NATIONAL TRANSPORTATION SAFETY BOARD
OFFICE OF AVIATION SAFETY
WASHINGTON, D.C. 20594

September 23, 2002

SYSTEMS GROUP CHAIRMAN'S FACTUAL REPORT OF INVESTIGATION

DCA02MA001

A. ACCIDENT

Operator:	American Airlines
Aircraft:	A300-600R
Location:	Belle Harbor, New York
Date:	November 12, 2001
Time:	09:16 EDT

B. SYSTEMS GROUP

Chairman	Steven Magladry National Transportation Safety Board Washington, DC
Member	Robert Jones Federal Aviation Administration Seattle, Washington
Member	Gerald Gaubert Bureau Enquetes - Accidents Paris Le Bourget, France
Member	Albert Urdiroz Airbus France Toulouse Blagnac, France
Member	David Seratt American Airlines Tulsa, Oklahoma
Member	John David Allied Pilot's Association Fort Worth, Texas

C. SUMMARY

On November 12, 2001, about 0916 Eastern Standard Time, American Airlines flight 587, an Airbus A300-600, was destroyed when it crashed into a residential area of Belle Harbor, New York, shortly after takeoff from the John F. Kennedy International Airport (JFK), Jamaica, New York. Two pilots, 7 flight attendants, 251 passengers, and 5 persons on the ground were fatally injured. Visual meteorological conditions prevailed and an instrument flight rules flight plan had been filed for the flight destined for Santo Domingo, Dominican Republic. The scheduled passenger flight was conducted under 14 CFR Part 121.

The systems group convened on November 13, 2001 and completed the on-site portion of the investigation between November 13 and November 17. The vertical stabilizer and rudder were found in Jamaica Bay, not at the main accident site. A list of systems related parts recovered from the accident site is provided in Appendix A. This report describes some significant A300-600 systems and summarizes the accident site findings related to these systems.

D. DETAILS OF THE INVESTIGATION

1.0 Yaw Control System Description (Figure 1)

There is a single piece rudder mounted to the rear spar of the vertical stabilizer for control of yaw. The surface is actuated by three mechanically controlled hydraulic actuators, referred to as rudder servo controls. The rudder control linkage can normally be moved by four different mechanisms; the rudder pedals, the trim actuator, the yaw damper actuator, and the yaw autopilot actuator. Rudder motion from any of these mechanisms is limited by a rudder travel limiting system (RTLS). The RTLS is designed to reduce the maximum allowable rudder travel as airspeed increases. The maximum deflection of the rudder in each direction is 30 degrees, which is reduced as airspeed increases. The maximum no-load rate of the surface is 60 +/- 5 degrees per second.

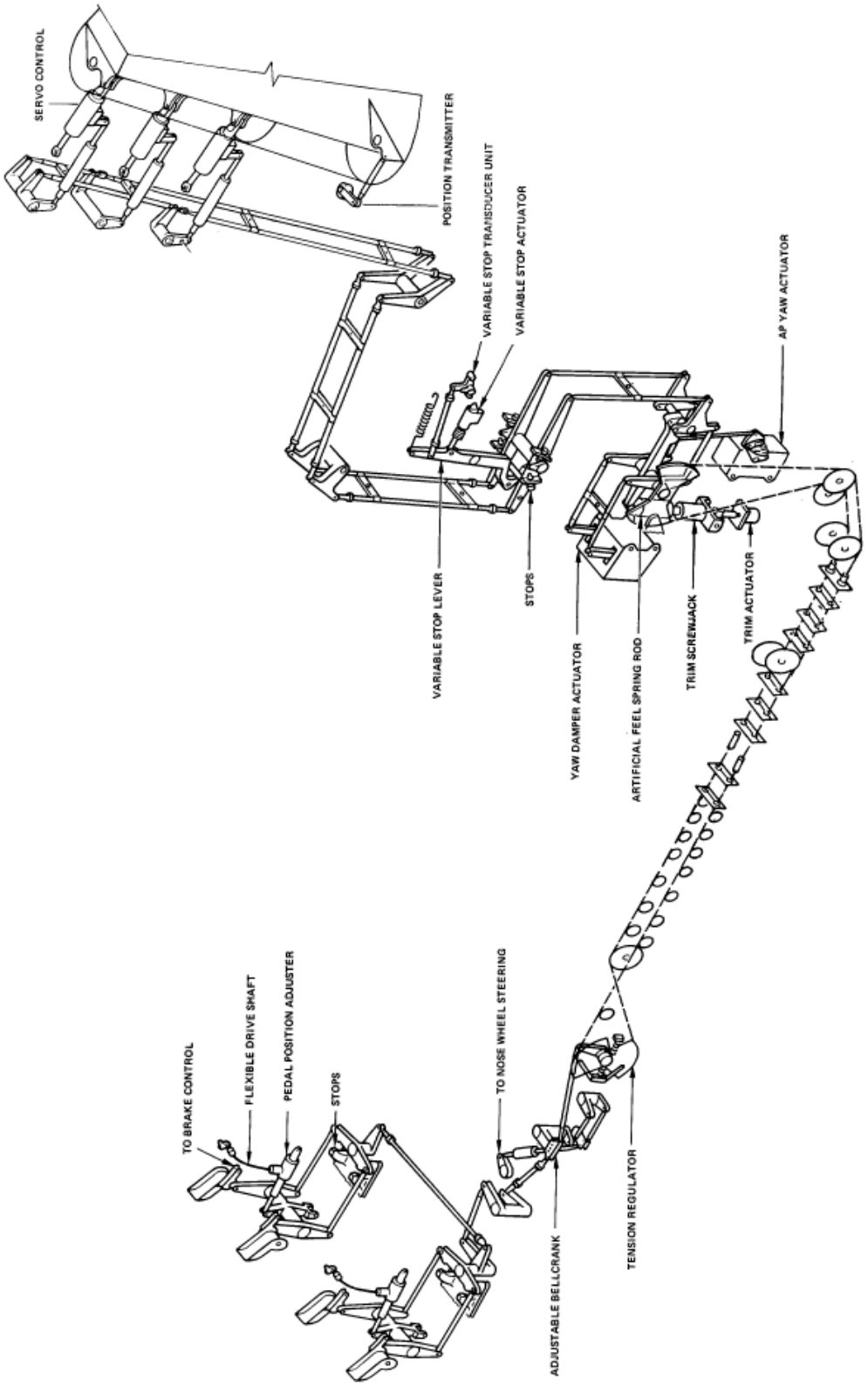

Figure 1. Yaw Control System

Each pilot has a pair of rudder pedals through which rudder inputs are transmitted. The pilots pedals are interconnected by rigid connections which permit rudder motion only if both captain and first officer pedals move in the same direction. The pedals are connected through rods and bellcranks to a cable tension regulator located under the cockpit. The cable tension regulator transmits rod motion to two cables, as well as maintains constant cable tension as the cables and fuselage change under varying temperature and pressure. The two cables run the length of the fuselage to a cable quadrant, located aft of the pressure bulkhead, below the vertical stabilizer. The cable quadrant converts cable motion to bellcrank and rod movements which travel up along the rear spar of the vertical stabilizer to the servo controls. Pedal feel forces are provided by springs in the artificial feel and trim unit (AFTU). The AFTU is connected through a bellcrank to the cable quadrant.

The cable quadrant, AFTU, parts of the RTLS, and the mechanisms listed above which can transmit inputs to the rudder, are all installed in an assembly called the rudder frame (Figure 2). Operation and interaction between the components of the rudder frame is central to understanding the operational characteristics of the rudder control system.

