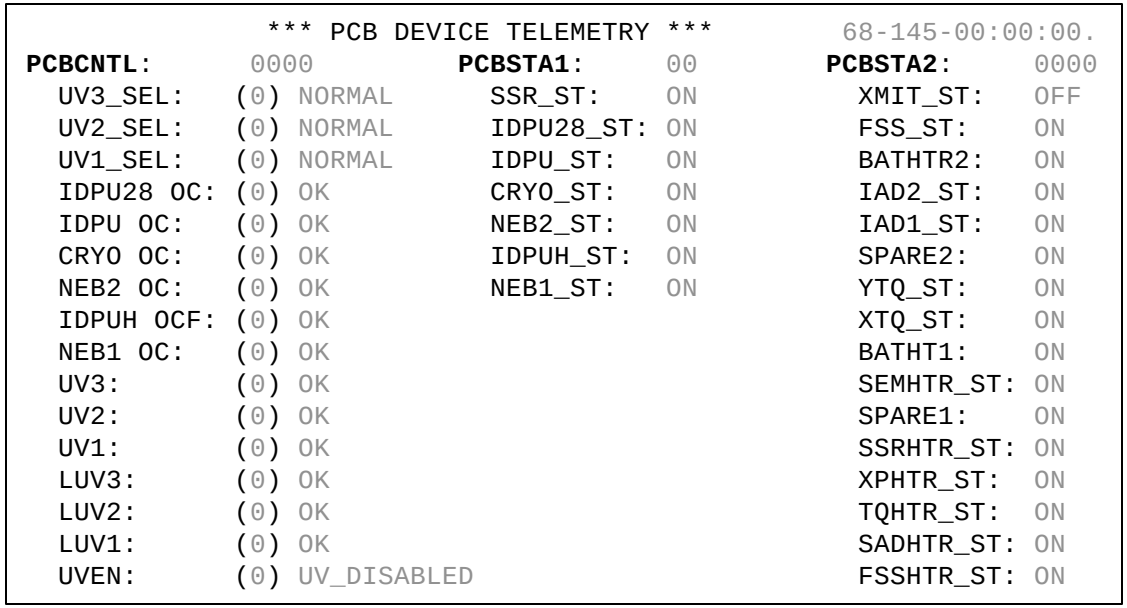
```
                    *** PCB INTERFACE TASK COMMAND/TELEMETRY ***      68-145-00:00:00.
# PCB TCs Received:   0      Rejected:   0       Errors:     0

TPCTC RECVD/REJECT/ERRORS

TPCB S1_NEB1 S1_SSR  S2_FSS      ON ON  OFF NEB1          ON ON  OFF SSR               ON ON  OFF FSS
             S2_XTQ  S2_YTQ                              ON ON  OFF Torque Rod XZ     ON ON  OFF Torque Rod YZ
             S2_IAD1 S2_IAD2                             ON ON  OFF IAD #1            ON ON  OFF IAD #2
             TPADINBIT21 S2_SPAR2                        FWDAFT FWD RF ANT            ON ON  OFF Spare #2
             TPAGPACH14                                  OFFON  OFF Magnetometer

TPCB S1_NEB2 S2_FSSHT S2_SADHT   ON ON  OFF NEB2          ON ON  OFF FSS Heater        ON ON  OFF SAD Heater
             S2_TQHTR S2_XPHTR                           ON ON  OFF Torq Heater       ON ON  OFF Xmit Heater
             S2_SSRHT S2_SEMHT                           ON ON  OFF SSR Heater        ON ON  OFF SEM Heater
             S2_BATH1 S2_BATH2                           ON ON  OFF BAT Heater #1     ON ON  OFF BAT Heater #2
             S2_SPAR1                                    ON ON  OFF Spare #1
TPCBS1_IDPUH                     ON ON  OFF IDPU Heater
TPCBS1_CRYO                      ON ON  OFF Cryocooler
TPCBS1_IDPU                      ON ON  OFF IDPU
TPCBS1_IDP28                     ON ON  OFF IDPU +28V
TPCBS2_XMIT  TPCTXSWENBL         OFFON  OFF Transmitter   OFFON  OFF Enable Transmitter On
```

PCB DEVICE TELEMETRY

PCB Device Telemetry Display Page

- **pcb.page**
- **Bold in display represents registers; all others are bit breakouts**

