

**NATIONAL TRANSPORTATION SAFETY BOARD**  
Office of Research and Engineering  
Washington, D.C.

March 26, 2001

**Second Addendum to Group Chairman's Factual Report - Flight Data Recorder**

**A. ACCIDENT**

**DCA00MA006**

Location:	About 60 miles south of Nantucket, Massachusetts
Date:	October 31, 1999
Time:	About 0150 EST
Aircraft:	EgyptAir Flight 990, a Boeing B-767-300ER, SU-GAP

**B. GROUP IDENTIFICATION**

No group was formed for this phase of the investigation.

**C. SUMMARY**

About 0150 eastern standard time (EST), on October 31, 1999, a Boeing 767-366ER, SU-GAP, operated by EgyptAir, as flight 990, crashed into the Atlantic Ocean about 60 miles south of Nantucket, MA. EgyptAir flight 990 was being operated under the provisions of Egyptian Civil Aviation Regulations Part 121 and United States Title 14 Code of Federal Regulations Part 129 as a scheduled, international flight from John F. Kennedy Airport (JFK), New York, New York to Cairo International Airport in Cairo, Egypt. The flight departed JFK about 0122 EST, with 4 flightcrew members, 10 flight attendants, and 203 passengers on board. There were no survivors. The airplane was destroyed by impact forces. Floating debris from the aircraft was recovered on the morning of October 31, 1999.

The entire contents of the accident airplane's flight data recorder (FDR), a Sundstrand Data Corporation (SDC - now named Honeywell Aerospace Electronic Systems) Universal Flight Data Recorder (UFDR) part number 980-4100-DXUS, serial number unknown, were transcribed.

A total of 8 autopilot disconnects and 7 autopilot connects, excluding the autopilot connect and subsequent disconnect during the accident flight, were identified in the entire 25-hour contents of the FDR. Data plots and tabular listings detailing each transition of the center autopilot "on/off" discrete are also included in this report.

## **D. DETAILS OF INVESTIGATION**

### **1. Center Autopilot Command Documentation**

The entire 25-hour flight history of the FDR was transcribed into computer memory using the Safety Board's Sundstrand UFDR Interface Unit. The FDR was transcribed at high speed into a binary computer file on the Safety Board's VAX computer. Each of the FDR's eight tracks was recorded into separate computer files. These files were transferred to the laboratory's Hewlett-Packard HP9000 minicomputer running TSB Canada-developed Replay And Presentation System (RAPS) software.

The 25-hour history of the airplane was examined further for instances of center autopilot disconnect and connect activity. Each instance of the autopilot command center transition, from "on" to "off" or vice-versa was noted within the data. Plots and tabular data for each transition are included in this report. For each of the events, the VAX, high-speed transcription FDR Elapsed Time was used as the time base.


A spreadsheet documenting each of the autopilot center command disconnects was included in Attachment 5. The spreadsheet documents the left and right elevator position just prior to and just after each center autopilot disconnect. The spreadsheet also indicates the flight leg for each autopilot disconnect event.

### **2. Co-Pilot's Master Warning Activation**

Observation of the 25-hour flight history recorded by the FDR determined that the first officer's master warning discrete continuously indicated "warning" for several hours. This condition occurred several times during the 25-hour history. However, the captain's master warning discrete did not exhibit similar activity and typically indicated "no warning".

The manufacturer of the digital flight data acquisition unit (DFDAU) was contacted regarding the continuously recorded warning. A representative of the manufacturer indicated that if the co-pilot's master warning pin connection (Port B46) to the rear of the DFDAU were intermittent an open signal condition would result. The DFDAU would interpret and the FDR would record the open signal as a zero value for the discrete. Since a zero value for the first officer's master warning was "warning", the first officer's master warning would be erroneously recorded on the FDR as "warning" whenever the pin connection was intermittent.

A plot of the 25-hour flight history of the FDR is included in Attachment 6. The plot includes selected pertinent parameters, including the captain and co-pilot's master warning discretes. Note that due to limitations of the RAPS software, the FDR Elapsed Time follows the 24-hour clock and does not reflect the total number of hours; therefore the end time of the plot is indicated as "01:00:00" and not "25:00:00".

  
Tom Jacky *TJ*  
Aerospace Engineer

#### Attachments

1. EgyptAir B767 SU-GAP FDR Data Plots Sets Regarding Autopilot Disconnects
2. EgyptAir B767 SU-GAP Tabular FDR Data Sets Regarding Autopilot Disconnects
3. EgyptAir B767 SU-GAP FDR Data Plots Sets Regarding Autopilot Connects
4. EgyptAir B767 SU-GAP Tabular FDR Data Sets Regarding Autopilot Connects
5. Spreadsheet Documentation of SU-GAP Autopilot Disconnects
6. Plot of EgyptAir B767 SU-GAP FDR Flight History

