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Thread Starter Join Date: Feb 2012 Posts: 64 Likes: 0 Received 0 Likes on 0 Posts Kingair 200/350 Start up sequence Hey guys This question would mainly be directed towards kingair pilots who know the a/c well...My question is this:Why when a 200/350 starts up,the right condition lever is put into low idle first,and then into high idle when starting the left engine? It may be a daft question to ask,but Im just curious...So..what would happen if you did not move the condition lever to High Idle when starting the left engine? And What would happen if the left engine was started first? These are just curious thoughts that crossed my mind today... Thanks for helping out Daniele Join Date: Feb 2006 Location: Here and there Posts: 216 Likes: 0 Received 0 Likes on 0 Posts Daniele, Whilst I am by no means experienced and I fly the King Air 90, we have exactly the same start sequence. I was taught that you start the right engine first and place the right condition lever into high idle after start to provide a greater electrical output from the generator to assist with starting the left engine. So long as I have decent battery voltage I tend to alternate starting left and right engines first and have never had any issues. I have played about with this a bit and have typically found that after the first flight of the day I don't need run the RH engine up to high idle before starting the left, with no negative impact on the start and ITTs, although I definitely needed to run the RH engine up to high idle this morning as the aircraft had been left out in the cold all night! Also, I was told that the checklist specifies the right engine to be started first as the battery compartment is in the right wing (at least on the King Air 90, not sure about the 200/350) and so there is less resistance due to the cable length being shorter to the right engine. Hope this helps! Kind regards, Adrian Thread Starter Join Date: Feb 2012 Posts: 64 Likes: 0 Received 0 Likes on 0 Posts hey Adrian, Your answer is kind of what I expected to hear.I just had no idea whether or not it would have a negative effect on the engines itself.But never the less,atleast I now know! Thanks for your reply. Join Date: Mar 2004 Location: schermoney and left front seat Age: 58 Posts: 2,451 Received 5 Likes on 5 Posts I have 4000+ hrs on the KingAir, mainly the B200, few on F90s, C90A and C90B...none on the 350. IMO there is no need to place it to low and then go to high. I always put it directly to high idle. And doing so has indeed to do with the relatively great strain the generator puts onto the engine. In low idle this would mean higher ITT than in high. I also alternate the starters, I do have the impression to equalize the high stress the first starter/gen has to bear...although there are people that never do that and their genes last as well... Never forget to check you current limiters on the 200 after start... The only reason to start right first is the somewhat shorter way from the battery to the starter, this might play a role with very low temperatures, less voltage drop, thats the only time I'd use R/H first. (although I think this is more or less academic...cause in very low temps one should use a GPU anyhow) The last KingAir I flew a was 1478 (4-Blade-prop), that had already electric heat (not radiant) Electric heat uses something around 80 amps and if you use it in low idle you can actually see the difference in ITT (hotter). So going and staying in high not only gives you more bleed air then but also a cooler ITT. When you start in hot conditions, the R/H engine provides for the A/C, therefore you'd need this one in high idle anyways (63% min IIRC). Taxing with on in high and one in low I found not practicable, so both go to high. I also land in high idle and props fully forward. Pros MHO: already somewhat spooled engine in case of a G/A, more readily available reverse and the short field technique practised.... Regarding the 90...its a considerably smaller engine. I would not recommend use of low idle for cross starts. Last edited by His dudeness; 23rd Nov 2012 at 15:25. Join Date: Aug 2001 Location: BFS Posts: 1,178 Likes: 0 Received 0 Likes on 0 Posts The reason for starting the starboard engine first was historically more to do with cooling the battery than anything else. This reason has become obsolete due to modern batteries. The modern 90 does not require high idle for cross starts. Last edited by silverknapper; 23rd Nov 2012 at 17:28. Thread Starter Join Date: Feb 2012 Posts: 64 Likes: 0 Received 0 Likes on 0 Posts goodday HD Thanks for your input...SO I assume that with regards to the starts.If you engage the gen while on low idle your ITT will peak?I was reading an article (cant remember the site) which stated,"If you engage the generator and AC system while in low idle,you can expect the ITT to over temp."Not 