

Crash to Boost FAA Scrutiny

Accident, subsequent findings, expected to spur agency to review transport maintenance inspection procedures

By David M. North

Washington—Long-term effect of the grounding, and later release for flight, of McDonnell Douglas DC-10s is expected to be increased vigilance by the Federal Aviation Administration on maintenance inspection procedures by operators of wide-body and other commercial aircraft.

FAA Administrator Langhorne Bond last week, in referring to the preliminary findings from the American Airlines DC-10 crash on May 25 at Chicago's O'Hare International Airport, said: "There is no question that somewhere along the way we did not do it right."

American Airlines Flight 191, en route to Los Angeles from Chicago, crashed shortly after takeoff at 3:04 p. m. CDT on May 25, killing 259 passengers, 13 crewmembers and two persons on the ground. The 274 fatalities make the crash the worst in U. S. history.

The American Airlines DC-10 departed from O'Hare's Runway 32R and, according to National Transportation Safety Board officials, the aircraft's ground run to its rotation point 8,000 ft. from the departure end of the runway appears to have been normal.

At the rotation point, the aircraft's cockpit voice recorder indicates that the DC-10's flight deck crewmembers called out "V, (pause) damn." At this point, the cockpit voice recorder lost its power. The voice recorder is powered through the No.

1 electrical bus by the No. 1 General Electric CF6-6 engine.

It was at the rotation point, according to observers, that the DC-10's No. 1 engine broke loose from and went over the left wing, damaging the wing's leading edge. The engine and pylon landed to the right of the runway's centerline, and came to rest on the grass on the right side of the runway, with the debris scattered along a distance of 1,800 ft.

Following rotation, the DC-10 attained an altitude of close to 600 ft. prior to falling off on its left wing and crashing into a field, approximately 1.5 mi. north of O'Hare International.

The DC-10's flight data recorder was recovered intact by the National Transportation Safety Board with more than 25 hr. of recorded flight data on the tape. The

safety board is looking closely at the last few minutes of flight to determine if there is any clue as to why the engine left the aircraft. The previous flights also are being studied to determine whether the aircraft registered any unusual g forces, such as hard landings or turbulence, that could have contributed to the accident. The flight data recorder operates through the No. 3 electrical bus, powered by the No. 3 engine, and it operated until shortly before impact.

The DC-10 crash started a chain of events that led to the grounding of the wide-body aircraft on May 29, a controversy between the NTSB and the FAA as to whether the aircraft could still fly minus one engine and a review by the FAA of the procedures for inspection of all engine mountings of all wide-body aircraft.

As of late last week the answers to the cause of the accident and the difference over whether the aircraft could have flown minus one engine had not been resolved. Review of the maintenance inspections for the engine mountings and possible other areas of the aircraft was just starting.

One of the first actions taken by the accident investigation team of the safety board was the recommendation to the board that the FAA issue an emergency airworthiness directive to inspect all pylon attach points on all DC-10 aircraft. This recommendation was based on the board's investigation revealing the presence of a fatigue fracture of the No. 1 pylon forward thrust link attach bolt.

The NTSB recommendation was followed by an emergency airworthiness directive issued by the FAA on May 28 directing all U. S. operators of all models of McDonnell Douglas DC-10s to complete an inspection or replacement of the bolts at both the forward and aft ends of the thrust link assemblies.

The directive gave a compliance time of 3 a. m. EDT on May 29 for completion of the inspection and added that any aircraft not inspected by that time could not depart on a revenue flight.

The directive further required that the operator visually inspect the inside forward flange of each wing engine pylon aft bulkhead for cracks, in accordance with a McDonnell Douglas DC-10 alert service bulletin, dated May 27.

All operators were directed to report to the Federal Aviation Administration the results of inspections, whether positive or negative.

It was at this point, that the apparent easy solution to the accident, that of a



Thrust link bolt from left engine pylon on American Airlines DC-10 that crashed at Chicago was found along the runway. Bolt had been sheared in two, allowing the thrust bushing to break away. Cause of the bolt's breaking is under investigation.

fatigue fracture in the thrust link attach bolt, started to pick up contradictory reports from investigators and from further inspections of the DC-10s' engine pylons. As one NTSB accident investigator said: "The link attach bolt does not carry the load of the forward thrust; the bushing does, and the bolt holds the bushing in place. It would appear that the fracture of the bolt is a symptom of the disease, rather than the problem itself."

