GOODRICH
Pump & Engine Control Systems, Inc.
Charter Oak Boulevard
West Hartford, CT 06133
860 236 0651

SHORT REPORT SUMMARY	PECS REPORT NO. S-2217
REPORT TITLE: EMC-35A ECU Material Review and Data Recovery Bell 407 (2) Mid-air Collision in Flagstaff Arizona	DATE: 29 August 2008
	DEPT. NO. D934

SCOPE OF REPORT: Document Results of ECU Material Review and Data Recovery Effort.

BACKGROUND:

Per the NTSB Preliminary Incident Report **DEN08MA116A** that is included in its entirety in Appendix A of this report, on June 29th 2008 two Bell 407 helicopters, owned and operated by independent medical evacuation services, collided on approach to the Flagstaff Medical Center helipad in Flagstaff Arizona. The collision destroyed both aircraft and was fatal to the seven passengers on board the two helicopters. The collision is reported to have occurred at 3:47 PM local time with clear weather conditions and was recorded by a parking lot rooftop security camera.

One of the aircraft, registered N407GA, was operated by Air Methods Corp. of Englewood, Colorado, registered to Flagstaff Medical Center, Flagstaff, Arizona and was consumed by a post impact fire. ECU serial number JG8ALK0554 was found to be installed.
The second aircraft, registered N407MJ was operated by Classic Helicopter Services, Page, Arizona, and registered to M&J Leisure, L.L.C., Ogden, Utah. ECU serial number JG0ALK0653 was found to be installed.

On or about July 2nd GPECS was notified by RRC Air Safety Investigator Jon-Adam Michael that the ECUs of both aircraft had been recovered and that they were being sent to GPECS in an effort to recover any incident related FADEC System data from the ECU's non-volatile memory devices. Jon also mentioned that the NTSB would be attending the ECU material review as well.

On August 5th an investigation team, lead by Jon Michael and NTSB representative Ronald Price convened at GPECS to begin the material review process. Tom Ronan, RRC Project Engineer also attended the review.

DESCRIPTION:

The objective of the ECU investigation was to download any Engine Monitor, Fault History, or Incident Recorder data from the ECU non-volatile memories that may exist and to provide interpretation of any data recovered. By design, the ECU has a real time capability to store FADEC System Engine History, Fault History, or abnormal engine system condition (incidents) information in a electrically erasable programmable read only memory (EEProm) integrated circuit (IC) device that is located on the ECU processor (CPU) board at design position U40. The information remains in the EEProm device and is retrievable even if the ECU power has been removed. If undamaged, the EEProm IC can be removed from a damaged CPU Board and installed in a "test" ECU to provide the information retrieval.

GPECS team members included:

Bruce Millar	Electronics Product Support Team Leader
Salvatore Vinci	Electronics Product Support Engineer
Dennis McBrine	Systems Engineering

ECU Investigation Results:

ECU "As Received" Material Review;

Under the observation of the investigation team, the ECUs were removed from the shipment packaging and examined (reference images in Appendix B). As documented by the images in Appendix B both ECUs were found to be damaged.

The ECU from the Air Methods aircraft that caught fire, s/n JG8ALK0554 was severely damaged and upon review of the CPU Board and the EEProm IC the device was also found to be damaged with no hope of data recovery as the IC lid was found off and the die exposed with several fractures (reference images B-13, B-14).

Written by: B. Millar [redacted] 9/12/08		Distribution: S. Vinci, B. Feller, T. Ziotas, J. Brennan, R. Bharadwaj
Approved by: [redacted] D. McBrine 9/15/08	Approved by: W. Wattley [redacted]	

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Approved by: D. McBrine	Approved by: W. Wattley	

The ECU from the Classic Helicopter aircraft, s/n JG0ALK0653 was considerably less damaged and upon review of the CPU Board and the EEProm IC, both were found to be relatively undamaged. The loading condition of the Main Power supplies was measured on the CPU Board and found to be normal (See Table 1). The CPU board condition was considered likely operable so it was removed from he ECU and installed in a "test" unit that allowed for the download of the EEProm data.

EEProm Data Review:

The Maintenance Terminal interpretation of the EEProm data is summarized and found in Appendix C-1.

Engine History Data:
The obtained Engine History data indicates engine-operating time "EngRnTm" to be 1375 hours with 11634 engine starts (NumStrt) also recorded. This engine related data is loaded into the ECU memory as a part of aircraft maintenance, if an engine or ECU were to be replaced on the aircraft.

