SABER Payload Operations Center

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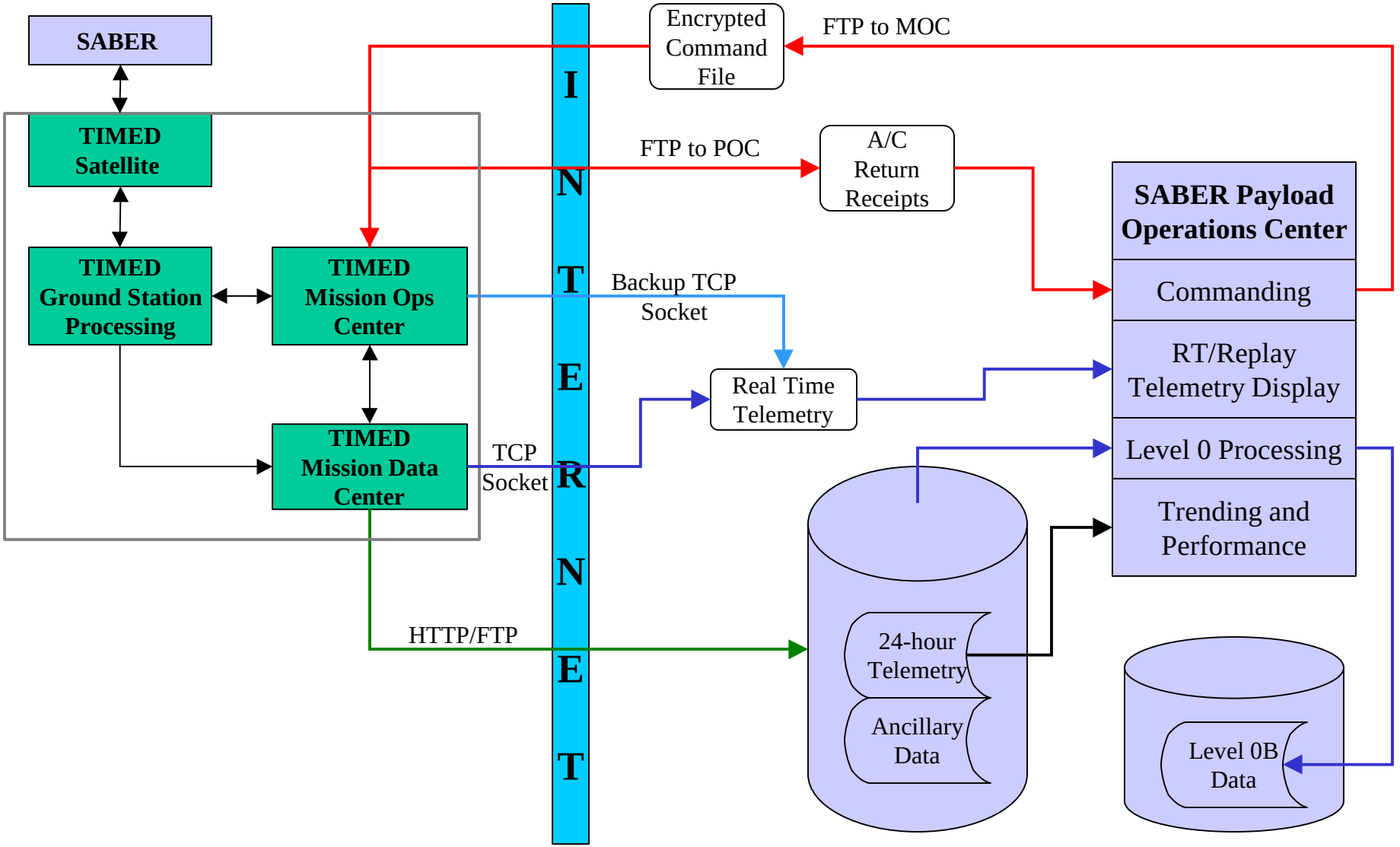
Topics of Discussion

- **System** Overview of POC
- Action Item Review
- Real Time/Replay Telemetry Display
- Level 0 Processing
- Trending and Performance
- Milestones (Past and Future)
- Schedule