TPCBCNTL	**TPCBSTA1**	**TPCBSTA2**
TPCBCTL_UVS3	**TPCBS1_SSR**	**TPCBS2_XMIT**
TPCBCTL_UVS2	**TPCBS1_IDP28**	**TPCBS2_FSS**
TPCBCTL_UVS1	**TPCBS1_IDPU**	**TPCBS2_BATH2**
TPCBCTL_OCI2	**TPCBS1_CRYO**	**TPCBS2_IAD2**
TPCBCTL_OCID	**TPCBS1_NEB2**	**TPCBS2_IAD1**
TPCBCTL_OCCR	**TPCBS1_IDPUH**	**TPCBS2_SPAR2**
TPCBCTL_OCN2	**TPCBS1_NEB1**	**TPCBS2_YTQ**
TPCBCTL_OCIH		**TPCBS2_XTQ**
TPCBCTL_OCN1		**TPCBS2_BATH1**
TPCBCTL_UV3		**TPCBS2_SEMHT**
TPCBCTL_UV2		**TPCBS2_SPAR1**
TPCBCTL_UV1		**TPCBS2_SSRHT**
TPCBCTL_LUV3		**TPCBS2_XPHTR**
TPCBCTL_LUV2		**TPCBS2_TQHTR**
TPCBCTL_LUV1		**TPCBS2_SADHT**
TPCBCTL_UVEN		**TPCBS2_FSSHT**



PCB ANALOG TELEMETRY

PCB Device Telemetry Display Page

- **pcbloads.page**
- **Bold in display represents registers; all others are bit breakouts**

```
 *** PCB CURRENT TELEMETRY ***

PCB CURRENT:       RAW:      VOLTS:         ENG:      UNITS:
ESSENTIAL BUS      2134       0.4139       0.8492     AMPS
NEB1 CURRENT       2084       0.1699       0.3607     AMPS
NEB2 CURRENT       2053       0.0186       0.0578     AMPS
IDPU BUS           2216       0.8141       1.6503     AMPS
IDPU LOADS         2047      -0.0106      -0.0008     AMPS
IDPU HEATER        2048      -0.0058       0.0090     AMPS
CRYO-COOLER        2395       1.6876       3.3991     AMPS
```

