

— LATEST BRIEFING —

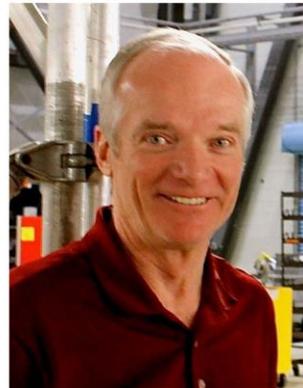
## Good bye 2020, Hello 2021!

Here's to a *much better* flying year for all of us...

by *Charlie Precourt, CJP Safety Committee  
Chairman*

Well 2020 has sure been quite a year. In spite of the damper it put on a lot of our flying we still managed to make up for it with some great new safety and education content. You can access the materials at any time on our web site Safety page. For example, you can revisit our virtual convention safety stand down including our deep dive into the Dale Earnhardt Jr. Latitude runway overrun. And we also added a number of podcasts throughout the year on topics like ambiguous cockpit indications, checklist use techniques, and landing performance and runway analysis. And our final podcast of the year was appropriately titled “2020, That Was The Year, That Was.” It’s had over 250 downloads in the first couple of days since release and you can catch it here:

<https://www.youtube.com/watch?v=uwekdOIA2Dc&t=90s> Hats off to David Miller and Neil Singer for their creativity in making all this happen.



As I write this, we’ve just had another Citation overrun that fortunately had no injuries but resulted in a likely total loss of the aircraft. This will make a very good case study for us at our next convention. Peter Basile of the Textron accident investigation team is on site in Lufkin, Texas performing the analysis of the accident. He did a great job on the Earnhardt accident presentation at our stand down so we look forward to hearing more on this

scenario at our 2021 convention. The aircraft was a Citation 551 model. You can Google for current information using the N48DK registration. As we like to say, “We don’t tell you how to fly your aircraft, we give you things to think about when you do.” And in this case we don’t have a clue yet what root cause was for the accident, but the scenario gives us lots to think about. There has been a healthy discussion on our forums about many of the considerations, but here’s a quick rundown you should keep in mind as you do your own flying. Peter can give us the full story in the fall.

First is the short flight situation. Just like the Earnhardt flight, this one was only 40 minutes. There’s a lot of time compression on flights less than an hour, and we see a lot of accidents occur in these situations. The Teterboro Lear Jet circling fatality was another example. On this flight from Austin to Lufkin, the aircraft had four aboard, including the presumptive Texas legislature Speaker of the House. It’s a good idea to get your arrival set up as soon as possible after takeoff to stay ahead of the curve, and keep passenger’s schedule pressures in check.

Second issue was the weather. There was heavy rain in the 10 minutes preceding landing. The Citation 551 performance charts call for a factor of 2.05 times dry landing distance for water between .01 and .4 inches in depth. This could have put the required landing distance as much as 4,400 feet with only 4,300 feet available on Lufkin runway 16, where they landed. And recall the supplemental data (the 2.05 factor) is not flight tested. It is analytical only. The dry distance that is used for adjustment factor is flight tested, and the test pilot that measured it touched down on speed at 1,000 feet, and had all deceleration devices deployed, including maximum braking, within one second of touchdown. When we’re traveling at 180 feet per second, every foot counts in this kind of scenario.

