

# Dynamics of Flight

By Adverse Yaw

*“Aviation in itself is not inherently dangerous. But to an even greater degree than the sea, it is terrible unforgiving of any carelessness incapacity or neglect.”* This story identifies one of the reasons why aviation accidents sometimes occur. The Wright Brothers made the first powered flight and introduced the heavens to their version of aerodynamics, and suddenly, the skies became eternally infected with the dynamics of human nature.

This story begins and ends on the 2<sup>nd</sup> of July 1969. Aviation was a relatively new form of transportation—less than 70 years since its humble beginning, yet just a few days after this incident happened Apollo 11 was launched, and a few days later the first lunar landing in history was made.

This story is about two pilots, a WWII veteran fighter pilot, Captain Bill, and the second pilot is Randy, my friend who became a very successful Airline Captain and served with TWA starting in the beginning of the Jet age and into their purchase by American Airlines. This story takes place when Randy was a fledging flight instructor in his mid-twenties trying everything possible to break into a career as an airline pilot.

Captain Bill was a pilot/salesman. He was best suited to being a pilot, however, and for whatever reason, he was trying to make a living selling airplanes and flying them professionally at the same time. Although it is very rare a few have been successful doing both. I've only met one that I know of and he was above average. It is a difficult combination to accomplish with any amount of real success in either endeavor.

Captain Bill was known around the Oklahoma City flying community as one that had been through the fire of WWII, and he was probably thought of as bulletproof by most of the young, inexperienced aviators that were always hanging around—trying to gain more experience and flying time. When the younger pilots saw Captain Bill they might have mistaken him for a god of sorts, someone who could do no wrong, especially in the cockpit.

Imperfection is a common trait among all mortals, however, it is difficult for many of us to admit especially if we are aviators always aware of our outward image. Most acts of carelessness and neglect are almost always sins of self preoccupation which is one of the most common sins that occur in the cockpit.

On this particular day, Captain Bill's mission was to demonstrate the Jet Commander 1121 to a perspective buyer. He was determined to show and confirm the range of the aircraft by flying it non-stop from Oklahoma City, OK to Pella, Michigan—an attainable feat but the conditions must be almost perfect. The weakest aspect of the Jet Commander 1121 is that they are terribly inefficient and consume fuel by the barrel. Therefore, the range is limited by the amount of fuel the aircraft is able to carry.

Typical July days in the Midwest begin with cool mornings that graduate into warm mid-mornings and hot afternoons. By mid-afternoon, there are always

cumulonimbus clouds developing somewhere in one direction or another. These clouds can grow into gigantic monsters containing thousands of cubic miles of violence with heavy rain, large hail, icing conditions, strong vertical wind shears, severe turbulence, bolts of blinding lightning, claps of thunder, and oftentimes, tornadoes. (That may sound over exaggerated, but it's true.) Many times these storms form in lines along fronts that can stretch hundreds of miles across the country. Usually by sunrise, they dissipate into a few layers of what is commonly called scud (that's pilot jargon for fluffy little white clouds scattered a couple thousand feet above the surface). Sometimes, those lines of storms remain strong and mature throughout the night surviving to grow even stronger the following morning.

Whether or not Captain Bill knew about the line of storms that crossed their intended route of flight is uncertain. He may have failed to get an in-route weather briefing or may have chosen to ignore part of it. Any of these possibilities would be hard for him to admit at the time. The truth of it may never be known, but Randy avows that Captain Bill never discussed the possibility of a line of storms with him.

The sun was still well below the eastern horizon as Captain Bill pushed the power levers forward creating enormous noise in all directions except inside the cockpit. Accelerating down the runway and lifting off into the cool calm morning air was as always, exhilarating. As the landing gear retracted, a light illuminating the landing gear handle attracted the attention of both pilots. It was an indication that the landing gear was still intransient—not fully retracted or fully extended. They recycled the landing gear, but the light remained illuminated. The nuisance of the warning light was ignored as the assumption was made that the light was an indication malfunction.

Air Traffic Control (ATC) cleared them to Flight Level 370 (37,000 ft above sea level). Around Tulsa they began notice cumulonimbus clouds more than a hundred miles ahead flickering occasionally in the darkness. As they progressed closer, they could see flashes of lightning jumping from one cloud to another and to the ground. ATC informed them that the tops were over forty thousand feet. In his own mind, Captain Bill knew that the aircraft was capable of operating at a much higher altitude than its certified ceiling of thirty seven thousand, and that they could probably top the approaching line of storms.

This line of reasoning was outside of the known envelope. Before an aircraft is certified to operate at higher altitudes, the manufacturer has to prove to the FAA, and others, how the airplane will perform. Tests that relate to pressurization, low and high speed buffet boundaries, and the ability to descend in a given period of time should an emergency arise, are all part of the certification process. All such factors directly relate to the safety of the aircraft and its occupants.