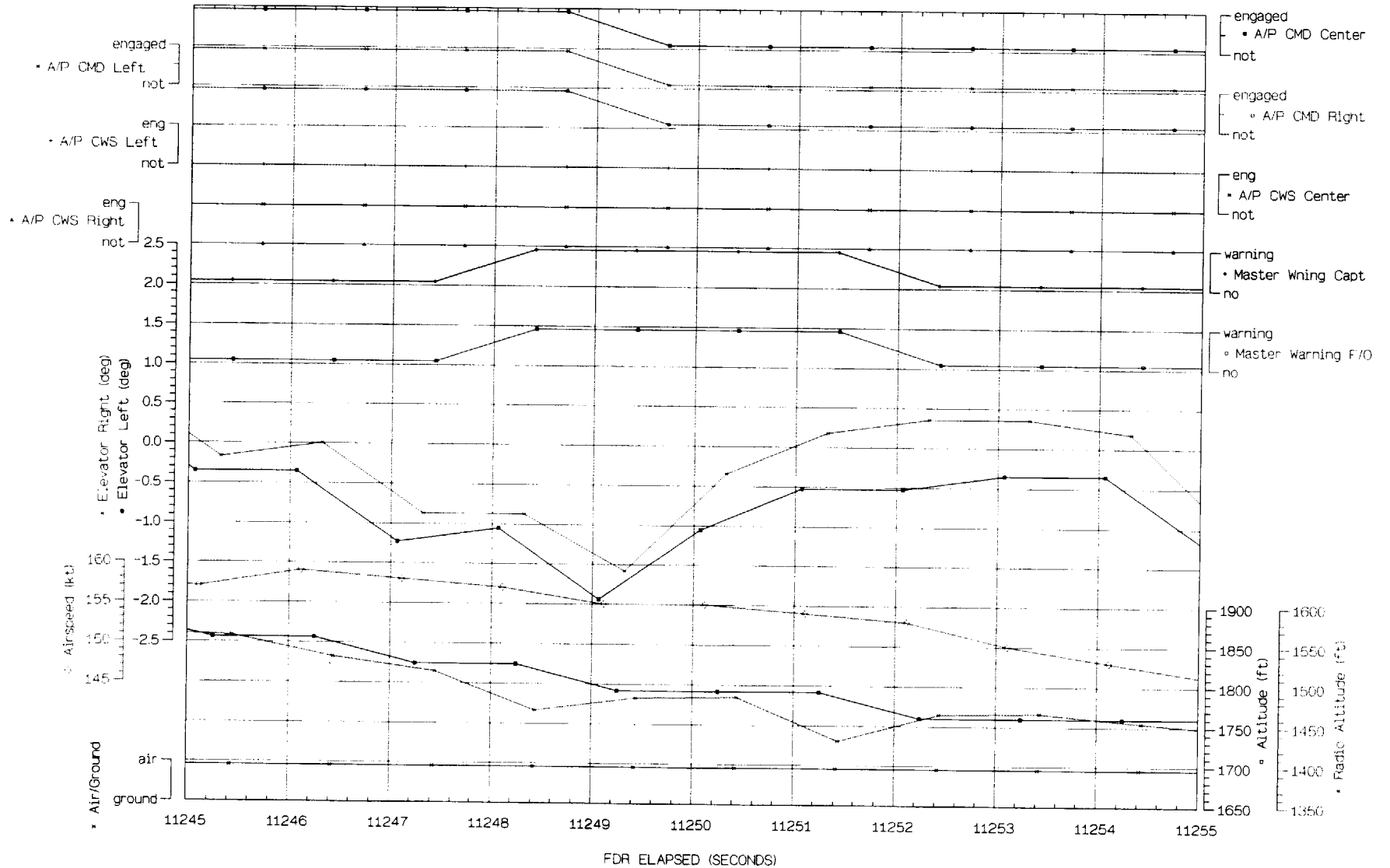
ATTACHMENT 1

**EgyptAir B767 SU-GAP FDR Data Plots Regarding Autopilot Disconnects**

# Egypt Air B767 SU-GAP

Elevator Data Check - Auto-Pilot Disc

All 25 Hours of FDR Data



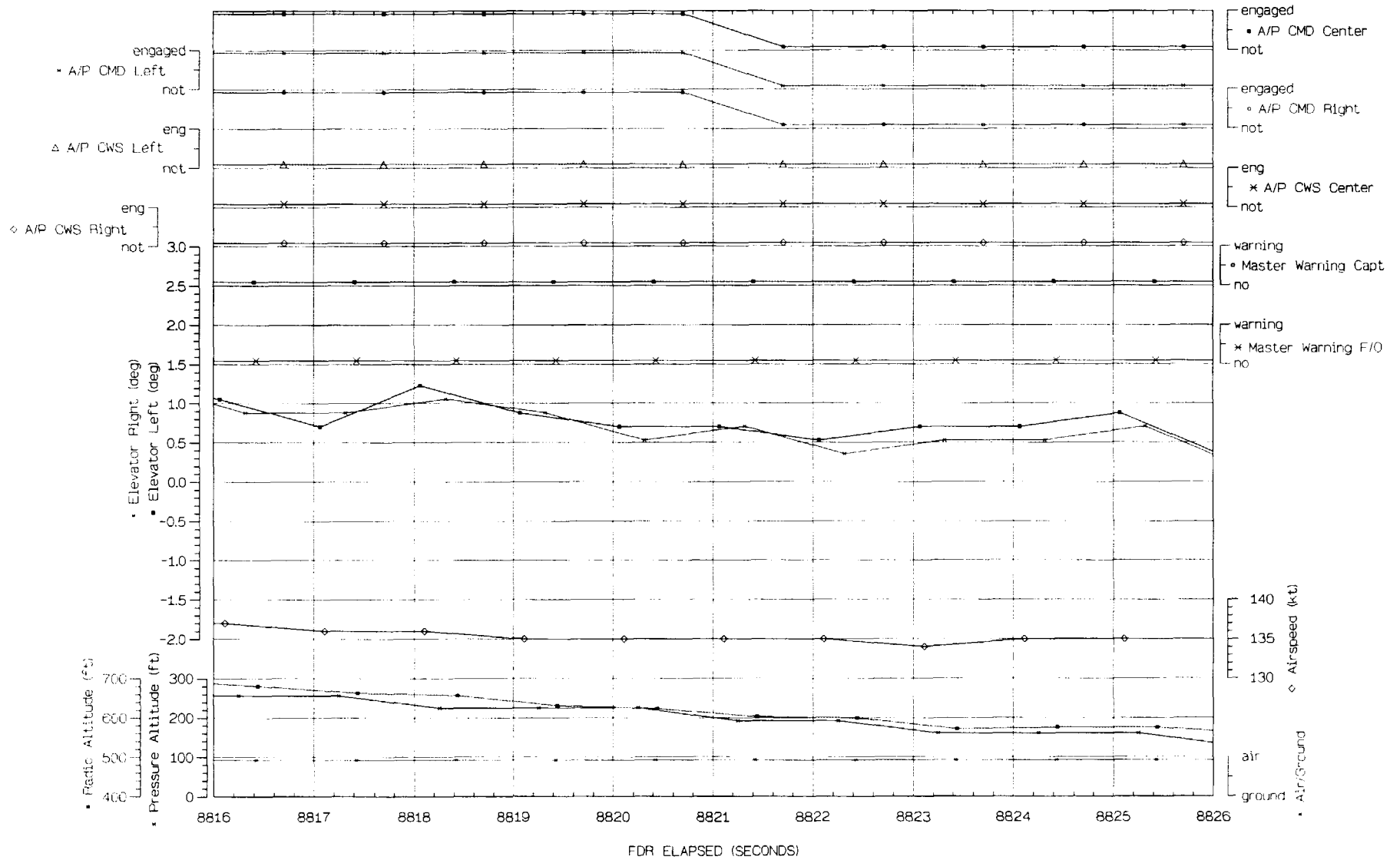
A/P Disconnect 1 - Track 3 Data  
Finalized: April 12, 2000

National Transportation Safety Board

# Egypt Air B767 SU-GAP

Elevator Data Check - Auto-Pilot Disc

All 25 Hours of FDR Data



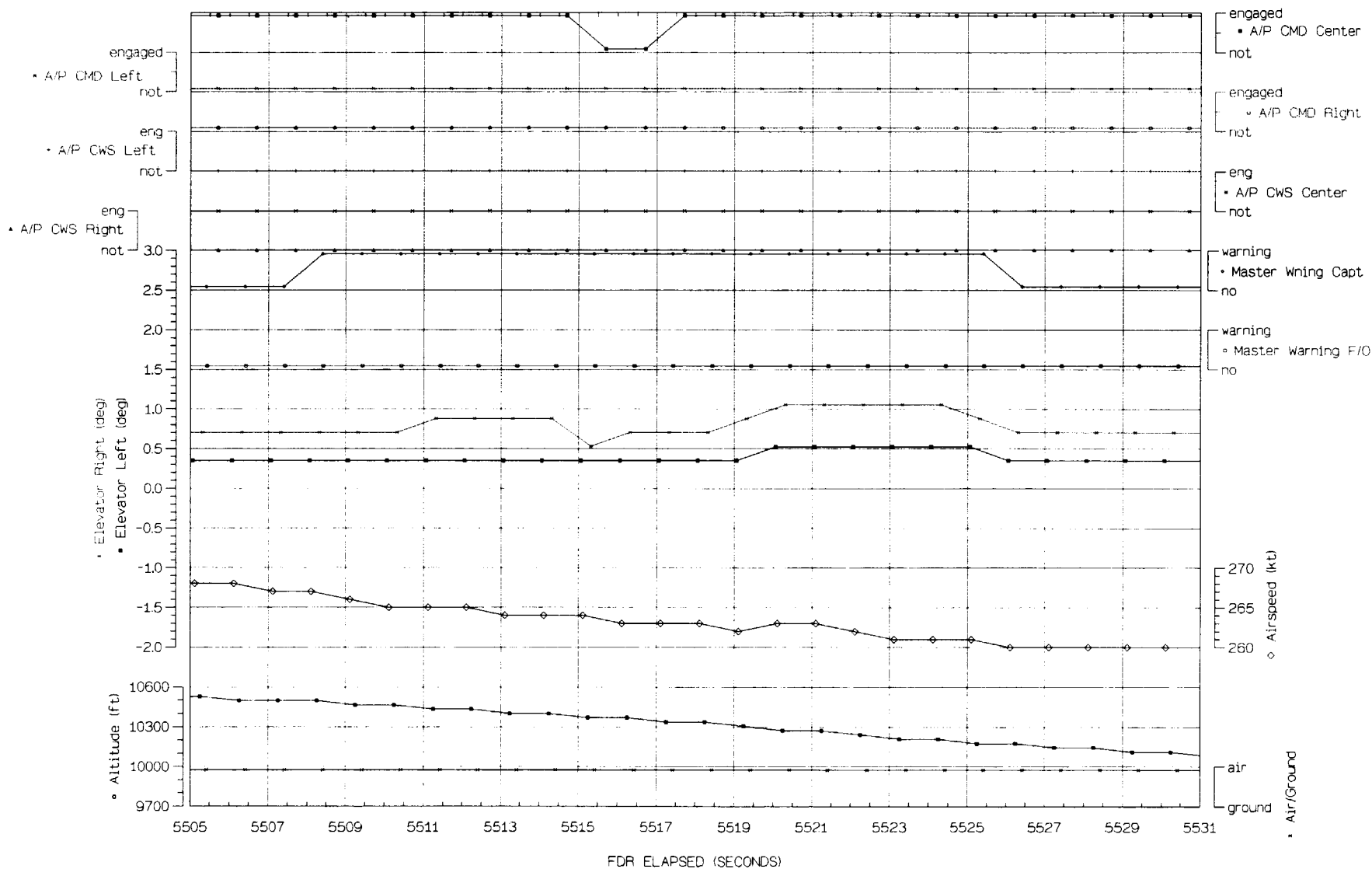
A/P Disconnect 2 - Track 7 Data  
 Finalized: January 22, 2001

