Stan/Eval Newsletter
CIVIL AIR PATROL
UNITED STATES AIR FORCE AUXILIARY
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What ESP is NOT

As newer aircraft are added to CAP's inventory, we are seeing more and more NXi equipped airplanes. NXi includes the ESP (enhanced stability protection) functionality. ESP is not just another "function" that we can ignore. Any pilot flying an NXi/ESP aircraft must understand the system, even if it is just enough to be able to turn it off. Although ESP is a great addition to the G1000, it can kill you if you do not understand it. It is for this reason that CAP pilots are required to have taken the NXi course in AXIS before flying an NXi aircraft. In addition, you should consider a checkout flight with an NXi qualified instructor before acting as PIC.

ESP is NOT an upset recovery system. In fact, when you really get into trouble and go past certain bank limits (about +/- 75 degrees) or pitch angles (+/- 50 degrees) ESP switches off. Unlike a GFC700, KAP140, or other function, ESP is always ON unless you specifically disable it.

So, what is ESP? It is a system designed to discourage the exceedance of established attitude and airspeed parameters. The emphasis is on "discourage". It will not force anything and can only help in moderate deviations. Get into a spin or go inverted and ESP will not help. Do not even think about icing. It might even get in the way so make sure you know how to disable it (press and hold the AP disconnect or press and hold the CWS). The electronic brain cannot handle excessive deviations and even if it could the servos simply don't have the power or the reaction time to get you out of trouble. You are on your own. What it does do and does very well is to keep you within an acceptable envelope. This can be very helpful when hand flying in IFR as well as other operations where you may get distracted.

NXi, when flown properly, certainly helps keep a sortie within reasonable bounds. But there are many inadvertent scenarios where ignorance of the system will cause NXi to work against us. Take for example executing a steep turn. Going past 45 degrees will cause ESP to try and get you back to 30 degrees. If you aren't expecting it and start fighting it the autopilot will switch on. If you fight the autopilot, you will get a severe out of trim condition. Not good.

If you have completed the NXi course in AXIS and want to get a hands-on feel for the NXi ESP, the following Training Profile can help.

Garmin G1000 NXi ESP Training Profile

Prerequisites

This profile describes a standardized approach to conducting AFAM training support for incorporation of STC SA01830WI in Cessna G1000 NXi (Technically Advanced Aircraft). This training profile shall only be flown by CAP pilots with a valid G1000 endorsement. Training shall be limited to those pilots who are likely to fly aircraft equipped with Garmin's Electronic Stability and Protection (EPSTM) system. A list of those aircraft is maintained at:

https://www.gocivilairpatrol.com/media/cms/G1000_NXi_ESP_Aircraft_B3806D53D577E.pdf.

This profile will be flown with a CAP IP who has previously completed this training or who has received both ground and flight training from Textron as part of their Cessna High Wing G1000 NXi Transition Training Course. This profile will not be flown more than once as an AFAM (A23 or B23) by any pilot. The ground training requirement listed below must be completed in advance of any flight training. Sortie duration should not exceed 1.5 hours.

Required Items

Ground Training:

- Complete "*Garmin G1000 NXi Electronic Stability and Protection*" on the AXIS LMS.

Pre-Flight Preparation

- Review Garmin G1000 NXi differences. https://www.gocivilairpatrol.com/media/cms/CAP_NXi_DifferencesApproved_1160377828CD9.pptx
- Review ESP-specific normal, abnormal, and emergency procedures. https://www.gocivilairpatrol.com/media/cms/FAA_G1000_NXi_STC_AFM_Supplement_6EB25D49B5792.pdf
- Brief ESP and E-AFCS Overspeed Protection (these modes will not be attempted).

Flight Training

- During ground operations, Disable and Enable ESP.
- Power-off stall till ESP active.
- Steep turns with ESP inhibited (using CWS and/or AP DISC).
- Steep turn till ESP active; allow A/P control force to roll the aircraft back to 30 degrees.
- Steep turn till ESP active; override servo input until A/P engages in LVL/LVL mode.
- Nose high till ESP active; allow control force to correct attitude.
- AFCS Under Speed Protection (USP) in *altitude critical* mode.
- AFCS Under Speed Protection (USP) in *non-altitude critical* mode.
- Coupled Go-around.