The ECU operating time "ECUOpTm" is 3557 hours that represent an approximation for amount of time the ECU has operated an engine since the last Repair Station action on the unit.

The Power turbine (Np) speed exceedance monitor levels are indicated by NpLmPk and NpLmTm, a record of previous engine operation. The Np peak exceedance time "NpLmTm"of 0.096 seconds, reflects an accumulation of time that engine Np exceeded 102.1 %Np and a peak exceedance value "NpLmPk" of 103.9 %Np is a maximum level of Np that has been detected. Recorded Np monitor values are not uncommon due to occasional flight operation conditions (quick landings or descents) and do not necessarily indicate any system or operating irregularities.

FADEC System Fault History:
Definitions;
"Last Engine Run Faults" are a record of fault conditions detected (one or more) during the most recent engine run only.
"Accumulated Faults" are an indication of faults (one or more) that have been detected, including the "Last Engine Run" faults, since the previous fault clear maintenance process of the ECU.
"Time Stamped Faults" are an accounting of frequency of recent fault AND exceedance detections with a record generated for each occurrence of fault detection, providing sequence and time stamping in terms of engine operating time. There is a limit of 30 Time Stamp records that can be recorded, after which the most recent record will overwrite the oldest record.
The fault history recovered indicates no Last Engine Run, or Accumulated faults but in the Time Stamped Fault area there is the indication of a partial Nr sensor fault record (NrFlt) being stored with the time stamp reading 00:00. This is likely due to power interruption from the collision and is discussed further in the Incident Recorder interpretation.

Incident Recorder (IR) data:
"Explanation of IR Operation"
The IR operates by monitoring a particular set of engine control conditions (indicated in the column headings of Appendix C-2), at the same rate as the engine control (24 msec./Set), for conditions that are determined to be abnormal or an "incident". The IR maintains a 12 second memory buffer (10 sample sets at 1.2 secs./ sample) of pre-incident data. All the IR monitoring and buffer data occurs in the volatile memory space of the microprocessor system. If an "incident" is detected, the "incident" data set is written to the system non-volatile memory space as "Snapshot" data. The IR then proceeds to write the 10 data sets of pre "incident ("buffered" data, and the next (post-"incident") 40 data sets (also at 1.2 secs./Set), to non-volatile memory (EEPROM). Non-volatile data storage priority is given to the "Snapshot" data, so that additional "incidents" detected, will be saved before completing the storing of pre- or post-incident data
NOTE: The IR functions are disabled (cease to monitor or record data) when the Power Lever Angle (PLA) drops below 40 degrees.

Table 2 provides a timeline of IR detected and recorded conditions related to the mid-air collision.

ECU Power Supply Condition Review;

Because of the understanding that certain ECU power supply component failures may result in a loss of engine power, the ECU was disassembled further to test for signs of such component failures. The Interface and Power Supply Boards were removed and inspected for thermally stressed components of which none were found. In addition the ECU Overspeed Power Supply (OS) outputs loading condition was measured on the Power Board using an ohmmeter. The readings are recorded in Table 1.

Supply	+5V	+15V	-15V	+5VOS	+15VOS	-15VOS
ECU	36 K	13 K	4.6 K			
Power Supply				2.0 K	4.0 M	1.8 M

Table 1.
ECU Power Supply Loading Condition Measured

No abnormalities were found that would indicate that an ECU power supply had malfunctioned.

The parking lot security video capture of the incident was provided for review by Jon Michael. The aircraft in the video were very distant appearing as not much more than dots that approached each other from opposite directions, collided, and quickly fell out of view.