National Transportation Safety Board

# Egypt Air B767 SU-GAP

Elevator Data Check - Auto-Pilot Disc

All 25 Hours of FDR Data



A/P Disconnect 3 & Connect 3 - Track 5 Data

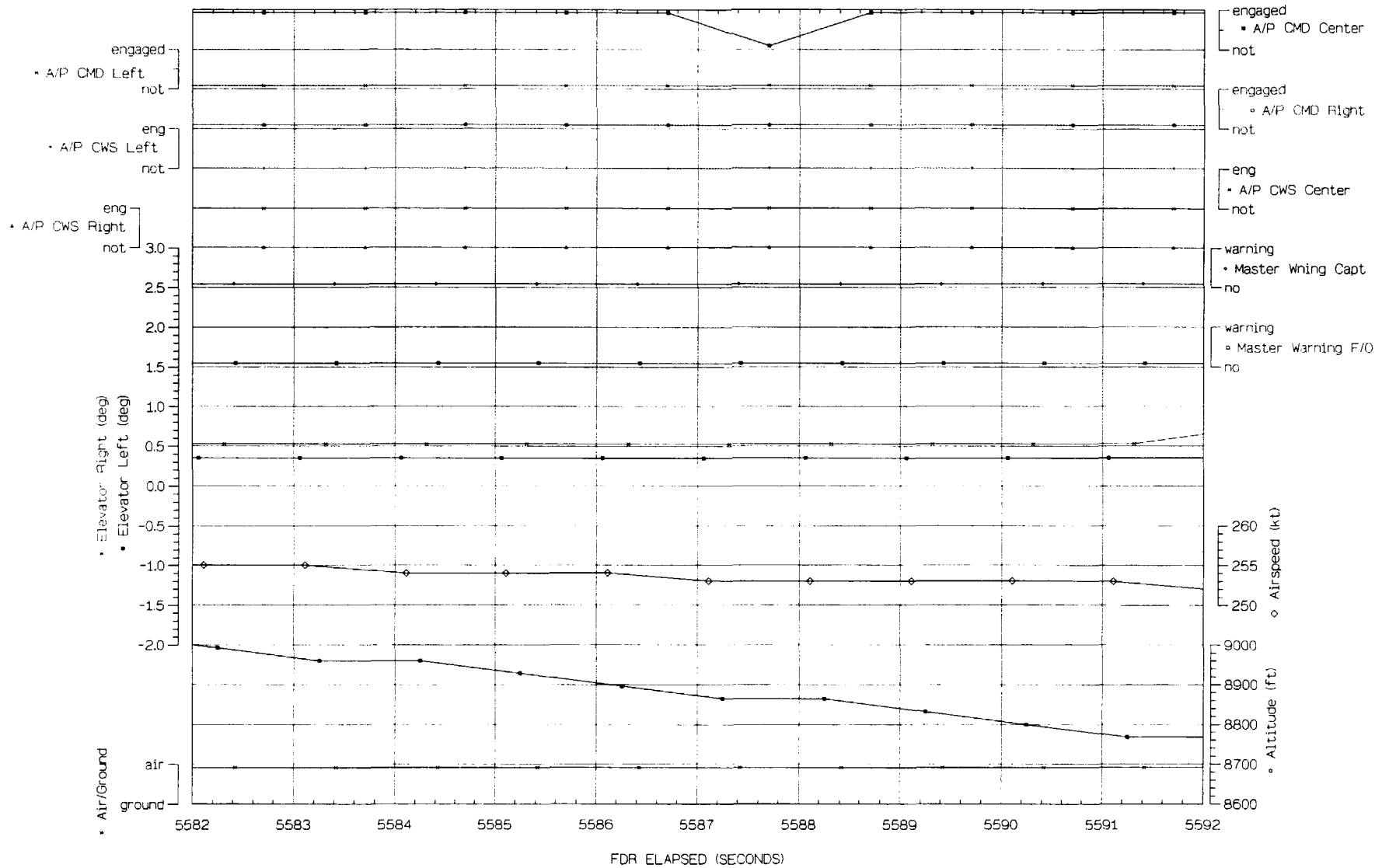
Finalized: April 12, 2000

National Transportation Safety Board

# Egypt Air B767 SU-GAP

Elevator Data Check - Auto-Pilot Disc

All 25 Hours of FDR Data



A/P Disconnect 4 & Connect 4 - Track 5 Data  
 Finalized: April 12, 2000

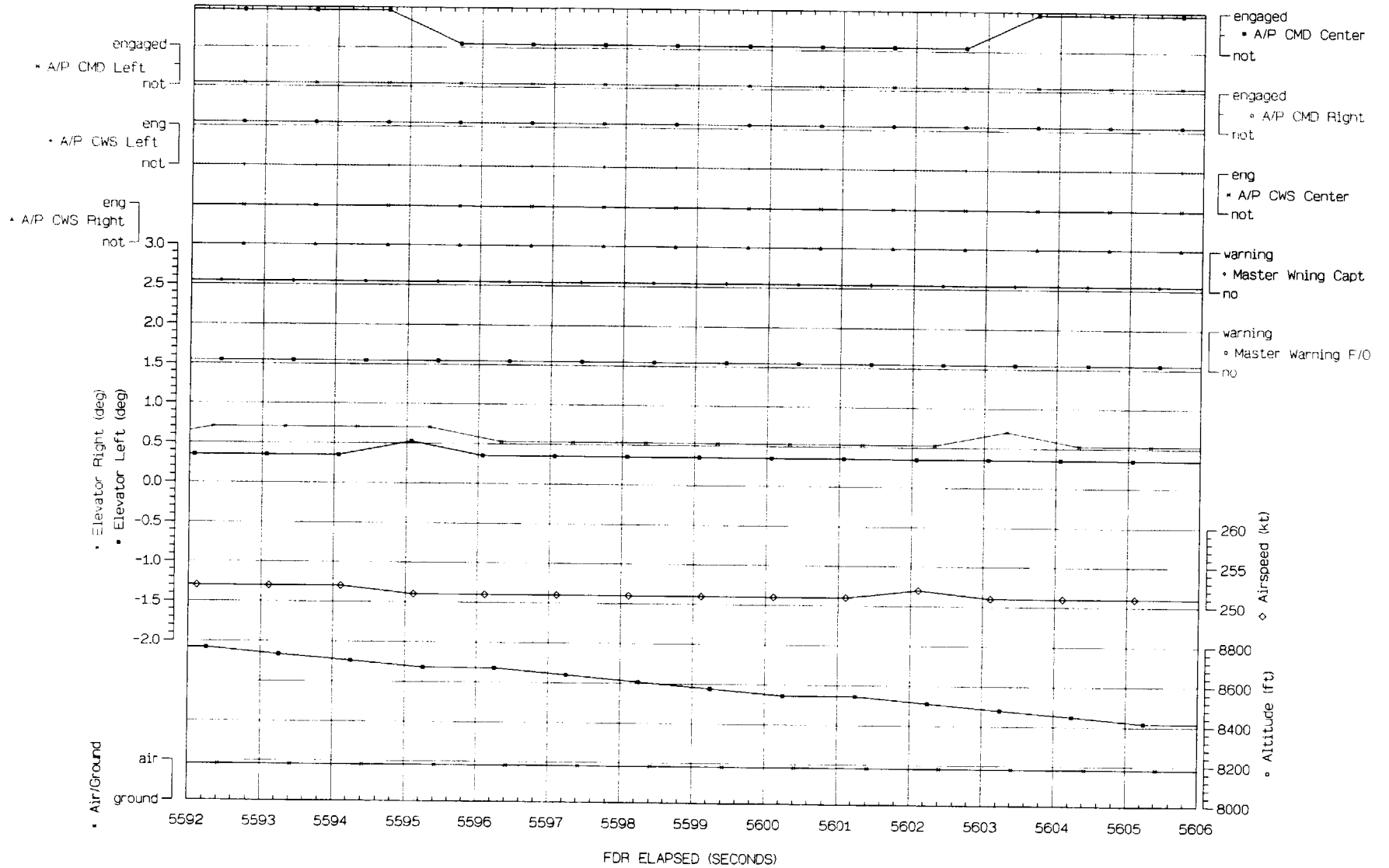