System Overview of POC



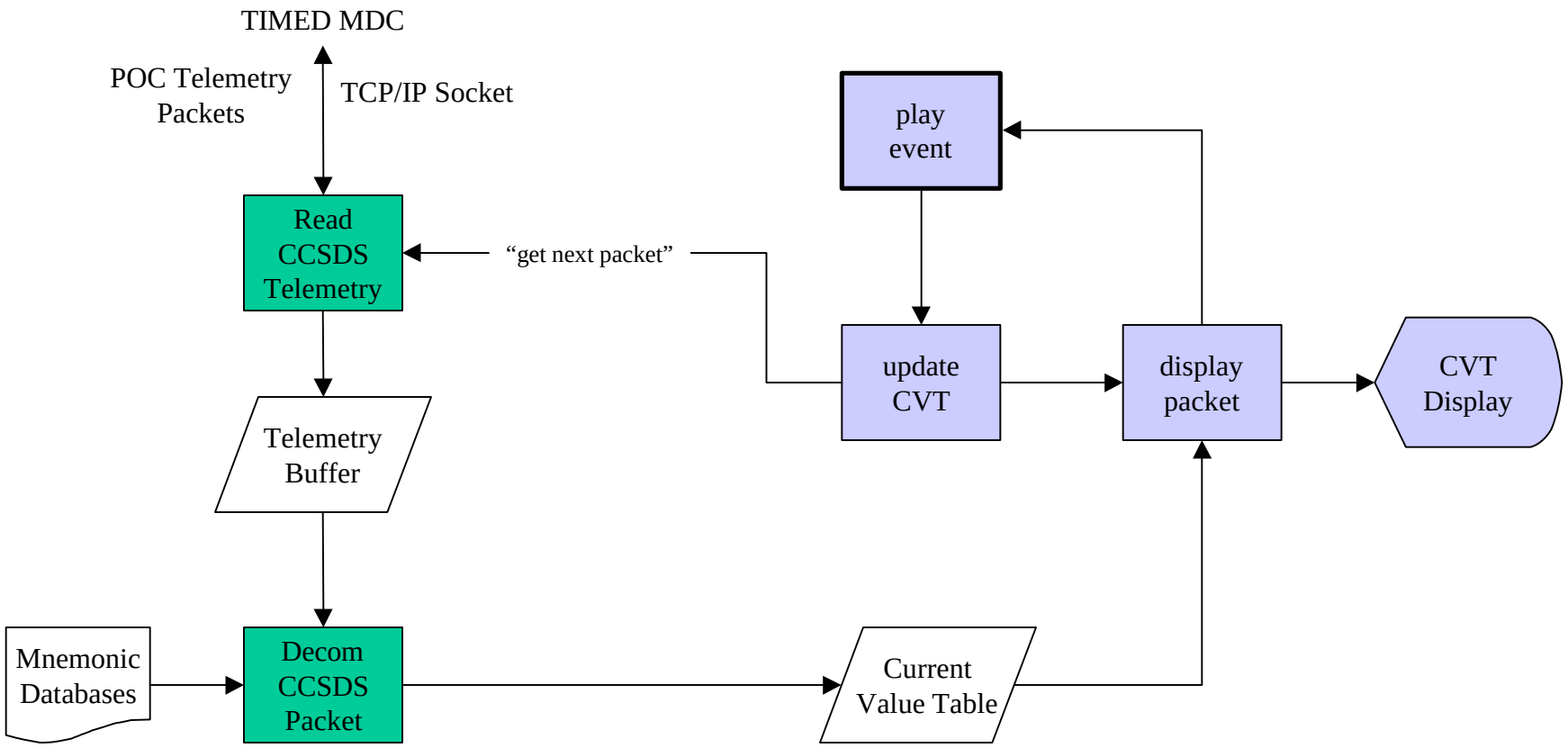
Action Item Review

All POC Action Items generated at
PDR or Instrument CDR have been closed.

POC Replay/Real Time Module Requirements Matrix

RN	Requirement	Expected Test
1	Communicate with TIMED MDC Telemetry Server via TCP/IP Sockets Packet, cf. TIMED General Instrument Interface Specification, Document # 7363-9050, Rev A., Section 8.2.5.1.	X (May 11, 1998)
2	Initiation of Telemetry Retrieval with TIMED MDC, cf. TIMED General Instrument Interface Specification, Document # 7363-9050, Rev A., Section 8.2.5.1.	X (May 11, 1998)
3	CCSDS Packet Format Read and Unpack, cf. TIMED General Instrument Interface Specification, Document # 7363-9050, Rev A., Section 8.2.5.1.	X (May 11, 1998)
4	Open and read local telemetry files	July 15, 1998
5d	Current Value Table display	X (May 11, 1998)
6d	Setting of step size in packets	July 15, 1998
7d	Packet number or time seeking capability	July 15, 1998
8d	Single step or continuous play modes forwards and backwards	July 15, 1998
9d	Marking of start/end packets	July 15, 1998
10d	Time history plotting capabilities	July 15, 1998

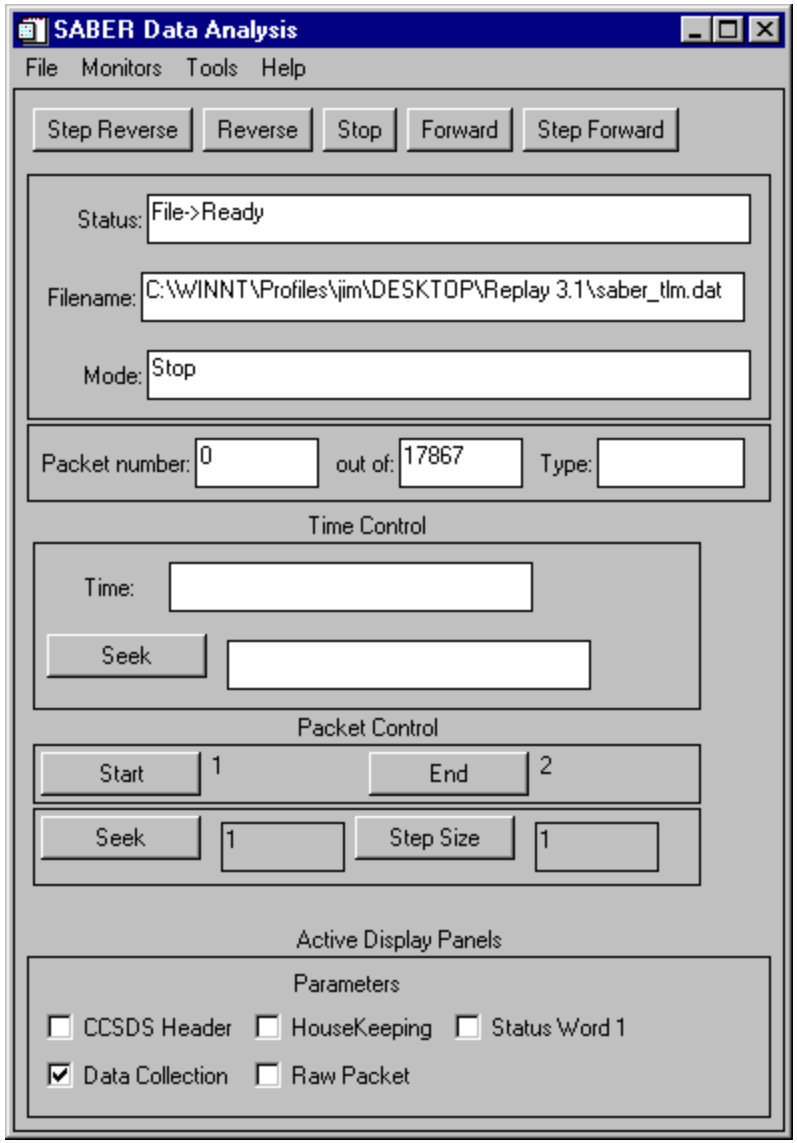
POC Replay/Real Time Module (Data Flow Overview)



Dynamically Linked Library

IDL

POC Replay/Real Time Module

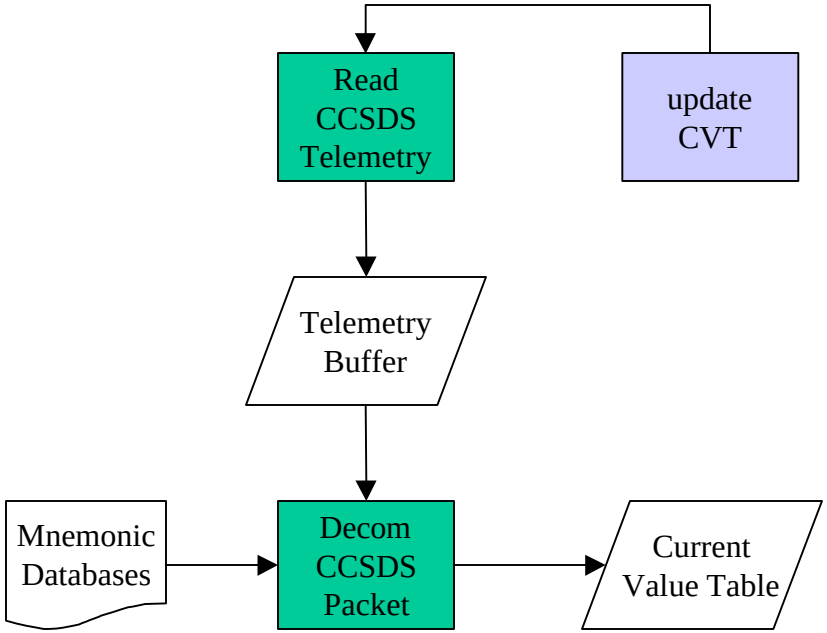


In **network mode** only **stop** and **forward** events are activated.

