WARBIRD NOTES #15 21 Feb 95 (25)
PROP FEATHERING SEQUENCE AND ACTIONS

Whenever this becomes the "subject du jour" it's guaranteed to create an intense discussion (and deservedly so) among experienced aviators and pilot examiners. And – this sequence is inevitably going to be far more important to some pilots than it is to others. It must also be noted that the sequence has undergone a change in focus and intent (to some degree) as flight training methods and objectives changed over several decades. We've undergone sort of a metamorphosis from that of operating round engined airplanes every day as a business to one of operating them more as a hobby. And the pilots have also changed, both in their level of knowledge and in the training procedures they've been exposed to. At the same time, however, we can't simply abandon flying safety in this equation simply because the pilot finds it "more difficult" in the current or modern world. Not if we still want to operate these old propeller airplanes. In other words, we may not be able to expect an airline level of competence or performance – as in years long gone by – but we certainly can (and need to) expect a safe one.

Some of the older flight manuals are likely to describe a feathering sequence that differs substantially from one contained in the more modern manuals. Back in those earlier days, little thought was apparently given to this. As experience was gained and standardization became more important, it's obvious that more thought was applied to this subject. Later, the jet mentality came along and that philosophy also had an effect on the procedures. With the advent of the jets, we easily took full advantage of their different design philosophy. The jet engine was enclosed within a pod or a nacelle that'd burn or break away from the airplane's structure. Accordingly, the training philosophy then became "don't worry about it this instant," it just wasn't as important in the overall scheme of things as it had been earlier. "You don't have to deal with it immediately", as had been the case of a propeller where it had to be feathered (either manually or by auto-feather) if you were going to have any hope of surviving an engine failure shortly after takeoff. Accordingly, we happily acquired the luxury of using the checklist as a "do list" for the failure instead of having to immediately feather it to provide a hope of salvation. There's a big difference between the jet engine and a prop that must be feathered in order to extract even a modicum of performance from an airplane whose performance has been suddenly – and radically – reduced by an engine failure with a windmillling propeller. Even in the more current manuals some differences in procedures are likely to exist, depending upon the author's background.

An airplane with propellers always has – and always will – demand an extra amount of proficiency from the pilot, especially if the engine fails at a critical time on takeoff. Jets have spoiled people over the past few decades, because of this difference. With props, you simply cannot "dawdle" as some might describe the prescribed drill in modern day jets, the best description I can think of is to "proceed with all deliberate haste!"

Many propellers utilize an electrical "step-head" motor mounted on the prop governor for blade pitch control. This was installed in a few early airplanes, one of which happened to be the Consolidated-Vultee C-87. If you've read "Fate is the Hunter" by Ernie Gann, this is the four engined aeronautical contraption that Ernie wrote about with such undisguised affection (tongue-firmly-in-cheek-mode)! In his personal descriptions to me, this beast certainly occupied a position of respect – intermingled with contempt – in his memories. In spite of its early teething troubles, after the war this method of prop control became almost universal. With this arrangement (in its most basic form), the prop

had an three-position electrical switch on the console for controlling the propeller's pitch. The switch utilized electrical wiring to control the step-head motor on the engine's nose case mounted hydraulic prop governor. On the upside, this eliminated the unwieldy system of cables and pulleys, the downside was that this system took much longer to traverse between the governor's limits than just manually moving the prop lever. It also relied totally upon having electrical power available. In a typical installation, the switch might have to be actuated for a total of TBD seconds for the step-head to traverse the entire distance between governor limits (low lights to high lights or vice-versa). Obviously this time factor makes it impractical to move the prop control to the LOW RPM setting as a routine precondition for feathering. Also, if one anticipates a possible loss of electrical power, then one might wisely prepare for this eventuality by setting the RPM setting to something higher right away, thus not limiting one's options later. A form of insurance – if you will.

← Mixture, prop , throttle, drag reduction, throttle, prop, mixture, feather. Easy to remember, but it also seems to help because it makes a little more time to think available. This is the way it was done at Capital Airlines. I should mention that I describe those last four steps as an "increasing degree of irrevocability."

By the way, right up front here, we should discuss or mention always taking care of the drag reduction, as "retraction of gear and flaps – unless otherwise required".

↑ Mixture, prop, throttle, drag reduction, throttle, feather. This takes less time, it was taught this way in the USAF in B-25's.

