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NATIONAL TRANSPORTATION SAFETY BOARD
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WITNESSES 4 - VIEWING ANGLES STUDY FOR WITNESS #32

***(7* Pages)**

NATIONAL TRANSPORTATION SAFETY BOARD
Office of Research and Engineering
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WITNESSES 4 - VIEWING ANGLES STUDY FOR WITNESS #32

By Kristin Bolte, Ph.D.,
National Transportation Safety Board (NTSB)

A. ACCIDENT: DCA-96-MA-070

Location: East Moriches, New York
Date: July 17, 1996
Time: 203I Eastern Daylight Time
Airplane: Boeing 747-131, N93119

B. GROUP

Not Applicable

C. SUMMARY

On July 17, 1996, at 2031 EDT, a Boeing 747-131, N93119, crashed into the Atlantic Ocean, about 8 miles south of East Moriches, New York, after taking off from John F. Kennedy International Airport (JFK). The airplane was being operated on an instrument flight rules (IFR) flight plan under the provisions of Title 14, Code of Federal Regulation (CFR), Part 121, on a regularly scheduled flight to Charles De Gaulle International Airport (CDG), Paris, France, as Trans World Airlines (TWA) Flight 800. The airplane was destroyed by explosion, fire, and impact forces with the ocean. All 230 people aboard were killed.

In support of the investigation into the TWA Flight 800 accident, the range of view out of a US Air 737-400 series airplane was investigated. The range was taken forward, aft, and downward from the window adjacent to seat 5F.

D. DETAILS OF INVESTIGATION

On June 9, 2000, a **US** Airways Boeing 737-400 series airplane was used to determine the viewing angles from the window next to seat 5F. This 737-400 series airplane was equipped with three rows of first class seats. Row 5 was the second row in the coach class.[1] The window for seat 5F was directly aligned with the seat and therefore was not obstructed by the seat back in front or behind. (See Figure I) This window was the ninth window counting from the front of the airplane. When looking at the window adjacent to seat 5F, the engine was visible in the window behind. (See Figure 2) A photograph showing the view straight out the window adjacent to seat 5F is shown in Figure 3.

An Abney hand level and a hand-held goniometer[2] (See Figure 4) were the tools used to measure the vertical and horizontal viewing angles, respectively.

The viewing angle to the bottom edge of the engine was approximately 45 degrees down (from horizontal) while the viewing angle to the bottom edge of the window was approximately 60-65 degrees down. The higher the point of reference (viewing position), the greater the viewing angle downward to the edge of the window. Therefore, the most downward view from this window was approximately 60-65 degrees (from horizontal). The engine was not obstructing the view from 45 degrees downward to approximately 60-65 degrees downward. Although a photograph showing the spacing between the engine and the airplane body was not possible, Figure 5 through Figure 7 do illustrate the location of the engine in reference to seat 5F.

The view forward out of the window adjacent to seat 5F was obstructed from 0 to approximately 20 degrees from the airplane nose, for the best case scenario. The range of view from airplane nose was approximately 20-120 degrees until the first obstruction by the outboard edge of the engine nacelle. At a viewing angle of approximately 45 degrees down, the range of view backward from the airplane nose was approximately 135 degrees before the first obstruction by the bottom (inboard side) of the engine nacelle.

Submitted by:

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[1] According to US Airways, the aircraft in which the witness was traveling was equipped with only two rows of first class seats, one less than the measured aircraft. The seat pitch for a first class seat was measured to he 36.5 inches while the seat pitch for a coach class seat was measured at 31 inches. Therefore, removing one row of first class seats and replacing that row with another row of coach class seats could position seat **5F** 5.5 inches closer to the front of the plane. Both the forward and rearward viewing angles are unaffected by the 5.5-inch forward placement of seat **5F.**

[2] A goniometer is a device typically used to measure joint ranges of motion.

