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The Anatomy of a Corporate Aircraft Accident: The Way It Was

Even though a flight crew is professionally competent to fly a safe trip, in an analysis of an accident a chain of errors is often shown to exist. The author points out that with thorough cockpit research management training the possibility of an accident can diminish.

by

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In the lives of professional corporate pilots, there is no novelty in rising before dawn, quickly downing a cup of coffee, and commuting an hour and 15 minutes to the airport for a scheduled flight.

That is exactly how it was on the morning of Friday, April 4, 1986 for the captain of a Westwind 2 scheduled to depart Teterboro Airport, New Jersey, U.S., with five passengers whose business would take them to Redbird Airport at Dallas, Texas.

On arrival at the airport on this overcast morning, he and his copilot busied themselves with all the usual preparations for their 0830 departure. They were ready when four of their passengers arrived — a fifth missed the flight but flew commercially to Dallas — and made an on-time departure.

After an uneventful flight, arriving at Redbird shortly before 1030, the crew began their preparations for the return trip that was scheduled for 1430 that afternoon.

Analyzing the Weather

At 1128 hours, while rain showers passed over Dallas, one of the pilots — we do not know which — called the Flight Service Station at Love Field to update the flight plan and to get a weather briefing for the trip home. The weather was not very encouraging.

He was told to expect thunderstorms both locally and along his route through northeast Texas and Arkansas. The cells would continue to build during the afternoon.

At 1400 hours, their lead passenger called with a message that, again, holds no novelty for the professional corporate pilot -their meeting was delayed, and they

could not make their scheduled departure time. The crew members were told that they could return to New York; the passengers would return by commercial air carrier.

The captain relayed this news to flight operations at Teterboro. It was agreed that if the passengers could make a 1900 hours or earlier departure, the crew should wait for them. This would produce a duty day of almost 11.5 hours for the crew from the time they arrived at Teterboro at about 0730. The company advised the passengers of the revised schedule.

Local weather at Dallas had worsened. It had rained and hailed at Redbird, denting some vehicles there. At 1714 hours, with the airplane serviced and prepared for departure, one of the crew again contacted the Dallas Flight Service Station.

He was briefed about a line of storms to the south of Dallas, running to the northeast, but was advised that the weather should not be a factor once they were outside the immediate area. The briefer suggested that he call back just before departure to see what this line of storms was going to do.

The crew then decided to make use of the FBO's commercial weather service computer to look more closely at the weather affecting their route. Logging on at 1728 hours, they were surprised that a convective SIGMET was in effect warning of hazardous flight conditions over the central and eastern United States; that SIGMET had not been included in their FSS briefing.

Shortly before 1900 hours, in full darkness, their passengers arrived at the airport. There were five of them; the man who had missed the earlier flight had rejoined the group. Probably because the captain had not anticipated this, the flight plan showed only six people on board the flight. In fact, there were seven.

At 1856 hours, four minutes ahead of the "no-go" time, the flight began. The only thing unusual noted by the tower was the length of the takeoff roll. The airplane rotated with only about 500 feet of runway remaining.

The First of Many Questions

Given the narration thus far, was this corporate flight crew performing professionally? There has been only one apparent error made — no doubt an oversight — in that the flight plan was not updated to show the proper number of people aboard. Then, perhaps, the hint of another: excessive runway usage on takeoff. Was rotation delayed for some reason? I would answer the question positively. This crew was *aware.* They were questioning the conditions in which they would operate. Unfortunately, they had not received the whole story.

The Way It Went

Just as the Westwind 2 lifted off from Redbird Airport, the National Weather Service National Aviation Weather Advisory Unit issued Convective SIGMET 2C, warning of severe weather over east and north-central Texas. This would directly impact the planned route of flight. The crew never received this advisory. Although it was broadcast, the timing was wrong. The flight was not using those frequencies when the warning was broadcast.

At 1900:35 hours, the flight was beginning its climb under the direction of the Dallas/Fort Worth departure controller. With the airplane now heading eastward into threatening weather and the copilot apparently flying (The captain was handling communications, a company standard operating procedure.), the first hint of a problem surfaced. The captain requested radar vectors for weather avoidance, saying that "our radar is not doing very well this evening."

At 1902 hours, the flight was handed off to Fort Worth Center. It was now traversing, as its climb continued, a low-altitude control sector known as the "Lake Low" sector. The Lake Low controller had not been advised by the departure controller of the airplane's radar problem, but at 1902:26 hours, the captain called him with ". . .if, uh, you help us pick our way through here, we would appreciate it."

He did not mention a radar problem then, nor throughout the remainder of the flight.

As the flight continued, other flights crossing the area were altering their courses to avoid the storms in the east Texas area. A flight of three U.S. Air Force Lockheed C-141 Starlifters detoured by 230 miles. Four airline flights diverted from their courses.