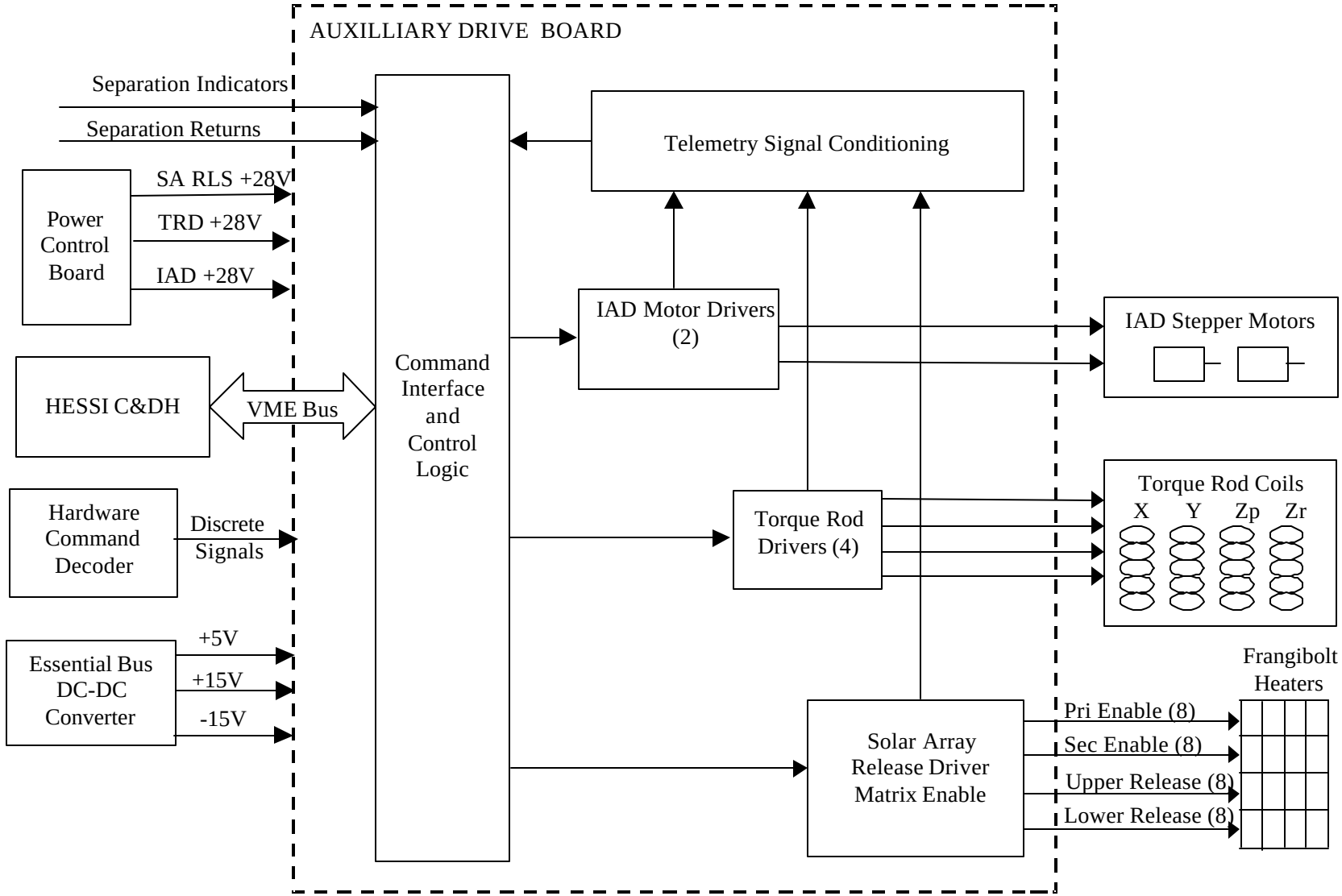
PCB ANALOG TELEMETRY

PCB Device Telemetry Display Page

- **paci.page**
- **Bold in display represents registers; all others are bit breakouts**

```
 APID 1 PACI Data                        *** PACI DEVICE TELEMETRY ***
                                                  Raw AD590s
 ANALOG INS:              ANALOG INS:              AVERAGED AD590s:          PRTs:              DIGITAL INS: FE08FFE3
  FSS SINE1:   -0.011      BAT CURRENT:   -7.062      FSE TEMP: -49.485     BATT TEMP:    8.524     XMIT SWITCH: FWD
   FSS COS1:   -0.006      BAT MIDVOLT:   12.843      IAD1 TEMP: -49.485  S/A WING 1: 127.237      XMIT POWER: OFF
      MAG X:   -2.260      BATT TEMP 1:    6.873      IAD2 TEMP: -49.485  S/A WING 2: 127.237     RCV SUBLOCK: NO_LOCK
      MAG Y:    0.926      BATT TEMP 2:    8.424       SEM TEMP: -49.485  S/A WING 3: 127.237     RCV CARLOCK: NO_LOCK
      MAG Z:    0.634      BAT VOLTAGE:   28.317     DC/DC TEMP: -49.485  S/A WING 4: 127.237     FSE SUNPRES: NOT_IN_SUN
BATT PRESS1: 5020.45       CCB XSISTOR:    9.984      OCXO TEMP: -49.485   IAD1 POSN:   -4.676      SSR CMDRDY: READY
BATT PRESS2: 4898.82        SA CURRENT:   -0.009       SSR TEMP: -49.485   IAD2 POSN:   -3.636     CCB MSMODE2: MISSION
RCVR STRESS:    0.024         VT CURVE:    5.860      TRQX TEMP: -49.485   SPARE PRT:    9.984     CCB MSMODE1: MISSION
RCV STRNGTH:    1.019      ESSBUS CUR:    0.763      TRQY TEMP: -49.485         CSS:               PCB IDPUPWR: ON
XMT VOLTAGE:    4.986      ESSBUS -15V: -15.215      TRQZ TEMP: -49.485  CHANNEL 1:    2.946     PCB OC TRIP: OK
XMT PWRAMPT:    0.253      NEB1 BUSCUR:    0.352     XPNDR TEMP: -49.485  CHANNEL 2:    2.946     PCB UV TRIP: OK
XMT PWRSPYT:    0.705      IPDU HTRBUS:    0.001      DECK TEMP: -49.485  CHANNEL 3:    2.946     CPU PWR STS: ON
 XMT RF PWR:   -0.006      NEB2 BUSCUR:    0.059      IDPU TEMP: -49.485  CHANNEL 4:    2.946     CCB TEMPSEL: A
   MAG TEMP:    3.414        IDPU CURR:    1.485       IPC TEMP: -49.485  CHANNEL 5:    2.946       FSS DIG 1: 0000
    FSE SOH:    3.527        CRYO CURR:    3.380       CPC TEMP: -49.485  CHANNEL 6:    2.946       FSS DIG 2: 0001
    SSR +5V:    3.664     IDPU LD CUR:    0.020      SPEC TEMP: -49.485  CHANNEL 7:    2.946       FSS DIG 1: 0
  SSR +3.3V:    2.293     TROD X CURR:    0.000       RAS TEMP: -49.485  CHANNEL 8:    2.946       FSS DIG 2: 1
    ESS +5V:    4.977     TROD Y CURR:    0.000     SPARE TMP1: -49.485
    CPU +5V:    5.026     TROD Z CURR:    0.214     SPARE TMP2: -49.485
TROD Z(RED):    0.000     ESSBUS +15V:   15.021     SPARE TMP3: -49.485
```