Elasped Time (secs.) Relative to first "Incident" Trigger	Description of Aircraft/Engine Operation
-8.2 To -0.672	Data records 3 through 10 show normal engine operation with low power, collective (Cp), and Torque (Q), presumably due to descending approach flight condition of aircraft. Engine status words ESW 1 thru 6 indicate the FADEC System is in Auto Mode with no indication of a fault condition in the 8.5 seconds of data captured preceding the collision. Normally the data records would complete in records 1 and 2 for a full 12 seconds of pre-incident data, the data records are incomplete presumable due to loss of power prior to completion of the information storage.
0.0	1374:54:52.896 – First incident trigger due to a rotor system (Nr) droop (below 92 %) with Nr recorded at 86% Torque (Q) has increased from the previous 18 to 56%. Np has dropped from the previous 100 to 84%. Fuel Flow (Wf) is increasing from previous 124 to 152 pph. No change is ESW's This record is presumably the start of the mid-air collision causing the rotor system decay.
0.312	1374:54:53.208 – Second incident trigger due to a torque sensor rate exceedence (sample to sample change exceeded 1500 %/sec) presumably due to the rotor system striking the second aircraft. Np and Nr continue to reduce from previous Q decreases from previous Wf and MGT increase as the control system adds fuel to recover Np No change is ESW's The torque sensor has likely produced a very brief high reading due to the first rotor system strike that is captured by the IR but does not persist long enough to confirm in the engine control fault logic.
0.528	1374:54:53.424 – first post incident data record. Np and Nr continue to reduce from previous Q again increases likely due to additional rotor system collisions Wf and MGT continue to increase to recover Np There is a change in ESW's 3, 4, and 5 indicating a degraded condition due to a confirmed Nr sensor fault detection. The condition is also partially recorded in the Time Stamp Faults area of the Maintenance Terminal Fault History downloaded. It is assumed the time stamp is missing due to system power loss to the ECU after the collision. Because of the loss of power it can not be determined whether the Nr sensor fault was range, rate, or continuity related. In either case the sensor fault was likely caused by mechanical damage to the sensor or by abnormal rate change due to the rotor system collision.

Table 2.
Interpretation of the Incident Recorder (IR) Data
Recovered from Classic Helicopter ECU s/n JG0ALK0653

CONCLUSION:

Damage to the Air Methods aircraft ECU s/n JG8ALK0554 was extensive due to the post crash fire and no information could be retrieved from the unit. Damage to the Classic Helicopter aircraft ECU, s/n JG0ALK0653 was considerably less and the incident data was retrieved. Both ECU's are damaged beyond economical repair.

The fault history and incident data retrieved from ECU JG0ALK0653 has what is believed to be witness data that is the result of the mid-air collision. There is no data that suggests there were any abnormalities in the FADEC System prior to the collision.

The JG0ALK0653 ECU power supply component condition review detected no material anomalies.

Appendix A:
Aircraft Incident
NTSB
Preliminary Report

NTSB Identification: **DEN08MA116A**
Nonscheduled 14 CFR Part 135: Air Taxi & Commuter
Accident occurred Sunday, June 29, 2008 in Flagstaff, AZ
Aircraft: Bell 407, registration: N407GA
Injuries: 7 Fatal.

This is preliminary information, subject to change, and may contain errors. Any errors in this report will be corrected when the final report has been completed.

On June 29, 2008, at 1547 Mountain Standard Time, a Bell 407 emergency medical service (EMS) helicopter, N407GA, and a Bell 407 EMS helicopter, N407MJ, collided in mid air while approaching the Flagstaff Medical Center helipad (3AZ0), Flagstaff, Arizona. Both helicopters were destroyed. N407GA's commercial pilot, flight nurse, and patient sustained fatal injuries; and N407MJ's commercial pilot, flight paramedic, flight nurse, and patient sustained fatal injuries. N407GA was operated by Air Methods Corp., Englewood, Colorado, and registered to Flagstaff Medical Center, Flagstaff, Arizona. N407MJ was operated by Classic Helicopter Services, Page, Arizona, and registered to M&J Leisure, L.L.C., Ogden, Utah. Visual meteorological conditions prevailed, and company flight plans were filed for each of the Title 14 Code of Federal Regulations Part 135 air medical flights. N407GA's flight departed the Flagstaff Pulliam Airport (FLG), Flagstaff, at 1544, and N407MJ's flight departed the Grand Canyon National Park Service South Rim helibase, Tusayan, Arizona, at 1517.

At 1516, the pilot of N407GA, call sign Angel 1, contacted Guardian Air dispatch at FLG and reported that they were departing Winslow, Arizona, with four people on board; the pilot, the two flight nurses and the patient. The pilot stated that his estimated time en route was 25 minutes and he was either going to land at FLG or proceed directly to the Flagstaff Medical Center (FMC) helipad. The pilot was not sure if he would be at the proper weight to land with enough power margin to execute an out of ground effect hover on the rooftop helipad. At 1519, the Guardian Air dispatch transportation coordinator contacted FMC and reported that Angel 1 was inbound to the helipad in approximately 23 minutes.