→ Mixture, prop, throttle, drag reduction, throttle, mixture, feather. This was the way it was done at North Central Airlines.

↓ Throttle, feather. This procedure has one extremely vocal and ardent advocate. Problem here was involving pilots on a computer forum without a (in general) clue in the decision making process, sort of a decision by poll - generally of the unknowing. It does have the advantage of being about the simplest procedure possible, sort of a latter day jet reactive deal. Or, easier to teach in a training situation.

Some of the recognized downsides of each of the above procedures are discussed below:

Those procedures that don't move the mixture control to IDLE CUT-OFF will let the fuel run right through the carburetor – if – the booster pump is ON at the time.

Not pulling the prop control back to the minimum RPM stop entertains the strong possibility of unfeathering to a low pitch (more RPM than you desire) or overspeed since we're been unfeathering almost as soon as we shut down during training/checking maneuvers. This problem has surfaced in the more recent times because the focus or intent of this procedure has changed over the years. We now devote a lot of attention to reducing as much as possible the possibility of damaging an engine during this maneuver. We used to worry much less about this, truth be told. The training concept has changed over the years.

Not advancing the power (mixture, prop, throttle) will allow the airplane to stagger and/or lose airspeed while you are attempting to deal with the failure. It might prove to be anywhere from disastrous on takeoff to merely an inconvenience in cruise. It also may not provide enough of a difference in the unbalanced power between sides to enable you to correctly determine the failed engine. To say, "Well, we'll get to that later as a checklist item" probably will prove to be too late, unfortunately these are not jet airplanes we're dealing with.

Clearly, the number of memory items to be performed increases the difficulty of the procedure. However, the downsides of this recognized problem have been discussed in the paragraph immediately above.

By the way, we're only discussing here the type of propeller that has a separate feather button, not the type used on light general aviation twins where moving the lever all the way to the rear (around and past a detent) feathers it.

The Catalina PBY demands an extra amount (if that's possible) of attention to identifying the correct "failed" engine, some pretty adept aviators have misidentified the failed one and started to shut down the good one! You'll need to go to at least METO, and possibly more, to establish sufficient differential power and yaw to make a correct determination. Centerline (or nearly so) engines are a bitch-kitty, in my book!

I hate the thought that anyone would/could entertain the thought (seriously, that is) not immediately adding a substantial amount of power on the good engine(s) if he loses 50/33/25 percent of his available power. And, if you're adding power, I'd again doubt the sanity of anyone who would use anything other than the time tested and honored (for good reasons) mixture, prop and throttle while increasing it. If you then reduce – or at least think about it – the drag of gear and flaps, then that only leaves the relative order of the shutdown and feathering for us to have this discussion and/or argument about here.

I've always slapped my leg that wasn't doing anything – "dead foot - dead engine"! Several instructors have confided in me that, while they initially laughed at this procedure, they later came to appreciate the value of it. By the way, it isn't my idea; it was taught to me by an old timer in the multi-engine instruction business. He said he'd not had a misidentification of the failed engine since he started teaching it that way. Even if I'd had the inclination to do so, I sure wouldn't have argued with him! Perish the thought, he'd previously been a lineman at Texas A&M! (And yes, I know almost all of those "Aggie" jokes.)

17 OCT 97

Dear John,

Thanks for taking the lead on a subject that for some causes considerable confusion. I agree with you 100% that there needs to be a consensus on how the warbird community will handle engine failures. I'll tell you right from the beginning though, I'm going to be a hard sell on what you have proposed as a solution, but you might already know that.

In my mind, the keys to a good procedure are:

1. based on fact
2. work in as many situations as possible.

The 11 item procedure (I skip the carb. ht and only have 10 items) I have used since 1982 when I was trained to fly multi-engine airplanes by former RCAF pilots. Since then I have used this basic Power UP, Clean Up, Identify, Verify, Shutdown/Feather procedure for dozens of check rides in some 20 different propeller driven aircraft (both piston and turboprop) for 5500 hours. Although I've only had to use it in anger once, it has never failed me in training or during a checkride.

I like it. It works for me. It works for the people I've trained over the years and I'd be delighted it everyone would use it. Besides, it works <u>for</u> <u>real</u>, is based on fact and works in every situation I can think of.

I'd like to share my views on the "long list" memory items (flow).