ADB BLOCK DIAGRAM



ADB COMMAND INTERFACE

Three of Four Major Interfaces in the Power Subsystem

- **Torque Rods**
- **Inertial Adjustment Device**
- **Solar Array Releases**

HCD Bit 20 - If HCD bit 20 transitions from low to high three times in a 10 minute period, the Solar Array Release sequence will run automatically.

PCBCMDTORQUE - Command the torque rods

PCBDRIVEIAD - Drive the Inertial Adjustment Device

PCBFPGARESET - Resets the ADB FPGA Logic. Does not affect switch states.

PCBSAENABLE - Enable a Solar Array Release

PCBSADISABLE- Enable a Solar Array Release

ADB DEVICE TELEMETRY

ADB Device Telemetry

- **pcbadb.page**

Page Displays Each Defined Bit In ADB Registers

- **Bold in display represents registers; all others are bit breakouts**

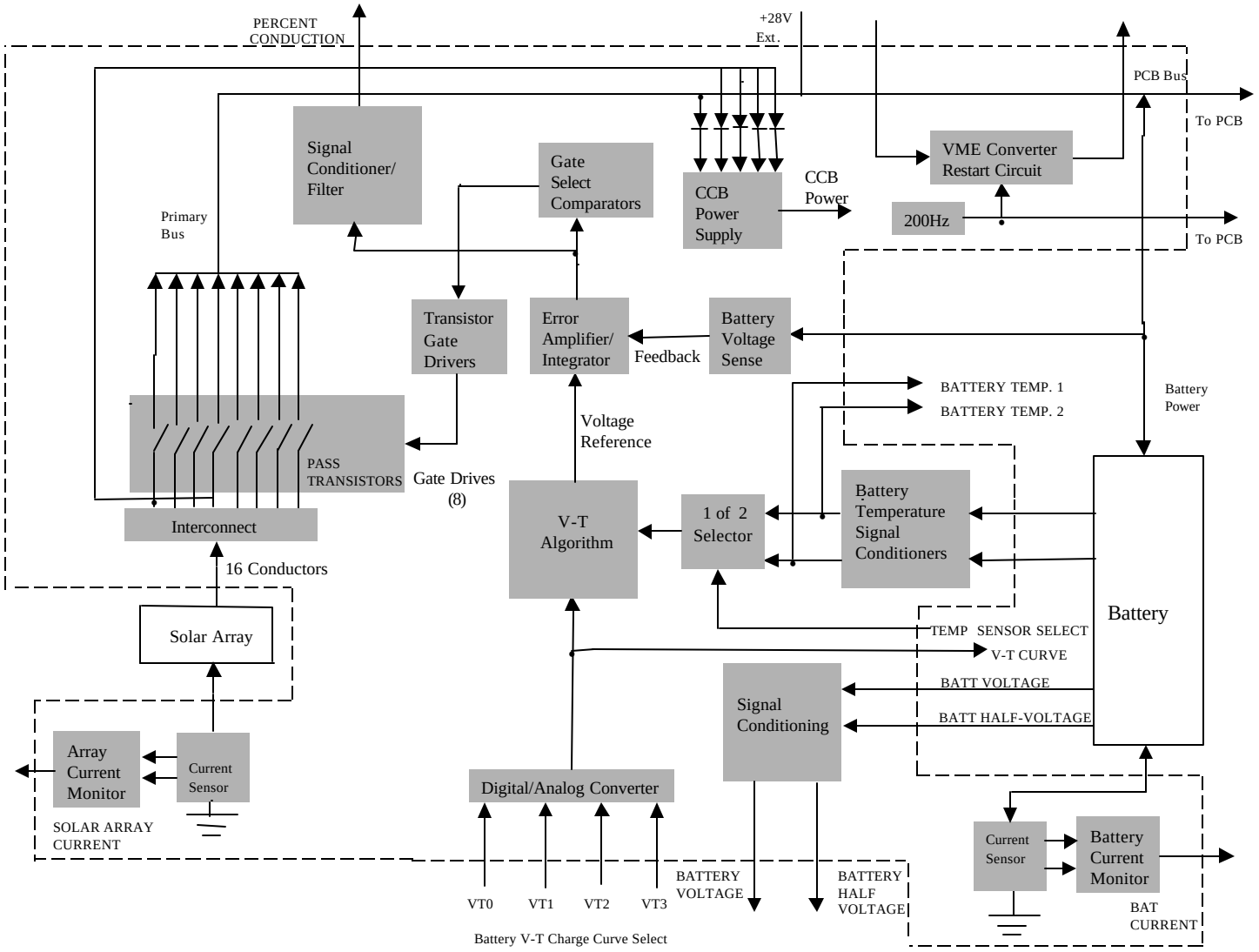
ADB Analog Telemetry

- **Torque Rod currents are displayed in the paci.page.**

TPCADBSAPDIS
TPCADBSASTAT
TPCADBSTCNT
TPCADBSTCNTL
TPCBTRQCMDX
TPCBTRQCMDY
TPCBTRQCMDZ1
TPCBTRQCMDZ2
TADBIADSEL
TADBIADXPHA
TADBIADXPHB
TADBIADYPHA
TADBIADYPHB
TADBPULSECNT
TADBSAPRI
TADBSASEC
TADBSAXLOW
TADBSAXUP
TADBSAYLOW
TADBSAYUP
TADBSEPCOUNT
TADBSTEPCNT
TADBSTFSEP1
TADBSTFSEP2
TADBSTFSEP3
TADBSTOVERRD
TADBSTSEP1
TADBSTSEP2
TADBSTSEP3
TADBUPCNT
TADBXLPRI
TADBXLSEC
TADBXUPRI
TADBXUSEC
TADBYLPRI
TADBYLSEC
TADBYUPRI
TADBYUSEC

```
                    *** ADB DEVICE TELEMETRY ***              68-145-00:00:00.

SAPDIS:    0000
SASTAT:    0000
STEPCNT:   0000
STEPCNTL:  0000
TRQX CMD:         0
TRQY CMD:         0
TRQZ1 CMD:        0
TRQZ2 CMD:        0
Which IAD device is selected; 0 = IAD#1, 1 = IAD#2:        0
Current command for the IADX Phase A:        0
Current command for the IADX Phase B:        0