National Transportation Safety Board



# Egypt Air B767 SU-GAP

Elevator Data Check - Auto-Pilot Disc

All 25 Hours of FDR Data



A/P Disconnect 5 & Connect 5 - Track 5 Data

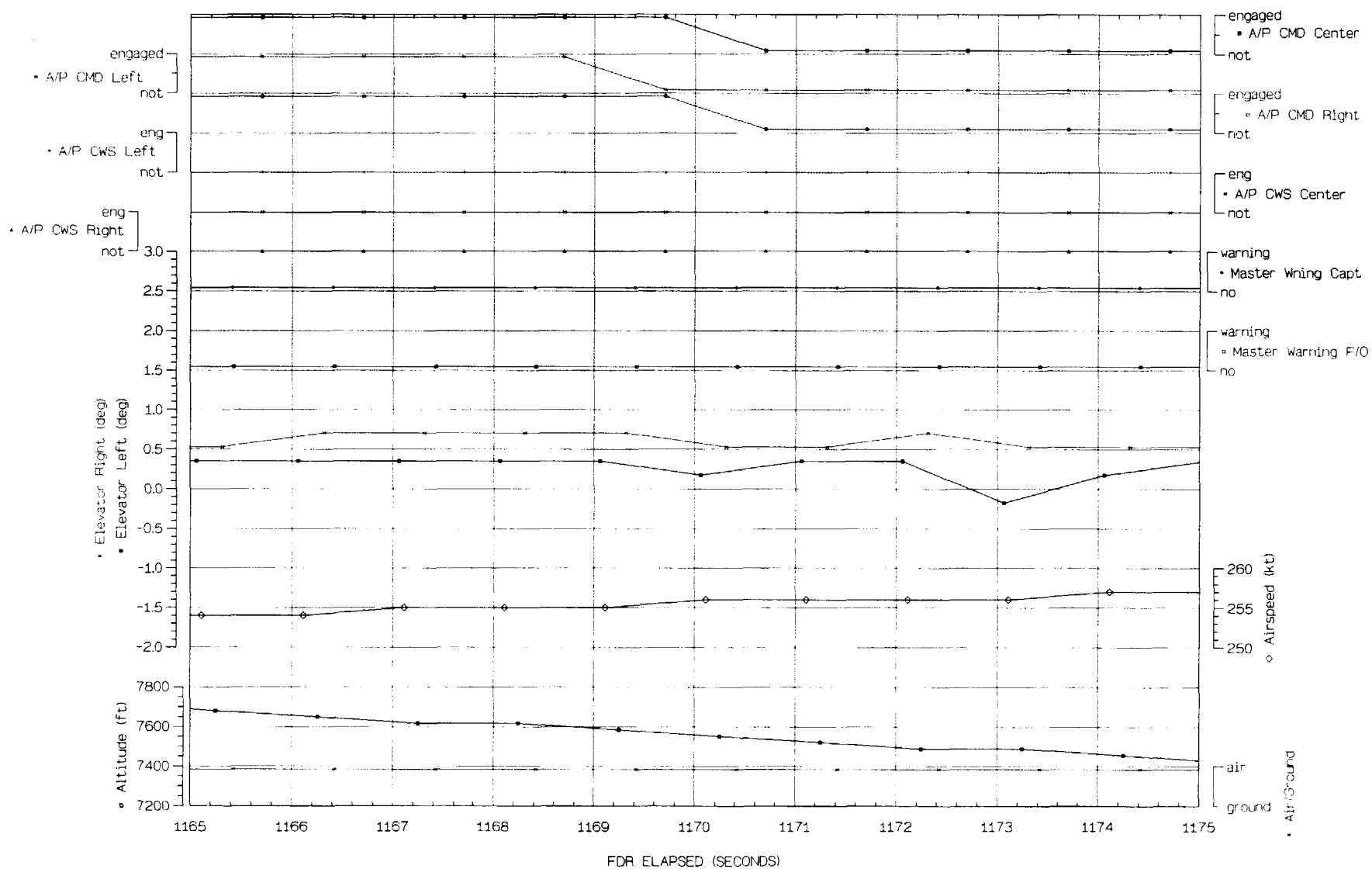
Finalized: April 12, 2000

National Transportation Safety Board

# Egypt Air B767 SU-GAP

Elevator Data Check - Auto-Pilot Disc

All 25 Hours of FDR Data



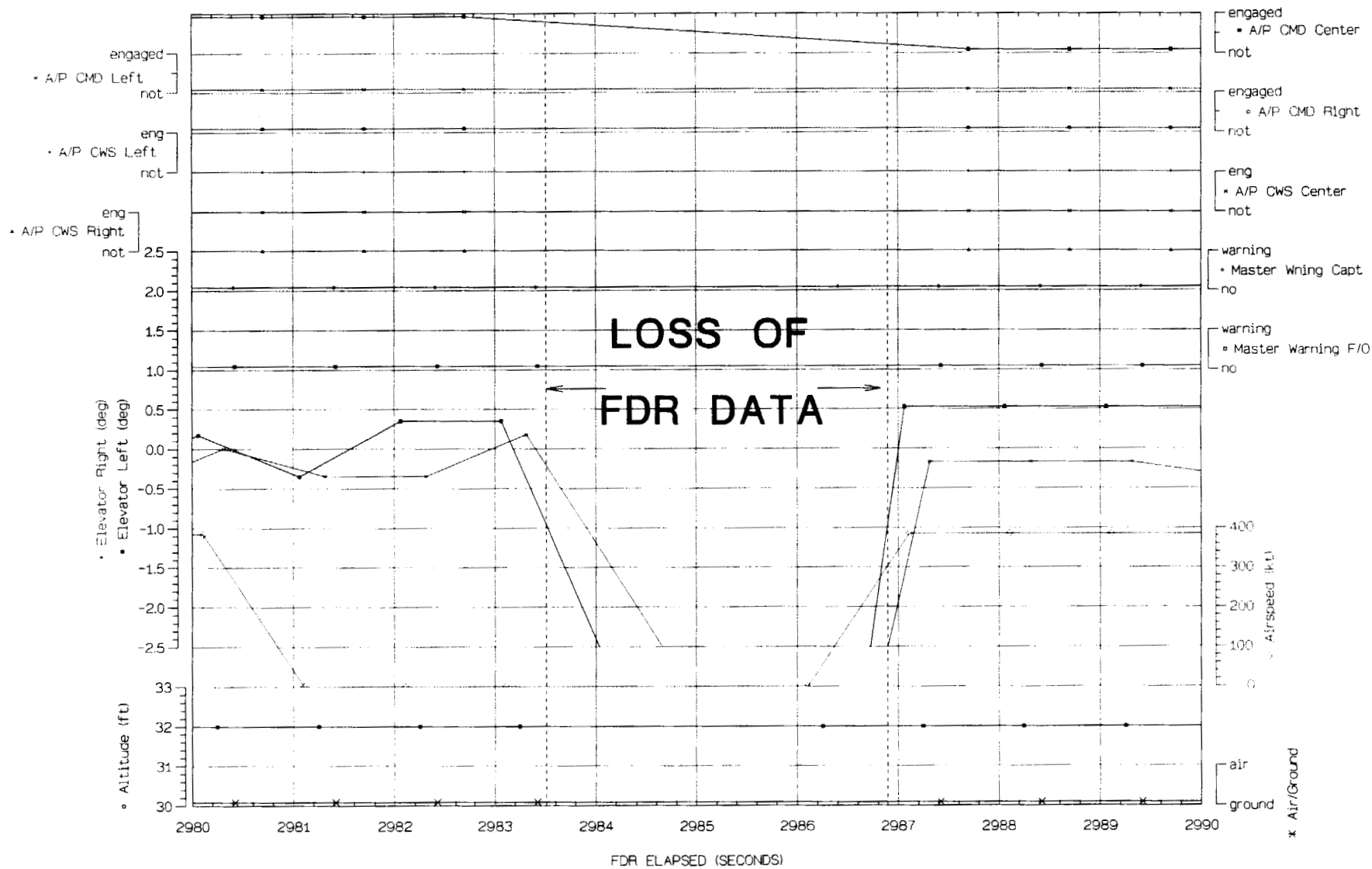
A/P Disconnect 6 - Track 5 Data  
 Finalized: April 12, 2000