The rudder frame has a mechanical summing device, called the differential unit, whose function is to send to the rudder servo controls a command which is the sum of the pilot (or autopilot) input and the yaw damper input. The mechanical summing device is a deformable parallelogram, which can change shape or rotate under pilot (or autopilot) input or yaw damper input. The pilot input through the cable quadrant is rigidly linked to the autopilot actuator input through the main bellcrank, but the yaw damper input can move independent of the main bellcrank. A result of this architecture is that autopilot inputs will result in pedal motion, but under normal operation a yaw damper input will not result in pedal motion. One exception to this could occur if a pedal is pushed so it contacts the RTL stop. In this position, if the yaw damper actuator commands rudder motion in the same direction that the pedal is displaced, the pedal will be pushed back by the yaw damper actuator motion.

1.1 The Yaw Damper

The yaw damper system is controlled by two Flight Augmentation Computers (FAC's). Each FAC controls one cylinder of the yaw damper actuator. The yaw damper actuator is an electro-hydraulic mechanism installed in the rudder frame. There is a common output axis of the two yaw damper cylinders, which is connected to two output levers to the differential unit.

The yaw damper system performs three functions: Dutch roll damping, turn coordination, and engine failure compensation. Dutch roll damping is active throughout the flight envelope. Turn coordination is not active if the autopilot is engaged, and engine failure compensation is only active if an autopilot is engaged. Yaw damper orders are rate limited by software in the FAC to a maximum of 39 degrees of rudder per second. The maximum allowable

displacement of the rudder by the yaw damper varies as a function of computed airspeed (Vc). The maximum displacement is 10 degrees, which is the limit up to 165 knots. Above 165 knots the limit is determined by the formula 10 * $(165/Vc)^2$, where Vc = computed airspeed (knots).

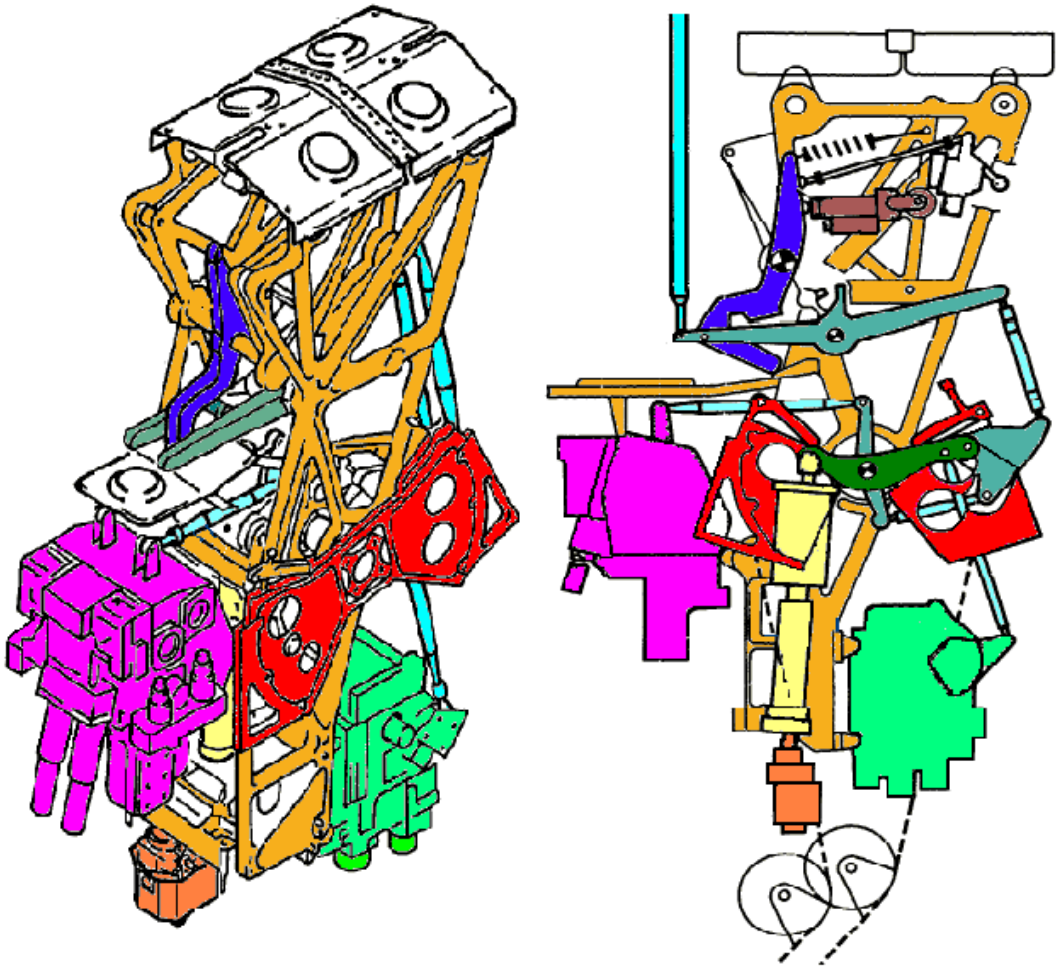

Figure 2. Rudder Frame Assembly

1.2 The Yaw Autopilot

The yaw autopilot is controlled by two Flight Control Computers (FCC's). Each FCC controls one electro-hydraulic actuator. Both of the electro-hydraulic actuators are housed in a single unit called the autopilot yaw actuator. The two actuators have a common output lever which is connected through a torque limiter

to a main bellcrank. The torque limiter allows the pilot to override the autopilot output. The pilot must apply approximately 143 lbs over the rudder pedal feel forces to override the autopilot output. Autopilot commands are rate limited by software in the FCC's to a maximum of 34 degrees of rudder per second. The yaw autopilot is only active with slats extended and with the autopilot engaged.

1.3 The Rudder Travel Limiter System (RTLS)

The RTLS is controlled by two feel and limitations computers (FLC's). Each FLC operates one of the motors of a variable stop actuator (VSA). The VSA adjusts the position of an articulating lever, called the variable stop lever, which limits the travel of the rudder control linkage downstream from the mechanical adder mechanism in the differential unit. There are two transducers, one for FLC 1 and one for FLC 2, which are connected to the variable stop lever through a single rod, which provide the VSA position to the FLC's.

The VSA consists of a screwjack driven by two AC motors. There is a rigid connection between the two motors which drive the screw through a reduction gear and torque limiter. The RTLS is designed to limit the rudder as a function of airspeed as shown in Figure 3.

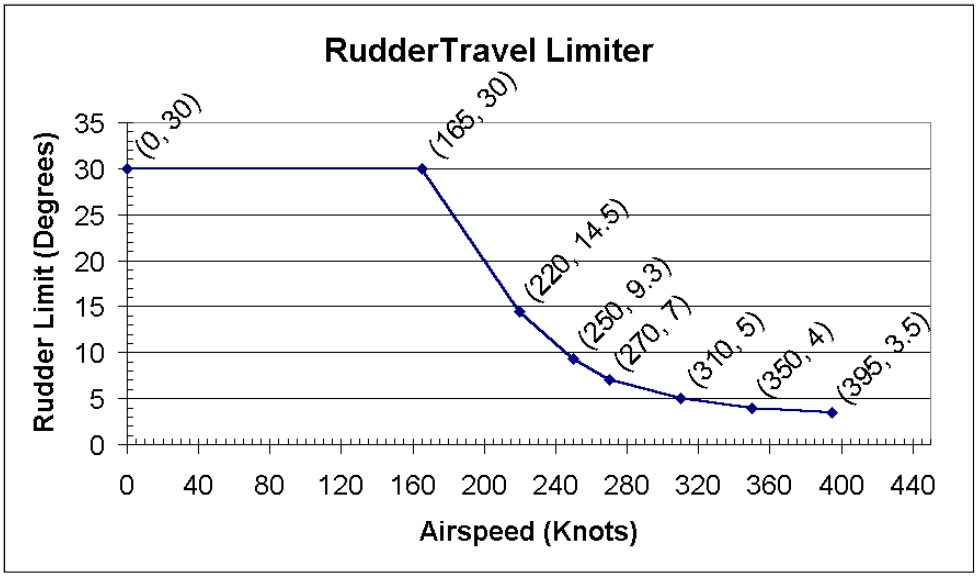

Figure 3. Rudder Travel Limiter

Each VSA motor is associated with one FLC. FLC 1 is normally the active computer, with FLC 2 in standby. Each FLC receives computed airspeed (Vc) data from both air data systems (ADS 1 and ADS 2), and uses the higher of the

two values in the determination of the appropriate rudder limit. In the event of failure of one ADS, both FLC's use Vc data from the remaining ADS.