In **file mode** all events are possible:

- **step reverse**
  allows the user to step backwards a packet at a time
- **reverse**
  the file is played backwards
- **stop**
- **forward**
  the file is played forward non-stop
- **step forward**
  allows the user to step forward a packet at a time

POC Replay/Real Time Module



update CVT handles the communication between IDL and the DLL.

In network mode
- "get next packet" is sent to the DLL
- next packet is read from socket

In file mode
- "get next packet", file, and record pointer are passed to DLL
- if not EOF, next packet is read from disk

Decom CCSDS Packet decommutates the packet based on the mnemonic databases. The decommutated telemetry is stored in the CVT structure.

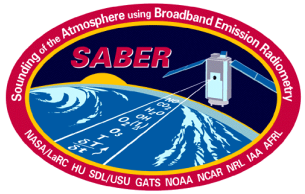
Update CVT receives Current Value Table from Decom

POC Replay/Real Time Module
(SABER CCSDS Science Telemetry Packet)

	Packet Primary Header							**Packet Secondary Header**			
		Packet Identification			**Packet Sequence Control**						
	Version Number	**Type Indicator**	**Packet Second Header Flag**	**AP ID**	**Grouping Flags**	**Source Sequence Count**	**Packet Data Length**	**S/C Time (to 1 sec)**	**S/C Time (to 1 ms)**	**Packet Identifier**	Total bits
Bits	3	1	1	11	2	14	16	32	10	6	96
Value	000	1	0	TBD	2	0 - 16383	Variable	MET	MET	0 - 31	

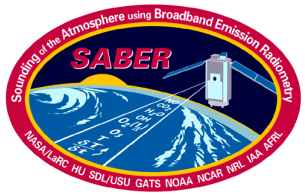
Field bits												
	Scan Location 20	Gain 20	CH #1 12	CH #2 12	CH #3 12	CH #4 12	CH #5 12	CH #6 12	CH #7 12	CH #8 12	CH #9 12	CH #10 12	160
	Scan Location 20	Gain 20	CH #1 12	CH #2 12	CH #3 12	CH #4 12	CH #5 12	CH #6 12	CH #7 12	CH #8 12	CH #9 12	CH #10 12	160
	Scan Location 20	Gain 20	CH #1 12	CH #2 12	CH #3 12	CH #4 12	CH #5 12	CH #6 12	CH #7 12	CH #8 12	CH #9 12	CH #10 12	160
	Scan Location 20	Gain 20	CH #1 12	CH #2 12	CH #3 12	CH #4 12	CH #5 12	CH #6 12	CH #7 12	CH #8 12	CH #9 12	CH #10 12	160
	Scan Location 20	Gain 20	CH #1 12	CH #2 12	CH #3 12	CH #4 12	CH #5 12	CH #6 12	CH #7 12	CH #8 12	CH #9 12	CH #10 12	160
	Scan Location 20	Gain 20	CH #1 12	CH #2 12	CH #3 12	CH #4 12	CH #5 12	CH #6 12	CH #7 12	CH #8 12	CH #9 12	CH #10 12	160
	Scan Location 20	Gain 20	CH #1 12	CH #2 12	CH #3 12	CH #4 12	CH #5 12	CH #6 12	CH #7 12	CH #8 12	CH #9 12	CH #10 12	160
	Scan Location 20	Gain 20	CH #1 12	CH #2 12	CH #3 12	CH #4 12	CH #5 12	CH #6 12	CH #7 12	CH #8 12	CH #9 12	CH #10 12	160
	Scan Location 20	Gain 20	CH #1 12	CH #2 12	CH #3 12	CH #4 12	CH #5 12	CH #6 12	CH #7 12	CH #8 12	CH #9 12	CH #10 12	160
	Scan Location 20	Gain 20	CH #1 12	CH #2 12	CH #3 12	CH #4 12	CH #5 12	CH #6 12	CH #7 12	CH #8 12	CH #9 12	CH #10 12	160
	Scan Location 20	Gain 20	CH #1 12	CH #2 12	CH #3 12	CH #4 12	CH #5 12	CH #6 12	CH #7 12	CH #8 12	CH #9 12	CH #10 12	160
	Scan Location 20	Gain 20	CH #1 12	CH #2 12	CH #3 12	CH #4 12	CH #5 12	CH #6 12	CH #7 12	CH #8 12	CH #9 12	CH #10 12	160
	Command Echo 32				Housekeeping (1 of 32) 48								80

Total Bits 2096



POC Replay/Real Time Module
(SABER Telemetry Mnemonics Database)