A third issue is potential hydroplaning. We know hydroplaning will occur at nine times the square root of our tire pressure. So, if you have 100 psi, you can and likely will hydroplane if you apply brakes above 90 knots. This is another good reason to check tire pressures often and keep them serviced at the top of the specified range. Related to hydroplaning is antiskid performance expectations and braking techniques. When we want maximum performance braking we apply full brake pressure and hold. The anti-skid will do its job, which may mean that you get brake release if it senses skidding as in hydroplaning. Sometimes this can even feel like an acceleration to the pilot. The initial deceleration backs off or stops and the pilot senses an acceleration and can perceive the brakes are failed. All good reasons to avoid hydroplaning. That means firm landing, on speed, break through the water layer and make firm contact with the pavement, get wheel spin up and then apply max braking with certainty you are below hydroplane speed. It’s possible in this accident the crew thought the brakes had failed and went for the emergency brake. There was also some speculation they first tried to cycle the antiskid switch.... remember the system first goes through a 6 second test (no braking) when you power it on! There are some great discussions to be had in this whole area of braking techniques and failure response. A related accident in a Net Jets Phenom 300 involved similar braking issues. You can see the final NTSB report here [https://reports.aviation-safety.net/2014/20140919-0\\_E55P\\_N322QS.pdf](https://reports.aviation-safety.net/2014/20140919-0_E55P_N322QS.pdf) It’s worth a read. Not a Citation but similar considerations.

Another issue is pre-landing performance data calculation. We have been advocates of the Aircraft Performance Group runway analysis app for quite some time. It calculates all of the adjustment factors for you and it also provides obstacle analysis in both takeoff and landing planning. There are now three services available through Flight Plan dot Com that provide this kind of analysis. AeroData, APG and ASAP (Automated Systems in Aircraft Performance). You can check them out here... they can really make life easier and increase understanding of your runway performance expectations. <https://www.fltplan.com/Runway.htm>

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Related to landing performance, Neil Singer has provided us a copy of an AOPA article that gives interesting perspectives on the runway touchdown zone and implications for performance margins. His article is attached below.

A final issue for the Lufkin accident (and there may be more when we hear from Peter) is the choice of runway. The runway analysis tool could have shown the selection of runway 07, with an additional 1100 feet available and more into the prevailing wind, may have made a difference. As the saying goes, there's nothing more useless to a pilot than the runway behind you. When the choice is there, full length takeoffs and landings on the longest runway is the best option. If the data shows you can't get at least 20% runway remaining for landing margin you may want to think about going somewhere else.

Obviously in situations where margins are thin, we also have to ensure we are stable, on speed and altitude at the threshold, or else go around. History has shown that we don't opt for go around very often (only 3% of unstable approaches actually result in a go around). The airlines took this result into a scientific study of go around decision making with the help of the Presage Group. Presage has partnered with us to conduct a similar scientific study of go around criteria for our Citation flying. Our objective is to create better criteria for go around than we currently have in our SOPs, which are based on decades old, generic, stabilized approach criteria. This scientific study will look at the specific needs and constraints of Citation operations and will be the first of its kind in business aviation. To do this, we'll need your help and participation in the study... so look for more info on that later in the spring.

Our other big initiative for 2021 is incorporating FOQA where we can in our fleet. Flight Operations Quality Assurance uses flight data capture to track our performance against SOPs and look at our fleet aggregated results in a way that can spot safety issues before they result in an accident. We are looking to perform an expanded Beta test of the program starting this spring and will reach out to you for your help and participation in that program as well. We really believe FOQA and the Go Around study could be game changers to stop the trend in runway overruns, as well as other safety issues. We have been in touch with many of our underwriters and were invited to place a CJP article in The Binder, which is published by the Aviation Insurance Association (AIA). Additionally, we have received permission to include in this edition of Right Seat one of The Binder's recent articles about personalizing insurance premiums. This is included below.

In the fun category, I wanted to share my experience flying a demonstration of Garmin's new Autoland system. The technology is going to bring a lot of benefit to future aircraft designs that can further enhance flight safety. There's a copy of an article I wrote about this for EAA Sport Aviation attached below.

Fly Safe!

Charlie

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## MENTOR MATTERS: WHAT'S A TDZ AGAIN?

NOT ALL RUNWAY MARKINGS ARE ALIKE

From Neil Singer

Safety groups and training providers that focus on jet aircraft operations expend vast energy educating pilots about the ever-present hazard of runway overruns. As overruns continue year after year to represent the



most common accident type in everything from the lightest of light jets to airline-flown transport category planes, it's an understandable focus.