FLC 1 is provided AC electrical power from the emergency bus, and in the event of loss of all normal AC power the FLC will drive the VSA to provide full authority to the rudder control system.

The RTLS provides the primary stop for the rudder control system, with a correctly rigged airplane, in flight, under normal circumstances. There are other stops in the system which may limit motion of the components under unusual circumstances such as high pedal loads, a system anomaly, or airspeeds below 165 knots. These stops are as follows:

Pedal stops: Each pedal is connected through linkage to a bellcrank below the cockpit floor. The bellcrank will impact a non-adjustable stop at approximately 21 degrees of pedal travel in each direction.

Rudder control linkage stop: At the rudder frame, the linkage between the mechanical summing device and the variable stop lever will contact an adjustable stop at the equivalent of 30 degrees of rudder. This provides the effective rudder limit at airspeeds less than 165 knots.

Rudder servo control stop: Each servo control can only extend or retract to it's internal mechanical stop, which is equivalent of 32.5 degrees of rudder.

2.0 Condition of Accident Airplane Yaw Control Components

At the accident site there were no rudder control components identified forward of the rudder frame installation. The rudder frame installation was found detached from the empennage structure and in a pile at the bottom of the remaining empennage (Figures 4 and 5). Most of the control linkage in the rudder frame was fractured and melted. The AFTU, rudder trim actuator, yaw damper actuator, autopilot yaw actuator, and variable stop actuator were identified in the pile and shipped to the NTSB for possible further investigation. All of the components suffered considerable heat damage.

Figure 4. Empennage and Rudder Control Components

Figure 5. Rudder Frame and Components.

The vertical stabilizer and rudder were recovered from Jamaica Bay and moved to a hangar (Figure 6). The three rudder servo controls were still attached to the vertical stabilizer and all of the control linkage was intact to the base of the vertical stabilizer (Figure 7 and 8). The lowest control rods, which are normally connected to the output lever of the rudder frame, had the last or lowest approximately six inches missing. The rudder was found detached from the vertical stabilizer. The fittings which attach the servo controls to the rudder and small pieces of rudder structure were still attached to the servo controls. The vertical stabilizer, and the attached system components, were later shipped to NASA Langley for further investigation.