Late last week, the safety board's laboratory here was conducting tests on the pylon link attach bolts to determine whether the fracture in the bolt was due to fatigue or some other stress.

In carrying out the inspections required by the first airworthiness directive, United Airlines found "severe, significant" damage to the pylon web of a DC-10 in Chicago. In addition to cracks, some fasteners were missing, and even some tiny pieces of metal were missing, a United Airlines engineering official said.

The added damage in the pylon of the United DC-10 was found by two United mechanics, Lorin Schluter and Ernest Gigliotti, when they discovered that one of the pylon inspection plates was loose, and they decided to investigate further.

The United engineering official continued: "The damage was so significant and so unexpected that the decision was made to ground our fleets until we knew more about it." United decided independently on the grounding, but the FAA order to put down all U. S. DC-10s closely followed United's actions, the United official added.

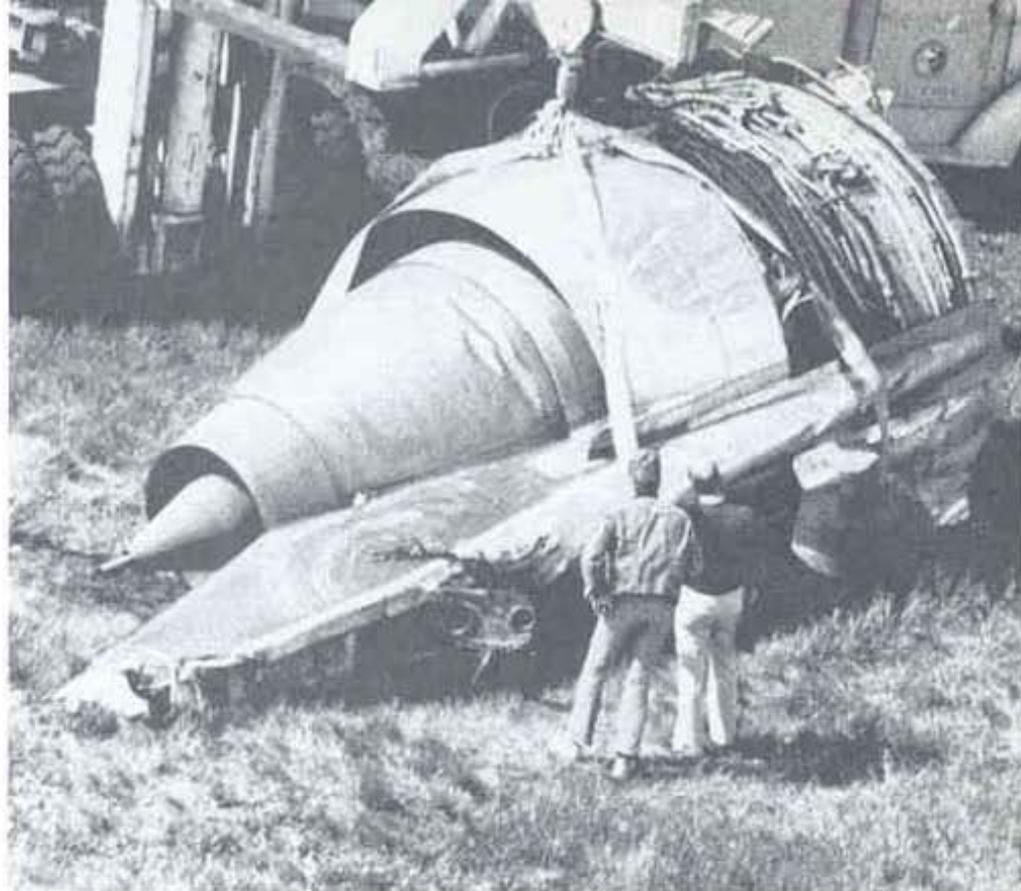
United has discovered missing fasteners in one other aircraft, but in this case there was no evidence of the associated damage found in the other DC-10.