100% clear on this if this is true or not...But it would make sense with regards to a higher fuel flow.? Also,Is it recommended to start the 200 with props feathered?But then if so,you torque will definitely peak to its limits.Not so? Daniele Join Date: Jul 2007 Location: somewhere Posts: 357 Likes: 0 Received 0 Likes on 0 Posts Quote: The reason for starting the starboard engine first was historically more to do with cooling the battery than anything else. This reason has become obsolete due to modern batteries. ...and perhaps the fact that the AC-compressor is powered by the starboard accessory gearbox. So if your cabin is a little to "toasty" you can cool it down while you wait for your pax. That's the story that was sold to us by FSI, although we operated in a not-so-tropical climate! DK Join Date: Mar 2004 Location: schermoney and left front seat Age: 58 Posts: 2,451 Received 5 Likes on 5 Posts Quote: SO I assume that with regards to the starts.If you engage the gen while on low idle your ITT will peak? I was reading an article (cant remember the site) which stated,"If you engage the generator and AC system while in low idle,you can expect the ITT to over temp."Not 100% clear on this if this is true or not...But it would make sense with regards to a higher fuel flow.? I engage the GEN when the engine has reached high idle (I go direct from cut-off into high idle) The whole idea basically is to have as little ITT spikes/transients as possible. If you'd go with the CL, you'd spike on the low idle niveau, engage the GEN, then go to high idle with another spike of ITT. These ideas stem from a former Beech engineer who was involved in the B200 development, later was (maybe still is) a freelance trainer for conversion on the airplane. The person that trained me was trained by this guy... The AC system clutch won't engage in low idle (n1 speed switch, below 62% -> triggers the AIR COND N1 LOW light). If it would the ITT would be higher for sure. Anything that draws power will increase the ITT. The engine is made to work above 90% really, anything below means that the airflow is not optimal...thats why the compressor bleed valves (P2.5) are put on the engines. Any power demand to the engine in lower n1 will result in a ITT raise, this raise will be higher the lower the engine n1 is. Quote: Also,Is it recommended to start the 200 with props feathered?But then if so,you torque will definitely peak to its limits.Not so? Daniele No and no. The only time I ever started a KA with props in feather was on a very slippery apron. I do know some guys that do start regularly in feather but I don't know the reason... If you can feather the prop in regular idle without overstressing (too high torque) why should there be an overtorque situation when starting? Another reason for starting RH first is the simple fact that the door is on the left, I was told once... Last edited by His dudeness; 23rd Nov 2012 at 19:12. Thread Starter Join Date: Feb 2012 Posts: 64 Likes: 0 Received 0 Likes on 0 Posts hi guys Thanks for the replies...I am Learning alot more than I originally thought I would.BUT,here's another one:The auto feather switch:if armed,the minute you have an engine failure,will it automatically feather the props? And another thing I read on a website,which stated,"Disengage the prop sync BEFORE adjusting throttles/power levers."If you do not disengage the prop sync and you increase/decrease power,what is the worst that can really happen?Maybe just damaging the prop sync? Daniele Join Date: Oct 2010 Location: Germany Age: 48 Posts: 409 Likes: 0 Received 4 Likes on 3 Posts is it only me who always has to laugh when the first words of an reply are a proud report of its own virtual logbook without being asked for this ? I must agree. I've got 10,000+ hrs but none of it on the King Air. I do have nearly 300 hours on PPRuNe I think you only start the right engine first if you're in the northern hemisphere with your back to the wind. Thread Starter Join Date: Feb 2012 Posts: 64 Likes: 0 Received 0 Likes on 0 Posts Thanks for the replies everyone... This Has helped alot..I'll be posting a few more questions on prrone sometime soon,so keep a lookout. Thanks again everyone. Daniele Join Date: Feb 2005 Location: Behind a computer screen Posts: 160 Likes: 0 Received 0 Likes on 0 Posts Hi Dudeness correctly points out that later models do not require the Gen to be turned off before second engine start, permitting a Generator Cross Start. I believe this only applies to aircraft with the 5 bus electrical system. However on the 90 I fly, this puts extremely high loads on the operating generator which I doubt does it any favours. According to at least one guy (to whom I think His Dudeness refers in an earlier post... wrote a book, no?) on models with the older electrical system you can do Generator Assisted starts, whereby you turn off the Generator after charging the