National Transportation Safety Board

# Egypt Air B767 SU-GAP

Elevator Data Check - Auto-Pilot Disc

All 25 Hours of FDR Data



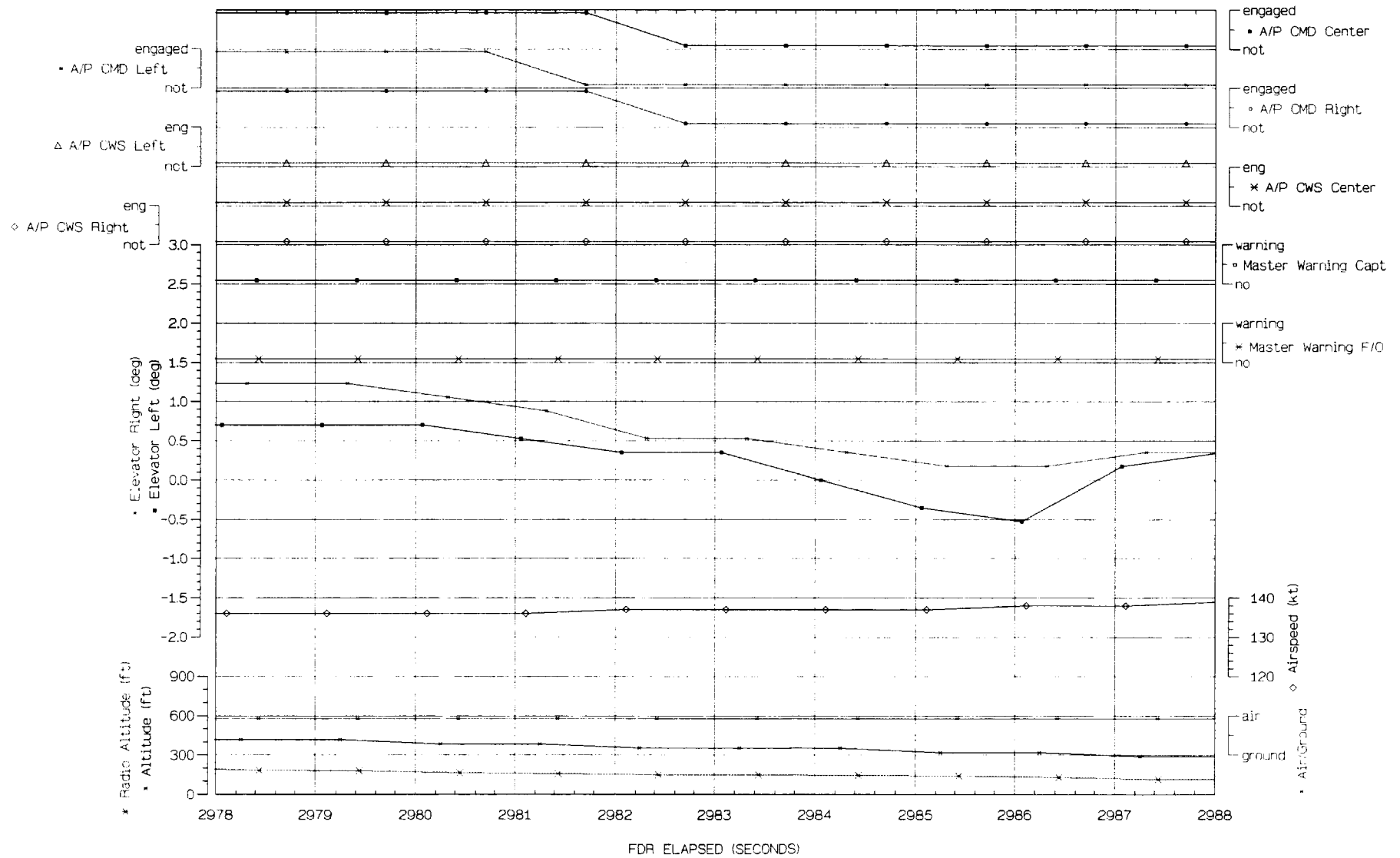
A/P Disconnect 7 - Track 5 Data  
 Finalized: April 12, 2000