"We are concerned," he said. "There is something going on in those pylons that is just unexpected." The inspections did not disclose any bolt problems, although "there may have been a couple that were loose," he said.

One FAA official amplified the United official's statements: "It was reported to us that of the six DC-10s checked in Chicago, four were found to have some type of a problem in the pylon attachments. In one aircraft, cracks were found in the attach fittings, some Huck bolts were sheared and the entire pylon was loose. The three other aircraft had a crack in a stiffener, corrosion and a crack in the thrust link assembly."

The FAA official also detailed what he believed was the sequence of events in the accident of the seven-year-old DC-10 that had accumulated 19,871 hr. of flight: "When the thrust link bolt fractured and the bushing taking the load left the aircraft, the thrust load was taken by the pylon aft monoball attach bearing which is designed for vertical and side loads, and not thrust loads. This bearing let go taking the tombstone fitting with it."

The findings of the United inspections,



Left engine and pylon assembly from American's DC-10 is recovered at Chicago's O'Hare International Airport. Note pylon attachment fitting to left of men.

plus the inspections conducted by Northwest Airlines, which found "three DC-10s with deficiencies in this area" prompted FAA officials to issue the grounding order for the DC-10s as of 1:00 p. m. EDT on May 29, the FAA official said.

FAA administrator Bond, in his grounding speech and in reference to the inspections required under the first directive said: "Two hours ago, I learned that these inspections are turning up grave and potentially dangerous deficiencies in many

Grounding Disruption Slight in East, Midwest

Little passenger disruption was caused on the East Coast and in the Midwest as a result of the temporary grounding last week of McDonnell Douglas DC-10 transports in wake of the American Airlines crash in Chicago.

Most of the airlines were able to substitute equipment or place passengers on other airlines. They generally agreed timing of the grounding was fortunate, because United Airlines was returning from its strike just in time to pick up much of the slack when the DC-10 use was lost.

Carrier officials also agreed the grounding resulted in at least some extra expenses for employe planning time and ferrying expenses to position other transports to fly routes normally flown by DC-10s.

Among the airlines flying DC-10s are:

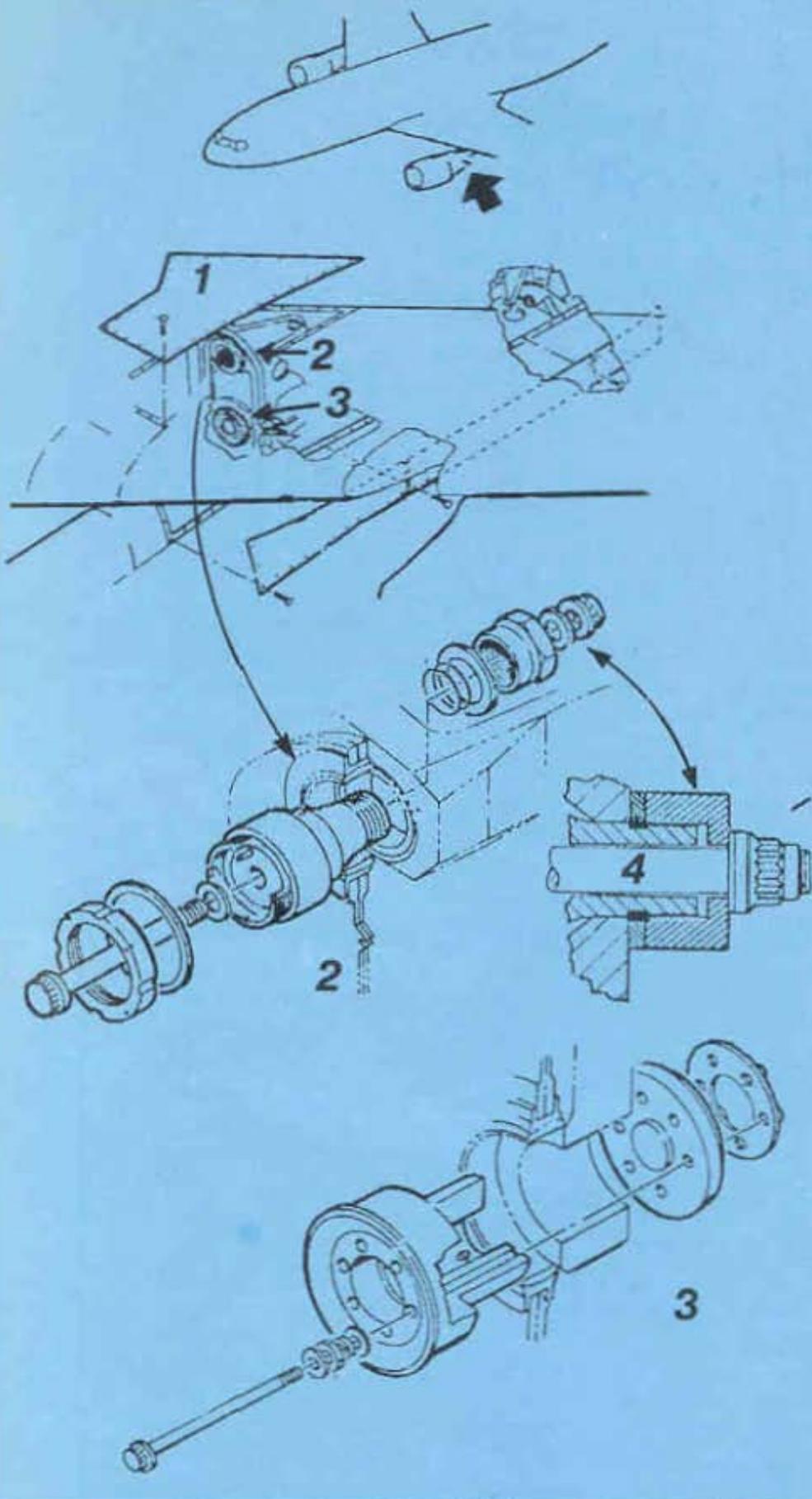
- **United** has 37 DC-10s in its fleet of about 350. They provide about 23% of the carrier's available seat miles. Grounding had little effect on passengers because of the carrier's phased startup and low load factors. The carrier used smaller DC-8s and Boeing 727s to fly most routes. Biggest delay in inspection procedure was need for a special set of tools. United had only one set and had to manufacture five more quickly and distribute them throughout the system. DC-10s returned to service May 31.

- **American Airlines** has 30 DC-10s, and expected all to be back in service by late last week. Boeing 747s and 707s were substituted on most routes, and almost all passengers were either accommodated or placed on other airlines.

- **Northwest Airlines** has 22 DC-10s. Eight were back in service by the morning of May 30 and the rest by later in the day. Little passenger disruption was reported as the routes were flown by 747s and 727s.

- **World Airways** has six DC-10s, and all were back in service by the morning of May 30. Carrier officials said only one flight on May 29 had to be canceled.

- **National Airlines** canceled two DC-10 Series 30 flights May 29 scheduled from Miami to London and Miami to Frankfurt, but inspection of the carrier's 16 DC-10s was completed by noon May 30, and the flight schedule was returned to normal.



Tombstone fitting on the McDonnell Douglas DC-10 connects the engine pylon's forward bulkhead (1) to the aircraft's front wing spar and is designed to carry vertical and lateral loads from the engine to the spar. The fitting is held by an upper plug (2) and a lower plug (3). Fig. (4) shows the cutaway of the upper plug and retaining nut. The thrust link assembly is located to the rear of the tombstone fitting's lower plug.

of the pylon mountings now being checked as a result of that order.

"I have no choice but to ground all U.S. DC-10s immediately. That order went out by telegraph just a few minutes ago. It also covers all U.S. certificated A300 Airbuses because of the similarity in the pylon."

The grounding order stopped flights of the about 135 DC-10s registered in the U.S. Although the airworthiness directives and grounding do not apply to foreign registered DC-10s, many of the foreign operators of the aircraft follow U.S. procedures. Immediately following the grounding order, FAA headquarters was fielding questions from Lufthansa and France's Union de Transports Aeriens (UTA), among others, trying to determine what actions the airlines should take concerning their DC-10s.