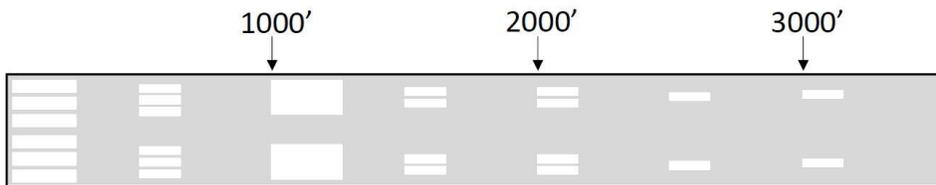
The problem is typically attacked in two primary areas. First, in increasing education of performance planning, especially in awareness of issues inherent with making a land/ divert decision and the necessity of using safety margins that allows for real world, not test-pilot, performance. Second is the focus on rigorous adherence to stabilized approach criteria, as even a landing calculated to have a conservative safety margin can result in an overrun if flown poorly.

This stabilized approach criteria often has the pilot perform a final land/ go-around decision at 500' above field level (AFL)- if the pilot meets a half-dozen criteria, most importantly airspeed and height within an acceptable window, the approach can continue. Otherwise, a go-around should be performed in recognition that the energy of the aircraft is too high to allow for a landing with adequate margins.

Unfortunately, many pilots treat this 500' AFL gate as the last box to check before committing to land, while in reality an approach could certainly be stabilized at 500' only to become unstable closer to the runway. A problem, though, with attempting continuous evaluations during the final 500' to touchdown is a tendency for the pilot focus to shift to visual cues, with a corresponding decrease in scan of the instruments that could alert to excessive airspeed or height. Fortunately, there is another tool that can be readily applied during the critical last few seconds of landing, one to prompt a go-around when landing margins are compromised- awareness of and adherence to the touchdown zone (TDZ) as the sole area in which the wheels should set down.

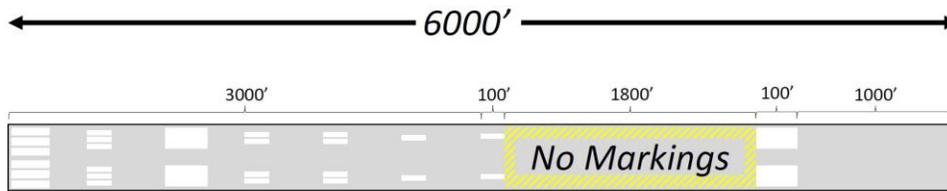
It's common for pilots to have forgotten the definition of the touchdown zone, likely last remembered during a cram session for the instrument rating oral exam. The AIM defines the touchdown zone simply enough: "The first 3,000 feet of the runway beginning at the threshold". There's a more nuanced and practical working definition of the TDZ we can use though, one especially relevant for the relatively shorter runways into which general aviation jets operate.

Central our understanding this working definition of TDZ are the pavement markings present in the TDZ on a runway served by a precision approach. For these runways, the TDZ will be painted with bars showing distance information from the threshold in 500' increments. After the aiming point markings located 1000' from the threshold, two bars on each side of the centerline indicate the 1500' and then the 2000' point, while a single bar on each side of the centerline are located at 2500' and 3000' from the threshold.



To avoid confusion, a runway is always designed to have at least an 1800' long area in the center without any TDZ or aiming point markings. If the runway has TDZ markings on both ends (because each end is served by a precision approach), any markings that would extend to within 900 feet of the runway midpoint are left off. If only one runway end features TDZ markings those markings will be omitted if they extend to within 1800' of the aiming point marking of the opposite runway end. These fact, and some simple math, can help define a rule to assist pilots with snap decisions if they find runway passing under them rapidly as their jet floats down the runway.

