

# Under Pressure

Improper care of aircraft tires treads a **hazardous course**.

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**N**ear midnight on Sept. 19, 2008, a Learjet Model 60 was departing Columbia, South Carolina, Metropolitan Airport (CAE) on a charter flight bound for Van Nuys, California, with a rock band aboard. The tower instructed the pilots to proceed to Runway 11 via taxiway Uniform, but the controller noticed that the Lear had turned in the wrong direction and had the crew back taxi on the runway and perform a U-turn at the departure end.

At that point, the captain and copilot reviewed their rejected takeoff procedures, readied the aircraft and began their takeoff roll.

Shortly after reaching V1, the pilots heard a loud, rumbling sound, followed by more unexpected noises. Alarmed, the crew elected to abort, activated reversers and hit the brakes. The aircraft began to decelerate, but it was clear to the crew that they were going to depart the runway's end.

After passing through the runway safety area, the jet smashed into light poles, crashed through the perimeter fence and concrete posts, and crossed a five-lane road before striking an embankment, where it exploded in a fireball. Both pilots and two passengers were killed in the crash; two passengers managed to escape the burning wreckage, but were seriously injured.

NTSB accident investigators found pieces of all four main aircraft tires on the runway, and later determined that one of the probable causes of the accident was inadequate maintenance that resulted in severe underinflation of the tires, resulting in their failure. The Safety Board noted that while there were instructions for maintaining tire pressure, the frequency of checks were not adequate and there were



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inadequate training standards for pilots in tire failure scenarios. In addition, the report said that while the preflight checklist states pilots should check tire condition, there was no visible means to determine if a tire is dangerously underinflated without using a gauge.

Unlike car tires, aircraft tires do not necessarily appear underinflated when they're unsafe. Tires can lose up to 5% of their pressure daily and a loss of just 10% can lead to their overheating and failure. Maintenance technicians and pilots alike need to know proper care and inspection of tires to ensure their safety and good service life.

## Aircraft Tire Basics

Although they look like their automotive cousins, aircraft tires are actually quite different. They must be able to absorb much greater loads. While traction is not a major concern, the tires must be able to resist hydroplaning at higher speeds. Aircraft tires are not designed with cornering properties like a car and thus fast turns are harmful. The typical service life of an aircraft tire is counted in number of landings, versus road miles for auto tires. In addition, the tire must meet all of these demands while providing safe and affordable service.

Unlike modern radial tire design, many aircraft tires employ bias ply construction since that was the technology available when the aircraft they support were designed. Radial plied tires, which have just begun to penetrate the aircraft industry, feature cords running in the same direction, 90 deg. to the tread centerline for better strength and handling response. By comparison, bias ply tires use multiple layers of nylon ply cords laid at alternating angles to the tread centerline. The bead area is usually made up of layered steel wires to hold the tire shape, as well as carry the heavy landing loads.

Many maintenance technicians (and pilots as well) tend to regard pressure in aircraft and car tires similarly and detect low pressure visually. However, because of the high deflection involved in aircraft tires, it is nearly impossible to detect when the pressure within is dangerously low.

Before the introduction of radial automobile tires, it was essential to keep your car's tires properly serviced or risk a blowout. As radial tires became dominant, most people tended to ignore their tires' pressure. Unfortunately, this complacency has crossed over to aviation, and this needs to end. There is really

no way around the fact that regular tire pressure checks with a calibrated gauge are necessary.

The accident in Columbia was a wake-up call for many business aircraft pilots and maintainers. It also hit close to home — literally — for Michelin Aircraft Tire Co., which is based in nearby Greenville, South Carolina. That company had been working with its customers for many years to extend tire life, but the accident inspired its people to even further action. In conjunction with the FAA Safety Team, they created a Web-based course on tire safety (see “Tire Pressure Smarts” sidebar) and talk about tire smarts in safety seminars.

Tire manufacturers test their products to rated conditions, but it is the airframe manufacturers that set those operating conditions and determine the correct operating pressure.

“When you deviate from the operating pressure, which is a function of the design deflection, you start to accelerate the wear rate,” cautions Keat Pruszenski, manager of Customer Support Engineering at Michelin. “If pressure gets too low, the deflection increases and builds up heat, which can damage the tire. Long taxiways like Denver’s can greatly accelerate heat damage on a tire.”