battery, get the second engine turning on the starter, then switch on the generator of the already running engine. h Join Date: Dec 1998 Location: Escapee from Ultima Thule Posts: 4,276 Received 2 Likes on 2 Posts I leave prop sync engaged while making power changes, but I move the levers slowly enough that I can manually keep in sync during the change. Prior to start I set the L. volt/ammeter to volt, and the R. V/Ammeter to Amps after checking Voltage. I start the R. engine first because it's closest to the battery and minimises voltage drop. I go straight to High Idle after a very low idle and then switch on the R. Gen. High idle is to keep temps as low as possible. Then I wait for then a valve is openend and dumps the oil from the prop -> thus feathering it. Before that, at 400 ft/lbs, the opposite site is disarmed (the Auto Feather light extinguishes), the light of the auto - feathered engine goes out passing the 200ft/kbs threshold. So if you have an autofeather happening, there is no indication other than the prop windmills... Regarding starting, there is a few things to be considered: first of all, what type of battery is installed: 1) NiCad, used to be the standard up to.... BB1631, but there are aircraft that were converted to: 2) lead- acid, standard an BB1632 and on. The converted ones should have the battery charge light removed and also the cooling intake below the battery on the R/H wings underside might be removed. There are also 2 types off generators put on the airplane, the standard being 250 Amps gens and optional 300 Amp gens. (Note: the amp meter reading is always 100%=250Amps) The regular procedure for NiCad batteries used to be: start first engine, switch generator on, load battery to below 50%, switch the gen off again, start second engine and going through 12% n1 switch gen back on. Later models did not require the first gen to be switched off. (not sure an the serial number there... take a look in the checklist, if its properly updated you should see it in there. Definitely not required on BB1476 and on) So start first engine, switch on gen, load to 50%, then start second engine. Perform current limiter check before switching on second gen (push for Voltage on second side and check for 28 V, if readout is 24 V -> opposite side CL blown, if 0 -> onsite CL blown) On the lead acid battery I was told you start one after the other and also leave the battery of the first one on, no need to wait. The main reason for this is as far as I know that the temperature rise in the lead acid does not mean anything vs. the possible thermal runaway of a Nicad. One should not take off with a load of more than 10 amps on lead acid batteries or a BATTERY CHARGE light on with Nicads. Last edited by His dudeness; 24th Nov 2012 at 17:08. Join Date: Oct 2010 Location: Germany Age: 48 Posts: 409 Likes: 0 Received 4 Likes on 3 Posts the gens who state they start up their king air 200 pt6 going entirely to high idle from cutoff , could you just for interest report how much fuel flow you read , when and how the fuel flow develops and whatkind of temps you read on such a startup ? thanks much Join Date: Feb 2009 Location: UK Posts: 52 Likes: 0 Received 0 Likes on 0 Posts Quote: is it only me who always has to laugh when the first words of an reply are a proud report of its own virtual logbook without being asked for this ? I must agree. I've got 10,000+ hrs but none of it on the King Air. I do have nearly 300 hours on PPRuNe I think you only start the right engine first if you're in the northern hemisphere with your back to the wind. Thread Starter Join Date: Feb 2012 Posts: 64 Likes: 0 Received 0 Likes on 0 Posts Thanks for the replies everyone... This Has helped alot..I'll be posting a few more questions on prrone sometime soon,so keep a lookout. Thanks again everyone. Daniele Join Date: Feb 2005 Location: Behind a computer screen Posts: 160 Likes: 0 Received 0 Likes on 0 Posts Hi Dudeness correctly points out that later models do not require the Gen to be turned off before second engine start, permitting a Generator Cross Start. I believe this only applies to aircraft with the 5 bus electrical system. However on the 90 I fly, this puts extremely high loads on the operating generator which I doubt does it any favours. According to at least one guy (to whom I think His Dudeness refers in an earlier post... wrote a book, no?) on models with the older electrical system you can do Generator Assisted starts, whereby you turn off the Generator after charging the battery, get the second engine turning on the starter, then switch on the generator of the already running engine. h Join Date: Oct 2010 Location: Germany Age: 48 Posts: 409 Likes: 0 Received 4 Likes on 3 Posts Quote: According to at least one guy (to whom I think His Dudeness refers in an earlier post... wrote a book, no?) on models with the older electrical system you can do Generator