At 1519, the pilot of N407MJ, call sign Lifeguard 2, contacted their communications center and reported that they had departed the south rim of the Grand Canyon and were en route to FMC with an estimated time en route of 32 minutes, and four people on board; the pilot, the flight nurse, the flight paramedic, and the patient. About a minute later, the pilot of Angel 1 called Guardian Air dispatch and reported that they were going to "drop one" at FLG before proceeding to land at Flagstaff Medical Center.

At 1523, the dispatcher on duty at Classic Helicopter Service contacted Guardian Air dispatch and reported that Lifeguard 2 was en route to FMC and would be arriving from the north. The dispatcher also reported that it would be a "cold drop," and the emergency department at the hospital had already been notified. The Guardian Air dispatch transportation coordinator then informed the Classic dispatcher that Angel 1 was also en route and would be landing at Flagstaff Medical Center in 20 minutes.

At the end of that call, the Guardian Air dispatch transportation coordinator called FMC and stated that Lifeguard 2 would also be landing at the hospital in "about twenty-eight minutes...and they know about mine coming in." The person who answered the phone in the emergency department responded, "all right." The transport coordinator then contacted the pilot of Angel 1 and informed him that Lifeguard 2 would also be landing at Flagstaff Medical Center in approximately 28 minutes. The pilot responded, "Roger will be looking for 'em thanks."

At 1532, the pilot of Lifeguard 2 contacted the Classic Helicopter Service communication center, provided a position report and said that they were 15 minutes from landing at FMC. The dispatcher on duty responded, "comm center copies all sir...I'll talk to you on the ground in fifteen minutes, 1532." This was the last recorded communication with the pilot of N407MJ.

Also at 1532, the pilot of Angel 1 contacted Guardian Air dispatch and reported that they were 10 minutes from landing at FLG. At 1544, the pilot of Angel 1 contacted Guardian Air dispatch and stated, "control Angel 1 if you haven't figured it out we've uh landed at the...airport departed and we're about two minutes out of the hospital." The transportation coordinator responded and copied the transmission. This was the last recorded communication with the pilot of N407GA.

There were no recorded communications between the pilots of the two helicopters.

A review of the recorded transmissions made between both medical crews and the hospital revealed that both of the medical crews contacted the emergency department at FMC and provided medical reports on their respective patients. At the time Angel 1 contacted the hospital, they provided an estimated time of arrival in 15 minutes. The Classic Helicopter Services medical crew reported an estimated time of arrival of 18 minutes. The hospital staff that received the phone calls from both aircraft did not provide any information about the other helicopter that was also en route to the Flagstaff Medical Center helipad.

Several people witnessed the collision of the helicopters as they approached the hospital helipad and reported seeing both helicopters descending into wooded terrain about 1/4 mile from the heliport. There was a small fire noted rising from the hilly terrain, followed by a loud explosion shortly after the collision.

A surveillance camera, mounted on a parking garage at the hospital, captured the collision on digital video. The video depicted one helicopter approaching from north and one helicopter approaching from the south, and shows both aircraft descending after the collision. The video was sent to the NTSB Vehicle Recorders laboratory, Washington, DC, for further examination.

The accident site was located in a partially wooded, rocky mesa, approximately 1/4 mile east of the FMC helipad at an elevation of 7,060 feet mean sea level. N407GA's main wreckage was located on the top of the mesa in a rocky, grass terrain; and N407MJ's main wreckage was located in wooden terrain. The main wreckages of both helicopters came to rest approximately 300 feet apart from each other. The debris area, approximately 1/4 mile in diameter, contained fragmented sections of main rotor blades, plexiglass, and fiberglass. N407GA was partially consumed by post-impact fire and N407MJ did not have a post-impact fire. N407GA experienced a secondary post-impact explosion approximately 3 minutes after the accident. Three first responders sustained minor injuries during the explosion.
At the time of the accident, the weather was reported as partly cloudy and winds were light and variable.