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# Egypt Air B767 SU-GAP

Elevator Data Check - Auto-Pilot Disc

All 25 Hours of FDR Data



A/P Disconnect 8 - Track 3 Data

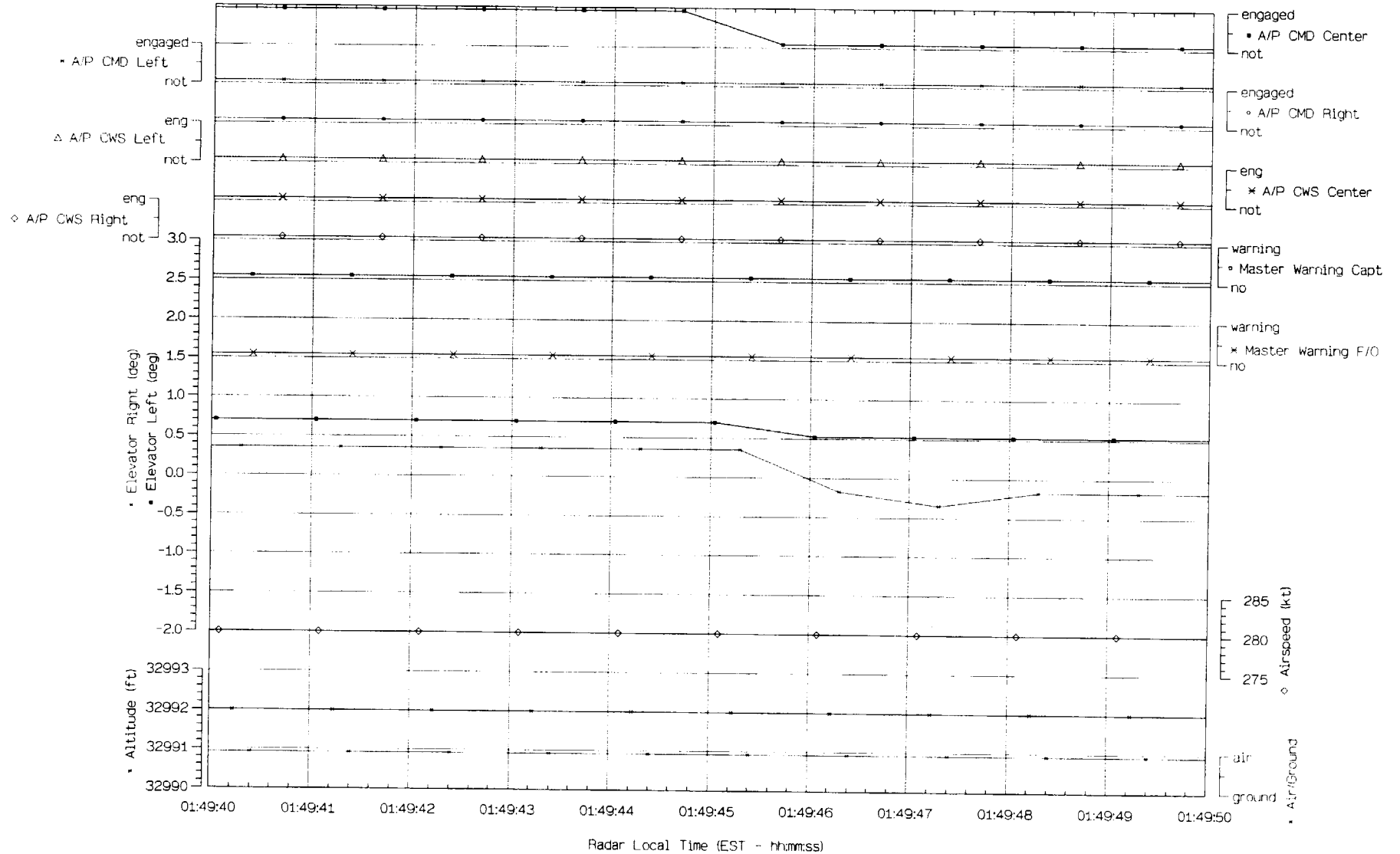
Finalized: January 22, 2001

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# Egypt Air B767 SU-GAP

Elevator Data Check - Auto-Pilot Disc

All 25 Hours of FDR Data



A/P Disconnect - Accident Flight  
 Finalized: January 22, 2001

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ATTACHMENT 2

**EgyptAir SU-GAP Tabular FDR Data Sets Regarding Autopilot Disconnects**



















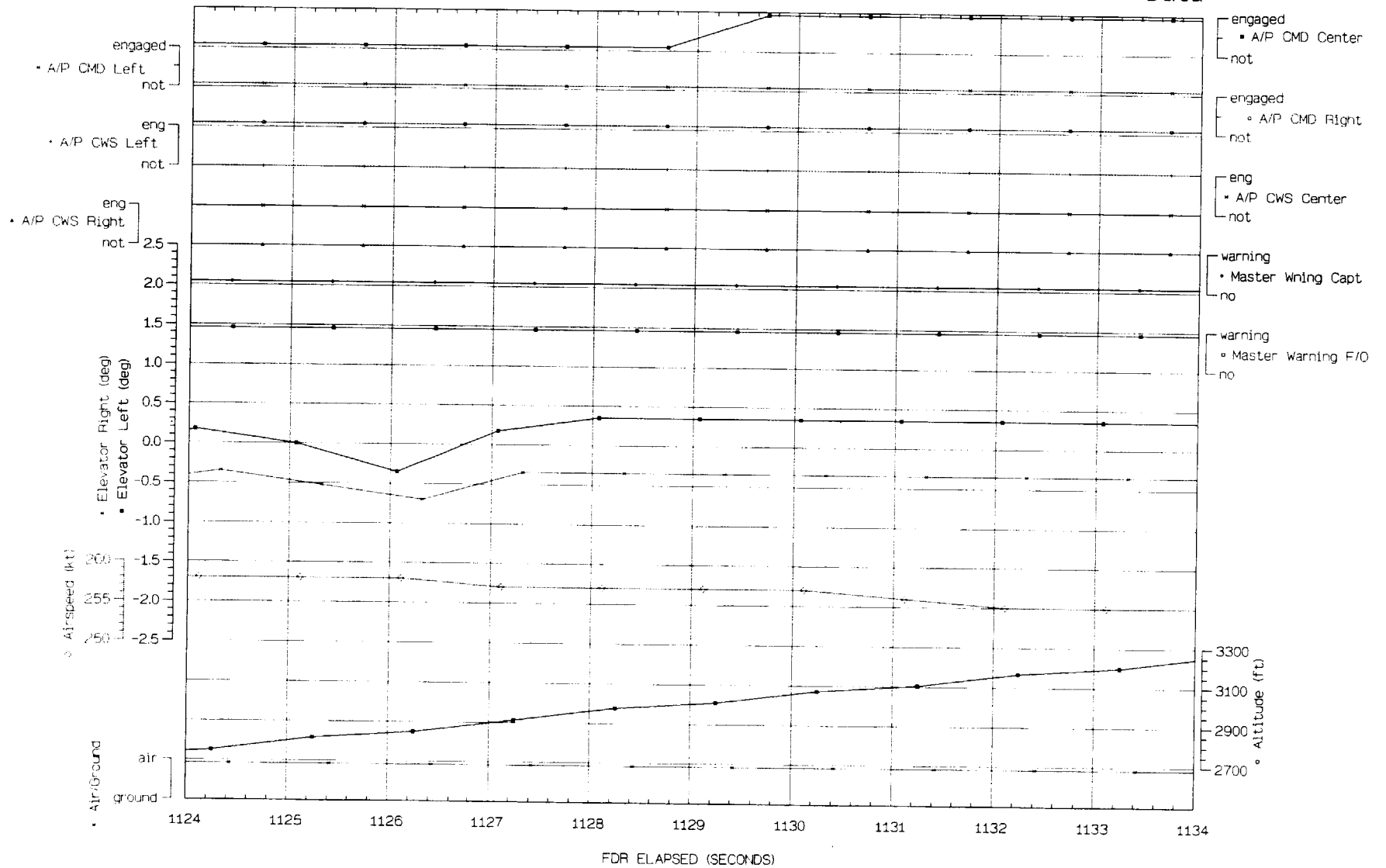
ATTACHMENT 3