Pressure is impacted by changes in ambient temperature. For each 5-deg. drop in temperature, a tire loses 1% of its pressure. This is a major concern when leaving an aircraft parked on the ramp overnight, or when flying to a cold weather location from a warm one. Aircraft tires demand a close tolerance to specified operating pressure, with a narrow band of best operating pressure between 95% and 105%. A preflight tire pressure check should take this into account, especially if traveling from a warm location to a cold one.

When tires lose more than 5% of their pressure in a day, you should investigate the cause. A good rule of thumb is that if a tire’s pressure drops to 94-90%, make a logbook entry and pay close attention. You should remove a tire if it drops below 90% and send it to the repair shop for inspection. A tire needs to be scrapped if its pressure is found to be below 80% and its mate must be scrapped as well. Always consult the aircraft maintenance manual for the appropriate maintenance actions.

Keeping tires properly serviced not only helps keep an aircraft safe, but it has additional benefits.

“Our customers have seen tremendous gains in tire wear life just by following

## Tire Pressure Smarts

Michelin Aircraft Tire Co., in conjunction with the FAA Safety Team, has created an online training course on the importance of maintaining proper tire pressure. The course is available online and when completed, pilots earn wings and AMT credits, respectively. Visit the website at:

[www.faasafety.gov/gslac/ALC/course\\_content.aspx?pf=1&preview=true&cID=269](http://www.faasafety.gov/gslac/ALC/course_content.aspx?pf=1&preview=true&cID=269) ✨  
or [www.airmichelin.com/generalcontent.aspx?id=12884901925](http://www.airmichelin.com/generalcontent.aspx?id=12884901925)

recommendations. This can extend the number of cycles before wear out and helps resist FOD [foreign object damage],” Pruszenski said.

FOD is always a major concern, but especially when aircraft tires are involved. The crash of an Air France Concorde in 2000 was caused by FOD destroying the SST’s tires, which in turn caused penetration of the aircraft fuel tank. The indelible image of the doomed, flaming aircraft should be both a reminder and a call to action to institute FOD control measures for all airports.

### Maintenance or Check?

Checking tire pressure is one of the more basic tasks a maintenance technician can perform. A calibrated gauge should always be used to ensure accuracy. Even though tire pressures are typically in the 200-psi range, a small deviation can have a huge effect on the gauge’s readout. New digital gauges are much more accurate and precise, and remove the possibility of an incorrect reading. The maintenance manual provides the specific temperature/pressure readings and they need to be followed.

Checks should be performed before flight, but beware of atmospheric conditions. If you are in a warm hangar and the aircraft to going to roll out into the freezing cold, be sure to service to the outside conditions. After landing, tires and wheels become very hot and should be left to normalize temperature before servicing. There are some charts that provide a correction factor, but this can be difficult to validate. Always follow the manufacturer’s recommendations.

One major problem the NTSB noted in its report on the Lear 60 crash is that some FAR Part 135 operators may not permit their pilots to check tire pressure since use of a tool is required to do so. But since there is no other way to verify safe pressure, this becomes a problem when operating away from home base. Part 91 operations do not have that restriction, but pilots need to be trained

on how to correctly check pressure.

“When we are out on the road, we always check the tire pressure before the first flight of the day,” said Cliff Jenkins, director of aviation and chief pilot for Milliken and Co. Inc., which also is based in Greenville. “We have a very high end, calibrated gauge and keep it in the back of the airplane. One of the pilots will check the tire pressure to ensure it is in the acceptable range. It may not be at max pressure, but we will take off knowing that the pressure is in the safe range.”

Tire pressure monitoring systems have been available for several years now and come as standard equipment on many new airframes. The system checks the tire pressure and alerts the crew when servicing is required. For older aircraft, there are sensors that can be installed on the wheel assemblies that can be checked with a wand that reads the pressure without touching the sensor. Essentially this creates a handheld monitoring system that pilots can use if operating procedures prohibit them from touching the aircraft with a tool.

Tires can be serviced through the sensor and pressure can be checked manually without removal. Maintenance technicians can verify the wand’s accuracy by cross checking tire pressure versus the output of the sensor. Servicing tires should only be done by properly trained and qualified personnel. Always use a calibrated pressure gauge on your tires, and run the gauge past normal filling pressure and then crank it back down to check for a sticking needle.

As has been tragically demonstrated, the consequences of a tire failure can be deadly. Keeping tires in safe operating condition is a critical part of any aircraft maintenance program. Pilots need to be aware of the importance of maintaining correct pressure and, depending on operating rules, take a more active role in ensuring tires are properly serviced.

The old axiom of “kick the tires and light the fires” needs rephrasing. Make it “check the tires to avoid any fires” and have a safe flight. **B&CA**