Index	Mnemonic	Description	Calibration Description	CT Index	Units	Limit Check	Red Low	Yellow Low	Yellow High	Red High	SF	EMI Limit Check	EMI Limit
0	CVT_SPARE	Place holder for index 0	0	0	0	0	0	0	0	0	0	0	0
1	CCSDS_VER_NUM	CCSDS Packet Primary Header ID Type Indicator	0	0	0	0	0	0	0	0	0	0	0
2	CCSDS_TYPE_IND	CCSDS Packet Secondary Header Flag	0	0	0	0	0	0	0	0	0	0	0
3	CCSDS_SEC_HD_FLAG	CCSDS Packet Application ID	0	0	0	0	0	0	0	0	0	0	0
4	CCSDS_AP_ID	CCSDS Packet Sequence Control Grouping Flag	0	0	0	0	0	0	0	0	0	0	0
5	CCSDS_GRP_FLAG	CCSDS Packet Sequence Control Source Sequence Count	0	0	0	0	0	0	0	0	0	0	0
6	CCSDS_SRC_SEQ_CNT	CCSDS Packet Data Length	0	0	0	0	0	0	0	0	0	0	0
7	CCSDS_DATA_SIZE	CCSDS Packet Secondary Header Spacecraft Time to 1 Second	0	0	0	0	0	0	0	0	0	0	0
8	CCSDS_SC_TIME_1SEC	CCSDS Packet Secondary Header Spacecraft Time to 1 millisecond	0	0	0	0	0	0	0	0	0	0	0
9	CCSDS_SC_TIME_1MS	CCSDS Packet Secondary Header Format Mode	0	0	0	0	0	0	0	0	0	0	0
10	CCSDS_SUB_ID	CCSDS Packet Secondary Header Packet ID	0	0	0	0	0	0	0	0	0	0	0
11	SCAN_LOC_1	Scan Location	0	0	0	0	0	0	0	0	0	0	0
12	PGA_GAIN_CH#1_1	Gain	0	0	0	0	0	0	0	0	0	0	0
13	PGA_GAIN_CH#2_1	Gain	0	0	0	0	0	0	0	0	0	0	0
14	PGA_GAIN_CH#3_1	Gain	0	0	0	0	0	0	0	0	0	0	0
15	PGA_GAIN_CH#4_1	Gain	0	0	0	0	0	0	0	0	0	0	0
16	PGA_GAIN_CH#5_1	Gain	0	0	0	0	0	0	0	0	0	0	0
17	PGA_GAIN_CH#6_1	Gain	0	0	0	0	0	0	0	0	0	0	0
18	PGA_GAIN_CH#7_1	Gain	0	0	0	0	0	0	0	0	0	0	0
19	PGA_GAIN_CH#8_1	Gain	0	0	0	0	0	0	0	0	0	0	0
20	PGA_GAIN_CH#9_1	Gain	0	0	0	0	0	0	0	0	0	0	0
21	PGA_GAIN_CH#10_1	Gain	0	0	0	0	0	0	0	0	0	0	0
22	DATA_CH#1_1	Data Collection channel # 1	0	0	0	0	0	0	0	0	0	0	0
23	DATA_CH#2_1	Data Collection channel # 2	0	0	0	0	0	0	0	0	0	0	0
24	DATA_CH#3_1	Data Collection channel # 3	0	0	0	0	0	0	0	0	0	0	0
25	DATA_CH#4_1	Data Collection channel # 4	0	0	0	0	0	0	0	0	0	0	0
26	DATA_CH#5_1	Data Collection channel # 5	0	0	0	0	0	0	0	0	0	0	0
27	DATA_CH#6_1	Data Collection channel # 6	0	0	0	0	0	0	0	0	0	0	0
28	DATA_CH#7_1	Data Collection channel # 7	0	0	0	0	0	0	0	0	0	0	0
29	DATA_CH#8_1	Data Collection channel # 8	0	0	0	0	0	0	0	0	0	0	0
30	DATA_CH#9_1	Data Collection channel # 9	0	0	0	0	0	0	0	0	0	0	0
31	DATA_CH#10_1	Data Collection channel # 10	0	0	0	0	0	0	0	0	0	0	0

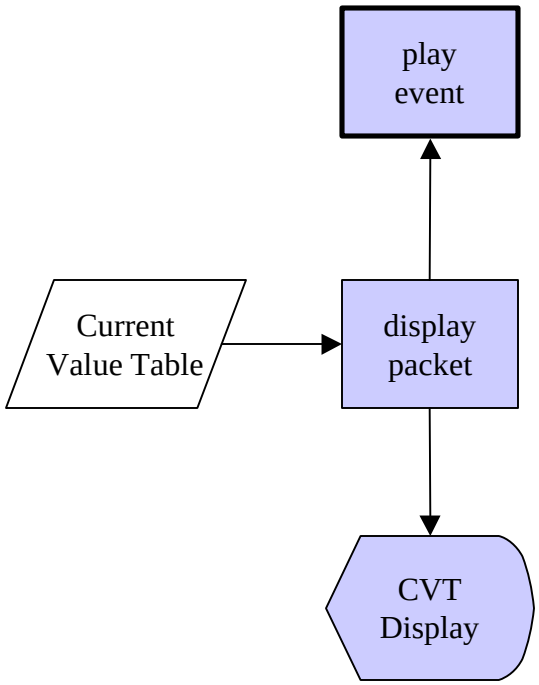


POC Replay/Real Time Module

(SABER Telemetry Decom Database)

Index	Mnemonic	Offset	Start Bit	# of Bits	Subcom
1	CCSDS_VER_NUM	0	0	3	0
2	CCSDS_TYPE_IND	0	3	1	0
3	CCSDS_SEC_HD_FLAG	0	4	1	0
4	CCSDS_AP_ID	0	5	11	0
5	CCSDS_GRP_FLAG	1	0	2	0
6	CCSDS_SRC_SEQ_CNT	1	2	14	0
7	CCSDS_DATA_SIZE	2	0	16	0
8	CCSDS_SC_TIME_1SEC	3	0	32	0
9	CCSDS_SC_TIME_1MS	5	0	10	0
10	CCSDS_SUB_ID	5	10	6	0
11	SCAN_LOC_1	6	0	20	0
12	PGA_GAIN_CH#1_1	7	4	2	1
13	PGA_GAIN_CH#2_1	7	6	2	1
14	PGA_GAIN_CH#3_1	7	8	2	1
15	PGA_GAIN_CH#4_1	7	10	2	1
16	PGA_GAIN_CH#5_1	7	12	2	1
17	PGA_GAIN_CH#6_1	7	14	2	1
18	PGA_GAIN_CH#7_1	8	0	2	1
19	PGA_GAIN_CH#8_1	8	2	2	1
20	PGA_GAIN_CH#9_1	8	4	2	1
21	PGA_GAIN_CH#10_1	8	6	2	1
22	DATA_CH#1_1	8	8	12	0
23	DATA_CH#2_1	9	4	12	0
24	DATA_CH#3_1	10	0	12	0
25	DATA_CH#4_1	10	12	12	0
26	DATA_CH#5_1	11	8	12	0
27	DATA_CH#6_1	12	4	12	0
28	DATA_CH#7_1	13	0	12	0
29	DATA_CH#8_1	13	12	12	0
30	DATA_CH#9_1	14	8	12	0
31	DATA_CH#10_1	15	4	12	0

