DISPOSITION OF PUBLIC COMMENTS

PS-ANM-25-02, Guidance for Screening for Engine Rotor Lock in Transport Category Airplanes During Aircraft Certification

No.	Comment	Requested Change	Disposition
	Commenter: AIA/ASD/GAMA		
1	Clearly state that this is only applicable to turbojets and turbofans, and the screening test described in the Policy section is not applicable to turboprop engines.	Specify in the summary section of the policy that it is not applicable to turboprop engines.	The FAA does not concur. The FAA is aware of a case of rotor lock on a turboprop installation. No changes made to the policy.
2	Clearly state that the screening test described in the Policy section is not applicable to jet aircraft certified to Part 23 requirements. This will prevent inappropriate application of the policy statement. Policy guidance for Part 25 aircraft tends to get applied to Part 23 aircraft, though it was never originally intended to.	Cleary state in the summary section that policy is only applicable to part 25 airplanes.	Partially adopted. The policy is only applicable to part 25 certification. It is not the Transport Airplane Directorate's responsibility to apply part 23 policy, it is the purview of the Small Airplane Directorate. The policy has been revised to clarify that it is applicable to transport-category airplanes.
3	For clarity and consistency, the word "core" should be added as follows: "Rotor lock is a condition where (1) an engine core rotor speed goes to zero following an in-flight shutdown or engine flame out and (2) the core rotor will not rotate during a subsequent start attempt."	Revise Page 2, 1st Paragraph per comment.	Adopted.
4	For accuracy, the word "generators" should be replaced with "accessories" as follows: "Because of the increased size, mass, and number of engine gearbox driven ~~generators~~ accessories…"	Revise Page 2, 1st Paragraph per comment.	Adopted.
5	To clarify ground conditions are not being referred to, "in the air" should be added as follows: "The engine's high pressure compressor rotor, or core rotor, is the only known rotating component of two- or three-rotor systems that slows and stops rotating in the air."	Revise Page 2, 1st Paragraph per comment.	Partially adopted. Added "during flight" rather than "in the air."
6	Given FAA's inability to quantify the operational threat that rotor lock would foreseeably occur during normal/typical operations outside a test flight scenario and in consideration of increasing reliability and decreasing in-flight shutdown events, the proposed policy should be revised to remove any indication the screening test include slowing to best glide and remaining at that speed until reaching the restart envelop. AIA/ASD/GAMA would endorse having	Revise Page 5 & 6 'Influencing Factors' 1 thru 4 and "Rotor Lock Screening Test" 1 thru 4 per comment to reduce time before initiating restart procedure.	The FAA does not concur. The FAA has provided a standardized approach that only screens for the engines most likely to lock-up, and not restart, as required. The standardized approach accounts for likely flight crew reaction to this unexpected and urgent situation that may involve inadvertent deviation from aircraft operating procedures. As the policy states, applicants may propose other approaches at other flight conditions to demonstrate that the engines can

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	manufacturers verify the associated emergency procedure has appropriate margin and accounts for flight crew trouble-shooting by using a screening approach that incorporates a delayed reaction to a loss of power. After such time has passed, the screening procedure would allow adherence to previously established requirements to ensure re-start capability. While it is physically possible for the pilot to select airspeeds that are lower than the operating procedure for an all-engine-out event, the minimum airspeed for descent in the aircraft operating instructions is normally governed by other considerations such as maintaining cabin pressurization. The FAA's stated expectation to select 'best glide slope is likely' is incorrect. The expectation is for the flight-crew to follow the aircraft operating procedures for an all-engine-out event; with time allowance only for recognition of the all-engine-out condition, and not 'troubleshooting the emergency for several minutes' which implies associated distraction from the primary responsibility of the flight-crew to maintain the required aircraft flight path.		be relit after a reasonable time frame.
7	In reference to the following statement: *"The engine should only be rotor lock tested once due to the inherent break-in or rubbing of seals that may occur during the test."* The FAA should clearly state the test described in the Policy is only to be completed once for any program. Without such guidance, different ACOs and individual specialists may decide more than one test is required. Requiring the test to be run on more than one engine, or rerun after design changes, could effectively prevent engine certification programs from ever being attempted due to the cost of additional engine test assets, ultimately delay, if not preventing, genuine safety	Revise Page 5, 1st Paragraph per comment.	Partially adopted. The paragraph referred to in the comment is discussing the condition of the test engine and not the application of the policy to certification projects. A later paragraph discusses when to apply the policy. That paragraph has been revised to clarify when it is appropriate to apply the policy to changed products.