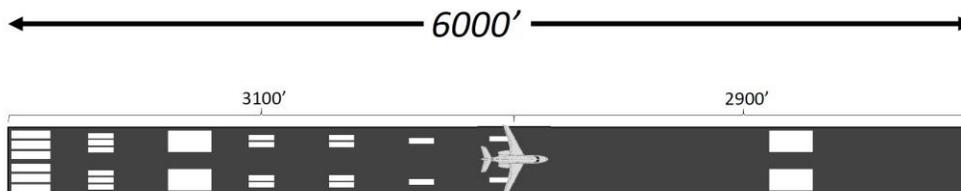
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Consider a runway with only one set of TDZ markings that is just short enough that the last TDZ marking (the one that would be at the 3000' mark) needs to be left off. If we do some simplification that won't change the final result much (e.g. the start of the aiming point markings actually reside 1020' from the threshold, and while TDZ markings are typically 75' long and aiming point markings 150' long, we'll use 100' for both for simplicity) we see that to have the very end of the 3000' marker just encroach into the 1800' "no markings" zone, the runway would have to be 3100' + 1800' + 1100', or 6000' long. Less than this and the TDZ effectively becomes 2500' long with the last marker absent. For every 500' of runway less than 6000' present another TDZ marker is removed- a 5500' runway will only have markings to and including the 2000' point, while a 5000' runway will only have the 1500' marker after the aiming point.

This helps with overrun prevention when we work the critical concept of landing safety margins into the equation. A common practice is to require the planned runway requirement not exceed 60% of the actual landing distance available. Using this safety factor on a runway just over our 6000' threshold to truncate the TDZ marks, we could need no more than 3600' of total air and ground distance to stop the plane, or 2600' of ground roll assuming the typical 1000' air distance from the threshold to touchdown (also a simplification, but again functional for rule of thumb purposes).

Here's where the math all comes together- if a pilot happens to float a bit and puts the wheels down at the end of the last TDZ mark (3100' from the threshold), they still have 2900' left to stop- slightly more than the 2600' calculated as necessary. This math follows as we look at shorter runways with fewer TDZ markings- a slightly longer than 5500' runway with a 2500' TDZ painted gives 2900' of ground distance is present past the last TDZ marking (don't forget the 100' roughly of length for the last mark), enough as no more than 2300' (60% of 5500' minus 1000' air distance) of ground roll could be required.



Putting all this math into simple terms- combine a 60% safety factoring with an operating practice to put the wheels down in the TDZ marking area or go-around and the situation stacks in your favor. There are some significant caveats, of course. Most obviously, many runways don't have the full TDZ marking set- a runway with no approach or only a non-precision approach, for example. Here a rule of thumb can help us- treat the TDZ as the first 3000' or half of the runway, whichever is less, and the same math will work out for you. Figuring out how to identify the 2750' point of a 5500' runway is certainly trickier than just ensuring the wheels are down before the end of the 2500' marker, but the basic concept still work just as well. Using runway remaining signs and/ or preplanned reference points on the ground will help.

The other major caveat relates to the ability to actually stop the airplane once the wheels are down. There is strong reason to suspect an approach which leads to floating past the

aiming point was flown too fast. Knowing you have more runway in front of you than stopping distance needed is only assured if touchdown occurs near the calculated VREF threshold speed. Forcing the plane down in the TDZ at 40 knots over VREF has historically shown to be a setup for an overrun, so while saying that any landing past the TDZ should be avoided is a good policy, it's not the same as saying any touchdown in the TDZ will end successfully. This strategy can add another layer of protection against a runway overrun, but just like proper performance planning and stabilized approach discipline, it is not a panacea.

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<https://www.aopa.org/news-and-media/all-news/2021/january/pilot/turbine-pilot-mentor-matters-tdz>

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## AIA SAFETY REPORT

### ARE PERSONALIZED INSURANCE PREMIUMS POSSIBLE?

Steve Bruneau - Vice President Aviation Services, Polaris Aero

Madeline Sullivan - Manager of Safety Training

There's a big debate in the sports industry during the time of Covid-19: is it safer to play or not to play? Without much thought, it's easy to assume "no play" is the obvious answer. No huddles, no contact, no problem. While this may be true, it isn't realistic. Aviation would be safer, too, if planes never left the ground. Yet, business must continue. Athletes must play and air planes must fly. A world without risk is not possible; a world with too much risk is unacceptable. To minimize risk, we must go beyond standard concepts of safety. We need to realize that actionable information is the key to minimizing risk.