Figure 6. Recovery of Vertical Stabilizer

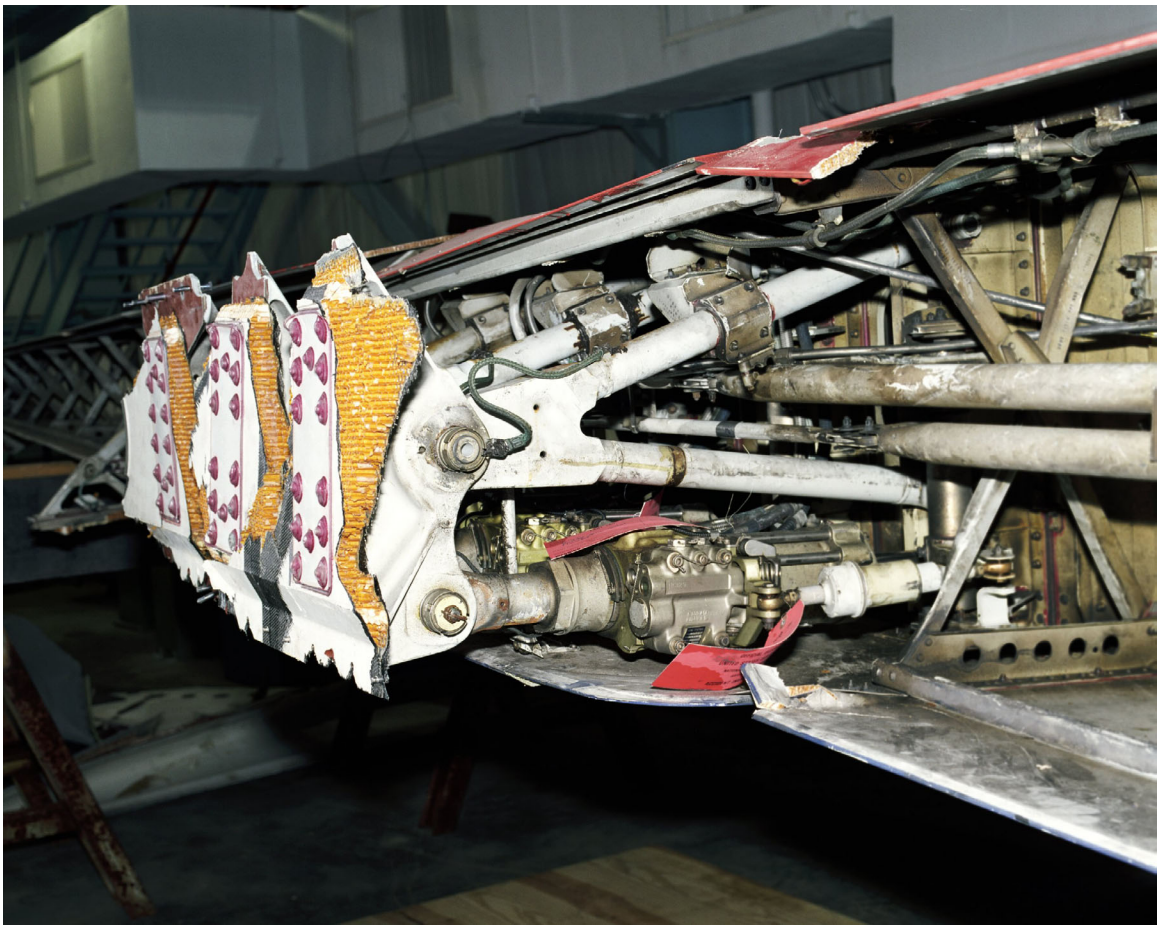

Figure 7. Rudder Servo Controls and Linkages

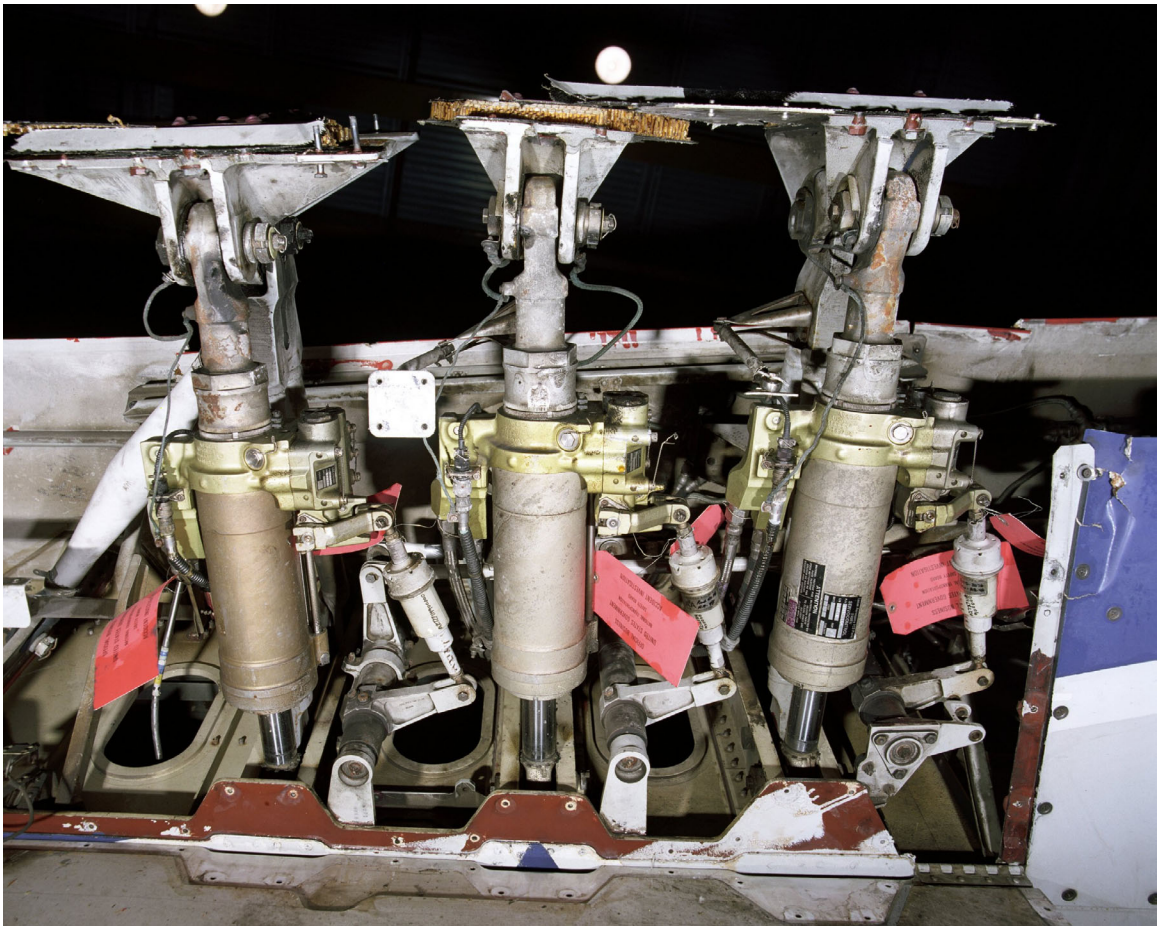

Figure 8. Rudder Servo Controls and Linkages

3.0 Roll Control System Description (Figure 9)

On each wing there is an aileron and 5 spoilers for control of roll. The aileron is actuated by three mechanically controlled hydraulic actuators, referred to as aileron servo controls. The two interconnected control wheels in the cockpit drive two symmetrical control systems, composed of levers, rods, tension regulators, and cables routed along each side of the fuselage up to the input levers of the aileron servo controls. A differential and droop unit is installed in the control linkage upstream of the servo controls. The unit receives two inputs. One is from the control wheels (pilots input), the other is a droop signal from the slat control system which droops the all speed ailerons 10 degrees when the slats are extended, in order to optimize aerodynamic efficiency of the wing. The maximum deflection of each aileron in the un-drooped configuration is 23 degrees up and 19 degrees down. The maximum no-load rate is 45 +/- 5 degrees per second trailing edge down and 41 +/- 4 degrees per second trailing edge up.

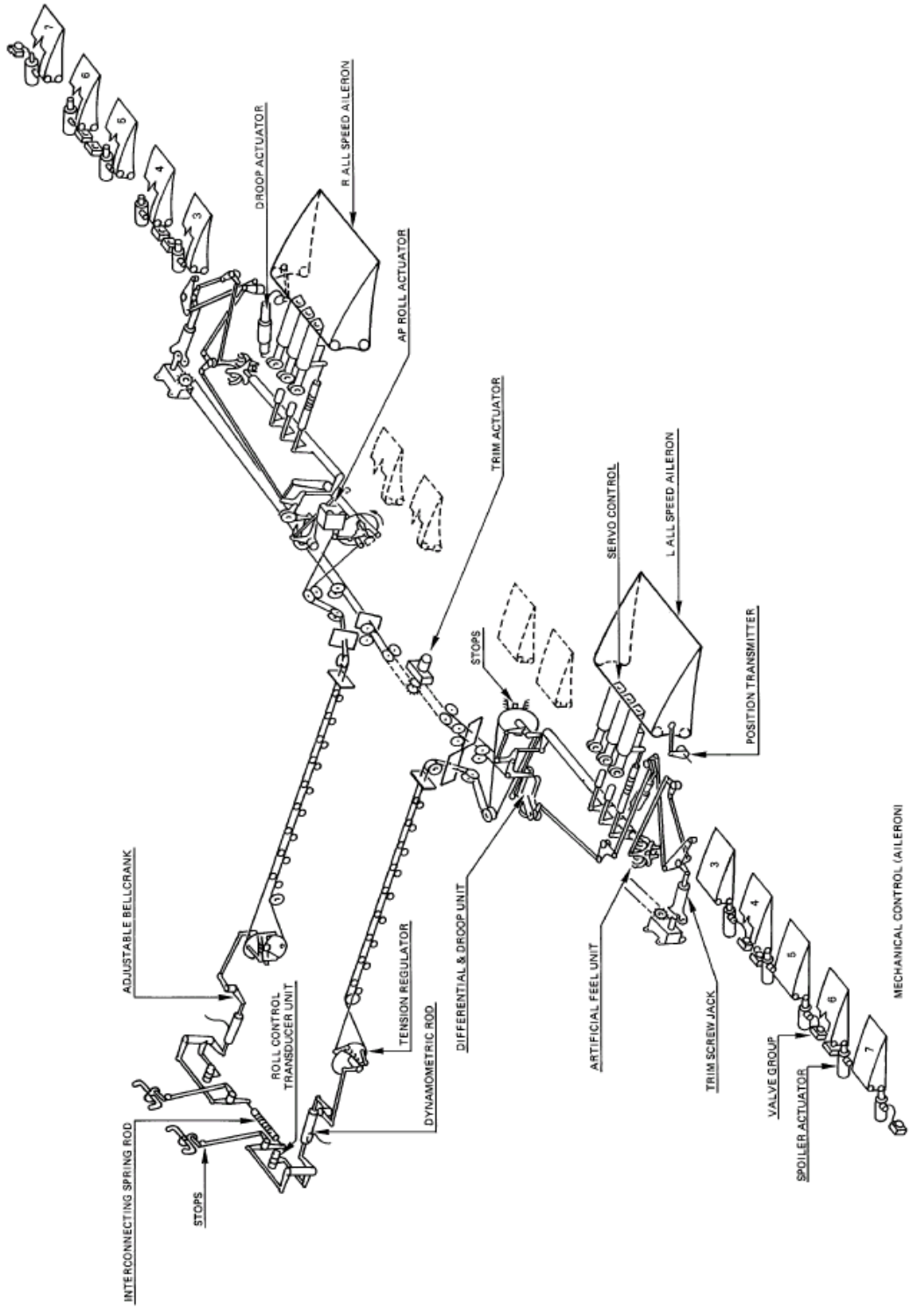

Figure 9. Roll Control Components

An autopilot roll actuator (APRA) is mounted adjacent to the right wing rear cable quadrant. It drives the complete control via a detent lever, which can be overridden by the pilots. Dynamometric rods, installed upstream of the cable tension regulators, provide control signals to the control wheel steering system.

4.0 Condition of Accident Airplane Roll Control Components

There were no roll control components identified forward of the wing. The six aileron servo control units were located on the accident site. The three units on the right wing were found in the area of the normally installed position. Two were detached from the rear spar, but still connected to one of the hydraulic tubes. The third was completely detached, lying on the adjacent ground. The three actuator positions varied. The unit had heat damage.

The three units for the left wing were found still attached to a small segment of wing rear spar. The piston rod ends were still attached to the aileron attach points along with a small portion of the aileron surface.

The right wing aileron droop and differential unit was located in the wing structure near the as installed position. The unit was badly damaged.

The left wing aileron trim screwjack was found just outboard of the aileron droop and differential unit. The unit was detached from the attach points.

The autopilot roll actuator was found near the normally installed position. The output was attached to the droop and differential unit. The unit appeared to be heat damage.