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	improvements (ie..through new technology)from becoming a reality.		
8	Aside from the questionable safety benefit the draft policy statement would achieve, AIA/ASD/GAMA asks the FAA to closely evaluate, with consideration of the broad types & sizes of aircraft which require Part 25 certification, the ability to execute the proposed testing scenario as we have the following (3) significant concerns: 1. It is potentially unsafe. 2. It may not allow compliance with certain flight test operational requirements such 14 CFR 91.151 and 91.167. 3. Depending on atmospheric conditions at the time of the test and aircraft performance limitations, it may not be possible to perform as written. For example, will the large majority of Part 25 aircraft (business jets to large commercial platforms) be able to conduct the test as prescribed and not deviate from operational regulations under which flight tests normally occur or greatly increase the risk of such flights? Some manufactures have simulated the test flight scenario using available modeling data and identified areas where operational rules will likely be violated. One example is minimum fuel level requirements. The described testing requires a fuel load at the start of the test point that assumes the aircrew of an aircraft in normal operation will violate the requirements of 14 CFR 91.167 Fuel Requirements for Flight in IFR Conditions. In many cases, the fuel load required in the testing scenario wouldn't even meet the requirements of 14 CFR 91.151 Fuel Requirements for Flight in VFR Conditions for day flight, when the increase in fuel burn at VFR altitudes is considered. The fuel load specified sets up a potential unsafe condition whereby any extension of a carefully planned profile for any reason could result in very high pilot workload to	Revise Page 5-6, "Rotor Lock Screening Test" per comment.	Part 91 does not apply to flight testing, which is done with an experimental certificate. It is not the intent of the policy to conduct the flight test at that airplane weight and fuel loading. It was provided in order to calculate the appropriate speed the airplane must use and time required to reach the restart envelope. The actual test would, of course, include more fuel and would not violate any safety or operational regulations. The policy has been revised for clarity.

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	manage fuel load, and potentially lead to fuel starvation. The described testing may also be very difficult to complete based on the performance characteristics of particular aircraft. The descent at best glide -10 knots may put an aircraft far enough on the back side of the performance curve that the aircraft may not be able to accelerate in level flight to the test condition, or it may take a very long time to reach the minimum windmill relight speed. Certain aircraft may not be able to achieve the minimum windmill relight speed at the top of the relight envelope on a single engine, especially above standard temperature conditions. These aircraft will require a pitch down maneuver at an altitude significantly above the top of the windmill relight envelope to reach the test condition speed at the top of the windmill relight envelope. In light of these unavoidable circumstances, will FAA provide manufacturers exemptions from the operational regulations, noting those regulations are also founded in safety concerns?		
9	AIA/ASD/GAMA feel the FAA has not adequately addressed what actions will be required if a rotor lock condition is experienced during the proposed screening test. Given broad types & sizes of aircraft which require Part 25 certification and the equal variety of associated engine designs, the potential to experience rotor lock under the proposed testing scenario is reasonably high. Yet, as has been the primary focus of AIA/ASD/GAMA comments, there is no substantive safety benefit to be gained by complying with the proposed policy statement. As such, the proposed grind-in option, while effective, is not an acceptable alternative to all aircraft/engine types in Part 25 and cannot be conducted on production or overhauled engines sent directly to the field. Furthermore, the option of	Revise Page 6, Last Paragraph per comment.	Partially adopted. The policy has been revised to clarify mitigating actions and to address production and overhauled engines sent directly to airlines. Procedures should be coupled with other mitigating actions to ensure they are effective, such as flight crew indications. A procedural solution will require that the flight crews can be expected to appropriately and consistently follow them. The policy has been revised to include this.