With the climb to their requested and assigned altitude of Flight Level 370 progressing normally except for vectoring around storms, the flight was handed off to the "Texarkana High" sector controller.

At their assigned flight level, the flight was apparently operating with a faulty radar on a *very* dark night — there was no moon, and the sky was sometimes obscured — and it was increasingly surrounded by thunderstorms graded from level three through six, which is as mean as they get. Except when those storms illuminated themselves, they would have been quite difficult to see and evaluate visually.

1910:14 hours. The captain requested and received clear-

ance to proceed direct to Texarkana.

1917 hours. At the controller's request, the captain advised that the tops of the storms to his left were 38,000 or 39,000 feet and still building. To the right, the tops were about 1,000 feet lower: 36,000 to 37,000. He also reported some "light bumps every now and then."

Flying Toward Danger

At 1918:57 hours, the copilot stated that they needed to maintain their heading but requested a climb to Flight Level 390. Later analysis indicates that, at this time, the flight was headed directly toward a level six thunderstorm and that the crew apparently intended to climb over it. That the copilot was the communicator indicates that the captain was now flying the airplane. Clear air turbulence associated with the storm ahead had obviously intensified.

1919:51 hours. With stress obvious in his voice, the copilot called, "Center, Westwind [garbled] need to get up! 11

1920:01 hours. Secondary radar returns from the airplane's transponder were lost. Later analysis indicates that in the preceding 30 seconds, the airplane was tracking straight toward an area of severe weather and that the climb was not initiated.

1920:13 hours. A garbled transmission from the flight, later tentatively identified as "negative thrust. . ."

1920:17 hours. The controller cleared the flight to Flight Level 390. There was no response.

Strong outflow from the storm just ahead had reached out a mailed fist. Clear air turbulence had become extreme. The airplane was forced out of its normal operating envelope. Despite the captain's best effort, it was beyond his control. Both engines flamed out. Within seconds, the airplane was within the maelstrom of the storm itself.

Dark, punctuated by intense bursts of lightning ... incredible turbulence... rain ... hail ... severe airframe icing ... probable intermittent electrical power causing erratic or erroneous attitude displays ... multiple emergency situations beyond salvation by most, if not all, pilots.

1922:07 hours. Primary (skin paint) radar returns were lost.

Approximately 27 minutes after takeoff from Redbird Airport, the Westwind 2 came out of the thunderstorm in an 82-degree pitch angle, inverted, and impacted explosively in a field near Redwater, Texas.

Destruction was total. Seven men died instantly. Six wives became widows, and 21 children became fatherless.

The Chinks in the Crew's Armor

Tragically, the crew members had not been provided with information that might have alerted their operational plan.

The weather briefing given one of the pilots at 1714 that afternoon had not been complete. It did not include all of the elements required for a full weather briefing. The briefer did include some elements of Convective SIGMET 46C, then current, but did not provide the SIGMET number. That may have diluted the importance of that information.

Alert Weather Watch 66, which covered the entire route flown, was also not briefed. Although it was current, its expiration time had been erroneously posted on the briefer's board and seemed to have expired. In part, it spoke of tornados, of hail 3 1/2 inches in diameter at the surface and aloft, of wind gusts to 75 knots, and of maximum storm tops to 55,000 feet.

There is evidence that the crew never accessed the severe weather sections of the commercial computerized weather service used.

And, of course, the crew never received Convective SIGMET 2C, issued coincidentally with their takeoff. The system of dissemination unfortunately did not mesh with the frequencies in use by the crew during the times that they were using them.

Finally, the controller at the time of the accident was not aware that the flight's weather radar was not fully operational. Neither the ARTC system nor the crew had so advised him. (Nor were either party required by regulation to do so.)

There were critical gaps in the crew's collective awareness of the operational situation. They could not fully appreciate the gravity of the challenges awaiting them.

The Findings of Probable Cause

The U.S. National Transportation Safety Board, on February 2, 1988, found these to be the probable causes of the accident:

- The partial failure of the airborne weather radar system;
- Clear air turbulence;

- A thunderstorm encounter with its gustiness and downdrafts;
- The issuance of an improper preflight briefing;
- The non-issuance of a hazardous weather advisory;
- The non-issuance of inflight weather advisories; and,
- Improper performance by FAA personnel.

The board also found, as contributing to the accident:

- The captain's continued operation with known equipment deficiencies; and,
- Improper use of procedures by both pilots due to excessive workload. (Task overload.)

The Inevitable Questions

Was the airplane properly certificated and maintained?

The NTSB found no discrepancies in this area. The airplane was dispatched with operational radar, and there was no indication that it had failed en route to Dallas.

Was the flight crew properly certificated, qualified and current in the aircraft?

Again, no discrepancies were found in these areas. The captain, 35 years old, had 7,353 flight hours, with 657 of them in the Westwind. He had been with the company for nearly seven years and was respected by both management and his peers. His copilot had 2,745 hours with 895 hours in the aircraft.