After the flight:

- Debrief the sortie.
- Document completion in WMIRS.

Routine Items

None

Helping Pilots Transition to the C182:

Many CAP pilots get their initial Form 5 in a C172 but at some point, want to add C182 privileges to their flying credentials. Instructor pilots must provide the transition training which can vary considerably from pilot to pilot depending on their experience. Many pilots already have considerable experience with high powered aircraft and constant speed propellers, but many do not. However, don't take anything for granted when it comes to the constant speed prop. I have seen many folks with a high-performance (HP) or complex signoff in their logbook and lots of hours who do not have a clue. Makes you wonder what the CFI was thinking when they endorsed the logbook. Or maybe it has just been a long time. So, the first thing to do is to find out the pilot's aeronautical experience, knowledge, and skill level. Ask them a few questions to see what they really know, not what their logbook may claim.

If the pilot has little or no HP or complex training, use the training suggested in CAPS 71-1. This provides an excellent course of instruction for the C182 and other HP aircraft. But it also provides a good list of topics to review even for those who have the HP logbook endorsement and a reasonable background in flying HP aircraft. One of the best resources for understanding manifold pressure is an article by John Deakin called "Manifold Pressure Sucks!" (you can find it here). It is easy to understand but provides all the fundamentals of flying a constant speed prop. It suggests asking this question to see how well the pilot understands manifold pressure and RPM. "If you are cruising at 23"MP and 2300RPM what happens to the MP when you increase RPM to 2400?" We all know the answer, correct? If not, go read the article. It also bashes folklore about flying "squared".

If your student has experience with HP aircraft and is reasonably competent, it is just a matter of reviewing a few basics and confirming their skill level in flight.

Some things to look for when transitioning pilots to the C182 from a C172.

- Preflight is like the C172 but spend some time on how to preflight a constant speed prop and danger signs to look for.
- Unlike the C172, a notch of flaps on takeoff is best practice.
- The C182 flies "heavy". The controls will have a heavier feel that takes a little getting used to. Think B747.
- Landing requires considerably more backpressure than a C172. Most C182 damage is from excessive loads on the nose gear on landing. Get the nose up before touchdown!!! Carrying some power into the flare can also work well.
- Some pilots fly the C182 like a C172 never really managing the power plant. They should be adjusting mixture, prop, and throttle in various phases of flight and do so smoothly and efficiently.
- Some pilots use the throttle like a saw – constant back and forth. We should teach "set it and forget it". Big engines do not like changes. But it is still a good idea to pull the power on landing!
- Pushing or pulling the prop lever is a danger sign. This is how prop seals get blown. Except for the runup or at idle, all prop adjustments should be done by a slow twisting of the prop control.
- When cycling the prop on runup, immediately push the prop back up as soon as the RPM starts to drop. Never let it drop more than a few hundred RPM. (Why?)
- Cycle the prop once per the checklist. Flight schools teach you to do it three times which puts a lot of stress on the seals. Not required and it is a bad idea. Flight schools do it to emphasize the RPM drop, then the oil pressure drop, and finally the MP increase. We are not a flight school. Once is enough. The only time you should cycle the prop more than once is in very cold weather if the prop response is marginal.
- Application of power should be right to left. Mixture adjust, prop adjust, then increase manifold pressure. Reducing power should be just the opposite.
- Prior to many of our F5 maneuvers which require application of full power, such as stalls or slow flight, ensure the prop is high RPM.
- When practicing engine out, you should teach pulling the prop all the way back when the engine is idle to further your glide. Just do not forget to push it back in before adding power!!!

The C182 is the backbone of the CAP fleet. Not only should we be training our pilots to fly them properly, but we should also verify on the Form 5 check ride that current C182 pilots are proficient in the C182. Although we have focused on the C182, many of the points made herein apply to a pilot transitioning to the C206 (and GA8) as well which is just an overgrown C182.