Appendix B:

Investigation
Digital Images

RRC Images Provided of ECU Condition at the Incident Site

Figure B-1
ECU S/N JG0ALK0653

Figure B-2
ECU S/N JG8ALK0554

GPECS Investigation Images

Figure B-3
Shipping Package

Figure B-4
Internal Packaging

Figure B-5
ECU S/N JG0ALK0653

Figure B-6
ECU S/N JG8ALK0554

GPECS Investigation Images

ECU S/N JG0ALK0653 **ECU S/N JG8ALK0554**

Figure B-7

Figure B-8

Figure B-9

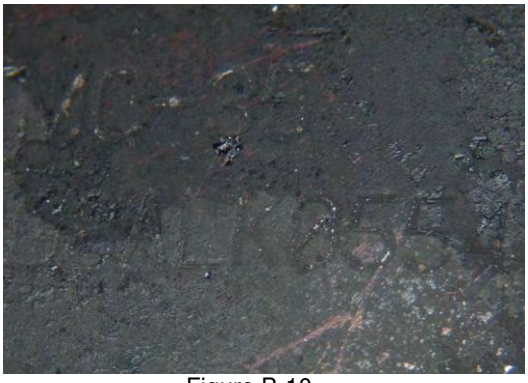

Figure B-10

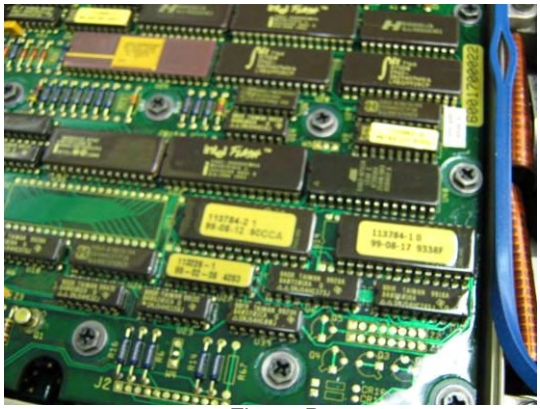

Figure B-11

Figure B-12

ECU JG8ALK0554 U40 IC Die Damage

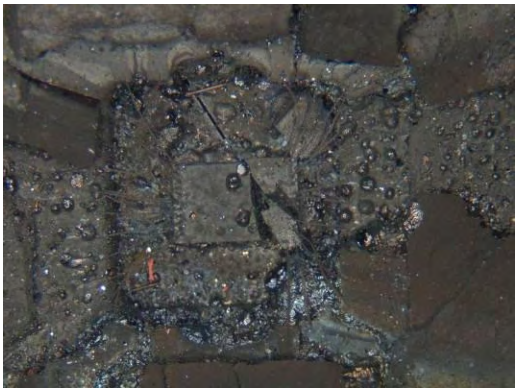

Figure B-13

Figure B-14

Appendix C:

ECU JG0ALK0653
EEProm Data Recovered.