**EgyptAir B767 SU-GAP FDR Data Plots Regarding Autopilot Connects**

# Egypt Air B767 SU-GAP

Elevator Data Check - Auto-Pilot Disc

All 25 Hours of FDR Data



A/P Connect 1 - Track 2 Data  
 Finalized: April 12, 2000

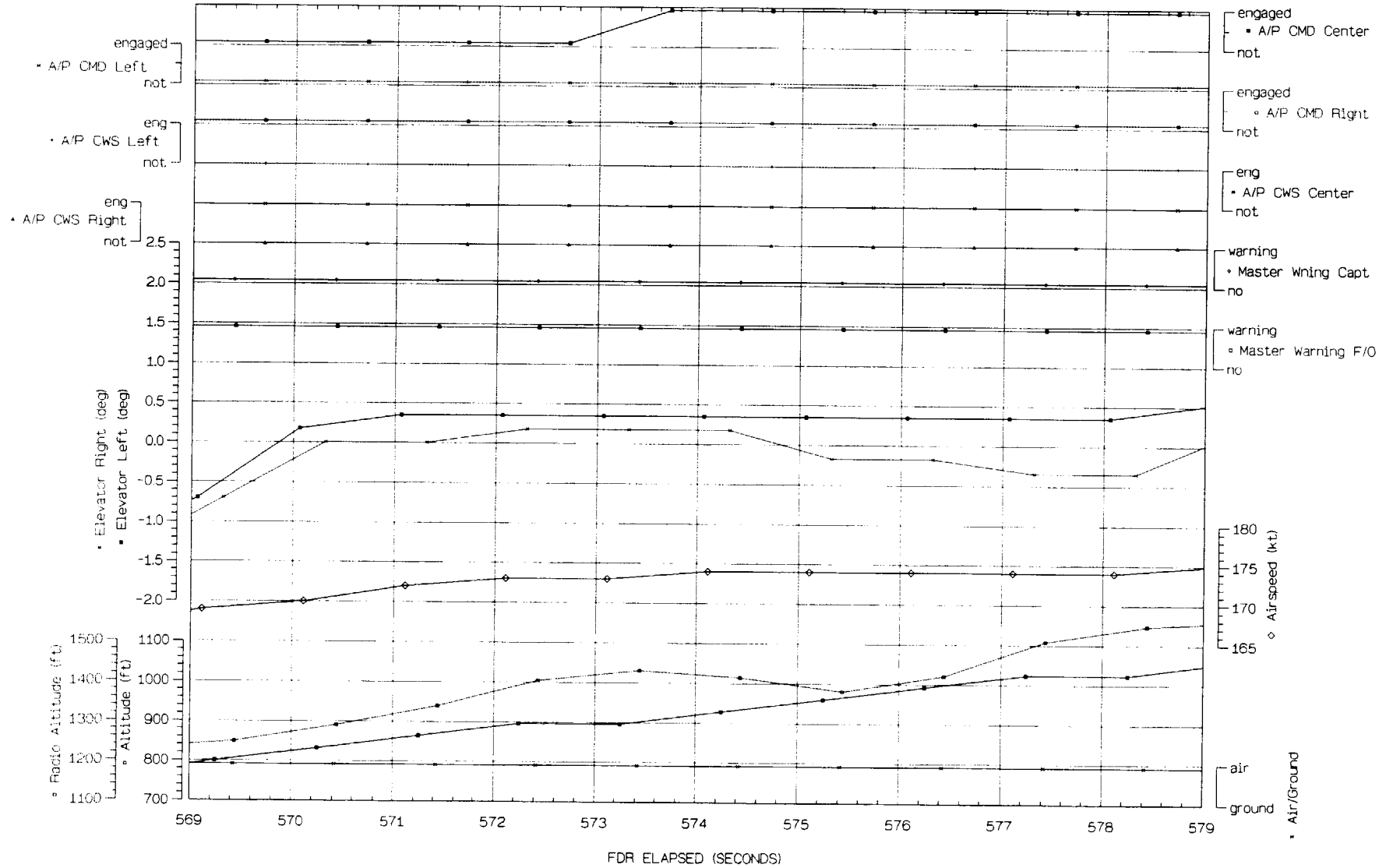
National Transportation Safety Board



# Egypt Air B767 SU-GAP

Elevator Data Check - Auto-Pilot Disc

All 25 Hours of FDR Data



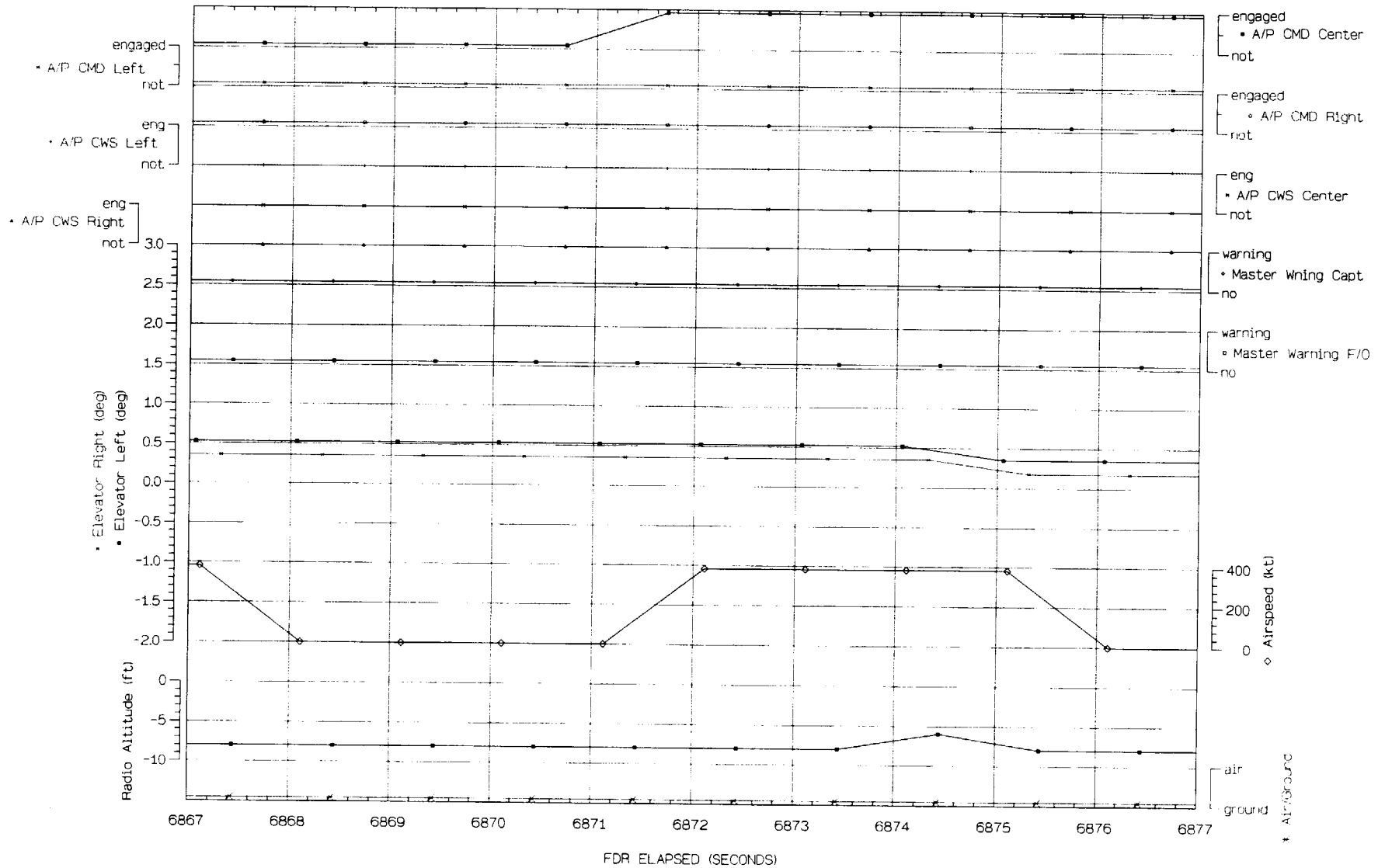
A/P Connect 2 - Track 7 Data  
 Finalized: April 12, 2000

National Transportation Safety Board

# Egypt Air B767 SU-GAP

Elevator Data Check - Auto-Pilot Disc

All 25 Hours of FDR Data



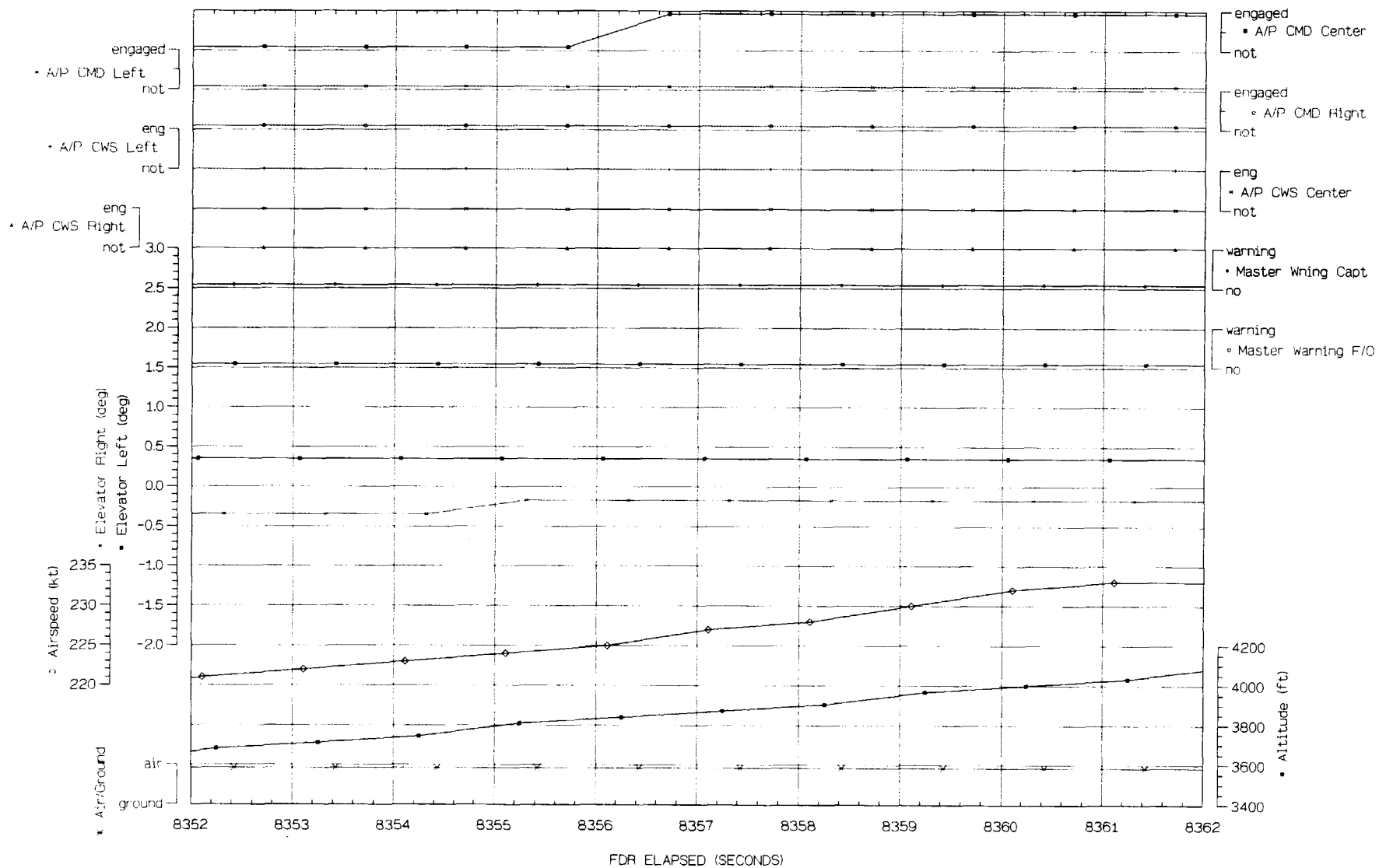
A/P Connect 6 - Track 5 Data  
 Finalized: April 12, 2000