They requested and were assigned FL 410 (41,000' above sea level). As the tops of the clouds became higher, they requested and were assigned FL 430 (43,000' above sea level). Bill was now operating the aircraft outside of the envelope. There was nothing written to define how it would fly, no graphs, and no data of how it would perform at this altitude.

Randy had made the assumption that Captain Bill knew exactly what he was doing and that this was standard operating procedure, normal stuff. This was a bad

assumption. "Newbies" seldom know what to think and being in a jet for the first few times is often so overwhelming that they are more passenger-like than crewmember. Flying in a modern jet aircraft can lull the most experienced aviator into carelessness and neglect which can end in death.

Both pilots became more concerned as they watched this solid line of storms grow. They were now consumed with searching for an opening where they could pass through safely. ATC advised them that this very storm had dropped three feet of water on the streets of Kansas City a few hours before. (*This had to be an exaggeration.*) Captain Bill indicated in his written report that as they approached the storm, the clouds were getting higher and eventually they were flying in the tops of the clouds with no outside visual reference.

Obviously, a change in course a few minutes earlier would have made their future problem nonexistent. They could have gone around the line of storms to the south, and then if necessary, they could have landed somewhere and bought more fuel. Now, they were too heavy to be this high and too close to turn away.

They were operating off the chart and into the unknown, a place where only test pilots dare to fly. A test pilot flying outside the known envelope at this weight and this altitude is seldom concerned about his safety, because engineers have made a scientific and educated prediction about what will happen to an aircraft at a given weight and at a given altitude. More importantly, the test pilots are not into taking unnecessary risks. Test pilots test out the engineers' theories, but they do it in perfect meteorological conditions. Captain Bill and Randy were way outside the envelope and were rapidly approaching the most horrible, meteorological condition known to aviators—a solid line of thunderstorms over forty-five thousand feet tall. The very thought of where they were about to be, and the feeble flying condition of the aircraft (too heavy & too high) makes me shiver just writing about it.

Panic began to creep into the cockpit. Both pilots were closely monitoring every sweep on the radar. They constantly changed the range of the radar from the forty mile range to the ten, to the twenty mile range, etc, etc. They were trying to find a place where it looked and felt safe to fly. The air was extremely thin and the airplane seemed mushy and slow to respond. It seemed as if they were barely flying. The high speed buffet boundary was precariously near as was the low speed buffet boundary. The meaning of "coffin corner" was becoming very realistic and understandable to them both.

Captain Bill and Randy were about to find themselves in a place where they were out of solutions, ideas and almost completely out of control of the airplane. It was not a comfortable place to be.

The high speed buffet boundary is a speed where sound waves affect airflow. This means that a pilot flying an aircraft designed for sub-sonic flight, faster than the high speed buffet boundary allows, will experience some loss of flight control. A pilot flying any airplane slower than the low-speed buffet boundary will experience some loss of flight control. The higher the altitude the aircraft is flown, the higher the *indicated* low speed buffet boundary. Whereas, the high speed buffet boundary becomes a lower indicated speed with the increase of altitude. As an aircraft is flown

at higher and higher altitudes the high and low speed buffet boundaries become closer and closer to each other. This is referred to in pilot jargon as “coffin corner.”

Bill and Randy were working very hard trying to stay out of harms way. Due to the aircraft they were flying and the enormity of the weather that they were confronted with, they both sensed imminent danger and became more and more concerned. It was too late for a course change. In his written report, Captain Bill mentioned trying to make a slight turn just as things began to rapidly deteriorate.

Bill stated in his report, “Before the aircraft turned, it started to porpoise. The airspeed dropped to about 160 knots, then rose rapidly to about 270 knots, then started down again. I disengaged the autopilot and pushed the wheel forward. A quick glance showed the airspeed was dropping below 160 knots. The porpoising had been smooth up to this point, but then it became rough. I heard a series of puffs, or small explosions that accompanies a compressor stall. The annunciator panel lit up on the left side.”

When the aircraft slowed to 160 knots it was possible and probable that it slowed because the altitude hold function of the autopilot was trying to maintain altitude in a strong downdraft. In order to maintain altitude, the autopilot caused the aircraft to pitch nose-up which caused the speed to drop off. As they sped eastward, they moved from strong downdrafts to strong updrafts. The altitude hold function was doing its best to maintain altitude causing the aircraft to pitch nose-down into the strong updrafts. The indicated air speed (IAS) gained more than a hundred knots rapidly to 270 knots IAS. This was partly due to the updraft and partly due to gravity helping to increase the speed as the aircraft was now pointed down. When Captain Bill disconnected the autopilot he caused things to go from bad to worse. When he tried to correct the nose down pitch attitude of the aircraft he pulled too hard and deflected the normal air flow to the engines which caused a dual engine flameout.