5.0 Spoilers

There are fourteen spoilers, seven on each wing, numbered 1 through 7 starting with the most inboard. They are controlled electronically by two electronic flight control units (EFCUs). Each spoiler is controlled by one servo control consisting of an actuator and a separate valve group.

The spoilers are used for: Roll control (spoilers 3 through 7); Speed brake control (spoilers 1 through 4); Ground spoiler control (all spoilers, 1 through 7).

6.0 Condition of Accident Airplane Spoiler Controls

Only two of the 14 spoiler actuators were identified at the accident site. They were both separated from the wing structure and had pieces of splintered graphite spoiler surface attached to the rod ends.

7.0 Pitch Control System Description (Figure 10)

There is one elevator attached to the rear spar on the left and right side of the trimmable horizontal stabilizer (THS). The THS allows for pitch trim of the airplane.

7.1 Elevators

Each elevator is operated by three mechanically controlled servo controls. The inputs from the control columns are transmitted to the elevators by dual control systems, each system routed along one side of the fuselage. The left and right systems are interconnected at two points by detent bellcranks, one beneath the flight compartment floor, the other between the two elevators. Artificial feel is achieved by a dual system, the stiffness of which is dependent on flight conditions. Maximum deflection of the surface is 30 degrees nose up and 15 degrees nose down. The maximum no-load rate of the surface is 34 +/- 4 degrees per second nose up and 42 +/- 5 degrees per second nose down.

An autopilot actuator is mounted adjacent to the left elevator. It drives the control via a detent lever, which can be overridden by the pilots. Dynamometric rods are installed upstream of the tension regulators, for control wheel steering.

7.2 Condition of Accident Airplane Elevator Control Components

With the exception of a portion of one of the control columns, no control components were identified forward of the THS.

The six elevator servo control units were located. The right-hand and left-hand outermost servo controls were found detached and laying on the ground near the THS rear spar. The four remaining ones were found attached to the THS rear spar. The attachment fittings to the elevator were still connected to the servo controls but the surface was not present. The units appeared to have some heat damage.

The pitch artificial feel unit was located beneath the THS. The two jacks appeared to be in good condition, with some heat damage. The frame was deformed.

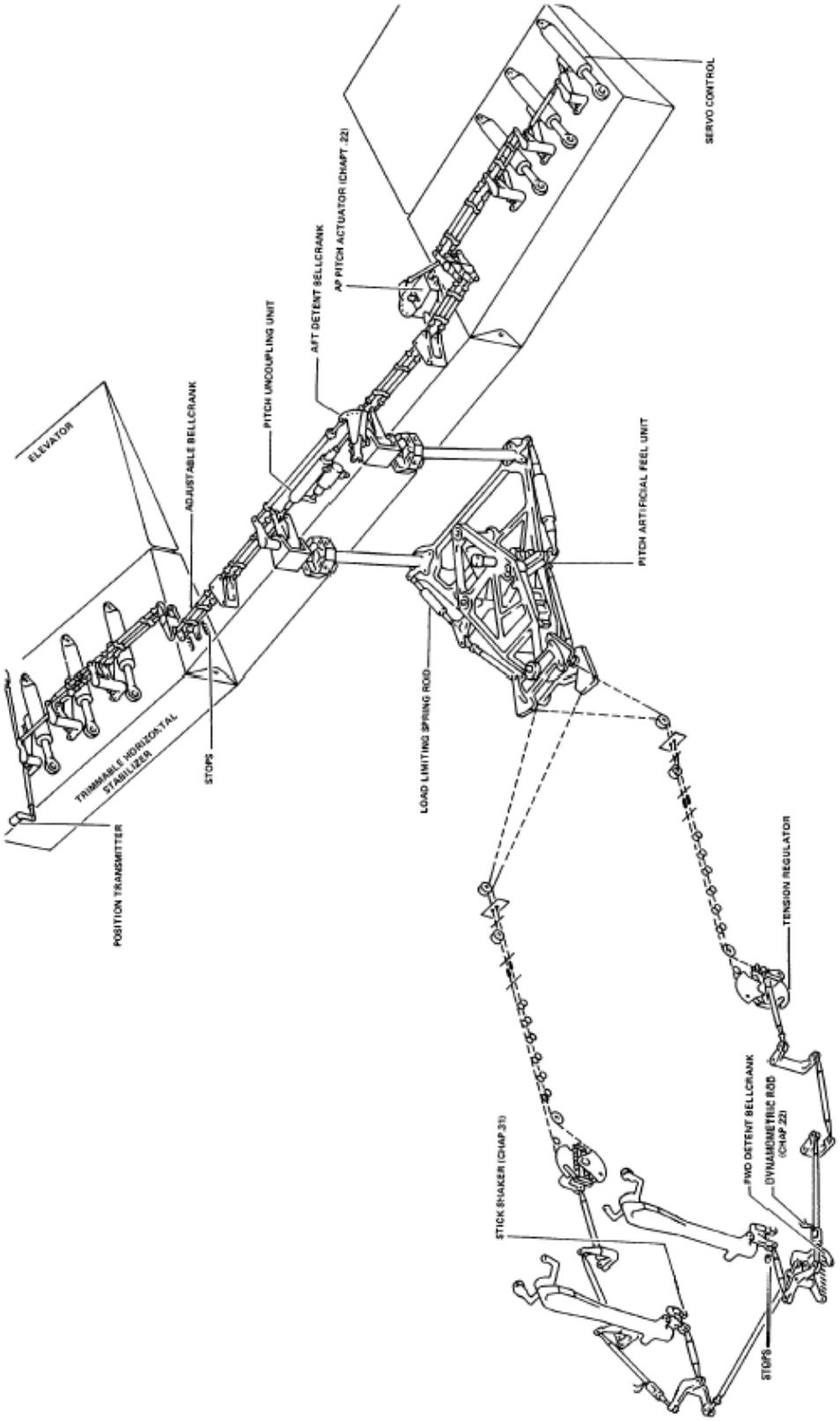

Figure 10. Elevator Control Components

7.3 THS (Figure 11)

The THS is operated by a THS actuator (THSA) within a range of 3 degrees nose down to 14 degrees nose up. The THSA consists of a fail-safe ball screwjack actuated by two hydraulic motors coupled by a differential gear. The mechanical control system consists of two rotating control wheels mounted one on each side of the center pedestal, driving a chain and cable loop up to the mechanical input of the actuator. The pitch trim system provides the following functions:

7.3.1 Electric trim

This basic function provides pitch axis stabilization and enables loads applied to the control column in manual flight to be overridden by means of the pitch trim control switches located on the control wheels.

7.3.2 Automatic trim or autotrim

This function which is activated at AP engagement in CMD or CWS without any action on the pitch trim control switch, permanently stabilizes the pitch axis, and overcomes out-of-trim conditions to enable AP operation around a zero control surface position and to prevent abrupt movements at AP disconnection.

7.3.3 Pitch stability correction

The purpose of this function is to restore static stability.

8.2 Condition of Accident Airplane Trimmable Horizontal Stabilizer (THS) Actuator

The THS Actuator was attached to structural parts. The unit appeared to have some heat damage.

The screwjack was fractured between the actuator and the ballnut. It was attached to the horizontal stabilizer front spar. The distance between the endstop and ballnut was 520 mm, which Airbus reported, normally corresponds to a horizontal stabilizer position of zero degrees.