The challenge with quantifying safety in our industry is that it's nearly impossible to track a lack of outcomes. Instead, the industry relies on abstract and incomplete information to guide decision making, and subsequently insurance premiums. So, what is the best way to determine insurance premiums? How can we determine an operator's level of safety? Before we can answer these questions, we must understand the inadequacies of how the "safeness" of an operator is widely measured.

The absence of incidents or accidents is generally used to indicate a company's level of safety. While this can be true, it is a woefully inadequate way of gauging the safeness of an operator. As an analogy, consider a drunk driver who does not cause an accident. Does that mean he was safe? No, the danger was still there, despite the lack of a bad outcome. The lack of outcomes are not a reliable method for determining safeness.

The consistent use of hazard scoring systems is another indicator of a company's safeness. These systems assign arbitrary values to various hazards. For example, night may be assigned a score of 5 and a wet runway may be assigned a value of 3. These values are then added together to get an overall score of 8. Here the problem lies in assuming qualitative values can be used quantitatively. After all, we cannot claim that two 3-star restaurants are better than a 5-star restaurant simply because the sum of the two 3-star restaurants (6) is greater than 5. Scoring systems fail to address the risk in a meaningful way and lull users into a false sense of security.

Third-party auditors are also used to determine an operator's level of safety. These auditing organizations provide a 2-tier or 3-tier rating system that categorizes an operator's safeness based on the level of conformance to an accepted standard. These third-party audits are certainly an improvement over the aforementioned methods; however, the data accumulated during the audit does not paint the complete picture. The main pitfall with audits is that they only capture the organization's safeness during a very small snapshot of time.

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Finally, participation in data sharing programs-for example, Aviation Safety Information Analysis and Sharing (ASIAS) program, Aviation Safety Reporting System (ASRS)-is another indicator of an organization's interest in safety. It's important to recognize that most of these programs were not created to help individual companies; they were created to gather data for the FAA. While these data sharing systems have many benefits, they also have drawbacks: the data collected in these programs is inconsistent, incomplete, and difficult for operators to access.

So, how do we overcome these shortcomings to comprehensively quantify safety for the purpose of offering personalized insurance premiums? It's easy to say we need better data analysis and information sharing. Though fundamentally important, these are not novel concepts. The multifaceted solution lies in the type of data we're tracking and way that information is shared. Let's dig deeper.

We've already established that collecting safety data is a must here, but it's equally important to discuss the different types of data.

Take, for example, the operator who looks at the safety data and sees that they've had four unstable approaches in the last two weeks. If they were to act only on this data (i.e., the number of unstable approaches), they would likely conclude that pilots require remedial training. They would remind the pilots of the published stabilized approach criteria. If, on the other hand, the operator conducts a proper root cause analysis, they may have discovered that all the unstable approach events were completely unrelated-they all had different causes. Since they had different causes, they will require different remedial actions to fix. Therefore, the original proposed risk control (more training) will not fix the problem!

Consider a different example where the safety data shows a few sporadic events (e.g., unstable approach, near mid-air collision, incomplete pre-flight checks) over the past couple of weeks, but nothing seems to be trending. If the operator were to do a root cause analysis on each event, they may actually discover a common causal factor-fatigue. Only after identifying the root causes can we put in place corrective actions to avoid negative outcomes.

To understand the cost of safety, we need to look at more than just the cost of incidents and accidents. We need to systematically capture the impact that safety-related deviations and malfunctions have on a business. How many flight delays did they cause? How many flight cancellations? How much revenue was lost? How much did it hurt the organization's reputation? By capturing these hidden costs, we can get a more complete picture regarding the true cost of safety.