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	applying a "mandatory minimum airspeed airplane operational procedures" is the equivalent of existing windmill restart envelopes and therefore removes any value, perceived or otherwise, of the proposed policy. At a minimum, AIA/ASD/GAMA request the referenced paragraph be edited as follows: *"If rotor lock, rotor drag, hung start, or any condition adversely affecting restart capability is encountered during the applicant's engineering or certification testing, the FAA certification office should report this to the Transport Airplane Directorate Standards Staff. It is up to t~~T~~he applicant ~~is encouraged~~ to determine if ~~incorporate engine~~ design changes are an appropriate solution ~~that would mitigate those adverse conditions~~. Other mitigating actions to address these adverse conditions may include developing ~~an in-flight~~ engine seal grind-in procedure, procedures to reduce drag from gearbox accessories or mandatory minimum airspeed airplane operational procedures aimed at mitigating the condition, potentially in combination with other mitigating actions, such as the use of starter-assist."*		
10	The 1st sentence, "*The general policy stated in this document does not constitute a new regulation.*" should be deleted. As noted in the attached response letter, rotor lock, as described in the draft policy statement is outside the scope of 14CFR Part 25.903(e). This is clearly articulated in the preamble language and by FAA's repeated acceptance of compliance demonstrations. FAA should review Order IR 8100.16 2-2 (a), (b) and (c) and revise the draft policy statements accordingly.	Revise Page 7 Effect of Policy per comment.	The FAA does not concur. The policy is in compliance with Order 8100.16 since it is not adding requirements to the existing rule. The policy provides guidance in showing compliance to the 25.903(e) in-flight starting compliance demonstration. As the policy states, other methods are also acceptable. The policy provides guidance as to how the FAA would evaluate alternate proposals.
11	The section exaggerates the threat of encountering a rotor-lock condition, as the only all-engines power loss event in which crew had "difficulty" restarting	Revise Page 7 Conclusion per comment.	The FAA does not concur. The policy has been revised for clarity to reflect rotor lock is a subject of all-engine power loss events. (See GE comment

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	the engines was the referenced accident. This section should be deleted, which would also better align with the format of the Part 33 draft policy statement (which has no Conclusion section).		7.)

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	Commenter: Airbus		
1	Page 1 Summary Second sentence. "*…the results can be catastrophic if the engines cannot be restarted*." This language exaggerates the threat, given the circumstances of the accident in October 2004.	Delete this sentence.	The FAA does not concur. An all-engines-out scenario is a potentially catastrophic condition, regardless of the cause. The policy has not been changed.
2	Page 1 Summary Fourth sentence. "*…major engine design change programs…*" This policy should not be applied to engine design change programs that have no effect on rotor lock characteristics.	Re-phrase to say "…major engine design change programs that could significantly affect engine rotor lock characteristics,…" at every appearance of this text in the policy.	Partially adopted. The policy has been revised to clarify the scope of engine changes that will require a rotor lock evaluation.
3	Page 2, first paragraph "*Because of the increased size, mass, and number of engine gearbox driven generators,…*" It is not only the generators that have increased in size, mass and number.	Re-phrase to say "Because of the increased size, mass, and number of engine gearbox driven accessories,…"	Adopted. See AIA/ASD/GAMA comment #4.
4	Page 5, rotor lock factor 3. "*This airspeed should be representative of an expected pilot's response where best glide slope is likely set while the crew troubleshoots the emergency for several minutes prior to descending in altitude to relight the engines.*" Do not agree likely pilot response will only be best glide slope. Other considerations may prevail and be mandated by the AFM.	Re-phrase to say "This airspeed should be representative of an expected pilot's response, based on AFM procedure for multiple engine shut down. "	The FAA does not concur. The commenter assumes the optimal flight crew response to an all-engines-out scenario where the FAA position is to apply a reasonably expected flight crew response. The policy has not been changed.
5	Page 6, last paragraph "*The applicant is encouraged to incorporate engine design changes that would mitigate those adverse conditions.*" This is not realistic in the middle of an aircraft certification programme. Other mitigation actions are required.	Delete this sentence.	The FAA does not concur. Design changes are an option to mitigate potential rotor lock issues. The policy has been revised to clarify the possible mitigation options.