53079 Summary.mtd

```
Data Source:     ECU
Data Time:       8/5/08  10:13:15 AM
Aircraft Model:  Bell 407
Engine Model:    250-C47B
ECU Version:     257-5202
ID:              33B6
User Name:       guest
Engine S/N:      CAE-847227
ECU S/N:         JG0ALK0653
Compressor S/N:  CAC-44311
Turbine S/N:     CAT-44513
HMU S/N:         JGALM0548
Eng Gearbox S/N:CAG-47503
Aircraft ID:     53079

Last Engine Run Faults
   No Faults Found

Accumulated Faults
   Fault Name   Description
   ----------   -----------
   NpLmTOut     - Np Limit Exceedance

Time Stamped Faults
   Fault Time           Fault Name      Description
   ----------           ----------      -----------
   1371:01:18.216       NpLmTOut        - Np Limit Exceedance
   00:00:00.000         NrFlt           - Nr Fault

Engine History Data
   Name          Value   Units   Description
   ----          -----   -----   -----------
   ECUOpTm       3556.53 Hours   ECU Operating Time (counter)
   EngRnTm       1374.80 Hours   Engine Operating (Running) Time (counter)
   MGTLmPk          0.0  Deg F   MGT Limit Exceedance Peak
   MGTLmTm         0.00 Seconds MGT Limit Exceedance Time
   MGTRLmPk         0.0 Deg F   MGT Run Limit Exceedance Peak
   MGTRLmTm        0.00 Seconds MGT Run Limit Exceedance Time
   MGTSLmPk         0.0 Deg F   MGT Start Limit Exceedance Peak
   MGTSLmTm        0.00 Seconds MGT Start Limit Exceedance Time
   MGTSRLmPk        0.0 Deg F   MGT Start Run Limit Exceedance Peak
   MGTSRLmTm       0.00 Seconds MGT Start Run Limit Exceedance Time
   NgLmPk          0.00 %Ng     Ng Limit Exceedance Peak
   NgLmTm          0.00 Seconds Ng Limit Exceedance Time
   NgRLmPk         0.00 %Ng     Ng Run Limit Exceedance Peak
   NgRLmTm         0.00 Seconds Ng Run Limit Exceedance Time
   NpQNppkExLm     0.00 %Np     Np Peak Value During NpQ Exceedance Limit Advisory
   NpQNppkRnLm     0.00 %Np     Np Peak Value During NpQ Run Limit Advisory
   NpQQpkExLm       0.0 %Q      Q Peak Value During NpQ Exceedance Limit Advisory
   NpQQpkRnLm       0.0 %Q      Q Peak Value During NpQ Run Limit Advisory
   NumStrt        11634 Starts  Number of Engine Starts
   OEITMInd       FALSE Boolean Maintenance indication of a 2 minute event (EEPROM Parameter)
   OEITSInd       FALSE Boolean Maintenance indication of a 30 second event (EEPROM Parameter)
   OSCyc              A Boolean Overspeed Cycle
   QLmPk            0.0 %Q      Q Limit Exceedance Peak
   QLmTm           0.00 Seconds Q Limit Exceedance Time
   QRLmPk           0.0 %Q      Q Run Limit Exceedance Peak
   QRLmTm          0.00 Seconds Q Run Limit Exceedance Time
   SgCtr              0 Surges  Number of Surge Occurrences Counter
   TMTmExcFlg     FALSE Boolean Maintenance Flag (EEPROM) to Indicate Excessive use of 2 Minute OEI Power.
   TSTmExcFlg     FALSE Boolean Maint Flag (EEPROM) Indicating Excessive Use of 30 sec Power
   TMEvents           0 Events  Total Number of 2 min Events (EEPROM)
   TMLmTm          0.00 Seconds Total Time (counter) at 2 min OEI Power
   TSEvents           0 Events  Total Number of 30 Second Power Events (EEPROM)
   TSLmTm          0.00 Seconds Total Time (counter) at 30 sec OEI Power
   EngRunCtr       0.00 Seconds Engine Run Time Interval Counter
   NpLmPk        103.09 %Np     Np Limit Exceedance Peak Value
   NpLmTm          0.96 Seconds Np Limit Exceedance Time
   OSCtr              0 Events  Engine Overspeed Counter
   SpareData1         0 packed word
   SpareData2         0 packed word
   SpareData3         0 packed word
   EmData_Chksum   19934        packed word
```

Page 1

C-1 Maintenance Terminal Data

53079.eep - Snapshot Data Page 1 of 1

ECU Version: C-00257-5202 33B6 Date Extracted: 08/05/08 14:16:53 UTC
Description: 53079 Flagstaff Accident - Classic Helicopters

	Snapshot	TypeWrd1	TypeWrd2	Time Stamp HH:MM:SS.mmm	NgInRcrd %Ng	NrInRcrd %Nr	MGTInRcrd Deg F	QInRcrd %Q	NpInRcrd %Np	WfActInRcrd pph	NDOTFilt %Ng/Sec	P1InRcrd psia	Mode	CPInRcrd %CP	ESW Counts	ESW2 Counts	ESW3 Counts	ESW4 Counts	ESW5 Counts	ESW6 Counts	NDOTWRCd	PLAInRcrd Deg PLA	T1InRcrd Deg F	EngRnTm	EngRnCtr	Spare1	Spare2	Spare3	Spare4
	1	0x0002	0x0000	1374:54:52.896	84	86	920	56	84	152	0.5	11.46	1	20	0x0001	0x0000	0x0000	0x0000	0x8090	0x8080	23	64	80	10311	17204	0	0	0	0
	2	0x0400	0x0000	1374:54:53.208	86	81	980	42	68	196	5.2	11.46	1	24	0x0001	0x0000	0x0000	0x0000	0x8090	0x8080	7	68	80	10311	17217	0	0	0	0
E	3	0x0000	0x0000	00:00:00.000	0	0	0	0	0	0	0.0	0.00	0*	0	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0*	0	0	0	0	0	0	0	0
E	4	0x0000	0x0000	00:00:00.000	0	0	0	0	0	0	0.0	0.00	0*	0	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0*	0	0	0	0	0	0	0	0
E	5	0x0000	0x0000	00:00:00.000	0	0	0	0	0	0	0.0	0.00	0*	0	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0*	0	0	0	0	0	0	0	0
E	6	0x0000	0x0000	00:00:00.000	0	0	0	0	0	0	0.0	0.00	0*	0	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0*	0	0	0	0	0	0	0	0
E	7	0x0000	0x0000	00:00:00.000	0	0	0	0	0	0	0.0	0.00	0*	0	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0*	0	0	0	0	0	0	0	0
E	8	0x0000	0x0000	00:00:00.000	0	0	0	0	0	0	0.0	0.00	0*	0	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0*	0	0	0	0	0	0	0	0
E	9	0x0000	0x0000	00:00:00.000	0	0	0	0	0	0	0.0	0.00	0*	0	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0*	0	0	0	0	0	0	0	0
E	10	0x0000	0x0000	00:00:00.000	0	0	0	0	0	0	0.0	0.00	0*	0	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0*	0	0	0	0	0	0	0	0