Eastern Airlines, operating six of the Airbus Industrie A300s, protested the grounding of the Airbuses, stating that although the engine is the same as that on the Series 10 Model of the DC-10, the pylon and attach points are different, and Eastern insisted that the A300 need not be grounded. In fact, the telegram that was sent after Bond's statement did not include the A-300.

The supplement to the May 28 airworthiness directive was issued in the evening on May 29 and was applicable to all DC-10 series aircraft. The amended directive stated that prior to further revenue flight after 1 p. m. on May 29, additional inspections were required.

The new supplement directed operators to conduct a detailed visual inspection of the upper and lower plug areas of the pylon-to-front-spar attach fittings, the aft monoball joint attachment and the pylon upper spar web.

The amended directive further directed operators to conduct a visual inspection of the entire remaining pylon-to-wing attach area paying particular attention to the thrust link support fittings, the pylon-to-front-spar attach fittings, and the aft pylon support bulkhead and associated wing support fittings for evidence of cracks, condition and security of fasteners and other signs of structural distress. The thrust link bushings and bolts also are to be inspected on a regular basis.

The inspections of this area are to be done at intervals not to exceed 100 hr. time in service since the last inspection, or 10 days since the last inspection, whichever occurs earlier.

The inspection required by the amended airworthiness directive prompted the United engineering official to say: "It is not a major chore. We just pull off access plates in the same general area where we were looking before, shine the flashlight in there and look for cracks and loose or missing fasteners. It is not real difficult. The impact on operations should be minimal, unless we discover a lot of problems."

Although late last week the sequence of

events that led to the crash was not known, one aviation industry official well qualified in the area of fatigue and stress in aircraft outlined the procedure that would normally be taken by the FAA in its post accident procedure:

"The FAA will now have to assess the service experience of the operators in this area of engine and wing fittings. Perhaps during an inspection, a problem was found in the attach points and corrected. If there are enough of these reports, the agency might have to direct a change in the design of the pylon. I am not saying this is the case, but it will have to be investigated thoroughly."

The second procedure to be initiated, once the pylon and design of the attach point is found to be safe, is to devise a new inspection directive that will direct the operators to inspect their aircraft at intervals and specify the procedure they should use, the industry official said.

The third step in this process will be for the FAA to look at other areas of the aircraft that might be subject to the same stress, strain or conditions, and devise maintenance procedures to handle those areas. This would also include the same attach points on other aircraft, the official concluded.