Figure I: **A** digital photograph showing seat 5F and the associated window

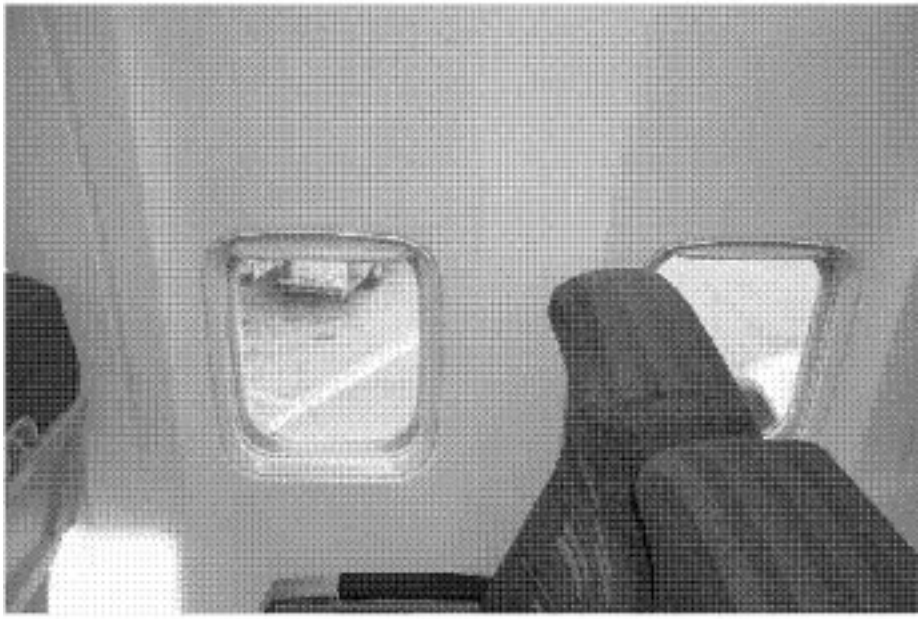

Figure 2: **A** digital photograph showing the window adjacent to seat 5F and the engine visible in the window behind.

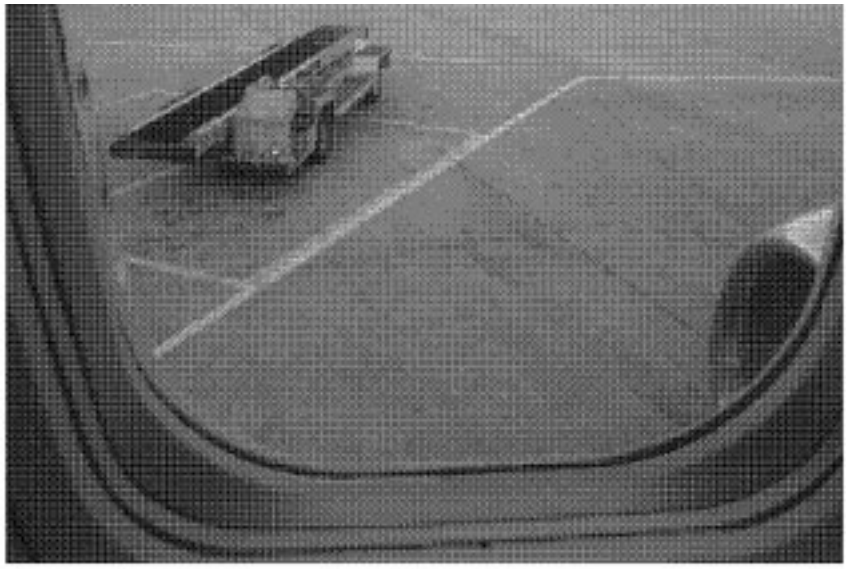

Figure 3: **A** digital photograph showing the view downward and straight out the window adjacent to seat 5F along with the engine.

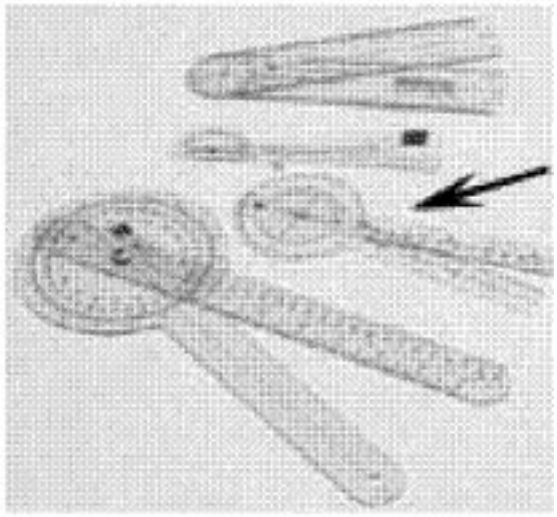

Figure 4: **A** picture of a plastic hand-held goniometer.