POC Replay/Real Time Module



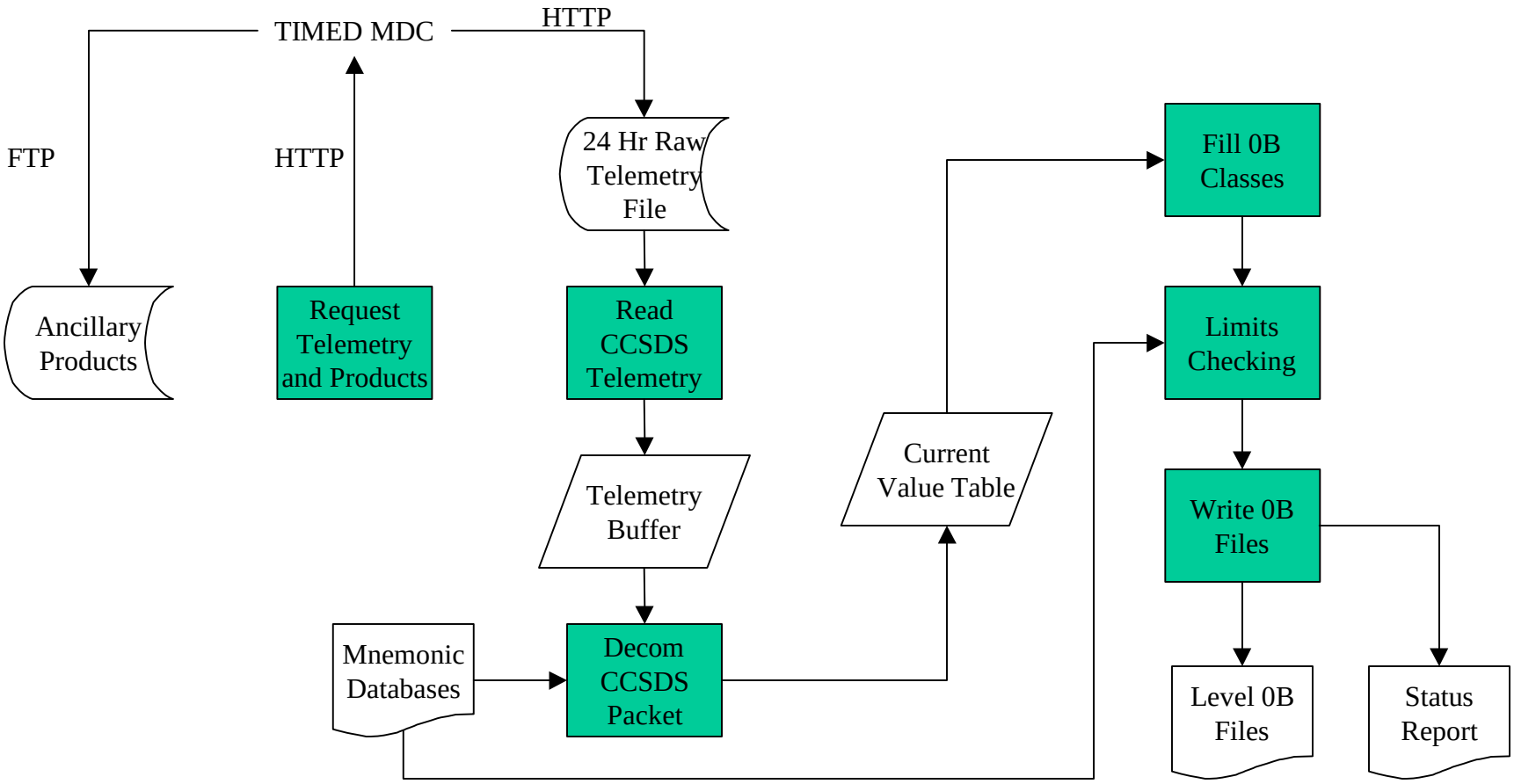
House Keeping Packet Display

TFO1VG1	0	TTO12V	1006	V9+5	0	GE7	0	O1	2048
TFO1VG2	0	TTO13V	979	V10+28	69	GE8	1	O2	2048
TFO1C	0	TTO14V	1	BBSETV	4080	GE9	1	O3	2048
TFO2VG1	0	TTO15V	2	JSCUR1	4080	GE10	0	O4	2048
TFO2VG2	0	TTO16V	3	JSCUR2	4080	GHTP1	4080	O5	2048
TFO2C	0	TMO1V	35	JSCUR3	4080	GHTP2	4080	O6	2048
TFO3V	0	TMO2V	160	RCS	0	GHTP3	4080	O7	3072
TFO3C	0	TMO3V	64	RBS	0	GHTP4	4080	O8	3072
TFO4V	0	TMO4V	82	RCC	0	GHTP5	4080	O9	3072
TFO4C	0	TMO5V	128	RBC	0	GHTP6	4080	O10	256
TFO5V	0	TMO6V	192	RAO	0	GHTP7	15	Mem Dump	0
TFO5C	0	TMO7V	66	TRCH	0	GHTP8	15	JSSETCUR1	128
TFO6V	0	TMO8V	128	Status1	0	GHTP9	15	JSSETCUR2	663
TFO6C	0	TMO9V	192	Status2	0	GHTP10	15	JSSETCUR3	128
TTO1V	0	TCO1V	66	Status3	0	GLTP1	4080	BBT	570
TTO2V	1017	TREF	0	Status4	0	GLTP2	15	ADSCOFF1	1268
TTO3V	1061	V1+5	202	Status5	0	GLTP3	15	ADSCML1	3399
TTO4V	913	V2+15	0	TI	0	GLTP4	15	ADSCOFF2	1188
TTO5V	1165	V2-15	0	GE1	0	GLTP5	15	ADSCML2	1869
TTO6V	1273	V4+5	0	GE2	1	GLTP6	15	DFSA1	0
TTO7V	2947	V5+15	0	GE3	0	GLTP7	2048	DFSA2	0
TTO8V	2040	V5-15	255	GE4	0	GLTP8	2048	DFSA3	0
TTO9V	3080	V6+15	192	GE5	0	GLTP9	2048	RCON1	0
TTO10V	2066	V7+15	192	GE6	1	GLTP10	2048	RCON2	0
TTO11V	3059	V7-15	0						