The flight department, managed professionally, placed great importance on regular recurrent training for its pilot staff. This flight crew had undergone such training.

Can we fully accept the NTSB's findings of the probable causes of this accident?

Absolutely, with respect to the question, "What happened?" We note that the crew and its performance did not figure as a probable cause. Except for the partial failure of the airborne radar, failures of the FSS and the ARTC systems were held to be the causes. The captain's continued operation with a faulty radar was cited as a contributing factor. We can largely discount the finding that neither pilot used proper procedures while under "task overload." In their final circumstances, any other finding would be surprising. But these findings beg the all-important question:

Did this accident become inevitable once the flight was airborne?

Absolutely not! In common with the vast majority of all aircraft accidents, a chain of errors culminated in disaster.

The Chain of Errors

Let us begin with a look at this crew's duty time. The captain must have risen that morning at about 0515 hours in order to make station time at Teterboro one hour prior to the scheduled departure time of 0830. At the time of departure from Dallas, then, he had been awake for 13 hours, 45 minutes.

Had the flight progressed normally, he would have landed at Teterboro at about 2240 hours local for a total duty day of 16 hours, 25 minutes.

There had been no opportunity to take any significant crew rest during the 8.5 hours during which they were on the ground at Redbird.

There is nothing very unusual about such a duty day for a corporate flight crew, but it produced somewhat tired pilots who were about to face the supreme challenge of their careers. Conjecturally, this may have been the first of this chain of errors.

We have noted that this crew was aware that, at least during the first third of their flight that night, they faced heavy weather problems. Skepticism would dictate that their preflight weather briefing should have been especially thorough. The search for severe weather warning advisories should have been pointed and unremitting. During this phase, the possibility of alternate routing should have been considered. Possible error two.

Once aloft, with the discovery that their radar was not operating properly and that vectoring around storms was necessary, an immediate request for alternate routing around all severe weather should have been made. This was not done. Error three.

As the flight continued, climbing to cruise altitude while still being vectored around weather, the controller should have been informed that the aircraft's radar was unreliable. Vectors out of the hazardous area might still have been possible. Error four.

At cruise level, a request to proceed direct to Texarkana, considering the weather surrounding the flight, was a poor decision. Error five.

The crew adhered to their cleared flight path and altitude even though it was apparent to them that the situation

was becoming more threatening. It would have been appropriate to alter either their attitude or their course, or both. A request for a higher altitude *was* made, but was not necessary. In such a situation, the captain has full emergency authority to take any action he deems necessary to preserve the safety of the flight. Error six.

When, finally, the airplane was surrounded by major storms, the crew apparently attempted to outclimb the storm in front of them. Error seven.

The chain of errors ends here: It had become too late to avoid disaster.

The Final Frontier

In 1988, for the first time, the corporate aviation accident rate per 100,000 hours equalled that of the scheduled air carriers. Commendable though that record certainly is, it is no cause for complacency. Corporate aviation's night safety record can and must be further improved: The goal is zero.

That is the final frontier for us all. It will be approached only when every flight crew member has been trained in, fully accepts, and practices the philosophies and application of Cockpit Resource Management (CRM).

In the accident being reviewed here, we can accept that the flight crew was operationally competent. We can believe that each of the pilots was able to competently manage the aircraft, its systems and all flight procedures.

But that chain of error exists. Had any one of those first six errors been avoided, the accident would not have happened.

There is not, however, any evidence that the captain of this flight was competent in the precepts of CRM and practiced them. This type of management encompasses basic pilot skills, systems and procedures expertise, and — of critical importance — the management of the human element in flight.

At every phase of this flight, including preflight planning and briefing, the captain, having identified any problem areas, should have taken his copilot completely into his confidence. Briefing. Explanation. Soliciting *his* input. Complete, concise communication — directed by the cockpit resource manager — is a basic requirement.

Cockpit resource management must be based on truly professional attitudes on the part of every crew member, especially including the captain himself. Those attitudes *must* allow the crew to accept and implement these basic operational philosophies:

- Every crew member's knowledge of his duties with his flight department must be encyclopedic. This requires constant recurrent and upgrade training;
- He must be skeptical of everything and cannot relax that skepticism, ever;
- Every crew member's continually updated awareness of the flight's current situation must correspond exactly with the real world, and must include the acute awareness of time. Professional intercrew communication becomes vitally important here;
- Any response to a challenge encountered during flight operations must enhance the safety of flight; and,
- Standard operating procedures must be in place *and used* when appropriate.

When coupled with practical tools for their implementation, these philosophies produce true professionalism.

Professionalism is Forever

Aircraft designers and engineers have done a magnificent job in providing the pilot with safe and efficient high-performance flying machines.

It is essential that every pilot make himself fully and forever professional by mastering that final frontier: the management of the human factors on the flight deck.

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