With both engines flamed out—each of the pilots donned their respective oxygen masks which now complicated communication between the two of them. The Captain, who was trying to fly the aircraft, mistook an instrument for something that it was not. He was attempting to fly the aircraft using a turn coordinator—all the while thinking that the instrument was an attitude gyro. He was ignoring his primary instruments that would have been operating normally using power from the battery, but this required movement of a switch. For some reason, Captain Bill failed to close this switch. Evidently, he was preoccupied with the turn indicator. Vertigo and total upset were likely to have been a major factor in this calamity. Randy expressed that he tapped the Captain on the shoulder and pointed to the flight directors. The Captain chose to ignore him and continued to try to fly via the turn coordinator. Randy recounts going through a series of turning maneuvers that took them from nose up vertically to nose down vertically several times, speed changing from extremely fast to extremely slow. During one of these violent maneuvers they heard a loud crashing sound. They later learned that this noise occurred when the right hand landing gear broke free from the up latch and came crashing out of the wheel well. The suspected cause was extreme positive 'g' forces along with a faulty up latch. At one time, their descent rate and speed became so high that both pilots

were pulling back vigorously on the yoke trying to slow the aircraft. They were going from heavy positive g-forces to zero g-forces to negative g-forces and back again, all in extreme meteorological conditions.

“It was by the grace of God that we survived,” Randy explained. “God had other plans for me on this earth or my life would have ended that morning.”

The first visual reference was recognized when a section line appeared in one of the upper eyebrow windows. They were at about 25,000 feet when they broke out and they were up-side-down. All of their gyrations, high speeds to very slow speeds, up to down movements, right side up to upside down cost them 18000 feet of altitude. Captain Bill split out of inverted from 25,000' MLS (mean sea level). Again both pilots pulled on the controls to level off at 19,000' MSL. Their speed at the bottom of this maneuver must have been extremely fast because they relit both engines while descending from 19,000' to 18,000' MSL. Their circumstances required them to make tight turning maneuvers in order to stay out of the clouds.

ATC advised them that the nearest airport was Jefferson City, MO. They circled around storms that extended to the ground and seemed to be all around them. Randy noticed a landing strip that was directly below them. ATC identified it as Columbia Regional, and they advised them that there were no maintenance facilities on the field. At this point, they didn't care if there was a maintenance facility on the field or not. They were ready to feel some terra firma under their feet.

Luckily, the landing gear's diagonal brace had gone over top-dead-center which locked the gear down, but in a partially retracted position. As they touched down, a fog bank rolled in and they had to stumble around in the fog to find the parking area. Isn't God's grace wonderful? Randy believes that Providence provided that short span of good weather over this little airport just for them.

A turn coordinator is an antiquated instrument designed to provide a timed turn and can be used along with an airspeed indicator and altimeter to maintain level flight. It was one of the first and most reliable gyro instruments ever placed in early aircraft. Using the instrument for any other purposes without a good understanding of how it works could cause confusion in the mind of the pilot. This kind of confusion often ends in vertigo which often means a total loss of control. Usually the loss of control is exhibited by a fiery crash—the very sudden stop at the bottom of what is commonly known as a graveyard spiral.

The airplane endured with a wrinkled surface on the upper side of both wings. The wing spars were x-rayed and found to be intact. The airplane was repaired and flown again. There is no strange or unusual phenomenon that caused this event. It was pure and simple human error. Captain Bill opted to venture into the unknown without concurrence from Randy. He chose to take them into a situation that was questionable at best. Randy assures that he is not willing to go to a place similar to this again, nor will he allow anyone to take him there.

It shouldn't take a shrink, a psychologist, or a minister to understand what happened almost 40 years ago. Captain Bill and Randy were blessed by the grace of God on that horrifying morning. Most events of this nature end in death.

Randy is still a very active, veteran aviator with over 27,000 accident free hours of experience. He still views that day as the scariest of his career, but says that it has made him a much more cautious pilot.

The grace of God is the very best gift that has ever been offered to mankind, without it, all of us would be lost.

*This is a true story. Randy has since flown a complete carrier as an Airline Pilot and was forced to retire a couple years ago due to the very discriminatory "Age 60 Rule". He is presently the Chief Pilot of a corporate flight operation in Oklahoma City. He has been a Sunday school teacher for young adults for more than 20 years. It may be that God had this position in mind for Randy when he kept Captain Bill and Randy safe on that July morning back in 1969.*