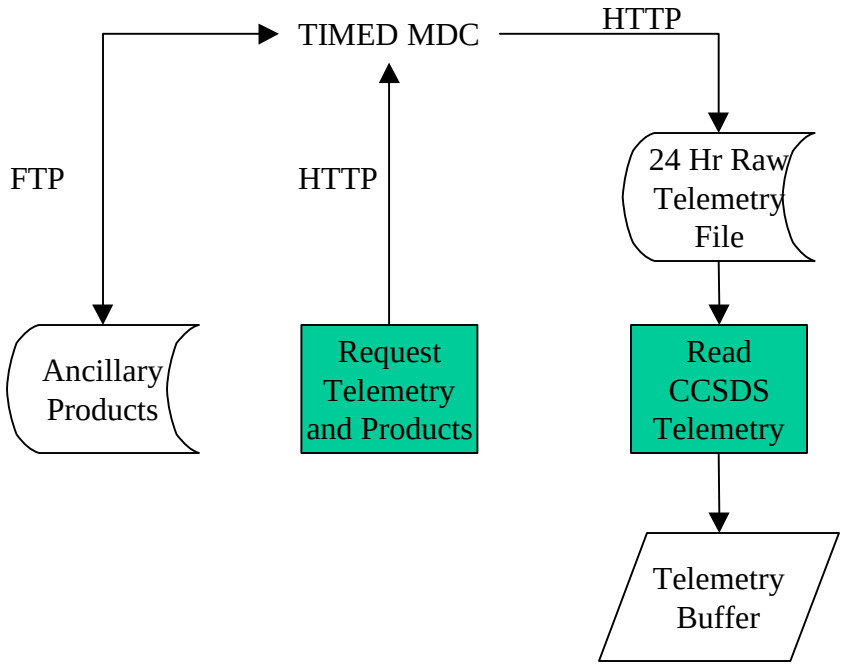
POC Level 0 Module Requirements Matrix

RN	Requirement	Expected Test
1	HTTP/FTP File Transfer of 24 hours of Raw Telemetry, cf. TIMED General Instrument Interface Specification, Document # 7363-9050, Rev A., Section 8.2.5.1.	?
2	CCSDS Packet Format Read and Unpack, cf. TIMED General Instrument Interface Specification, Document # 7363-9050, Rev A., Section 8.2.5.1.	X (May 11, 1998)
3	Open and read local telemetry files	July 15, 1998
4	HTTP/FTP File Transfer of telemetry status files, cf. TIMED General Instrument Interface Specification, Document # 7363-9050, Rev A., Section 8.2.5.1.	?
5	HTTP/FTP File Transfer of ancillary files, cf. TIMED General Instrument Interface Specification, Document # 7363-9050, Rev A., Section 8.2.5.1.	?
6	Level 0B Data and 0B File Generation and Storage	Sept 30, 1998
7	Gap Annotation of data	April 30, 1999

POC Level 0 Module Overview



POC Level 0 Module



Request Telemetry and Products

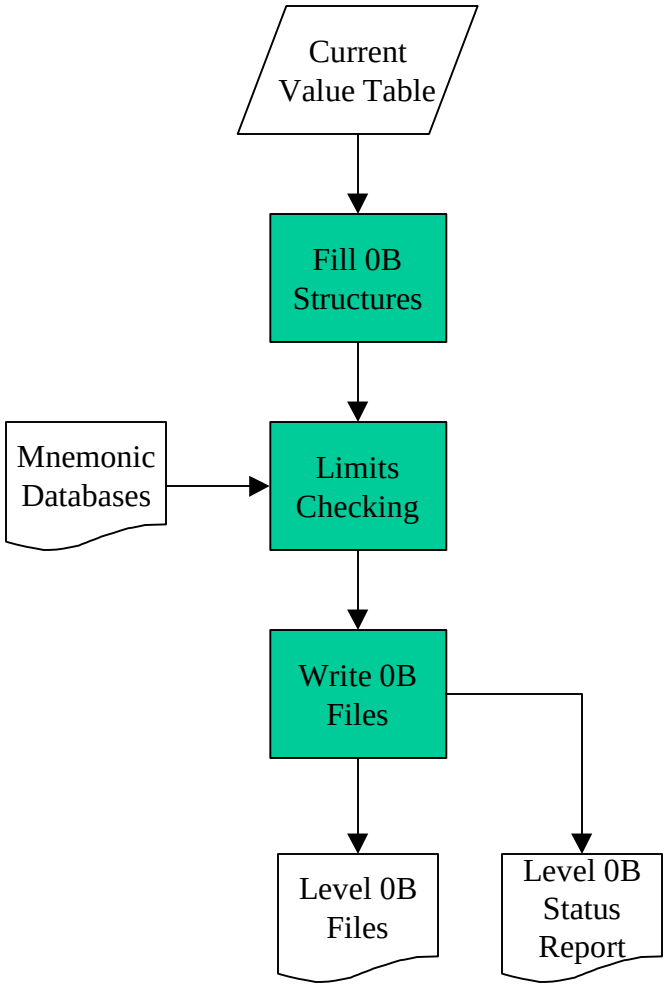
sends AP Id's, packet format, requests for ancillary products, and requests for POC telemetry packets ordered in spacecraft time to the TIMED MDC via HTTP communications.

Ancillary Products

ftp from the TIMED MDC the following ancillary data products:

- 24-hour NMC file
- 24-hour solar/geomag file
- MDC telemetry status report
- PVAT File
- Orbit Number File

POC Level 0 Module



Fill 0B Structures

Extracts telemetry parameters from CVT and loads up 0B structures based on data mode.

Limits Checking

Checks that the parameters are within the values specified in the mnemonic databases. If limits are exceeded a data quality flag is set in the minor frame of data.

Write 0B Files

When a major frame of data has been processed it is written to the respective 0B file. 0B status is recorded in a status report.

POC Level 0 Module
(Level 0B Major Frame)

Record #	Description
N to N+1	Level 0B File Header Record
N+2 to N+4	Data Collection Subframe 1
N+5 to N+7	Data Collection Subframe 2
N+8 to N+10	Data Collection Subframe 3
N+11 to N+13	Data Collection Subframe 4
N+14 to N+16	Data Collection Subframe 5
N+17 to N+19	Data Collection Subframe 6
N+20 to N+22	Data Collection Subframe 7
N+23 to N+25	Data Collection Subframe 8
N+26 to N+28	Data Collection Subframe 9
N+29 to N+31	Data Collection Subframe 10
N+32 to N+34	Data Collection Subframe 11
N+35 to N+37	Data Collection Subframe 12
N+38	“EndFrame”

POC Level 0 Module
(Level 0B Header and Minor Frame)

