Civil Aviation Authority

In Focus Special

Handling a trim runaway

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Guidance on handling a trim runaway

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Trim runaway was a possible scenario identified by the Air Accidents Investigation Branch in a report into a 2017 Piper PA-31 fatal accident. The pilot reported pitch control problems and diverted to Caernarfon Airport where the aircraft crashed on an attempted landing. The elevator trim was found in a significantly nose-down position. You can read the full AAIB report in the AAIB March 2019 bulletin.

Handling an electric trim runaway

Ask a bunch of pilots if they could handle an electric trim runaway in flight, and the likelihood is that some will say "Yeah, sure, how hard can it be…?" The answer to that is 'potentially very hard indeed'.

Just ask anyone who's simply flown by error out of trim, manual or electric, and they'll tell you precisely that, depending on things like the size of the elevator, the aircraft's speed and the control mechanisms, the pull or push on the yoke or stick can be worse than you might think. Some accidents have occurred where forces of around 20 kg have been needed to keep the aircraft straight and level – some might think 'Is that all?'… But when did you last try lifting that for a sustained period of time whilst trying to fly accurately?

Don't believe it? If an electric trim runs away, it happens quickly. Depending on the type, just three seconds can put you significantly out of trim, and within five seconds an aircraft can be almost unmanageable.

Just think about that for a moment; if left badly out of trim mid-flight, how would a pilot on their own cope with the heavy yoke/stick forces, while trying to manage the myriad other tasks such as engine management, navigation and radio?

This abridged report by Robert I Snow* of a flight in a light aircraft type answers some of those questions and provides a sobering insight into the issues involved.

"At lift-off I was holding an annoying amount of forward pressure to maintain the proper climb angle," he says. "It didn't seem excessive, but I was immediately aware that there was no way we could do this all the way to our destination.

"Returning to the airfield, even at reduced speed, the amount of forward pressure needed to maintain control, inconsequential at first, had become exhausting by midfield on the downwind leg. I needed both hands to control the pitch.

* Robert I Snow writes for AOPA in the U.S.

"I thank my lucky stars that there were two of us aboard. The boss handled the throttles, landing gear, and radio. By the time we turned base, he was helping me on the yoke, taking off some of the pressure whenever he didn't need his hands for something else. Relief did not come until we started the flare. Finally, I was able to ease off forward pressure to raise the nose.

"Although I knew philosophically that the trim is a powerful part of the control system, I had never really experienced its potential before. Trimming away pressure had become such a reflex that I virtually never had to use more than minimal force on the yoke.

"If you are the kind of person who has to see things on your own, try it in flight some time. While straight and level (at sufficient height), roll in enough trim in either direction to force you to exert some effort to maintain pitch attitude, and then hold it for a while. You will quickly learn the lesson."

That scenario related to a nose up trim malfunction. In the nose-down case, the forces could make it difficult to slow the aircraft down, and/or configure it for landing.

The problem with electric trim malfunctions is that, as more and more weight suddenly and progressively comes onto the yoke, some pilots will initially be confused whilst trying to understand what's happening. As the situation quickly worsens, coping with the problem becomes harder by the second — it's an issue that needs immediate action.

To see how a pilot would cope we gave an unsuspecting trainee commercial pilot, who was flying straight and level in a simulator, a runaway trim in the nose-up sense.

It was fascinating to watch. At first, as the yoke came backwards the pilot reacted (as most would) by instinctively pushing forwards. As the yoke continued to push back with increasing weight, the pilot's thumb went instinctively onto the forward trim switch to try to ease the load. However, it quickly became obvious that the switch was having no effect, because the load continued to increase — that's when you could almost see the thought bubble saying "what the heck's going on…" meanwhile, the seconds ticked by.

Realising that the trim button wasn't working, as the aircraft moved out of stable flight, the pilot went for the red 'electric trim disconnect' button on the yoke. This solved the immediate issue before they then (correctly) pressed the 'electric trim off' button on the panel, to be sure.

With the electric trim off, manual trim restored, and a stable flightpath, some problem solving went on. This meant checking the circuit-breaker location in case it needed to be pulled.

In total, the event took the best part of a minute to resolve and there was a clear 15-20 seconds of "what's going on" confusion, as height and heading started to wander. In reality it was quite a quick response, but then this was a pilot going through commercial training, who had already learned about this malfunction.

But how quickly would the average GA pilot react to the surprise, and take the correct steps to deal with it before the situation became much worse?

First of all, make sure you know the checklists and procedures for your autopilot and trim systems.

Most electric trim and autopilot systems have multiple methods of disengagement and pilots need to know them all. The first, and closest, is often the disconnect button or switch on the yoke (if fitted), as our pilot showed. There might also be an 'electric trim off' button on the panel, as with the simulator aircraft. Electric trims operated by an autopilot can also sometimes be disconnected via the mode buttons on its control panel.

The electric trim in some types can also be overridden by using the manual trim wheel, if fitted - though that can be challenging because it means taking a hand off the yoke at a potentially difficult time.

However, in some failures simply 'switching off' won't completely solve the problem. With the loads increasing, altering speed can ease some of the yoke pressures.

However, remember that an airspeed which is physically more comfortable, may not be appropriate for approach and landing.

In some types it can be essential to know from memory which circuit-breaker to pull to stop the trim motor before the loads become too high. Some owners make the relevant circuit breaker identifiable, to ensure it is easy to locate. Bear in mind, though, that some circuit-breakers can power more than one function. Check the flight manual and only pull the circuit-breaker if it says to do so.

Remember, too, that valuable information about the autopilot and trim systems might not only be in the main body of a flight manual or set of procedures, but may be contained in supplements.

Pre-take-off, don't just check the electric trim for full and free movement, also check that the trim wheel is moving in the correct sense, and that the disconnection mechanism works (on both yokes, if fitted). Know the emergency procedures and, if that involves pulling a circuit breaker, know where it is. Prepare for a trim malfunction by thinking through the actions you'd take and practicing them for each type you fly.

Electric trim malfunctions and runaways are quite rare, but they can and do happen.

Most electric trim and autopilot systems have multiple methods of disengagement and pilots need to know them all. If normal trim controls don't work then the first, and closest, is often the disconnect button or switch on the yoke (if fitted)

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