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	Commenter: Boeing		
1	We fully concur with the concerns raised by the Aerospace Industries Association (AIA), General Aviation Manufacturers Association (GAMA), and AeroSpace & Defense Industries Association of Europe (ASD) relative to this proposal and the associated Part 33 proposed policy (PS-ANE-33.89-01, "Guidance for Engine Rotor Lock Screening during Turbofan Engine Type Certification"), as discussed in their combined letter of comments.	See AIA/ASD/GAMA comments.	See AIA/ASD/GAMA comments.
2	On Page 5, Item 3: The proposed text states: *"...A low airspeed that is a conservative representation of operational conditions, with a safety margin. This airspeed should be representative of an expected pilot's response where best glide slope is likely set …"*	We recommend revising the text as follows: *"...A low airspeed* ***prior to engine shut down,*** *that is a conservative representation of operational conditions, with a safety margin.* ***The airspeed after shut down*** *should be representative of an expected pilot's response* ***(dictated in order by AFM airspeed limitations, published operationally recommended airspeeds, or where best glide slope is likely set)*** *…"* Rationale for suggested change: There may be existing AFM limitations for other considerations that should not be breached.	Partially adopted. The airspeed was modified to include "after shutdown." This paragraph refers to the drift-down speed, not the aircraft conditions prior to shutdown. Those requirements are in the preceding paragraph. The policy was not changed. The commenter's request assumes that an optimal flight crew response can be selected. The intent of the policy is to evaluate rotor lock considering a reasonably expected flight crew response. The policy was not changed.
3	On Page 6, Item 2: The proposed text states: *"2. Minimize altitude loss (drift-down) using the non-test engine thrust, as required, and reduce airspeed to the best glide airspeed (or max L/D) minus 10 knots (or lower airspeed, if a lower airspeed is operationally recommended), …"*	We recommend revising the text as follows: *"2. Minimize altitude loss (drift-down) using the non-test engine thrust, as required, and reduce airspeed****, where other all engine out AFM airspeed limitations dictate,*** *to the best glide airspeed (or max L/D) minus 10 knots****, or operationally recommended*** *(or lower airspeed, if a lower airspeed is operationally recommended), … "*	The FAA does not concur. The commenter's request assumes that an optimal flight crew response can be selected. The intent of the policy is to evaluate rotor lock considering a reasonably expected flight crew response. The policy was not changed.

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		Rationale for suggested change: There may be existing AFM limitations for other considerations that should not be breached.	
4	On Page 6, Item 2: The proposed text states: *"...plus fuel onboard equal to 45 minutes at normal cruising fuel consumption."*	We recommend revising the text as follows: *"...plus fuel onboard equal to 45 minutes at normal cruising fuel consumption,* ***or a representative fuel loading deemed to be safe for the flight test conditions and locations.****"* Rationale for suggested change: Our recommended change is appropriate to address flight test safety considerations.	Partially adopted. It is not the intent of the policy to conduct the flight test at that airplane weight. It was provided in order to calculate the appropriate speed the airplane must use and time required to reach the restart envelope. The policy has been revised for clarity.

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	Commenter: Bombardier		
1	General: Bombardier Aerospace supports the position of AIA and GAMA: 1. The proposed flight test for rotor lock susceptibility is unrealistic and unwarranted given current high-altitude engine restart instructions. 2. The engine restart requirements of 14 CFR Part 25 are not consistent with the proposed rotor lock testing conditions. As written, the proposed policy creates new certification requirements.	Withdrawal of proposed policy statement.	The FAA does not concur. See AIA/ASD/GAMA comments for response to specific concerns.
2	Page 6, point 3 of the rotor lock screening test: The described procedure does not allow full use of the restart envelope Significant altitude is lost during the acceleration from the target airspeed to the minimum windmill relight speed. By anticipating the top of the envelope and accelerating to minimum windmill restart speed before it is entered, the full height of the envelope can be used. A similar request is made for PS-ANM-25-02.	"Acceleration to minimum windmill restart airspeed should begin *prior* to reaching the top of the restart envelope, with the intent of attaining minimum windmill restart speed at the top of the envelope."	The FAA does not concur. As discussed in the open forum AIA meetings, the time to drift down from top of the envelope to the top of the restart envelope defines the critical time for thermal mismatch which can lead to rotor lock. An engine should be able to be started within the start envelope when starting at the top of the restart envelope.

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	Commenter: Cessna		
1	Cessna suggests that it should be clearly stated that this is only applicable to turbojets and turbofans, and the screening test described in the Policy section is not applicable to turboprop engines.	Change Summary section to specify which engines this policy is applicable to.	The FAA does not concur. See AIA/ASD/GAMA comment #1.
2	Cessna suggests clearly stating that the screening test described in the Policy section is not applicable to jet aircraft certified to Part 23 requirements. Policy guidance for Part 25 aircraft tends to get applied to Part 23 jets even when it was never originally intended to. Due to the small core size of the engines used on these aircraft, there are already turbofans used on Part 23 aircraft that cannot be windmill restarted once N2 has dropped below a certain percentage, even if the core continues to rotate at some speed or is not affected by rotor lock. Said another way, there is no airspeed within the airframe limitations that provides enough flow through small turbofan cores to achieve an N2 speed sufficient for starting once N2 has dropped below a certain threshold. These engines have other design features, such as electric starters, which can be used to minimize their exposure to rotor lock.	Change the Summary section to specifically exclude part 23 airplanes.	The FAA does not concur. See AIA/ASD/GAMA comment #2.
3	Cessna suggests that this would be a good place for the FAA to acknowledge that advanced technology engines being designed for the 'small' end of the Part 25 range (approximately 5,000 to 12,000 lb thrust) will have the same characteristics as many turbofan engines used on Part 23 aircraft today, i.e. once N2 speed drops to a certain percentage, there is no airspeed within the airframe limitations that will provide enough flow through the core to windmill restart, even in the absence of rotor lock. From this perspective, the testing described in this policy statement really only makes sense when	Change the Summary section to allow for alternative means of compliance for smaller part 25 engine/aircraft combinations because the proposed testing may not be appropriate for that class of airplane.	Partially adopted. The FAA has not dictated specific mitigation methods, only provided options an applicant has to address. Having zero N2 speed is not necessarily an issue if the engine can be restarted successfully. Also, starter-assist is specifically an option for mitigation. The FAA also clearly states that alternative procedures may be proposed based on the key factors that influence rotor lock. The policy has been revised to provide the mitigating options more clearly and that specific designs may require alternate means that can be proposed based on the key factors influencing rotor lock.

