SAFETY FIRST

LESSONS FROM LEXINGTON

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In that strange place of betwixt and between, half-asleep and half-awake, my mind struggled with the images of the crash. Was it real? I wanted to believe I was having a nightmare and that it was too unlikely to ever happen. As I crossed the boundary into wakefulness, it hit me that the crash was indeed a reality. I became aware that the reason I was waking up in the middle of the night in a hotel in Lexington, Kentucky, was for the purpose of going out on the airport runways and taxiways to try to help determine why and how such a bizarre tragedy could ever happen.

I had been retained as an expert to evaluate and provide opinions on the visual perception factors involved. Later, when I wrote my report for federal court, I summarized the crash of Comair flight 5191 as follows:

"The two-pilot flight crew of the accident airliner attempted unsuccessfully to take off from an unlit "day-use-only" runway (26) which was only about half as long as the 7000-foot runway (22) to which they had been assigned. The aircraft ran off the end of the runway and crashed, fatally injuring 49 persons and seriously injuring the sole survivor of the crash (the copilot who was the 'pilot flying' when the takeoff roll was begun). The accident took place almost one hour before sunrise, at approximately 29 minutes before the beginning of civil twilight, under dark visual meteorological conditions. There were no obstructions to vision and no precipitation was present."

There were numerous visual cues forming images on the retinas of the two pilots and they both had 20/20 visual acuities at distance. How could it be that their eyes "saw" the cues, but their minds did not comprehend? I will try to answer that question after describing the visual cues that were obvious.

Photo 1 is a photo of the entire airport that I took in my Cessna 210 from just above the Class C airspace. They were cleared to take off on the black asphalt runway, 22, that runs diagonally across the entire photo. Since it was dark at the time, it was the only runway open for use, and the only runway that had lights. However, they attempted takeoff on the runway that runs more horizontally in the photo, runway 26, which can be seen to be mostly white concrete, and much shorter. Runway 26 was designated a "day-use- only" runway and used for smaller aircraft. Both pilots had prior experience flying as pilots at the airport.

Photo 2 is a close-up photo of the taxiways and the runways where takeoffs begin. The pilots taxied the airliner on taxiway Alpha near, but short of the "hold-short" line for runway 26, and stopped for almost a minute, time enough to look outside and read the signs. When duplicating their path, I observed that the brightly lit sign for runway 26 located at the hold-short line was especially conspicuous at night as shown in Photo 3. However, despite such obvious signage, the captain, who had the steering tiller on his left, made a sharp turn of approximately 135 degrees to position the airliner on runway 26, instead of making a 90-degree left turn to taxi to the well-lighted

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Photo 1. Blue Grass Airport (LEX) at Lexington, Kentucky

Photo 2

runway 22. He then turned the controls over to the first officer for takeoff.

While proceeding onto runway 26, they could have read the large number "26" on the pavement at the end of the runway onto which they were turning. They could have seen that the lighted taxiway resumed past the threshold of 26, and that the continuation of the taxiway led to a well-lit runway that had a sign next to its "hold-short" line that read "4-22," clearly indicating the location of the runway to which they had been assigned. I believe that they were aware that runway 22 was their assigned runway since they specifically referred to it almost a dozen times in their communications with each other and with the local controller.

As they lined up on runway 26 and began to roll down the runway, alarm bells should have gone off in their heads considering all of the visual cues that were presented to them. The most obvious was the fact that there were no lights bordering the runway. Besides that, the appearance did not look right for a precision-approach runway like runway 22, the type of runway with which they had considerable experience in their flying careers. Runway 26 was white concrete at that end, not black asphalt like 22. Runway 26 had painted line markings restricting its use to a somewhat narrow (for an airliner) 75 feet, whereas runway 22 was useable for its full 150-foot width. Diagonal chevrons were painted along the somewhat deteriorating shoulders of runway 26, compressing it to the 75-foot width, not at all like a main runway. Runway 26 lacked the markings of a precision approach runway (like runway 22) which they had seen countless times, such as the 12 white bars at the end, the 500-foot "touchdown-zone-markings", and the 1000-foot "aiming point markings."

