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PC-12

SWEET TO BE SINGLE

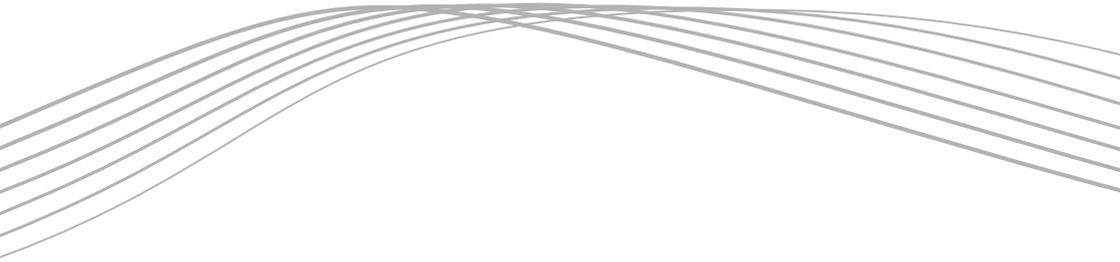


≡PILATUS≡

THE TRUTH ABOUT SINGLES



PC-12





“IF I ONLY HAD A BRAIN”

We humans are not half as objective as we would like to be. A little well-executed sleight of hand can make us believe in magic – a few squirrels in the attic can convince us a house is haunted.

Despite our powers of reason, it takes only a little expert prodding of our right brains to make the smallest fears grow into great ones. Orson Welles’ radio drama caused panic in the streets. Hitchcock made us terrified of seagulls. Spielberg confined half a generation to dry land (the other half was out hunting sharks).

A PARALLEL EXISTS IN AVIATION

People have been talked into an irrational fear of single-engine aircraft based on the general premise that airplanes with two or more engines are significantly safer. Proponents of multi-engine superiority have so demonized single-engine planes, it’s a wonder they haven’t been systematically wiped out by panic-stricken pilots (little surprise many of those perpetuating the myth of multi-engine safety make their living building, flying or selling multi-engine aircraft).

Yet, in spite of the prolonged campaign against them, single-engine aircraft are alive and well. Why?

THE TRUTH IS SIMPLER THAN YOU MIGHT THINK

Single-engine aircraft are safer than we’ve been led to believe. In fact, when safety statistics from the last twenty years are examined closely and objectively, we discover something most pilots already know: in some situations, a twin can actually be more challenging to handle safely than a single. Once this misperception is corrected, the real advantages of single-engine performance and economy become too compelling to ignore. This booklet will explain how singles were saddled with an unsafe reputation, reveal the truth behind the hype, and show you where the Pilatus PC-12 fits in. So, relax your right brain, rev up your left, and find out why it’s sweet to be single.

SAFETY & THE SINGLE ENGINE

The most persistent myth about single-engine aircraft is that they are less safe than multi-engine aircraft. That's simply not true of today's advanced turboprop singles like the PC-12, and a wealth of independent safety statistics proves it. Admittedly, there was a time when all aircraft engines — reciprocating, turboprop, and jets — were far less reliable and powerful than their modern counterparts. Particularly on transatlantic flights, additional engines were welcome and served as necessary insurance against a powerplant failure.



THE MULTI-ENGINE MINDSET

In the early days of aviation, aircraft engines lacked both power and reliability, and multiple engines were needed to lift high payloads and deliver them dependably to their destinations. Since the failure rate of engines was high compared with those on modern aircraft, adopting a multi-engine mindset was not only appropriate, it was an act of self-preservation. “The more engines the better” was the philosophy, and it gave rise to a bevy of multiple-engine planes, the B-36 and B-52, the DC-4, DC-6, and DC-7, and the Lockheed Constellation among them.

THE CULT THICKENS

With increased production of multi-engine models came new investment in aircraft development, factory tooling, and new facilities. Once committed, a need to justify the huge expenditures accompanied the surge in production. Since aircraft with more engines were more expensive to acquire and operate, and more complex to fly, pilots themselves extolled their praises as a badge of honor and a justification for higher compensation. No wonder, then, multi-engine aircraft were deemed king by those considered to be expert. There certainly is a place for multi-engine aircraft today, but safety is no longer a valid reason for adding more engines.