If we can track the costs of a lack of outcomes-which we can, given today's technology-then we're really not that far away from being able to achieve objective safety analysis. As flight operations and insurance underwriters embrace information sharing, we can create industry-level safety analyses that will highlight which companies are lagging and which are leading. Not only will this process allow underwriters to accurately assess the "safeness" of an operator compared to their peers, it will allow flight operations to justify future safety investments, thrusting the benchmark for safety into uncharted territory.

So, are personalized insurance premiums possible? Let's answer that question with a question: Will sports continue during Covid-19?

*This article was originally published the Aviation Insurance Association magazine, "The Binder." Reprinted with permission.*

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## Flying Garmin's New Emergency Autoland

Or should that be watching it do the flying?

## BY CHARLIE PRECOURT

I RECEIVED A CALL completely out of the blue from Garmin last month asking if I'd like to see a demonstration of its new Autoland system. I thought, "Who, me?" Why, of course, I'd jump at the chance! I certainly could not pass up seeing how Garmin developed this new technology and try it out in flight. Most of us have heard by now of its capability to take over for an incapacitated pilot and get the aircraft on the ground. But, as it turns out, there is a lot more to this system, including tremendous potential for application to other scenarios, that make this a real game-changer for aviation.

The plan was to meet in Vero Beach, Florida, at Piper Aircraft's headquarters and fly its M600 aircraft, which is now certified with the autoland system (Cirrus' Vision Jet and Daher's TBM 940 have also certified the system). Garmin made arrangements for the M600 flight, with Bailey Scheel and Conor McDougall, part of the autoland team at Garmin, joining me in Vero. We set up a "prebrief" the evening before so I could learn about the development of the system. Bailey is a lead engineer on the autoland development program, and she filled me in on its history and how Garmin leveraged new computer technologies in the design and coordinated with the FAA and the European Union Aviation Safety Agency to program the system to operate in the national airspace system ... a fascinating evolution through multiple challenges. Bailey and Conor related that during flight testing, while the program was still a company secret, FAA controllers noted the repeatable flight paths of the aircraft and asked, "What are you guys doing, some kind of autoland thing?" To which the test pilot answered, "Ah, we'll call you when we're on the ground."



As I listened to their story, I couldn't help but think back to when we tried to demonstrate autoland in the space shuttle back in the early 1990s. We were gearing up to fly much longer duration spaceflight missions, and there was a genuine concern the crew might be physically deconditioned from time in zero g to the point that reentry and landing could be at risk. The shuttle had been designed to land on autopilot, but it had never had provisions for lowering the nose after touchdown or braking to a stop. For STS-53 in December 1992, the commander and pilot, Dave Walker and Bob Cabana, were asked to demonstrate a landing of the shuttle where they would leave the autopilot engaged through touchdown. Now, the computers on the shuttle could do some amazing things, including parallel processing of five computers for redundancy, but at the time they had only 256K of memory! For reference, a typical smartwatch in 2020 has more than 130,000 times that much memory.

So, Dave and Bob began training in the Gulfstream GII shuttle landing simulator aircraft, with the main objective being to learn when to take over should a gust upset or a computer glitch cause a problem late in approach. After numerous attempts to devise a flight demonstration protocol everyone was comfortable with, the test objective was finally abandoned as there were too many scenarios from which the crew couldn't recover to a safe landing trajectory. Some approaches, for example, flared too high and left the crew wondering if the autoland system could self-recover.



Fast-forward to today with Garmin's autoland. With only 25 pounds of equipment (mostly adding a radar altimeter and servos for autothrottle and autobraking) and a bunch of new algorithms for

flight control software, you have an incredibly capable system. Garmin autoland has now demonstrated over 1,100 landings in four different aircraft.