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# Egypt Air B767 SU-GAP

Elevator Data Check - Auto-Pilot Disc

All 25 Hours of FDR Data



A/P Connect 7 - Track 5 Data

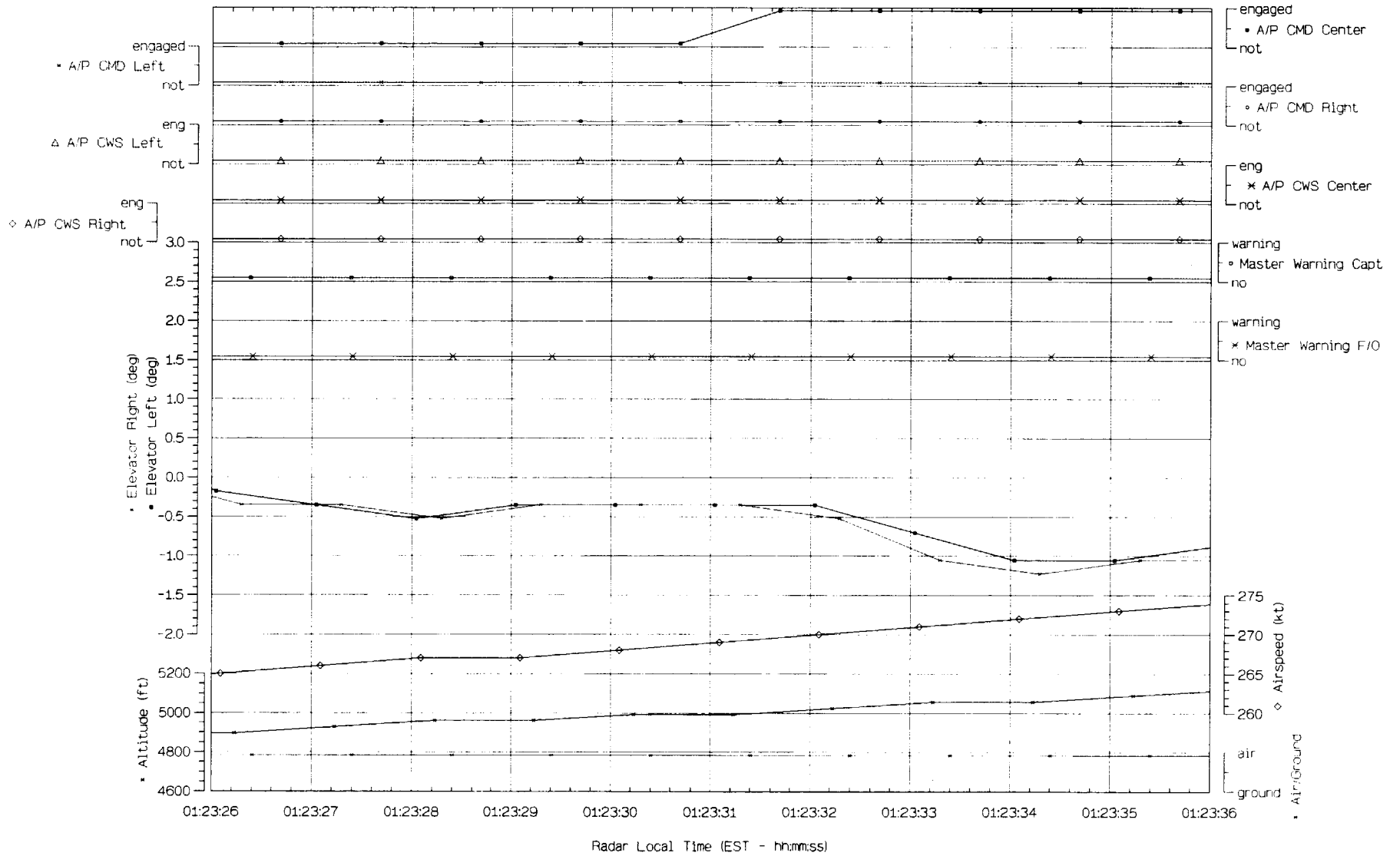
Finalized: April 12, 2000

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# Egypt Air B767 SU-GAP

Elevator Data Check - Auto-Pilot Disc

All 25 Hours of FDR Data



A/P Connect - Accident Flight  
 Finalized: January 22, 2001

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ATTACHMENT 4

**EgyptAir B767 SU-GAP Tabular FDR Data Sets Regarding Autopilot Connects**













ATTACHMENT 5

**Spreadsheet Documentation of SU-GAP Autopilot Disconnects**

Center		Pressure		Just Prior to A/P Disconnect		Just After A/P Disconnect		Change	
Autopilot	SU-GAP	Altitude	FDR	Left Elevator	Right Elevator	Left Elevator	Right Elevator	Left Elevator	Right Elevator
Disconnect #	Flight Leg	(Feet)	Track #	(degrees)	(degrees)	(degrees)	(degrees)	(degrees)	(degrees)
1	? - Cairo	1,792	3	-1.05	-0.88	-1.93	-1.58	-0.88	-0.70
2	Cairo - JFK	192	7	0.70	0.53	0.70	0.70	0.00	0.17
3	JFK - LAX	10,368	5	0.35	0.88	0.35	0.53	0.00	-0.35
4	JFK - LAX	8,864	5	0.35	0.53	0.35	0.53	0.00	0.00
5	JFK - LAX	7,584	5	0.35	0.70	0.53	0.70	0.18	0.00
6	JFK - LAX	7,584	5	0.35	0.70	0.18	0.53	-0.17	-0.17
7	JFK - LAX	ground	5	n/a	n/a	n/a	n/a	n/a	n/a
8	LAX - JFK	384	3	0.53	0.88	0.35	0.53	-0.18	-0.35
9 (accident)	JFK - Cairo	32,992	3	0.70	0.35	0.70	0.35	0.00	0.00

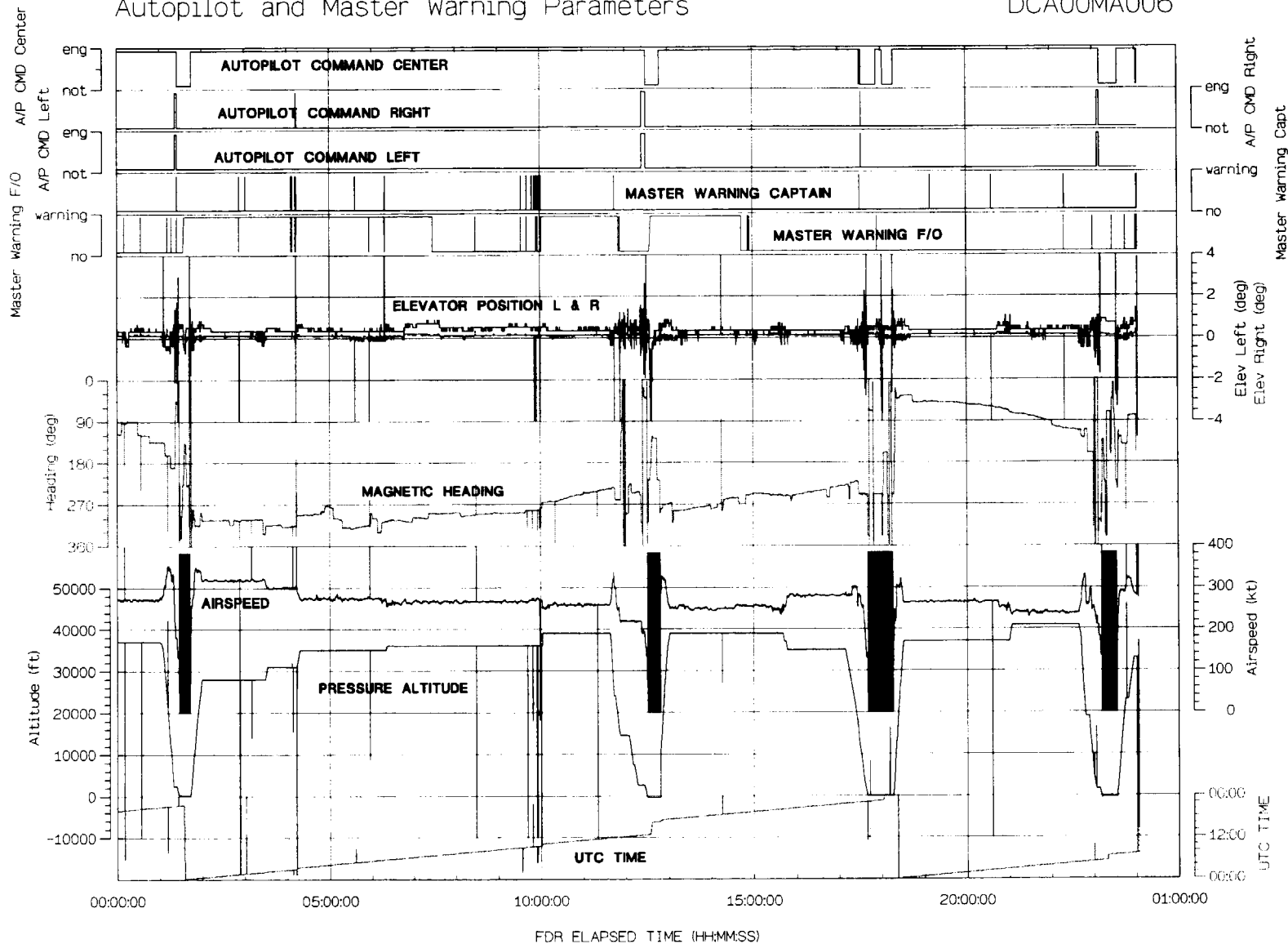
ATTACHMENT 6

**Plot of EgyptAir B767 SU-GAP FDR Flight History**

# EgyptAir B767 SU-GAP

Autopilot and Master Warning Parameters

DCA00MA006



All 25 Hours of FDR Data  
Finalized: March 14, 2001

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