B-36 Peacemaker

“SINGLES ARE FOR SISSIES”

There's another reason singles are perceived as inferior to multi-engine planes. Pilots in training usually learn to fly in singles. Later they move on to multi-engine aircraft to earn their commercial ratings and build time. Once they've invested the time and money in training to become multi-engine pilots, few want to fly an aircraft they associate with their “greener” days. They've joined an elite group who have mastered more complex and, by extension, more challenging aircraft – to return to singles once they've graduated to twins would seem, at least among their peers, to signal a retreat. These pilots, many of whom are working toward careers with the airlines, have a vested personal interest in logging multi-engine time – and it has nothing to do with safety.

AND HEREIN LIES THE IRONY

The concern voiced most often about singles as an aircraft category is that they're inherently less safe than multi-engines. Yet the Federal Aviation Administration, the militaries of many western countries, and most of the world's flight schools endorse putting the least-experienced pilots in single-engine aircraft. Why? Because singles are easier to operate, easier to control, and easier to recover. But easier doesn't mean it requires less talent; anyone who thinks flying a single isn't a badge of piloting skills hasn't flown an F-16.

THE MOVE TO “LESS IS MORE”

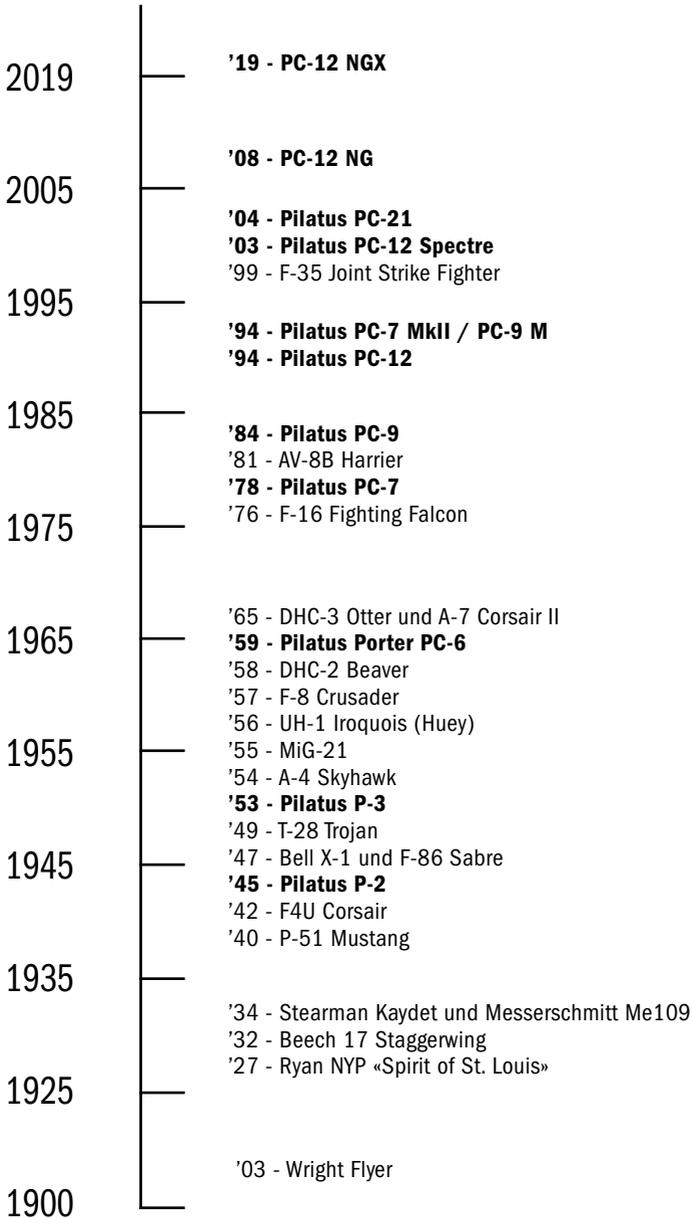
The military has long seen the advantage in single-engine tactical aircraft – the F4U Corsair, P-51 Mustang, A-4 Skyhawk, and F-16 Fighting Falcon – which carry a much higher percentage of their gross weights as payload than their multi-engine counterparts. As the sophistication and reliability of aircraft engines have increased, more manufacturers are trending back to fewer engines. Fewer engines result in less fuel consumption, lower maintenance costs, and higher payload/range capabilities.