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	applied to a generation of 'small' engines intended for Part 25 aircraft that is increasingly becoming economically obsolete for new aircraft TC programs. Future engine installations will have other features that can be used to mitigate the potential for rotor lock and allow satisfactory airstart characteristics, such as FADEC controls and electric starters that can be used to provide instantaneous relight or maintain a minimum core speed until the relight envelope is reached. Cessna suggests that the FAA be open to alternate methods of compliance and not fixate on the method described in this policy for the smaller Part 25 engine / aircraft combinations. Perhaps it should be more clearly stated within the policy that the applicant may propose alternate methods of compliance where the described testing does not make sense due to the engine size and flow characteristics.		
4	Cessna recommends the following for clarification: Rotor lock is a condition where (1) an engine core rotor speed goes to zero following an in-flight shutdown or engine flame out and (2) the core rotor will not rotate during a subsequent start attempt.	Revise Page 2, 1st Paragraph per the comment.	Adopted. See response to AIA/ASD/GAMA comment #3.
5	Cessna recommends the following for clarification: "Because of the increased size, mass, and number of engine gearbox driven ~~generators~~ accessories…" (Comment: The gearbox drives more than generators.)	Revise Page 2, 1st Paragraph per the comment.	Adopted. See response to AIA/ASD/GAMA comment #4.
6	Cessna recommends the following for clarification: The engine's high pressure compressor rotor, or core rotor, is the only known rotating component of two- or three-rotor systems that slows and stops rotating in the air. (Comment: Clarification that ground conditions are not being referred to.)	Revise Page 2, 1st Paragraph per the comment.	Partially adopted. See response to AIA/ASD/GAMA comment #5.
7	Cessna suggests the need for a better definition on limited testing, that should include ground and flight time. For example: "The engine condition should be representative of an entry-into-service installed engine but it should not be an engine that	Revise Page 5, 1st Paragraph per the comment.	Partially adopted. The policy section describing the condition of the test engine has been revised to include what types of use the engine has had prior to test.

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	has been through ~~extensive~~ ground or flight testing beyond normal engine pass off testing in the test cell and the on-aircraft testing required to verify the performance of the engine and any instrumentation."		
8	Cessna feels the following sentence needs clarification: "The engine should only be rotor lock tested once due to the inherent break-in or rubbing of seals that may occur during the test." (Comment: At some place in the document it needs to be clearly stated that the test described in the Policy is only to be completed once for the program. Without such guidance, different ACOs and different specialist may decide more than one test is required. Requiring the test to be run on more than one engine, or rerun after design changes, could effectively prevent 'small' engine programs from ever being attempted, due to the cost of additional engine test assets. This could prevent block point type programs to address safety, efficiency, emissions, or reliability in existing engines. This could also have a negative impact on the number of new engine certification projects attempted, with the associated benefits in advancing technology lost.)	Revise Page 5, 1st Paragraph per the comment.	Partially adopted. See response to AIA/ASD/GAMA comment #7.
9	Cessna feels that Factor 3 makes assumptions in the way it is worded that should be definitively stated for clarity. First, this factor describes the pilot response as to set best glide slope as a low airspeed. This is only true if all engines have stopped producing thrust – the Factor should clearly state that is the assumption driving the choice of the airspeed. Second, the Factor states "…while the crew troubleshoots the emergency for several minutes prior to descending in altitude to relight the engines". This is a significant mischaracterization of how aircrew are trained to operate aircraft. Loss of thrust from all engines generates indications requiring immediate aircrew action per the AFM. These normally require setting a descent speed	Revise Page 5, Factor 3 per the comment.	The FAA does not concur. As discussed in the AIA/GAMA meetings, the FAA position is that while normal flight crews will adhere to the AFM it is reasonably expected that some flight crews may react differently and set best glide slope (max L/D) before proceeding to the AFM. Therefore it cannot be expected that the flight crew will always immediately proceed to the AFM procedure.