Assisted starts, whereby you turn off the Generator after charging the battery, get the second engine turning on the starter, then switch on the generator of the already running engine. thats basically correct on any pt6a driven aircraft, not only kingair,but his dudeness , really should describe us how he starts a pt6a with going from cutoff to high idle immediately. i questioned him but somehow memory seems to fade here. i,m wondering how fuel flow and ITT develop in such a startup In Response to aerobat77 On the PT6 the FTG contains Py putting pressure on the pneumatic bellows allowing fuel through the FCU, on initial startup, you are on the Min Flow valve/FCU bypass. As Py builds the bellows allow some flow through the FCU, through approx 40-45% the secondaries open, and "at least on the -67" at about 60% N1 allow full operation of the FCU. At least that is my experience. Last edited by rigpiggy; 1st Dec 2012 at 10:30. Reason: addition As far as the OP's question, the start gen has a limit for internal cooling. I will have to dig out the book, but something like more than 50% load on the -67 requires 72%N1 Join Date: Oct 2010 Location: Germany Age: 48 Posts: 409 Likes: 0 Received 4 Likes on 3 Posts yeah right, but the question to the other guy with his cutoff-high idle immediately startup what readings on fuel flow he has on the gauge. does the flow rise steadily as the engine spools or does the needle jump from zero to idle flow when you put in the condition lever ...? cheers Page 2 on idle cutoff 90-110#, slowly building till secondaries cut in around 220-250# this is -67 , don't remember the -42 numbers Join Date: Feb 2008 Location: Europe Age: 60 Posts: 28 Likes: 0 Received 0 Likes on 0 Posts I haven't flown a 200 for about 12 years but I'm more current on the 300 series, both 300 and 350. The first thing we have to remember is that this is aviation and there are thousands of, "I was told once," stories. I always wait for the ITT to stabilize before going to high idle because I was told once that until the ITT is stable the boundary layer of air that separates the fire from the combustion chamber wall is not fully formed. I have seen historical data that shows the benefit of alternating starts when it comes to the cost of overhauls. The worry about amperage drop comes from the days of smaller gauge wires being used. The wires used now days is thick enough that amperage drop is negligible. I've never understood the starting in feather unless you were starting both engines using a GPU so the person disconnecting wouldn't get blown away. As I understand it, going to high idle prevents the engine from bogging down under the increased load. The start on newer models is still just using the battery until higher n1 it's just that the generator control unit (GCU) is taking care of taking the generator off line and putting it back. The leaving of the type II prop sync on is perfectly fine airmanship. The old saying is, you turn it on when you buy the plane and turn it off when you sell it. Join Date: Feb 2005 Location: Behind a computer screen Posts: 160 Likes: 0 Received 0 Likes on 0 Posts So is there any reason NOT to do generator assisted starts, opposed to cross starts, on aircraft with the 5 bus system? h Join Date: Feb 2008 Location: Europe Age: 60 Posts: 28 Likes: 0 Received 0 Likes on 0 Posts I'm not sure I understand your question. By 5 bus do you mean a triple fed system with left and right gen, centre, triple fed and battery bus? If so, I believe most triple fed systems have the newer GCU's that won't allow you to do a cross start. So there would be no reason to turn the generator off and then back on at a specific n1. In fact I don't think you would find a procedure that would specify the n1 required before putting the generator back online. If you were using the older GCU's I wouldn't do a cross start often unless you wanted to purchase a lot of current limiters. However I did notice that our engineers started our old straight 200 without turning off and on generators. When I asked them about it, they showed me the starting procedure in the maintenance manual it didn't indicate a need to turn off the generator. The manufacturer's POH did however. Join Date: Feb 2005 Location: Behind a computer screen Posts: 160 Likes: 0 Received 0 Likes on 0 Posts m2f, Yes, that is the system I am referring to, sorry if my last post wasn't too clear... The C90A manual does not stipulate turning the generator off for starting the second engine. Indeed, when doing generator cross starts the current limiter is bypassed. My question relates to generator assisted starts. In The King Air Book, Tom Clements suggests starting the second engine with both generators off, though once the N1 is through a certain value (not a book figure, just suggested) turning on the generator of the running engine. This will provide higher N1 and a cooler start. He does say