The trend can be seen in commercial aviation with the airlines’ move from four-engine aircraft to three- and two-engine aircraft. More recently, the U.S. Air Force and U.S. Navy selected a single-engine turboprop platform – based on the Pilatus PC-9 – as the basis for their Joint Primary Aircraft Training System (JPATS), which has replaced their aging twin jet training fleets with a common aircraft. By doing so, they’ve effectively endorsed the single engine concept and debunked the myth of superior multi-engine safety. Furthermore, the militaries of the U.S. and nearly a dozen other countries have entrusted their national security to a new single-engine jet fighter, the F-35 Joint Strike Fighter.



The military’s reliance on single-engine aircraft has a long history that extends to the current day with the F-16 and the single-engine turboprop chosen for the Joint Primary Aircraft Training System.

BIG SINGLES OF HISTORY



SPINNING THE TWIN

Over the years, some pretty tortured logic has been used to muddy the waters on the issue of the safety of single-engine turboprop aircraft. Occasionally, we're blessed with moments of clarity. Richard N. Aarons, writing on single and twin-turboprop comparisons for the Federal Aviation Administration's Accident Prevention Program, cites this finding by the National Transportation Safety Board: "An engine failure-related accident in a twin-turboprop is four times more likely to cause serious or fatal injuries." Two important factors contribute to the greater danger in twins with a failed engine: asymmetric thrust and altitude. In twin-turboprops, the engines are mounted a considerable distance off the aircraft's center line. When one engine fails, the ability to climb can drop by 80percent, and the unbalanced thrust on one side of the aircraft can cause the aircraft to yaw and roll dramatically. If engine failure occurs during takeoff or at low altitudes, the pilot has precious little time to compensate. A single doesn't suffer from asymmetric thrust in the event of powerplant failure, so the pilot can concentrate on landing the aircraft rather than gaining control.

THE LAST DEFENSE OF TWINS

To say twins have no advantage over singles would be misleading. Their importance in building multi-engine time in preparation for a professional career is unquestionable. Under certain circumstances, namely on transoceanic flights and during engine failure or shutdown at altitude, a second engine can provide additional options. But in the latter case, the advantage isn't nearly what it used to be, though no one with a predilection for multi-engine aircraft is likely to tell you why. Today, the reliability of modern turbine engines is so high that an engine malfunction is rarely the primary contributor to an accident or incident. In fact, turboprop and jet engines have advanced to the point where mechanical failures are essentially non-existent, which means any argument in favor of twins based on the presumption of engine failure is built on a false premise. What's more, in some situations, a single-engine aircraft with a power loss is an arguably safer environment than an aircraft with two engines, as we've already seen.

SINGLE ENGINE VS. TWIN ENGINE AIRCRAFT

Accidents per 100,000 flight hours, U.S. & Canadian Registered Aircraft.

Aircraft	Cumulative Flight Hours	Accidents	Accident Rate
CE-208	10 101 355	168	1.63
TBM-700/850/900	988 577	40	4.05
PA-46-500TP	810 980	49	6.04
PC-12	4 018 362	24	0.60
Single Engine Turboprop Aircraft	16 452 849	304	1.85
Twin Engine Turboprop Aircraft	59 582 215	1115	1.87
U.S. Fleet of All Business Jets 1964-2015	87 484 650	759	0.87

Source: Single-Engine Turboprop Aircraft Accident Analysis, Robert E. Breiling Associates, Inc., April 2016



THE FACTS ARE IN

Don't just take our word for it. Independent analyses compiled from government safety statistics tell an even more compelling story. The table to the left, published annually by Robert E. Breiling Associates, Inc., presents a summary of accident data by model and type of aircraft. The numbers clearly indicate that the single-engine turboprop fleet has actually established a lower accident rate than that of the twin-engine turboprop fleet of aircraft. As a result of careful design, robust construction, rigorous training, and continuous focus on safety, the Pilatus PC-12 fleet has even earned a record that is statistically equivalent to the fleet of all U.S. business jets.



THE POWER OF 1

The concept of outfitting a light and efficient airframe with one massively powerful engine isn't new – it's been demonstrated in tactical military aircraft such as the F4U Corsair, P-51 Mustang, F-86 Sabre, and F-16 Fighting Falcon. Pilatus borrowed the concept (and little else) when it set out to produce a “clean sheet of paper” aircraft that married state-of-the-art structural design with a powerful, turbine engine.



The PC-12 forward mounted engine keeps the propeller away from the cabin for increased passenger safety and comfort.