C-2 Incident Recorder Snapshot Data

Record	Timestamp	NgInRcrd	NrInRcrd	MGTInRcrd	QInRcrd	NpInRcrd	WfActInRcrd	NDOTFilt	P1InRcrd	Mode	CPInRcrd	ESW	ESW2	ESW3	ESW4	ESW5	ESW6	NDOTWRCd	PLAInRcrd	T1InRcrd	EngRnTm	EngRnCtr	Spare1	Spare2	Spare3	Spare4
		%Ng	%Nr	Deg F	%Q	%Np	pph	%Ng/Sec	psia		%CP	Counts	Counts	Counts	Counts	Counts	Counts		Deg PLA	Deg F						
1	00:00:00.000	0	0	0	0	0	0	0	0	0	0	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0	0	0	0	0	0	0	0	0
2	00:00:00.000	0	0	0	0	0	0	0	0	0	0	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0	0	0	0	0	0	0	0	0
3	1374:54:43.824	81	100	960	12	100	112	-0.2	11.43	1	26	0x0001	0x0000	0x0000	0x0000	0x8090	0x8080	4	66	80	10311	16826	0	0	0	0
4	1374:54:45.024	82	100	960	16	100	128	1.4	11.43	1	24	0x0001	0x0000	0x0000	0x0000	0x8090	0x8080	4	66	80	10311	16876	0	0	0	0
5	1374:54:46.224	83	100	940	16	100	120	0.2	11.46	1	24	0x0001	0x0000	0x0000	0x0000	0x8090	0x8080	4	66	80	10311	16926	0	0	0	0
6	1374:54:47.424	83	100	920	18	100	136	0.2	11.46	1	26	0x0001	0x0000	0x0000	0x0000	0x8090	0x8080	4	66	82	10311	16976	0	0	0	0
7	1374:54:48.624	85	100	940	20	100	136	0.4	11.46	1	26	0x0001	0x0000	0x0000	0x0000	0x8090	0x8080	4	66	80	10311	17026	0	0	0	0
8	1374:54:49.824	85	100	940	20	100	132	0.2	11.48	1	26	0x0001	0x0000	0x0000	0x0000	0x8090	0x8080	4	66	82	10311	17076	0	0	0	0
9	1374:54:51.024	84	100	900	18	100	116	-1.8	11.45	1	24	0x0001	0x0000	0x0000	0x0000	0x8090	0x8080	4	66	80	10311	17126	0	0	0	0
10	1374:54:52.224	84	100	920	18	100	124	-0.1	11.54	1	24	0x0001	0x0000	0x0000	0x0000	0x8090	0x8080	4	66	82	10311	17176	0	0	0	0
11	1374:54:53.424	87	69	1020	62	65	212	6.3	11.55	1	26	0x0001	0x0000	0x0004	0x8000	0x8092	0x8080	7	70	80	10311	17226	0	0	0	0
12	00:00:00.000	0	0	0	0	0	0	0	0	0	0	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0	0	0	0	0	0	0	0	0
13	00:00:00.000	0	0	0	0	0	0	0	0	0	0	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0	0	0	0	0	0	0	0	0
14	00:00:00.000	0	0	0	0	0	0	0	0	0	0	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0	0	0	0	0	0	0	0	0
15	00:00:00.000	0	0	0	0	0	0	0	0	0	0	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0	0	0	0	0	0	0	0	0
16	00:00:00.000	0	0	0	0	0	0	0	0	0	0	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0	0	0	0	0	0	0	0	0
17	00:00:00.000	0	0	0	0	0	0	0	0	0	0	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0	0	0	0	0	0	0	0	0
18	00:00:00.000	0	0	0	0	0	0	0	0	0	0	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0	0	0	0	0	0	0	0	0
19	00:00:00.000	0	0	0	0	0	0	0	0	0	0	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0	0	0	0	0	0	0	0	0
20	00:00:00.000	0	0	0	0	0	0	0	0	0	0	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0	0	0	0	0	0	0	0	0
21	00:00:00.000	0	0	0	0	0	0	0	0	0	0	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0	0	0	0	0	0	0	0	0
22	00:00:00.000	0	0	0	0	0	0	0	0	0	0	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0	0	0	0	0	0	0	0	0
23	00:00:00.000	0	0	0	0	0	0	0	0	0	0	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0	0	0	0	0	0	0	0	0