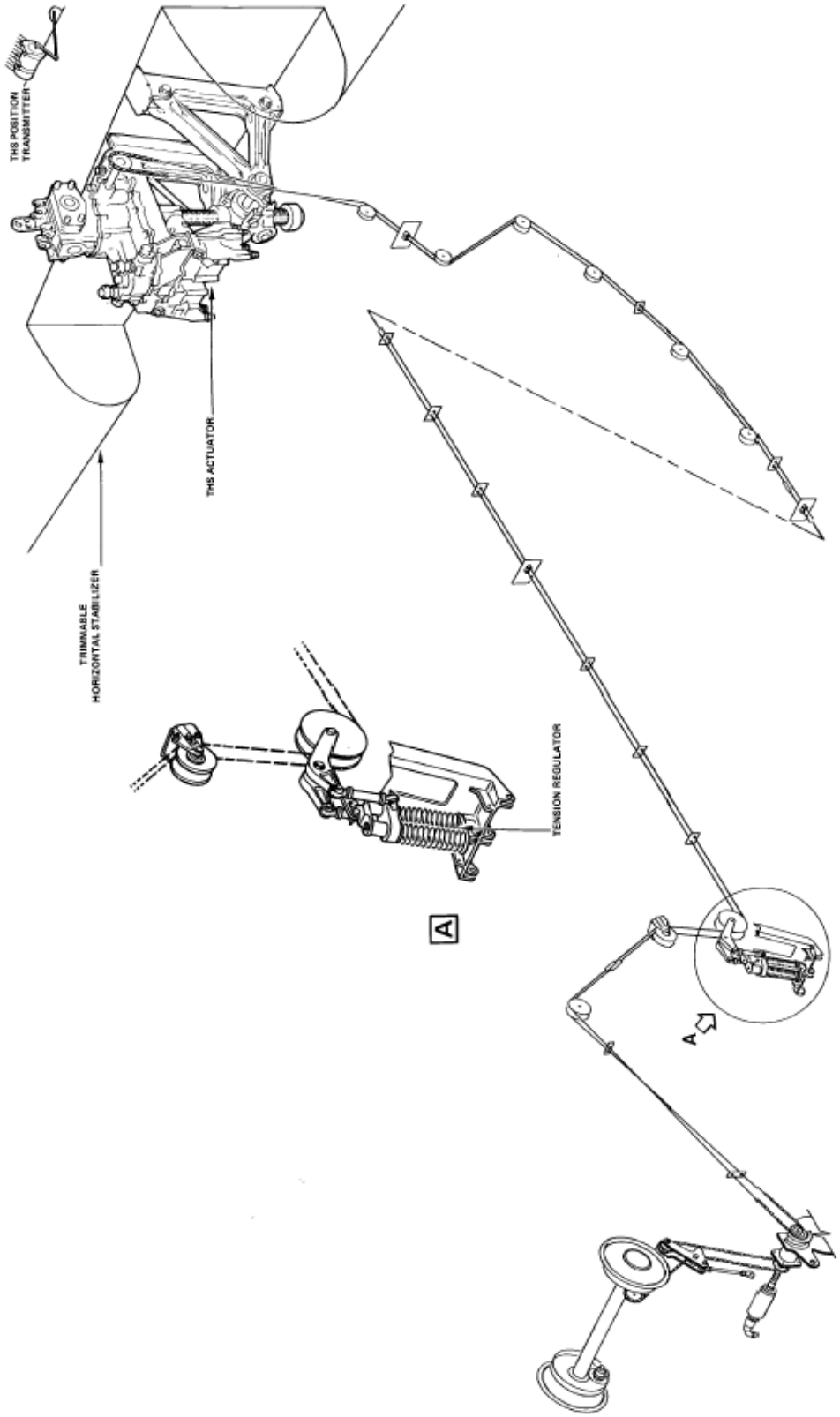

Figure 11. Trimmable Horizontal Stabilizer Components

9.2 Flap Controls (Figure 12)

There were nine out of twelve flap screwjacks identified at the accident site. Seven of the screwjacks were in good condition and the position of the gimbal on the screwjack was consistent with flaps in the fully retracted position. Two screwjacks were found with the threads fractured between the gearbox and the gimbal. The threads and gimbal had slid down the secondary load path. The distance between the endstop and gimbal was measured and was consistent with the flaps in the fully retracted position.

The flap power control unit was located at the accident site in good condition, with some heat damage.

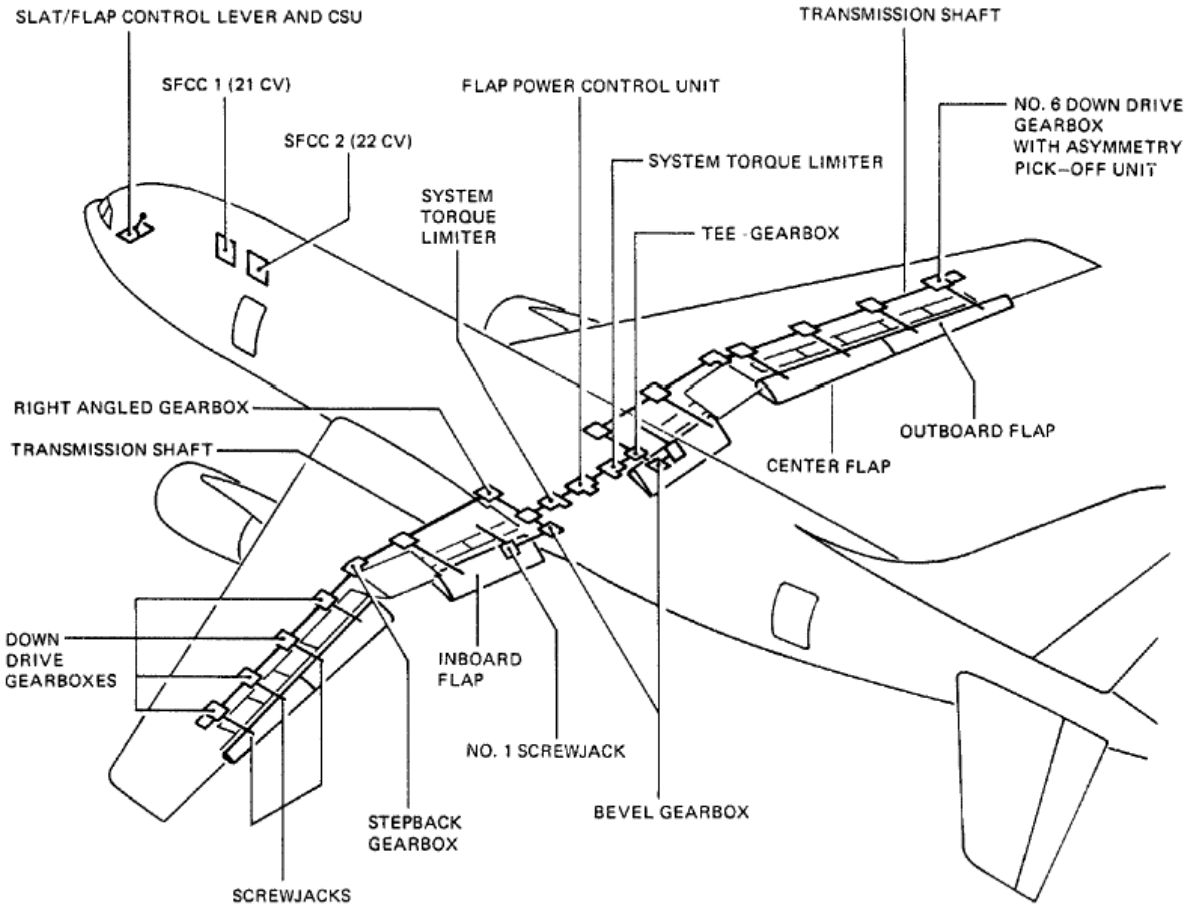

Figure 12. Flap System Components

10.2 Slat Controls (Figure 13)

There were seven out of twelve slat screwjacks identified at the accident site. For six of the seven, the position of the gimbal on the screwjack was consistent with the slats in the fully retracted position. One of the screwjacks had the end stop and connection to the drive mechanism fractured, so the position could not be determined.

Five slat tracks were located at the accident site. One of them had the surrounding can compressed on it at a position consistent with slats fully retracted.

The slat power control unit was located at the accident site. The unit had some heat damage as well as damage to the output gearbox and the position pickoff units.