that this practice should not be used on the later models with the aforementioned electrical system. It seems a little strange to me that it is ok, as per the AFM, to do a cross start but not an assisted start. Any thoughts? h Join Date: Feb 2008 Location: Europe Age: 60 Posts: 28 Likes: 0 Received 0 Likes on 0 Posts Just leave it on. The system is designed to deal with the start and any other method would be superfluous. In the straight 200 with the dual fed bus system using the method of turning off the generator until a specific n1 we would still loose current limiters from time to time. I don't remember ever having lost a current limiter in a triple fed bus system and I have 6 times the time on a triple fed bus system. Last edited by mad2fly; 5th Dec 2012 at 14:40. Join Date: Oct 2010 Location: Germany Age: 48 Posts: 409 Likes: 0 Received 4 Likes on 3 Posts Quote: on idle cutoff 90-110#, slowly building till secondaries cut in around 220-250# this is -67 , don't remember the -42 numbers thanks for answering , however- i do not think this is what you read on the fuel flow gauges starting any real pt6. Quote: In The King Air Book, Tom Clements suggests starting the second engine with both generators off, though once the N1 is through a certain value (not a book figure, just suggested) turning on the generator of the running engine. This will provide higher N1 and a cooler start. thats pretty correct. start one engine, turn on generator, load battery, turn off again, start the second and at lets say 30%, ,when the current from the starter dropped , kick the opposite generator in. cheers Join Date: Feb 2008 Location: Europe Age: 60 Posts: 28 Likes: 0 Received 0 Likes on 0 Posts Quote: thats pretty correct. start one engine, turn on generator, load battery, turn off again, start the second and at lets say 30%, when the current from the starter dropped , kick the opposite generator in. Actually that's not correct. If his King Air has a triple fed bus system like he says and the POH doesn't say anything about turning off the generator then you absolutely don't have to do it. Yes you need to let the battery charge but once the generator loads have reduced to at least 50% then just activate the starter ignition switch. Join Date: Oct 2010 Location: Germany Age: 48 Posts: 409 Likes: 0 Received 4 Likes on 3 Posts when the aircraft is approved for generator cross starts then you are right of course, the above was referred to models not approved for this. cheers Join Date: Sep 2011 Location: N.A Posts: 15 Likes: 0 Received 0 Likes on 0 Posts Hi guys, On one of my very first flights on a A90, I didn't notice the condition levers weren't in the cut off position before start. They were already both in the low idle position, what created the confusion they appeared to be in the cut-off position I noticed it when I started the first engine because it lighted up much sooner as usual.. In other words, the N1 wasn't stable yet (around 15%) while fuel was already introduced... Might it be damageable to any part of the engine ? Should it be checked? Thank you Join Date: Feb 2005 Location: Behind a computer screen Posts: 160 Likes: 0 Received 0 Likes on 0 Posts What was peak ITT? The higher the Ng prior to introducing fuel, the more airflow through the engine and therefore greater cooling. Starting the engine with Condition Levers at flight idle could cause an excessive temperature on start. Also, there may have been an accumulation of fuel in the combustion chamber when you engaged the Starter/ Ignition. This can cook an engine. To answer your questions: 1) Yes, it might 2) Yes h A77 considering. I did 9starts yesterday, and will do 5 tomorrow chances are it is a real PT6. On start when the condition lever is moved out of ICO, the minimum pressure valve will allow fuel to flow to the FCU, and the min flow valve, roughly 90-110#/hr or around 50% N1. The pneumatic bellows will not allow the fuel metering cup to distribute fuel until P3 air runs through to the fuel topping governor in the PCU . The pressure compresses the bellows, allowing the N1 flyweights to adjust fuel flow to the corresponding selected rpm. If somebody wants to send an email address, I will record a start or two if you will post it here rigpiggy 29th Aug 2014 04:00 A77 considering. I did 9starts yesterday, and will do 5 tomorrow chances are it is a real PT6. On start when the condition lever is moved out of ICO, the minimum pressure valve will allow fuel to flow to the FCU, and the min flow valve, roughly 90-110#/hr or around 50% N1. The pneumatic bellows will not allow the fuel metering cup to distribute fuel until P3 air runs through to the fuel topping governor in the PCU . The pressure compresses the bellows, allowing the N1 flyweights to adjust fuel flow to the corresponding selected rpm. If somebody wants to send an email address, I will record a start or two if you will post it here