Even if they did not notice all of the outside visual cues, there were at least five indications in the cockpit that they were on the wrong runway. Each pilot's primary flight display and each pilot's navigation display would show a heading of about 266 degrees. Moreover, the magnetic compass would show a heading of about 260 to 270 degrees. Those errors of about 40 degrees from the assigned runway are not small errors! If they had set their heading bugs for runway 22, the bugs would be seen to be about 40 degrees off center to the left. Photo 4 is a representation of the displays.

Of all the visual cues discussed so far, they didn't need to get them all right, or even a majority of them. If they had only perceived ONE correctly, they would have realized they were on the wrong runway. However, that is not the end of the story. There was yet another chance to avert the disaster. Shortly after taking the controls, the first officer remarked ***"Dat is weird with no lights"*** and the captain agreed when he said ***"Yeah."*** It sounds like they realized something did not make sense. This is a simple airport with only two strips of hard surface that are identified as runways. At night, only the long, wide useable one was lighted, so it should have been easy to recognize their error. They did not.

Photo 3

Then some of the most compelling visual cues of all came into view. The "4-22" sign could be clearly seen as they approached to cross the runway 22 that they should have been using. At that time, they had another "last-chance" to avert disaster. They could have pulled off the power, come to a safe stop, taken a minute or two to figure out their mistake and taxied back to take off on runway 22. They did not. They persisted in attempting to take off, riding over the wide, well-lit, overlay of runway 22, into the darkness on their way to disaster.

Photo 4

How could this have happened? No doubt their eyes picked up images of most, if not all, of the visual cues discussed here. However, there is a difference between simple vision, and visual perception.

In order for a human being to make a decision (perceive) what exists in the real world, it can be said that three components must be present.

1. There must be light from a scene providing a stimulus.

2. The light from the scene must be collected by the eye.

3. The information collected by the receptors on the retina of the eye must be coded, transmitted along the optic tract to the brain, and then processed into a percept; a cognitive process that results in a decision about what exists within the field of view of the real world.

It is possible for light from a scene to be projected onto the retinas of human eyes as clear and unmistakable retinal images and yet visual perception does not result. That happens when the third essential, mental processing, is absent or erroneous. That fact has significant relevancy to this accident in which cognitive visual processing of multiple visual cues presented to the flight crew appears to have been suspended.

Possibly some of the "same old" factors that affect us as general aviation pilots came into play, namely distraction, complacency, and fatigue.

When I looked at the transcript of the cockpit voice recorder, I noted that they did not observe the rules for a sterile cockpit, instead having intermittent discussions about family, pets, employment, and other issues. Although the intermittent "social" conversations were mostly at lulls in the ground operations, they could have been using that time to observe the signage and markings in their environment, and they could have been concentrating their attention on where they were located and where they were going to taxi. Some scientists have concluded that humans really don't multitask like a computer. Rather we may appear to be multitasking when in fact we are simply jumping back and forth between various tasks. Given that we have finite mental processing resources, it follows that when attention is given to socializing, that subtracts from our ability to concentrate on ground and flight tasks. The saying that "two sets of eyes are better than one" is only true if both of those sets of eyes (and the brains behind them) are being focused on the task at hand. Having two persons in the cockpit is worse than just one if the two persons distract each other, or focus their attention on each other. One of the first things I told my students was that they should not look at each other while flying. Although it is a natural thing for sociable people to seek eye contact, we can't be looking where we are going while we are looking at each other. Limited mental and visual resources should be focused on the priority tasks at hand.

It appeared to me that the pilots recited their checklists without giving each item complete attention. I'm sure they had gone through them so many times that they could do so in their sleep, but it seemed like they were almost asleep and just hurrying through them with speech so slurred from rushing so that it was a little difficult to tell what they were saying at times. In so many of the accidents that I investigate, it appears to me that high time pilots sometimes pay lip service to checklists and procedures without adequate concentration. They appear to have lost their sense of caution. There appears to be an attitude that they have done it without incident so many times that they are so good that they cannot make a mistake. This accident would suggest otherwise.

A little fear and self-doubt is a good thing for a pilot to have. The pilots in this accident sounded to me like they were trying to sound very "cool" and important, and even trying to impress each other. I have noticed that when I make several consecutive "greaser" landings in my Cessna 210, I become overconfident, get complacent, don't pay attention to checking my height with a side-glance, and drop it in or bounce. My mental resources were not be-

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