Runway Shopping

Choosing a suitable runway is something we do every day. At most non towered airports with a single runway, the decision is often determined by the prevailing wind. But it may not be straightforward if traffic is using a runway with a tail wind or if the wind is directly cross wind. At some airports it really is only practical to land in one direction independent of the wind such as Falwell (W24) which has a severe upslope (4.7%) or Telluride (KTEX) where mountains get in the way.

At non towered airports with multiple runways there are lots of factors to consider:

- Wind direction
- Runway length
- Runway slope
- Runway condition
- Nearby terrain or obstacles
- NOTAMS
- Lighting
- Sun position (landing or taking off with the sun in your eyes can be problematic)
- Traffic
- Noise abatement
- Convenience or operational considerations (e.g., landing on one runway may put you closer to the FBO or your favorite pub).

At towered airports, the runway is usually chosen for you, but you are not required to accept the assignment. If for some reason you need a different runway, ask for it. Most towers are accommodating, although if you are landing at LaGuardia at a busy time, it may not be such a good idea.

If you are in the clouds and doing an instrument approach, runway of choice may be based more on which runway has the lowest minimums and the best lighting. No point doing an approach to a runway where the minimums are higher than the prevailing ceiling and visibility unless you need to practice a missed.

Normalization of Deviance

(Maj G. Michelogiannakis)

Imagine that you decide to drive a new route on your way to work. There are large signs clearly stating that the speed limit is 65 mph, but the flow is moving at a 75-mph pace. Would you “go with the flow”, or would you follow the rules and drive at 65 mph? What if you chose 65 mph and then keep driving that route? Are you more likely to speed up to 75 mph at a later day?

Now imagine that you are driving at 75 mph but a few minutes later, you are suddenly the only car on the road. Would you slow down to 65 mph?

Let us shift to flying airplanes. Imagine a pilot outside of CAP, who is flying a Cessna 182 with a 15-maximum demonstrated crosswind component on landing. That pilot finds themselves in a situation where, for many reasons that are outside of our scope, feels pressured and lands with a 20-knot crosswind component. What will the pilot say to themselves after that? Do you think it would be “Phew, I got away with it now, but I won’t do it again” or maybe “Huh, I must be a better pilot than I thought”?

What if the pilot does it again? Are they more likely to shift to the second answer?

It is likely no surprise to anyone that pilots have egos. If they pull something like this off, they are tempted to conclude that it was skill instead of luck. They may not even consider that equipment, such as a heavier plane they were flying that day, helped them out and therefore may think they can rise to the challenge in any airplane. To make things worse, pilots are often under some kind of pressure.

The above discussion hints at the problem. Part of it is that humans are good at rationalizing. We do it every time we cut corners to justify our behavior. Then, rationalizing can change our behavior so what felt wrong before now feels normal. One example is instead of doing a detailed flight plan for every flight, to rationalize by answering “But I regularly fly this route and it usually takes me 20 gallons”.

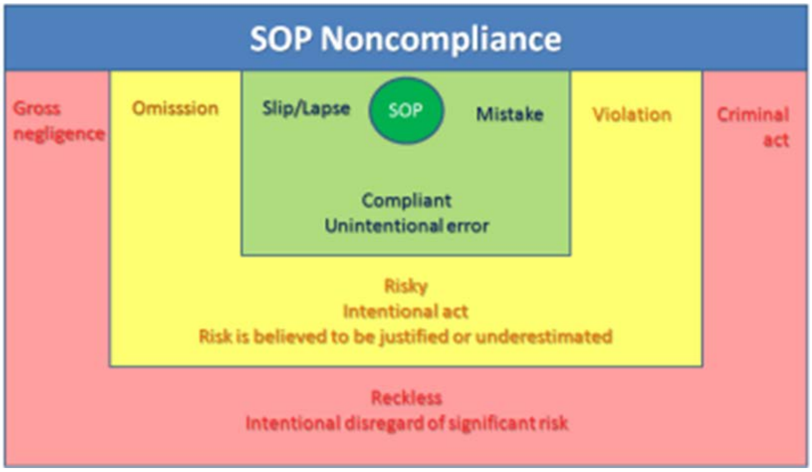
The first definition of normalization of deviance by Dr Diane Vaughan sums it up nicely: “The gradual process through which unacceptable practice or standards become acceptable. As the deviant behavior is repeated without catastrophic results it becomes the social norm for the organization”. *(Ed note: Dr Dianne Vaughan wrote a fascinating study on the Challenger accident titled “Normalization of Deviance” which has since become a classic. If you have not read it, do so!)*