Current command for the IADY Phase A:        0
Current command for the IADY Phase B:        0
The IAD Pulse Count:        0
Solar array release primary bus command monitor:        0
Solar array release secondary bus command monitor:        0
Solar array release X-axis lower command monitor:        0
Solar array release X-axis upper command monitor:        0
Solar array release Y-axis lower command monitor:        0
Solar array release Y-axis upper command monitor:        0
The current automated array release count:        0
The IAD step count:        0
Filtered separation #1 input:        0
Filtered separation #2 input:        0
Filtered separation #3 input:        0
Three correct pulses occurred to start array release sequence:        0
Raw separation #1 input:        0
Raw separation #2 input:        0
Raw separation #3 input:        0
IAD rotation direction; 0 = clockwise, 1 = counter clockwise:        0
Status of X-axis lower primary array release:        0
Status of X-axis lower secondary array release:        0
Status of X-axis upper primary array release:        0
Status of X-axis upper secondary array release:        0
Status of Y-axis lower primary array release:        0
Status of Y-axis lower secondary array release:        0
Status of Y-axis upper primary array release:        0
Status of Y-axis upper secondary array release:        0
```

CCB Block Diagram



CCB COMMAND INTERFACE

PCBMISSNMODE - Sets mission mode which determines the boot-up sequence. Valid arguments are “launch” and “nominal”.

HCD BITS 12-15 - Sets the battery voltage charge level.

HCD BIT 16 - Controls which battery temperature sensor the CCB uses for battery charging.