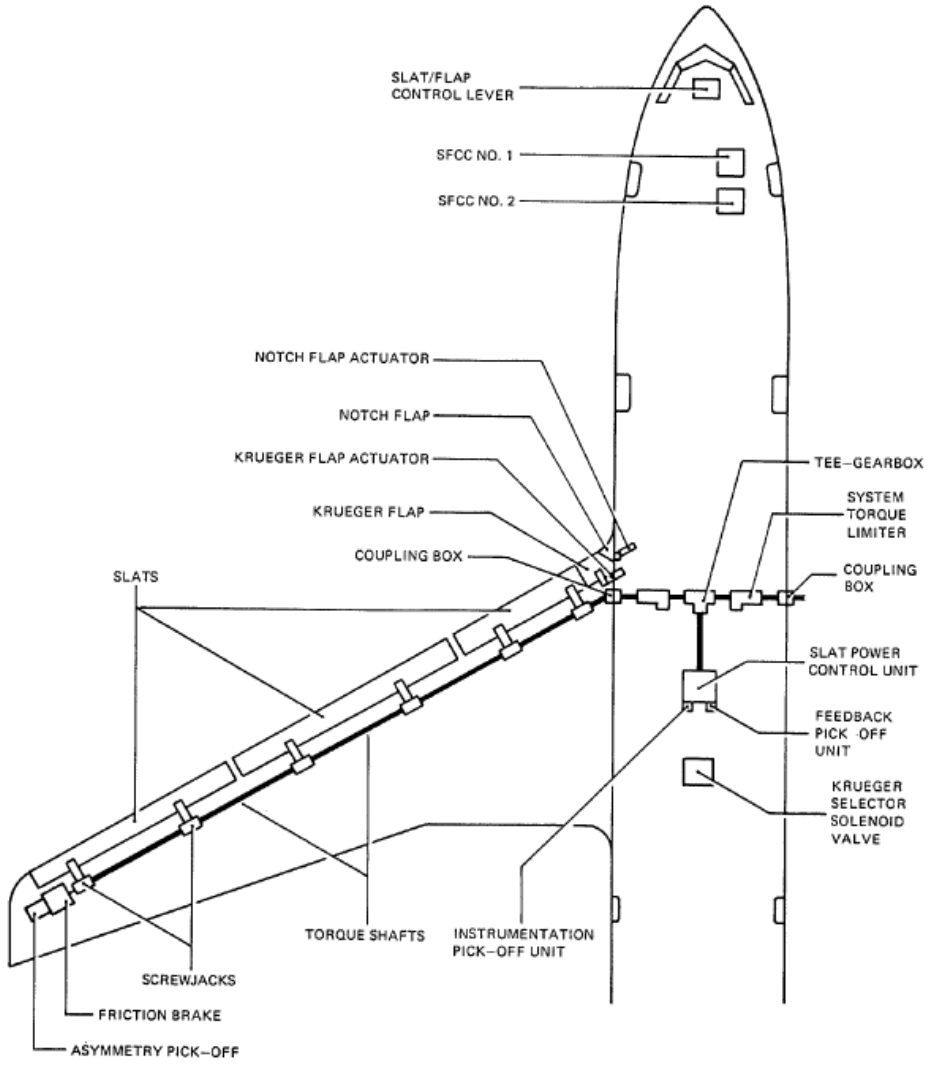

Figure 13. Slat System Components.

Steven H. Magladry
Aerospace Engineer

Systems Group Number	Part Name	AAL Identification No.	Manufacturer	Man. Part Number	Manufacturer Serial Number	Unit Has NVM?	Date	Position	AA CPN	Torque Limiter Activated?
1	VOR/Marker Receiver			AJK9URPN 622-5220-103	2771					
2	Control Display Unit			404391__93 (Assembly), 65-8371-56-00	910-10?		July 08 1997			
3			Rockwell Collins	?						
4	Unknown									
5										
6			Allied Signal							
7	Inertial Display Unit			C811 36A601	?					
8	Air Data Computer (ADC)			404 5053-910	90010914	Yes				
9	Circuit Card			58960-4052574						
10	SGU-EFIS (Signal Generator Unit)			9512660314	1138					
11	Avionic Unit	BBBRCBF						33XU		
12	Pneumatic System Controller									
13	SGU-EFIS (Signal Generator Unit)			951266-03-14	1649					
14			Rockwell Collins							
15	Standby Altimeter			A4619710003/Boeing p/n S231T11-3	287					
16	Control Box			593-22200B	2223					
17	Avioncs Unit			?						
18	4 Circuit Boards									
19		REC 70?								
20	Generator Control Unit	BBBRNKP		M740120AB	0905					
21	Radio Altimeter			9599-607-14901	8871	Yes				
22	Avionics Unit			?						
23	Position Pick Off Unit			9028 A 8002-01	1012					
24	Rack With 3 Units									
	VHF Transceiver			822-0693-003	7140	Yes				
		BBBQZVG								
	Passenger Address Unit	?		622-5342-101						
25	Control Display Unit			4043912-903	88100690					
26	Avionics Unit		Thomson-CSF	116(?) 218-014-023						
27	Bleed Fan		Techno Fan	EVA3745A	242					
28	Power Supply Unit			8ES 003-761-00 (Rack #:4XE-A)	00305					
29	Avionics Unit	BBBQZXT								
30	NAV Receiver Card									
31	Cockpit Display Unit (CDU)	BBBPCTF		965-0720-001	381					
32	Non Racked Controller			?						
33	High Resolution Color CRT			?						
34										
35	Rudder Pedal			C11A272 10 106 200						
36	N1 Indicator			65 833-108-00						
37	Rack With 2 Units									
	VOR Receiver			622-5220-103	1469	Yes				
	DME Receiver			622-9540-001	2	Yes				
38	Weather Radar Control Board									
39	EFIS Control Panel			96-126-096	0767					
40	Indicator, Partial									
41	Flap/Slat Command Unit			560 A 0000-02	305					
42	Radio Altimeter Transceiver			9599-607-14901	3415					
43	Slat/Flap Position Indicator			61551-101_2	421					
44	RDMI (Radio Digital Magnetic Indicator)									
45	Altimeter Indicator			65-205-240-1	1328					

Systems Group Number	Part Name	AAL Identification No.	Manufacturer	Man. Part Number	Manufacturer Serial Number	Unit Has NVM?	Date	Position	AA CPN	Torque Limiter Activated?
46	Standby Attitude Indicator			14301 AKMI	6431					
47	RDMI (Radio Digital Magnetic Indicator)			?						
48			_ Aerospeciale	A955B						
49	APU Fire Handle			239T505Y03	1030					
50	Engine #2 Fire Handle			237TSO5403	801					
51	Smoke Detector Processor			RC6SK_____	1152					
52	Controller Pneumatic System			627248-1	106C-902					
53	TCAS/VSI Display			066-50002-6102	3569					
54	Unknown Avionics									
55	Unknown Power Supply Card									
56	GCP ALT Display									
57	Unknown Avionics Box									
58	TCAS Display			O66-50003-0101						
59	Cabin Altitude			37000-3						
60	Computer Unknown Rack									
61	Computer Unknown Rack									
62	Door Unlock Assembly									
63	Audio Amplifier			772295-3						
64	Part Of Computer			?						
65	A3 Driver			8917004						
66	Part Of Computer			?						
67	Mechanical Unit w/ Pushrod End	BBFCXNK								
68	Avionics Computer - Rack Type			?						
69	Part Of Computer Case									
70	Hydraulic Damper	104749002		DRG/378/87						
71	RMI Case			6225001-502						
72	EFIS Control Panel	BBBPMZF							PAN 537	
73	Indicator			APL 2650						
74	ACARS Printer			109-_0-105	120				PRI7002	
75	Mode Control Panel			622-5130-209	2081					
76	HF Antenna Coupler		Rockwell Collins	792-6140-001	4037					
77	Seat MUX Controller IFE									
78	Cabin Electronic Box									
79	Power Supply			V303FF 059	1202					
80	Relay			131CC0						
81	Front of FCC Computer	BBBPSSW			20					
82	Comm Radio Selector Panel									
83	CVR Control Head									
84	LRU Face									
85	EGPWS		Allied Signal	Reference No:950-0329	896	Yes				
86	EGPWS Faceplate									
87	Computer Unknown			?						
88	Landing Elevation Selector				396					
89	Avionics Part			?						
90	Mode Select Unit			CG1137A001	265					
91	Unknown Box with Audio Jacks									
92	VHF Transceiver			822-0693-003	1760	Yes				
93	Speed Brake Transducer			659-698-00300	927549					
94	Thrust Control Computer Front Face	BBBIGDN				Yes				
95	Avionics Unit			?						