Unsurprisingly, there have been numerous accidents attributed to normalization of deviance. One illustrating example is the 2014 crash of a Gulfstream on takeoff [1]. In that unfortunate accident, the pilots had grown accustomed to not diligently running checklists and not checking for a gust lock because none was installed for as long as they were flying that airplane. This worked fine until one day when a gust lock was installed; the pilots failed to remove it (something that is called for four times in their checklists) and missed important cues to alert them of the problem.

NASA’s shuttle Columbia and shuttle Challenger are other examples, as is the RJ-85 crash in Colombia with 71 fatalities [2]. There is also a very informative and scary example from military operations [3].

The pilots and personnel in these situations were not inherently careless or bad pilots. They were just humans with the same potential flaws and tendencies that we all have. It could have been us in those situations.

Normalization of deviance does not happen overnight. It happens slowly. In the image below, borrowed from [2], straying due to simple human mistakes from standard operating practice (SOP) keeps us in the large green rectangular region. On the other hand, if someone commits reckless behavior and strays into the red area, it would be obviously gross negligence. It is the in-between region that is the problem. That is the area of intentional acts that carry some risk, but the risk is believed to be justified. The more often we stray into that yellow region, the more likely we are to do it again. Worse, the more likely others are to mimic our behavior, especially if we are figures of respect for authority. Every time we deviate, we establish a new normal that gets reinforced with every repetition.



One danger is that sometimes we learn a deviant behavior from others, and we don't even know it is deviant. Also, deviance often happens for what is believed to be the good of the group, to make operations more efficient, or because of a view that the rules are too strict. The last step to establishing a deviant behavior is silence. When your crew does not speak up, it does not mean they are comfortable. If you are crew, express what behavior you do not agree with.

Another fallacy is that we interpret our actions based on the outcome. If we take the inverse of Murphy's law, that is "What goes well couldn't have gone wrong". This leads us to believe that if the outcome is favorable, our actions must had been the only cause of this, and thus our actions were good. This is not how reality works. Instead, what can go wrong will still often go well because there are numerous other factors involved. Therefore, if you do the same thing again, the outcome may then be catastrophic. We cannot judge our actions solely by the outcome.

How can you protect yourself? Prove that you are safe, instead of looking for reasons that you are not. Check your rationalization. Ask your crew, instead of relying on their silence. Listen to skeptics. Self-censor your actions based on regulations and personal minimums (that you never change in flight). Beware of hazardous attitudes, for example as defined by the FAA. Finally, how would your story sound if you had to explain it to the NTSB?

What does this mean for us in CAP? This is where you come in. Observe your behavior and that around you, and critically think based on what you just learned. Please give feedback to your peers and up your chain so we can learn more as an organization. Do you ever run the checklist from memory? Fly with your cell phone on? Skip on a full weather briefing?

References

1) https://www.rapp.org/archives/2015/12/normalization-of-deviance/
2) https://livingsafelywithhumanerror.wordpress.com/2016/12/03/normalization-of-deviance/
3) https://fastjetperformance.com/podcasts/how-i-almost-destroyed-a-50-million-war-plane-when-display-flying-goes-wrong-and-the-normalisation-of-deviance/

Short Field Landing!

In a recent “Flying Lessons” by Tom Turner, he posted a video of a Twin Otter landing on the world’s shortest runway (1312’) for commercial operations. Watch it here. As Tom points out this professional crew does a very good job. Just watch how carefully airspeed is reduced to almost a stall, how the attitude stays very constant despite the addition of flaps, the descent rate remains constant, and the stall warning comes on as the flare begins. Heck, he makes the first turnoff, so he does not even use all the runway. Lots of lessons here for instructors and check pilots on the finer points of short field landings. Note also the pilot does not “drag it in” which we often see on check rides. Rather he brings the aircraft down on a rock-solid descent.

Articles for the National Stan Eval Newsletter:

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