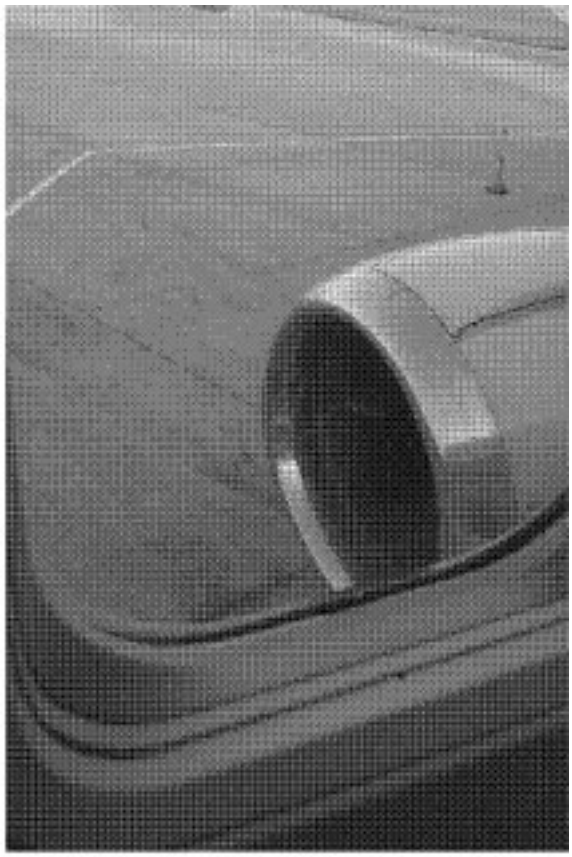

Figure 5: **A** digital photograph showing the engine looking downward and backward from the window in seat 5F.

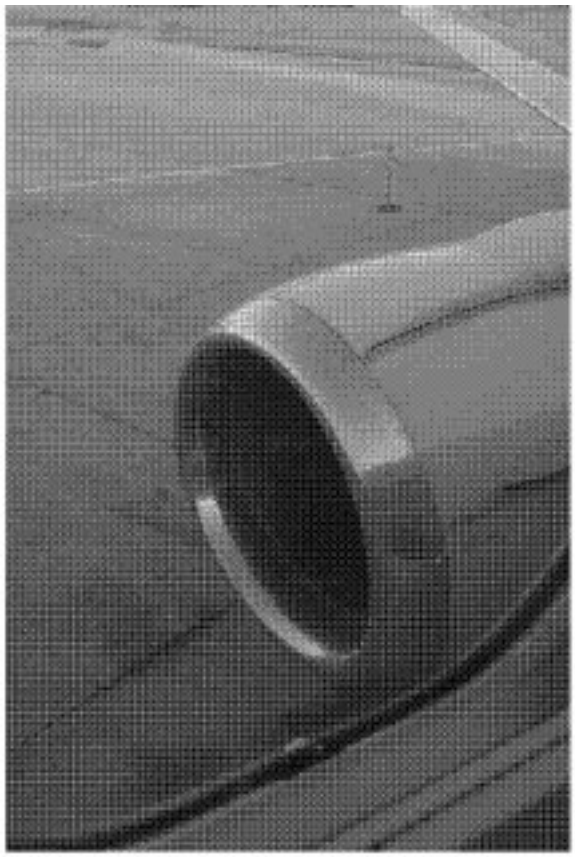

Figure 6: Another digital photograph showing the engine looking downward and backward from the window in seat 5F.

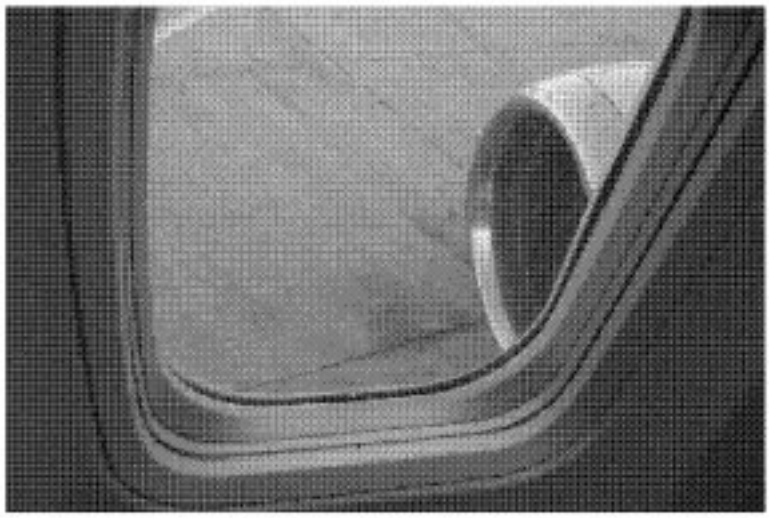

Figure 7: Another digital photograph showing the engine looking downward and backward from the window in seat 5F.