CCB Operation and Telemetry

Mode #	Voltage	VT Command
1	31.0V	1010
2	31.3V	1011
3	31.6V	1000
4	31.9V	1001
5	32.2V	1110
6	32.5V	1111
7	32.8V	1100
8	33.1V	1101
9	33.4V	0010
10	33.7V	0011
11	34.0V	0000
12	34.3V	0001
13	34.6V	0110
14	34.9V	0111
15	35.2V	0100
16	35.5V	0101

Zero ºC battery voltage is shown at left. Voltage is temperature compensated with a coefficient of -80mV/ ºC . The VT level should be selected to attain the highest battery voltage without causing the battery to run too warm.

CCB Telemtry is available from the paci.page and ccb.page.

Telemetry points are:

- **Battery Voltage**
- **Battery Half Voltage**
- **Battery Pressures**
- **Battery Temperatures**
- **Battery Current**
- **Solar Array Current**
- **Charge Monitor**
- **VT curve selected**

CCB Operation and Telemetry


```
 *** CCB DEVICE TELEMETRY ***

CCB ANALOGS:        RAW:      VOLTS:         ENG:      UNITS:    VT CURVE SELECT
BATTERY CURRENT       -7      3.3468       6.7100      AMPS      VT0       VT8
SARRAY CURRENT      -0.0     -0.0106      -0.0090      AMPS      VT1       VT9
BATT MID VOLTAGE    1e+0      6.4212      12.8626      VOLTS     VT2       VT10
BATTERY VOLTAGE     3e+0      7.0702      28.3759      VOLTS     VT3       VT11
CCB TRANSISTORS       10      9.9836       9.9836      VOLTS     VT4       VT12
VT CURVE SELECT        6      0.9263       0.9263      VOLTS     VT5       VT13
BATTERY TEMP 1         7      1.6242       6.7391      DEG C     VT6       VT14
BATTERY TEMP 2         8      1.9902       8.2524      DEG C     VT7       VT15
BATT PRESSURE 1     5e+0      3.7958       3.7958      PSI       VT SELECT BITS
BATT PRESSURE 2     5e+0      3.5469       3.5469      PSI            0000

CCB DIGITAL INPUTS
CCB BATT TEMP A/B STATUS : PRI
CCB MISSION MODE STATUS 1: OFF
CCB MISSION MODE STATUS 2: OFF
```

ITOS CONFIGURATION FILES DIRECTORY STRUCTURE

~/hessi/

~/hessi/bin

~/hessi/dbx

~/hessi/dbx/idpu

~/hessi/dbx/systems

~/hessi/loads

~/hessi/pages

~/hessi/pages/i+t

~/hessi/pages/idpu

~/hessi/pages/sc

~/hessi/procs

~/hessi/procs/fsw_test

~/hessi/procs/fsw_test/hb

~/hessi/procs/fsw_test/sc

~/hessi/procs/hb

~/hessi/procs/i+t

~/hessi/procs/idpu

~/hessi/procs/sc

~/hessi/test-results

~/hessi/test-results/fsw_test

GROUND UTILITIES

Distributed in the ~/hessi/bin Directory

"binToTableLoad" is used to generate an ITOS formatted image load file

- **The ITOS LOAD command can be used to uplinked the file to the spacecraft**

binToTableLoad [-c] -t tableName -i inputFile -o outputFile

Parameters:

-c compress file for uplink

-t *tableName* is the table identifier from the SMTBLSELECT TABLEID parameter

-i *inputFile* is the name of the file from which to generate a formatted image load file.

-o *outputFile* is the name of the generated formatted image load file. Should probably be a file name with a complete path to the ITOS loads directory

"gen_itos_report" is used during FSW testing to generate reports from ITOS log

gen_itos_report < filename

where *filename* is an ITOS log file.

GROUND UTILITIES

"hessiChecksum" Is Used to Calculate the Checksum of a File on the Ground

- **Checksum Is Calculated Using the Same Method As Used in FSW**

hessiChecksum filename

where *filename* is the file for which to calculate a checksum.

"hessiLogTool" Is Used to Decode Event Message (APID 40, 41) and Telecommand Log (APID 10, 11, 12) Telemetry Into Human Readable ASCII Output

- **hessiLogTool Is Started Via the 'forward_fswevents.proc' STOL Script**

hessiLogTool -e eventFile -t tcFile [-p portnum]

Parameters:

-e *eventFile* is the hessi/include/auto_events.h header file

-t *tcFile* is the hessi/build/itos/dbx/itos-tc-query.txt telecommand database extract file

-p *portnum* is an optional port number for the socket (default=20342) used for input communications