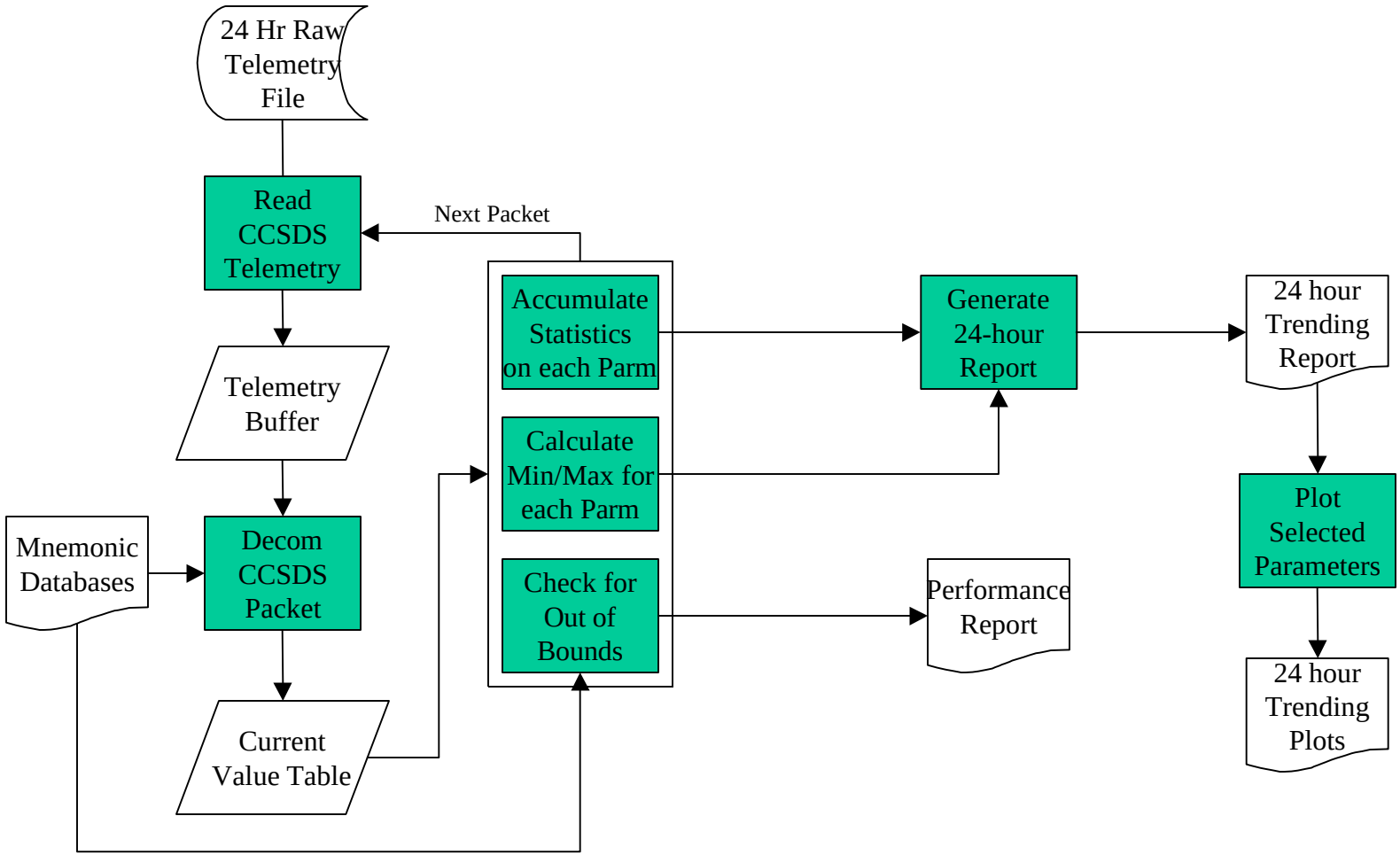
Record #	Field #	Mnemonic	Value	Units
N	1	year	Year	YYYY (1998 – 2???)
N	2	doy	Day of Year	DDD (1-365)
N	3	msec	Record start time msec since UT midnight	(0-86400000)
N	4	buildNum	Build Version Number	
N	5	scanMode	Scan Mode Type	
N	6	pktQualFlg	Packet Quality Flag	
N+1	7	apid	Application Process Identifier	
N+1	8	srcSeqCnt	Source Sequence Count	(0-16383)
N+1	9	pktDataLen	Packet Data Length	
N+1	10	sc1sec	S/C Time to 1 second	(sec)
N+1	11	sc1msec	S/C Time to 1 ms	(ms)
N+1	12	subid	Subframe Identifier	(1-30)

Record #	Field #	Mnemonic	Value	Units
N+2	1	scanAngle	Scan Angle	Counts
N+2	2-11	gain [10]	Channel 1-10 PGA Setting	[ ]
N+3	12-21	chan [10]	Channel 1-10 Voltage	Counts
N+4	22	qualityFlag	Quality Flag	[TBD]

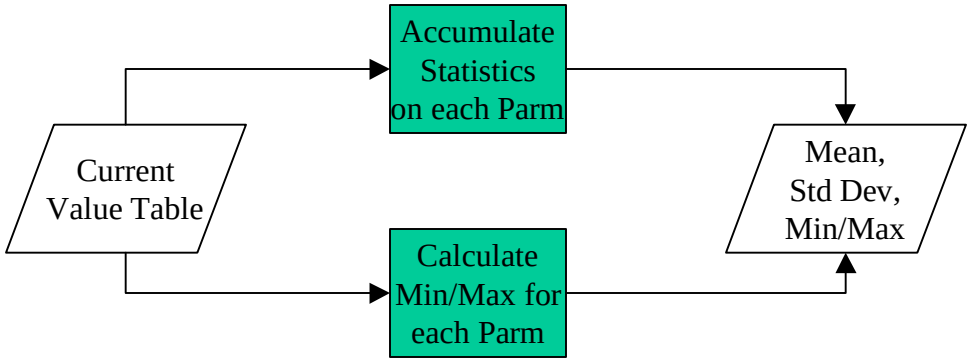
POC Health Monitoring and Performance Module Requirements

RN	Requirement	Expected Test
1	HTTP/FTP File Transfer of 24 hours of Raw Telemetry File, cf. TIMED General Instrument Interface Specification, Document # 7363-9050, Rev A., Section 8.2.5.1.	?
2	CCSDS Packet Format Read and Unpack, cf. TIMED General Instrument Interface Specification, Document # 7363-9050, Rev A., Section 8.2.5.1.	X (May 11, 1998)
3	Open and read local telemetry files	July 15, 1998
4	Calculation of 24-hour mean for each parameter	Sept 30, 1998
5	Calculation of 24-hour standard deviation for each parameter	Sept 30, 1998
6	Calculation of 24-hour min/max for every parameter	Sept 30, 1998
7	Check for limits violations for every parameter	Sept 30, 1998

POC Trending and Performance Module



POC Trending and Performance Module



Accumulate Statistics

Calculates the Mean and Standard Deviation for each parameter in the specified 24-hour period.

Calculate Min/Max

Calculates minimum and maximum of each parameter in the specified 24-hour period.