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	much greater than that described in Factor 3 and do not allow for 'minutes' to troubleshoot. These procedures require immediate action to completion, at which point the crew may then resume flight or move on to the next required procedure. Cessna requests clarification on why the FAA is going to assume that aircrew will ignore the requirements of the AFM, and their training.		
10	Cessna requests clarification: define "fuel chop (fuel cut-off)". Is the intent to have the throttle remain in MCT and use the firewall shut off valve, or is it acceptable to move the throttle rapidly to cut off?	Revise Rotor Lock Screening Test: Paragraph 1 section per comment.	Adopted. The FAA concurs with providing clarity. The policy has been revised to clarify "fuel chop" as a rapid throttle movement to the off position.
11	Cessna has three significant concerns regarding the test procedure described in the policy statement, and suggests revision: 1. It is potentially unsafe. 2. It is not representative of operational requirements in 14 CFR 91.151 and 91.167. 3. Depending on atmospheric conditions at the time of the test and aircraft performance limitations, it may not be possible to perform as written. Cessna analyzed the recommended screening test for two aircraft using data found in the operating manual for the respective aircraft and the procedure outlined in the policy. Any data required that was not found in the operating manual was calculated from the aircraft aerodynamic model and the engine deck. The flight profile analyzed started with the aircraft at the maximum certified altitude at MCT and the weight (including fuel) defined in the procedure. To model the initial descent, thrust was assumed to go to zero instantaneously, the aircraft held at the certified ceiling until reaching best glide speed minus 10 knots, and then the aircraft descended at that speed until reaching the top of the windmill relight envelope. At that point, a 2 minute, single engine acceleration in level flight to reach minimum windmill relight speed and 5 minutes of single engine operation in level flight at the test condition were assumed. Then a descent at	Revise Rotor Lock Screening Test section per comment.	Partially adopted. This policy does not apply to part 23 airplanes, only part 25 and the part 23 data is irrelevant. It is not the intent of the policy to conduct the flight test at that airplane weight and fuel loading. It was provided in order to calculate the appropriate speed the airplane must use and time required to reach the restart envelope. The actual test would, of course, include more fuel and would not violate any safety or operational regulations. The policy has been revised to clarify.

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	recommended high speed descent, 2 minutes to maneuver for approach, and 1 minute for landing were assumed. To model fuel used: single engine idle with normal losses fuel flow was assumed during deceleration and drift down, single engine MCT fuel flow was assumed during acceleration and the test condition, multiengine high speed descent fuel use for the decent, and holding fuel flow for the maneuver to approach and landing. All analysis was done at ISA conditions. The first aircraft analyzed was a Part 23 commuter category business jet. The initial fuel load was 544 lbs and the fuel remaining at landing was calculated at 300 lbs. The second aircraft analyzed was a Part 25 business jet. The initial fuel load was 863 and the fuel remaining at landing was calculated at 467. These fuel remaining calculations are considered best case results, as the potential for the idle thrust of the remaining engine during drift down to extend the drift down time was not modeled. Actual single engine acceleration from low speed to the test condition may also take longer than estimated. (Comments Continued in Next Row) (Continued from Above) At 10,000 ft ISA conditions for the Part 23 commuter category jet, 300 lbs of fuel represents 12.2 min at MCT or 27.2 min at max range power setting. For the Part 25 jet at the same conditions, 467 lbs of fuel represents 11.8 min at MCT or 21.0 min at max range power setting. There is very little margin for anything to go even slightly wrong during this test when considering the fuel remaining at landing and the uncertainties in the calculation. There is little margin to deviate due to conflicting traffic during completion of the		