“SINGLE” DOESN'T MEAN SMALL

When most people think of a single, they imagine a two- or four-seat aircraft with a reciprocating engine flown for training and recreation. In contrast, a high-performance turboprop single can pack a lot of horsepower. And since it's free of the extra weight, drag, and fuel that come with twins, it can lift more of its gross weight as payload. The PC-12, for example, is bigger than a King Air 250, over twice as large as a Citation Mustang, and has a maximum payload of over 2,236 pounds (1014 kg).



Pilatus PC-12



King Air 250



Citation Mustang

The cabin volume of a PC-12 is 330 cubic feet, making it roomier than the King Air 250's 303 cubic feet and much larger than the Citation Mustang's 144 cubic feet.

THE CANADIAN ENGINE THAT COULD

The PC-12 performance is made possible by Pratt & Whitney Canada's PT6E-67XP engine, a powerful variant of the most dependable engine ever produced, the PT6. The PT6E-67XP produces 1,845 thermodynamic horsepower (shp), but it's flat-rated to 1,200 shp in the PC-12. Rating the engine at only 65 percent means the stresses and temperatures it was designed to withstand are never imposed on it, reducing engine wear and maintenance costs.



With Pratt & Whitney's PT6E-67XP engine, the PC-12 horsepower-to-weight ratio is comparable to a P-51 Mustang fighter.

Pratt & Whitney Canada PT6 Turboprop Engine Data	
Engines delivered (through May 2016)	59,150
Power range of series	500-1,940 shp
Hours flown worldwide (through May 2016)	418,399 000
In-flight shut down rate (12 month rolling average)	1 per 651,126 flight hours

Source: Pratt & Whitney Canada, May 2016

“CABIN SIZE REALLY DOES MATTER”

“The PC-12 is a breakthrough airplane. Its size for the purchase price and low fuel flow are propelling demand, but the fact that it has only one engine is mattering less and less, to more and more people, is indeed a big change. Pilots were, naturally enough, the first to know the facts and trade the tiny risk of a forced landing for the many cost efficiency benefits of a single, but now nonpilots are making the same decision. If there was ever any doubt, size does matter, and it's the size of the cabin, not the number of engines, that matters most to many.”

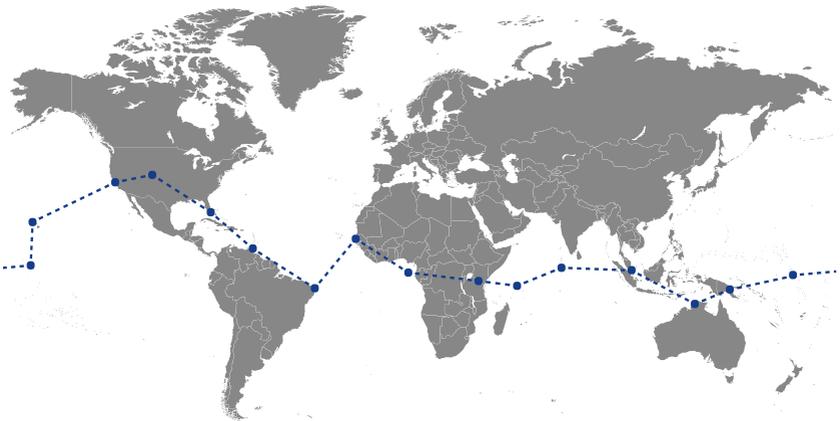
J. Mac McClellan in Flying Magazine

THE “LESSER” BENEFITS OF SINGLES

In several ways, singles deliver less than twins. Fortunately, delivering less is the single's most compelling quality. Less acquisition cost, less fuel consumption, less maintenance. Get the picture? For example, the PC-12 direct operating cost is about a third less than a comparable multi-engine aircraft and nearly half that of the nearest comparable jet. All of which is less likely to upset your accountant.

PUTTING OUR MONEY (AND OUR REPUTATION) WHERE OUR MOUTH IS

What would you consider to be the riskiest flight to take in a single engine aircraft? How about over the open Pacific Ocean, more than 1,000 nautical miles (1,800 km) from land? It seemed like a good way for us to prove, once and for all, how safe and reliable the PC-12 actually is. So, in June 2014, Pilatus provided a brand new PC-12 to Amelia Rose Earhart to circumnavigate the globe, following the original 1937 route of her namesake (no relation). Her total flight distance covered 24,300 nautical miles (45,000 km) – 80 percent of which were over water. In just 18 days, “our Amelia” safely completed the journey from Oakland to Oakland (the long way) and experienced zero squawks or delays the entire trip. How’s that for proof?