POC Trending and Performance Module

Generate 24-hour Report

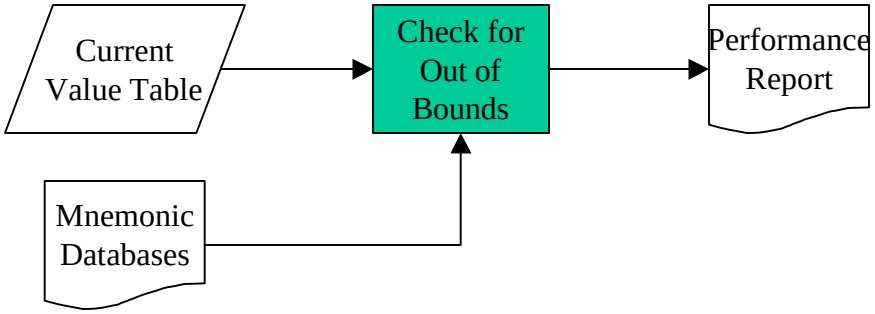
Opens and reports current values for each parameter in a daily file. Parameters stored are:

- CVT Index
- Mnemonic
- Total 24-hour count of each parameter
- Mean of each parameter
- Standard Deviation of each parameter
- Min/Max of each parameter

Plot Selected Parameters

Opens 24-hour Trending Report, and plots selected parameters in a specified time frame

POC Trending and Performance Module



Check for Out of Bounds

As each packet is processed the parameters are checked for out-of-bounds values. If any parameter exceeds their boundaries it is recorded in a Performance Report.

Report Fields:

- Time
- Parameter ID
- Value
- Red or Yellow
- High or Low
- Who to contact

Milestones (Past and Future)

Initial POC Interface Test, May 11, 1998

Tested the prototype POC Commanding Module and Telemetry Display Module while the SABER prototype electronics where at LaRC for EMI/EMC. Test was conducted over the LaRC intranet. The POC communicated with the SABER electronics via the TIMED Spacecraft Emulator.

Phase I POC Engineering Tests, November/December, 1998

Informal testing carried out during Engineering Calibration. All POC modules will be exercised throughout Engineering Calibration and Formal Calibration. While most tests will be conducted on SDL's intranet, some tests will be conducted between LaRC and SDL via the internet.

POC/MOC Test, November, 1998

This will be an informal test of the POC Command link. Encrypted Command Message Files will be sent to the TIMED MOC for decryption and generation of Return Receipts. Test will be conducted between LaRC and APL via the internet.

Milestones (Past and Future)

POC Acceptance Test, May, 1999

POC will undergo a formal testing prior to the shipment of the SABER instrument to APL. The test will exercise all modules of the POC and will be conducted over the internet between LaRC and SDL for the flight POC and on SDL's intranet for the test POC. This will verify the POC's readiness for I&T. All modules will be tested.

Pre-Integration Test, June, 1999

This test will be conducted after the instrument has reached APL prior to being integrated onto the TIMED spacecraft. The test POC will be located at APL and the flight POC will be located at LaRC. All POC modules will be tested.

Phase II POC Test, TBD (not before Jan, 2000)

This will be a final verification test of the POC prior to launch. It will be conducted during final I&T or mission simulations, as appropriate. All respective modules on the test and flight POC's will be tested.

Schedule

ID	Task Name	Duration	Start	Finish
1	1.2 POC Software Development	740d	Tue 7/1/97	Mon 5/1/00
2	1.2.1 Software Design	420d	Tue 7/1/97	Mon 2/8/99
3	Phase I - Design	67d	Tue 7/1/97	Wed 10/1/97
4	Phase II - Review and Design	5w	Thu 9/24/98	Wed 10/28/98
5	Phase II - Review and Design, cont'd	22d	Fri 1/8/99	Mon 2/8/99
6	1.2.2 Instrument Critical Design Review	15.5d	Thu 10/2/97	Thu 10/23/97
7	Prep for SABER Instrument CDR	2.5w	Thu 10/2/97	Mon 10/20/97
8	SABER Instrument CDR	3d	Mon 10/20/97	Thu 10/23/97
9	1.2.3 Ground Processing CDR	23d	Mon 6/1/98	Wed 7/1/98
10	Prep for SABER Ground Processing CDR	2.6w	Mon 6/1/98	Wed 6/17/98
11	SABER Ground Processing CDR	1d	Wed 7/1/98	Wed 7/1/98
12	1.2.4 Write Software	546d	Mon 10/27/97	Mon 11/29/99
13	Phase I - POC Commanding Module	36d	Mon 10/27/97	Mon 12/15/97
14	Phase I - POC RT/Replay	87d	Thu 1/1/98	Fri 5/1/98
15	Phase I - Level 0 Module	13.4w	Tue 5/12/98	Wed 8/12/98
16	Phase I - POC Trending and Performance	6w	Thu 8/13/98	Wed 9/23/98
17	Phase II - POC Commanding Module	8w	Fri 11/13/98	Thu 1/7/99
18	Phase II - POC RT/Replay Module	15w	Tue 3/9/99	Mon 6/21/99
19	Phase II - Monitoring and Trending	10w	Tue 6/29/99	Mon 9/6/99
20	Phase II - Level 0 Module	12w	Tue 9/7/99	Mon 11/29/99
21	1.2.5 Test / Maintain Software	521d	Mon 5/4/98	Mon 5/1/00
22	Initial POC Test	6d	Mon 5/4/98	Mon 5/11/98
23	Engineering POC Tests	44d	Mon 11/2/98	Thu 12/31/98
24	POC Pre-Ship Test	1w	Mon 5/10/99	Fri 5/14/99
25	POC I&T Acceptance Test	1w	Thu 6/10/99	Wed 6/16/99
26	Phase II - POC Test	10d	Mon 1/17/00	Fri 1/28/00
27	Maintain Software	17.2w	Mon 1/3/00	Mon 5/1/00
28	1.2.6 Program Support	183d	Thu 10/15/98	Mon 6/28/99
29	Initial Engineering Calibration Support	11d	Thu 10/15/98	Thu 10/29/98
30	Additional Engineering Calibration Support	2w	Fri 10/30/98	Thu 11/12/98
31	Initial Calibration Support	2w	Tue 2/9/99	Mon 2/22/99
32	Additional Calibration Support	2w	Tue 2/23/99	Mon 3/8/99
33	S/C Integration and Test	2w	Tue 6/15/99	Mon 6/28/99
34				
35	**Delta II Launch**	**1d**	**Thu 5/18/00**	**Thu 5/18/00**