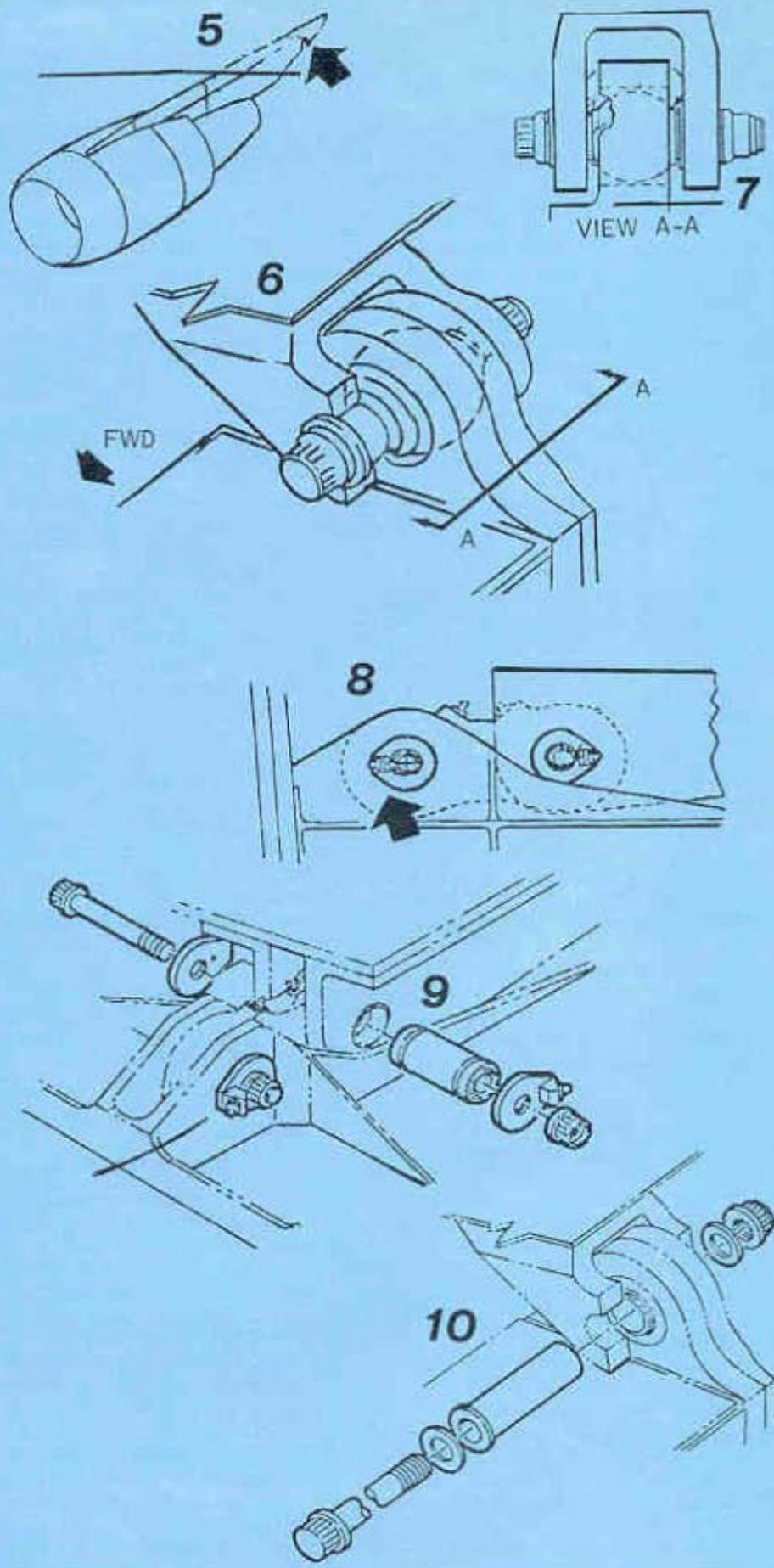
Bond addressed the subject of inspections and engine mountings: "This is the problem of how often those pylon mountings should be inspected. These deficiencies can be spotted and corrected during routing inspections."

He also said he has directed that the procedures for inspection of all engine mountings of all widebodied aircraft be reviewed. This review will cover the Boeing 747, Lockheed L-1011 and the Airbus Industrie A300.

The argument between the FAA and the safety board revolves around statements by officials of both agencies on the ability of the DC-10 to fly with one engine completely missing from the aircraft. One safety board member said that pilots were trained to fly the DC-10 on two engines, while Langhorne Bond countered that pilots were trained to fly without power on one engine, but there was no certification procedure or training procedure for DC-10 without an engine.

From the hydraulic lines found with the engine debris near the runway, safety board investigators believe that the leading edge flaps on the left wing, without hydraulic pressure to keep them extended, must have retracted to the faired position, which would give asymmetrical lift to the wings and could have complicated the pilots' efforts to keep the aircraft flying.

As of late last week, American Airlines training department in Ft. Worth, Tex., was planning on duplicating the factors that led to the crash in its DC-10 simulator to determine whether the aircraft could have been flown with all the failures attributed to the American Airlines crash in Chicago.



Pylon-to-wing thrust link assembly (8) on the DC-10 is designed to carry the full thrust load of the engine. Following the finding of the fractured thrust link assembly bolt (9) at the crash site, bolts at the forward and aft ends (10) of the assembly had to be inspected or replaced. Pylon aft monoball attach bearing (6 and 7), also designed to carry lateral and vertical loads, attaches the rear of the engine pylon to the aircraft wing (5).