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	profile, extra maneuvering in the vicinity of the airport, or for a go-around due to conflicting traffic on the runway. Second, the Cessna Engineering Flight Test department normally operates under Part 91 requirements. For day VFR flights, 91.151 require 30 minutes reserves. For IFR flights, 91.167 require 45 minute reserves. Finally, the difference between the minimum windmill relight speed at the top of the relight envelope and the single engine MCT speed for both of these aircraft at that altitude is less that 5% for both aircraft at ISA conditions. Both of these aircraft have better takeoff thrust to weight ratios than many larger commercial aircraft. There may be many instances where aircraft cannot complete the testing described unless done on a colder than ISA day at altitude. Cessna recommends that at a minimum, the procedure be revised to reflect a more realistic and safer initial fuel load, such as the fuel required for a multi-engine idle descent from maximum altitude plus 45 minute reserves per 91.167. Cessna also recommends allowing a pitch down before reaching the top of the windmill relight envelope to accelerate to a speed that will allow the required test speed to be reached for the test condition. If the FAA does not wish to increase the fuel load to account for the requirements of 91.167, it should be explicitly stated that those requirements do not apply to any person or company completing the testing as described in this policy, and the FAA will not hold them responsible for failure to comply with the minimum fuel requirements of any regulation while completing the described testing.		
12	Cessna recommends the following for clarification: "Other mitigating actions to address these adverse conditions may include developing an in-flight engine seal grind-in procedure, procedures to	Revise Page 6, Last Paragraph per comment.	Adopted.

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	reduce drag from gearbox accessories, or mandatory minimum airspeed airplane operational procedures aimed at mitigating the condition, potentially in combination with other mitigating actions, such as the use of starter-assist."		

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	Commenter: Embraer		
1	Embraer believes that the proposal to define a post-flameout operating envelope down to the speed for maximum lift-over-drag (L/Dmax) minus 10 knots will have a negligible effect on protection against rotorlock events in service, and may unintentionally result in an overall lower level of safety and possibly cause adverse environmental effects.	Revise proposed speed per comment. First of all, L/Dmax airspeed is not typically published nor is it part of the training program for Part 25 jets. In addition, there are other considerations like the pressurization loss the also result from all-engine flameout that cal1 for a more expedited descent. To characterize a deceleration to L/Dmax speed as "representative of an expected pilot's response" is not reflective of an optimal response considering all risks, not part of training, and as far as Embraer is aware, is not shown in service history as a normal or expected pilot response for all-engine flameouts that happen at altitude. As far as the safety effect of a pilot maintaining a higher windmilling speed, in addition to the oxygen and engine restart advantages, there is typically no significant loss in glide distance from using minimum windmilling speed as a target glidespeed rather than L/Dmax. In the case of one of our jet-powered products, a descent from maximum altitude at the higher windmilling speed would result in a trivial difference in glide range compared to a glide conducted at LIDmax. In the more unlikely case of a glide continued all the way to the ground, the use of the windmilling speed would result in the loss of only about ten percent of	The FAA does not concur. Embraer disagrees with the FAA's statement that max L/D is an expected pilot's target speed in reaction to an emergency all engine out condition. Embraer does not propose alternate language or a different proposal. The standardized approach accounts for likely flight crew reaction to this unexpected and urgent situation that may involve inadvertent deviation from aircraft operating procedures.

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		the glide distance. Given the safety advantages of the faster airspeed and more expeditious descent, the minor loss in glide distance is an acceptable trade.	
2	The policy does not recognize that some engines, typically turboprop and smaller turbofans with electric starter-generators, do not have a windmill start envelope and rely on assisted starts throughout the restart envelope.	Revise the policy to consider engine installations that rely on assisted starts throughout the restart envelope.	Partially adopted. The policy is applicable to turboprop engine installations. See AIA/ASA/GAMA comment 1. The policy already states that starter-assist is an acceptable method of compliance, as Embraer requests.
3	The FAA policy encourages engine design changes in response to installations that do not successfully pass the new Max L/D speed demonstration, but does not address the adverse economic and environmental effects due to the resulting increase in fuel consumption and emissions, nor the significant economic impact that would result.	Embraer believes that the proposed policy should not be implemented as written without a full accounting of these effects with the opportunity for public review and comment. Embraer would support a proposal to evaluate the time available to the flight crew to detect and respond to an all-engine flameout by pitching the airplane nose-down to achieve the required airspeed.	The FAA does not concur. The FAA has afforded the public an opportunity to comment on the policy. As discussed in the AIA rotor lock meetings, there were no adverse economic effects of either Airbus or Bombardier in-flight rotor lock screening tests. AIA never identified any specific adverse economic impacts. Embraer's alternate proposal appears non-specific and incomplete and was not discussed in the open forum AIA meetings.