Power (mixtures, carb ht., props, throttles)

Are you trying to tell me that if you take off in the big jet at a power setting reduced from maximum allowable, you won't push the power up to maximum if you have an engine failure after you lift off. This would surprise me.

This procedure is not there to determine if we do or do not need additional power, it is there to make sure we've done everything we could, as soon as we could. The way I interpret what the FAA expects during the loss of a powerplant comes from AC 61-21A, Flight Training Handbook, Engine Out Procedures. The first thing done following and engine failure: "Set mixture and prop controls as required; power controls should be positioned for maximum power to maintain at least Vmc." As you may recall, the loss of 50% of an aircraft's powerplants means the loss of about 75% of it's performance. This is not a good thing. So add power before it is to late. If it's too much of a good thing you can always take it off.

Gear and Flaps

You seem to think that in all cases any airplane will make it after takeoff with if the gear is forgotten and left down. Losing one of four likely won't be a big deal, but losing one of two is a big deal to me. If an airplane makes it or not may depend on the airplane, the conditions that day or the pilot. Just because it worked last time when it was cool does not mean it will make it when you are high and hot. We need a procedure that works in as many situations as possible, not a procedure for one condition and another if the conditions change. The same goes for the flaps.

Throttle (for identification)

This is, as you say, a most worthwhile item. However, it does not keep you from feathering the wrong engine. It just helps you identify the offending engine. Feathering the wrong engine is always just a finger tip away no matter how long or short the memory flow. I too believe that the pilot flying should accomplish this to feel for a change. I think you will agree with me if I add the fact that we should stay away from terms like push, pull, forward, back etc. as not all airplanes work the same. I could however be convinced, in the case of the throttle, to use the term move toward idle. This should cover every situation.

I have heard of a case in a B-25 where the pilot being examined was so nervous that he reduced power on the good engine without even noticing it. So lets not forget what the copilot might have to say.

Pull back the prop lever.

On most light twins and small turboprop airplanes, pulling the prop lever back was the only way to feather the prop. It wasn't until I flew the F-27 that I realized there was another way to feather a failed engines prop. So when we train pilots with a light twin background we need to make sure they understand that we are not going to move the prop toward (seems to work here) high pitch/low rpm to accomplish the feathering. We are doing this to further verify that we have the correct engine and positioning the propeller to its lowest governing rpm just in case the feathering system does not work. If the prop can not be feathered, this is where you will want the prop for minimum drag.

What we are looking for in the verification process when we pull the prop back is the degree of change in rudder pressure. If you pull the dead engines prop back you get very little change. If you pull the good engines prop back you get significant change. Go try it. Let me know if I'm wrong.

I'm not sure which airplane you've been flying with a Hamilton Standard that "ports high-volume governor oil to the front or the prop dome to feather the prop." However, I do know that the Hamilton Standards on the B-25, B-17, A-26, PBY, B-29, B-24 and DC-3 have some variation of the 23E50 hub. This hub moves the prop blades toward high pitch/low rpm by supplying oil to the back side of the prop dome and is also where the feathering oil goes to feather the prop. So moving the prop toward low rpm moves the prop blades a portion of the way toward the feathered position.

I concur with placing the prop in low rpm for start. It will hopefully help prevent an overspeed.

In your letter you really did not discuss in detail what kind of procedure you use to identify. You state Throttle (identify), but are you using rudder pressure, engine instruments or something else. I think that the procedure can be too easy and mistakes made too easily. The long checklist really does not take that long if practiced. It also comes as close as you can in making sure beyond a shadow of a doubt that you have identified which engine is to be feathered.

I could go on and on about how I think this procedure is better than some others, however the fact is we can't please everyone. I've been around the group that says that "when it comes to the real thing I'm going to do what needs to be done." Well just watch them and they will botch that up so fast it will make your head spin if the airplane already isn't. Yet the majority of new pilots are younger and less experienced in these airplanes. They don't know what to do and we will teach them a procedure. The pilots I've taught the long procedure accomplish it quickly and thoroughly and never seem to have a problem with it because they understand it and believe in it. Just as I do.

Now that I've shared my opinion, I would suspect that we won't have a shortage of things to discuss when we meet again. I think it will take a sit down meeting to resolve this issue.

Regards,

Tim Jackson

cc Randy Sohn