On the day of the flight, we met at Piper with CEO Simon Caldecott and test pilot Dan Lewis, who introduced me to the beautiful M600. They organized a full deep dive into the Autoland system. Garmin calls the system Autonomi, for advanced autonomous technology. Inside Autonomi are three integrated capabilities: ESP, for electronic stability and protection; EDM, for emergency descent mode; and autoland. These three pillars of the system provide the ultimate “co-pilot” for a variety of scenarios.

ESP will assist the pilot while hand-flying the aircraft if it is flown to excessive bank angles and if it inadvertently approaches stall or the never exceed speed. In any of these cases, the aircraft nudges the controls back in the necessary direction to prevent exceeding its limits. EDM will monitor for potential hypoxia situations and automatically descend the aircraft to a lower altitude. Finally, autoland will continue to a landing if there is no input from the pilot for a period of time.

Dan briefed me on each of these modes and how they could be entered either manually or automatically for an incapacitated crew. For our flight, we obviously would get to try them out manually. We got the M600 started, ran through the preflight checks, and got airborne in short order. The flight deck integration in the M600 makes the whole process of getting airborne quite simple. Climbing out to the east, we performed some steep turns to test the ESP, and I found the feedback force in the yoke was subtle and just enough to nudge me to roll out. It faded away as soon as I returned to less than 45 degrees of bank. I could also override it easily if I intentionally wanted to fly at slightly higher bank angles. The same was true of the slow-speed and high-speed protection. In each case, the aircraft made a timely, gentle nudge to either pitch down or up as appropriate until the speed trend was away from the low- or high-speed limit.

After getting a good look at ESP, we moved on to test autoland. What I really liked was the logic built into the system. It is based on the adage of aviate, navigate, and communicate. To aviate, the system incorporates an autopilot coupled with autothrottle, as well as automatic gear and flap deployment and braking and engine shutdown after stopping on the runway. It also will activate icing protection systems and reset the altimeter.

To navigate, the system is calculating the best emergency landing sites continuously. Within a millisecond of activation, it will select the best airport based on weather, runway, terrain, and several other factors. And finally, to communicate, the system will broadcast to air traffic control the nature of the emergency and intentions, and it will also communicate with passengers and provide them instructions about what the airplane is doing, what they need to do to prepare for landing, and where and when the aircraft will land. It is as if there were a flight attendant on board guiding the passengers through the emergency actions. After landing, the displays even show how to open the cabin door and egress the aircraft.



In our demo, the aircraft outsmarted us and decided it wanted to land at Fort Pierce (KFPR) just to the south of Vero Beach, as it had calculated a number of options that made it better in the moment than Vero. So, we had to fly in a different sector away from Fort Pierce and reinitiate the autoland for it to finally choose Vero Beach. Once the system activated, the screens brought up instructions for the passengers and the aircraft turned to join the final approach into Vero Beach. The system requires an airport have an approach with vertical guidance as well as a hard surface runway (it prefers 5,000 feet or more as it searches airports and requires 4,000 feet of landing distance for the M600), and it will avoid bad weather as well. For our approach to Vero, we watched the aircraft turn final, lower the gear and flaps, and then capture the LPV glide path and descend to a landing in a strong crosswind situation. Flawless!

The system can handle the incapacitated pilot scenario extremely well, which is bound to save lives in the future. There have been numerous hypoxia accidents that would not have ended badly had this system been in place. However, beyond these scenarios are others like systems failures or engine issues, particularly in instrument conditions. With the powerful navigation capability Autonomi has to provide emergency divert and flight guidance solutions, the system could help a fully functional pilot make better choices in any emergency to safely land the aircraft. The ultimate co-pilot for the single-pilot operator. This technology has broken through a major barrier and the possibilities for future applications are endless. Fly safe!

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Citation Jet Pilots is the world's premier Cessna Citation aircraft owner-pilot organization. If you are a Citation owner-pilot who wants to operate your aircraft more safely, professionally, and economically, this is the place to be.