Systems Group Number	Part Name	AAL Identification No.	Manufacturer	Man. Part Number	Manufacturer Serial Number	Unit Has NVM?	Date	Position	AA CPN	Torque Limiter Activated?
96	Avionics Unit			?						
97	HF Transceiver			?		Yes				
98	Antenna Assembly			700-1153-002						
99	Pressure Indicator			64882-202-1	370					
100	Avionics Unit									
101	Pressure Reducer			44-2201-241-112						
102	Torque Spring Motor Assembly			404-2071-003M						
103	Hydraulic Shutoff Valve									
104	Avionics Unit									
105	CRT Display Unit									
106	Rate of Climb (ROC)			33140____						
107	Power Amp Assembly			641-895-2001						
108	Dual Indicator			64880 420	586					
109	Misc. Computer Internal Components									
110	Screwjack (small)									
111	Engine #1 Fire Handle									
112	Avionics LRU				2484					
113	Avionics Transceiver LRU									
114	Transformer Rectifier	BBBRFNY								
115	Angle of Attack Sensor			861CAE1 0001	760					
116	Angle of Attack Sensor			861CAE1 00__	651					
117	Transformer Rectifier	BBBQZGY								
118	Hydraulic Filter Module				795					
119	Rate of Climb (ROC) Faceplate									
120	Radio Altimeter			89700000-03	126	Yes				
121	Lighting Transformer			61	194068					
122	Tape Media From Unknown Source-0.5" Wide									
123	Fan Motor									
124	Rack Connector From LRU									
125	OVHD Panel-Cabin Temp/Pressurization Control									
126	Misc. Switch Panel									
127	Radio/Intercom Control Head									
128	Source Input Select Panel									
129	Cockpit Indicator Housing									
130	Mode Select Unit				318					
131	Throttle Position Sensor			S 319 16 987 870	447					
132	Circuit Breaker Panel									
133	Transformer			700	199636					
134	Airspeed Display									
135	LRU Front Face									
136	GPWS Control Switch and SELCAL Placard									
137	MCDU Entry Key Pad									
138	MUX or Power Supply			8056733-501/3039 800-501						
139	Lock Tab Washer from 126-09 Cronston Ave. DW									
140	Ventilation Fan									
141	Misc. Switch Panel From Cockpit & Indicator									
142	High Resolution Color Display			E2826B22-_____						
143	Control Column									
144	Pump			205210						
145	Small Electric Motor on Frame									

Systems Group Number	Part Name	AAL Identification No.	Manufacturer	Man. Part Number	Manufacturer Serial Number	Unit Has NVM?	Date	Position	AA CPN	Torque Limiter Activated?
146	Fuel System Probe			ST0002BO						
147	Auto Pilot Hydraulic Servo									
148	Part From Slat PCU (P/N 234)									
149	Air Data Computer (ADC)			4045053-910	83030173	Yes				
150	FDR Rudder Position Sensor									
151	DME	BBBQZWA				Yes				
152	Altimeter (4,780') and VSI									
153	Elevator Actuator									
154	Antenna Mount			6225136-203	2670					
155	Relay Panel									
156	Avionics Rack with 5 Units, 2 Unknown									
	Digital Flight Data Acquisition Unit (DFDAU)	BBBRHCK		Hamilton Standard		Yes				
		BBBPGSW								
					338					
157	Main Entry Door Hinge									
158										
159										
160										
161										
162										
163										
164										
165										
166										
167										
168										
169										
170										
171										
172										
173										
174										
175										
176										
177										
178										
179										
180										
181										
182										
183										
184										
185										
186										
187										
188										
189										
190										
191										
192										

Systems Group Number	Part Name	AAL Identification No.	Manufacturer	Man. Part Number	Manufacturer Serial Number	Unit Has NVM?	Date	Position	AA CPN	Torque Limiter Activated?
193										
194										
195										
196										
198	IRU 1 & 3 (Rack # 302FP1 & 302FP2)					Yes				
199										
200	Trimmable Horizontal Stabilizer Jackscrew									
201	Elevator Servo Control, LH Inboard?			31043	W750					
202	Elevator Servo Control, LH Middle			31043	W781					
203	Aileron Servo Control, Center LH Wing			30501	1804					
204	Aileron Servo Control, Outboard LH Wing			30501	1815					
205										
206	Center Pedestal									
207	Spoiler Actuator									
208	Autopilot Yaw Actuator									
209	Yaw Damper Unit									
210	Rudder Trim Screwjack									
211	Variable Stop Actuator									
212	Roll Autopilot Actuator									
213	Aileron Droop, Artificial Feel Unit RH Wing									
214	Aileron Trim Screwjack			277170741200						
215	Flap Track and Carraige									
216	Slat Screwjack, Track and Carraige			CHA 1484	40					
217	THSA Trimble, Horizontal Stab Actuator			40176-01	DV28/AH-58007					
218	Spoiler Actuator									
219	Pitch Artificial Feel Unit			977-750	W885/W901					
220	Flap Track and Carraige			57942546 0000	TV7972					
221	Flap Screwjack and Carraige									
222	Flap Screwjack, Track and Carraige #2			CH 1487-0025	83					
223	Flap Jackscrew with Track #1									
224	Flap Jackscrew Assembly, Right Wing									
225	Flap Jackscrew and Gimble									
226	Flap Jackscrew Assembly #5			CHA 1479002H						
227	Flap Track and Screw Assembly									
228	Aileron Control Servo, Right-hand									
229	Flap Screw Assembly #4			CHA 1478-004H						
230	Flap Screw, Broken									
231	Slat Screwjack			CHA 1067-__59	__4					Yes
232	Slat Screwjack									No
233	Slat Screwjack									No
234	Slat PCU			58000000-03	G1014					
235	Flap Power Control Unit			658A0000-01	10G42					
236	Rudder Servo Control Upper									
237	Rudder Servo Control Middle			34042-130	487					
238	Rudder Servo Control Lower									
239	Rudder Servo Control Input Spring Rod-Top Upper									
240	Rudder Servo Control Input Spring Rod-Center									
241	Rudder Servo Control Input Spring Rod-Lower									

Systems Group Number	Part Name	AAL Identification No.	Manufacturer	Man. Part Number	Manufacturer Serial Number	Unit Has NVM?	Date	Position	AA CPN	Torque Limiter Activated?
242	Rudder Input Control Rod									
243	Rudder Input Control Rod									
244	Main Rudder Control Rod									
245	Main Rudder Control Rod									
246	Main Rudder Control Rod									
247	Main Rudder Control Rod									
248	Upper Rudder Control to Servo									
249	Slat Track									
250	Slat Screwjack				AA587_					No
251	Slat Screwjack				AA587					Yes
252	Slat Screwjack			CHA 10610051						Yes
253	Slat Screwjack									Yes
254	Slat Track									
255	Green/Blue Transfer Unit Pressure System Filter				2091					
256	Elevator Servo Control LH Outboard			31043	W782					
257	Elevator Servo Control LH Inboard			31043	W783					
258	Slat Screwjack in Bin #NJDEP 20947									
259	3 Bags of Circuit Boards									