On July 11, 2014, Amelia Rose Earhart completed an around-the-world flight in a standard Pilatus PC-12 NG outfitted with a 200-gallon (750 l) auxiliary fuel tank – 24,300 nautical miles, 108.6 flight hours, 80 percent over water, 18 days, 14 countries, 1 engine, and 0 squawks.



THE WIZARD REVEALED: OR, WHAT TO TAKE WITH YOU IF YOU GO BACK TO KANSAS

There's a meaningful scene in *The Wizard of Oz* that seems appropriate to mention here. It's when Toto pulls the curtain back to show a diminutive man fumbling with the machinery he uses to keep the entire Emerald City in fear of The Wizard. Once the deception is revealed, the man can do little but leave town by the nearest available means, which is, fittingly, a hot air balloon.

Much of the general fear of single-engine aircraft has been similarly manufactured. Hopefully, this guide threw some well-deserved light into that dark corner. But in case a few shadows still linger, here's a summary of the most important points – open up your mind, and see how sweet the truth really is.



10 REASONS

- The argument that single-engine aircraft are less safe than multis is based on the presumption of engine failure.
- However, modern turbine engines are so reliable they are rarely the primary cause of an accident or incident.
- According to an National Transportation Safety Board report, when engines do fail, serious injury or death is four times more likely to occur in a multi-engine turboprop aircraft than in a single due to sudden asymmetric thrust.
- Single-engine aircraft don't experience asymmetric thrust, and they typically have higher glide ratios and can land at slower speeds.
- As reliability has improved over the last century, airlines have specified fewer engines on new aircraft designs.
- The U.S. military continues to rely on single-engine aircraft to provide for the nation's security.
- Singles carry a higher proportion of their weight as payload.
- Singles cost less to acquire, operate, and maintain than comparable twins.
- Single engine aircraft are easier to fly due to less pilot workload.
- The environmental impact of single-engine aircraft is lower than that of twin-engine designs.

THE PILATUS PROFILE: SWISS, OVER 80, AND BUILDING THE FINEST AIRCRAFT IN THE WORLD

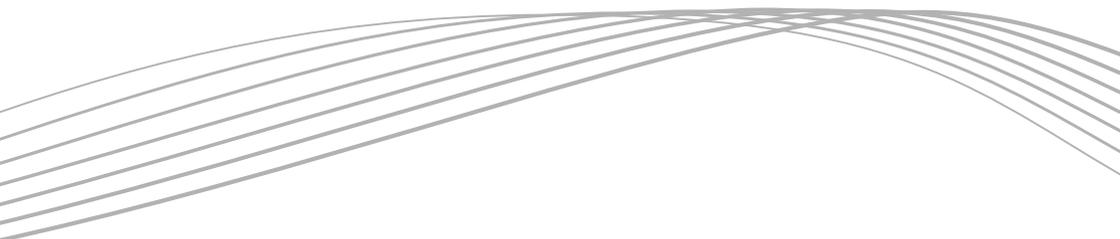
Pilatus has been designing, crafting, and supporting aircraft from our small factory in the Central Switzerland canton of Nidwalden for more than 80 years.

The core of our company design philosophy is optimized efficiency, and employing precisely the right resources with no unnecessary waste. In over 1,700 PC-12 aircraft delivered, we've proven the single-engine concept is a sound, economical, and safe option. And because we believe the power of single-engine design lies in the marriage of technology and simplicity, Pilatus has built more single-engine turboprops than any other manufacturer. These aircraft are considered the most versatile in the world and have earned the loyal following that grows every day.

If you want to know more about single engine safety, performance, and economy, call Pilatus. Find out what you've been missing.



Founded in 1939, Pilatus Aircraft Ltd is the only Swiss company to develop, produce and sell aircraft to customers around the world: from the legendary Pilatus Porter PC-6 to the best-selling single-engine turboprop in its class, the PC-12, and the PC-21, the training system of the future. The latest aircraft is the PC-24 – the world's first ever business jet for use on short unprepared runways. Domiciled in Stans, the company is certified to ISO 14001 in recognition of its efforts for the environment. The Pilatus Group includes two independent subsidiaries in Broomfield (Colorado, USA) and Adelaide (Australia). With over 2,000 employees at its headquarters, Pilatus is one of the largest employers in Central Switzerland. Pilatus provides training for about 130 apprentices in 13 different professions – job training for young people has always been a very high priority at Pilatus.

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