24	00:00:00.000	0	0	0	0	0	0	0	0	0	0	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0	0	0	0	0	0	0	0	0
25	00:00:00.000	0	0	0	0	0	0	0	0	0	0	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0	0	0	0	0	0	0	0	0
26	00:00:00.000	0	0	0	0	0	0	0	0	0	0	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0	0	0	0	0	0	0	0	0
27	00:00:00.000	0	0	0	0	0	0	0	0	0	0	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0	0	0	0	0	0	0	0	0
28	00:00:00.000	0	0	0	0	0	0	0	0	0	0	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0	0	0	0	0	0	0	0	0
29	00:00:00.000	0	0	0	0	0	0	0	0	0	0	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0	0	0	0	0	0	0	0	0
30	00:00:00.000	0	0	0	0	0	0	0	0	0	0	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0	0	0	0	0	0	0	0	0
31	00:00:00.000	0	0	0	0	0	0	0	0	0	0	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0	0	0	0	0	0	0	0	0
32	00:00:00.000	0	0	0	0	0	0	0	0	0	0	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0	0	0	0	0	0	0	0	0
33	00:00:00.000	0	0	0	0	0	0	0	0	0	0	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0	0	0	0	0	0	0	0	0
34	00:00:00.000	0	0	0	0	0	0	0	0	0	0	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0	0	0	0	0	0	0	0	0
35	00:00:00.000	0	0	0	0	0	0	0	0	0	0	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0	0	0	0	0	0	0	0	0
36	00:00:00.000	0	0	0	0	0	0	0	0	0	0	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0	0	0	0	0	0	0	0	0
37	00:00:00.000	0	0	0	0	0	0	0	0	0	0	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0	0	0	0	0	0	0	0	0
38	00:00:00.000	0	0	0	0	0	0	0	0	0	0	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0	0	0	0	0	0	0	0	0
39	00:00:00.000	0	0	0	0	0	0	0	0	0	0	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0	0	0	0	0	0	0	0	0
40	00:00:00.000	0	0	0	0	0	0	0	0	0	0	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0	0	0	0	0	0	0	0	0
41	00:00:00.000	0	0	0	0	0	0	0	0	0	0	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0	0	0	0	0	0	0	0	0
42	00:00:00.000	0	0	0	0	0	0	0	0	0	0	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0	0	0	0	0	0	0	0	0
43	00:00:00.000	0	0	0	0	0	0	0	0	0	0	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0	0	0	0	0	0	0	0	0
44	00:00:00.000	0	0	0	0	0	0	0	0	0	0	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0	0	0	0	0	0	0	0	0
45	00:00:00.000	0	0	0	0	0	0	0	0	0	0	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0	0	0	0	0	0	0	0	0
46	00:00:00.000	0	0	0	0	0	0	0	0	0	0	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0	0	0	0	0	0	0	0	0
47	00:00:00.000	0	0	0	0	0	0	0	0	0	0	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0	0	0	0	0	0	0	0	0
48	00:00:00.000	0	0	0	0	0	0	0	0	0	0	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0	0	0	0	0	0	0	0	0
49	00:00:00.000	0	0	0	0	0	0	0	0	0	0	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0	0	0	0	0	0	0	0	0
50	00:00:00.000	0	0	0	0	0	0	0	0	0	0	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0	0	0	0	0	0	0	0	0

C-3 Incident Recorder Data.