No.	Comment	Requested Change	Disposition
	Commenter: GE Aviation		
1	Need to clarify what type of engines the policy applies too.	Revise page 1, Summary section. Reason: For clarity. Clearly state the Policy is for turbofan and turbojet engines and not applicable to turboprop engines.	Adopted.
2	The sentence "Since then, there have been numerous all-engines power loss events due to several different causes and reoccurring situations of flight crews having difficulty rapidly restarting engines from an all-engines-out condition." Is misleading.	Revise Pg 1, Current Regulatory and Advisory Material. Reason: Not supported by the record. The probability of having an all-engine rotor lock accident in revenue service with passengers is extremely improbable (<1E-9) when the flight crew does a rudimentary job of following approved emergency procedures.	The FAA does not concur. The commenter is focused only on rotor lock as a cause. The service history supports the statement in the policy since there have been numerous events due to several different causes.

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No.	Comment	Requested Change	Disposition
3	While the physics may imply modern designs will have higher wind-milling speeds, current requirements maintain wind-milling speeds.	Revise Pg 2, Current Regulatory and Advisory Material, 1st paragraph. Reason: Unfounded conclusion not supported by the record. Industry work in PPIHWG showed that the left hand boundary of the published windmill start envelope has not trended up with time. (see figure). Issue papers written against airplane certifications since the mid-1990s have maintained the windmill start capability.	The FAA does not concur. The history supports the statement in the policy and shows how windmilling speeds have increased. The FAA in-flight engine restart issue paper was initiated to address this issue. The commenter is correct that it has addressed this issue.
4	Crew troubleshooting starts after the crew follows emergency procedures and best glide L/D is not the emergency procedure.	Revise Pg 5, Policy, paragraph 2, bullet 3. Reason: There are some serious flaws in the FAA proposed best L/D glide speed as the pass/fail criteria. Expecting a 5 minute delay between flameout of all engines and crew action to descend/ accelerate the airplane is in conflict with service experience and with the requirements of issue papers addressing windmill start capability. Service experience shows that all-engine flameout is quickly responded to by flight crews. In particular, airplanes meeting the requirements of windmill start issue papers by providing dedicated, prioritized flight deck annunciation of engine flameout or sub-idle conditions can be expected to have crew response times in the range 10 – 30 seconds, as typically used for meeting these issue papers. Typical issue paper wording is: "…the engine start must be initiated under windmill conditions corresponding to a shutdown time representing a delayed crew recognition of engine failure (15 seconds or more, unless a different time for crew recognition of all-engine loss of power can be substantiated)"	The FAA does not concur. The policy does not conflict with current FAA issue papers. The conditions in the in-flight engine restart issue paper address airplane restart capability and not flight crew procedures. Service experience shows that not all flight crews react quickly. The referenced FAA issue paper is discussing a specific scenario of an in-flight shutdown occurring during take-off or initial climb when the airplane is at high power and low altitude and the flight has a higher situational awareness. The expected crew response time for this condition is different for the rotor lock condition due to the different operating conditions.
5	Adding additional time is not representative of the expected crew response.	Revise Pg 5, Policy, paragraph 2, bullet 4. Reason: The level of conservatism in test conditions should reflect the rarity of the	The FAA does not concur. The FAA does not agree that the flight crew response will be

No.	Comment	Requested Change	Disposition
		accident. Allow for normal restart procedures to occur at the top of the restart envelope.	optimal at all times. The policy reflects a reasonably expected flight crew response. The policy has not been changed.
6	Developing an in-flight engine seal grind-in procedure is inappropriate for the transient thermal rotor lock issue.	Revise Pg 6. Rotor Lock Screening Test. Reason: The accident engines had significant service hours at the time of the event and built clearances should not have been an issue. The best alternative is mandating a minimum airspeed airplane operational procedures aimed at mitigating the condition	The FAA does not concur. Applicants have successfully used grind-in procedures to address rotor lock. A procedural solution will require that the flight crews can be expected to appropriately and consistently follow them.
7	The Conclusion fails to accurately define the rarity of the event.	Revise Pg 7. Effect of Policy. Reason: The section exaggerates the threat of encountering a rotor-lock condition, as the only all-engines power loss event in which crew had “difficulty” restarting the engines was the referenced accident. The probability of having an all-engine rotor lock accident in revenue service with passengers is extremely improbable (<1E-9) when the flight crew does a rudimentary job of following approved emergency procedures.	The FAA does not concur. The FAA does not agree that since there has been only one event that there is not a safety issue. The conclusion has been revised for clarity to ensure that rotor lock is a subset of all-engines power loss events.
8	Pg 7. Conclusion.		No change requested or specific comment given.

No.	Comment	Requested Change	Disposition
	Commenter: NTSB		
1	The NTSB believes that the proposed procedures and guidance will provide an appropriate test condition definition to identify an engine's susceptibility to rotor lock and is pleased to note that the proposed policy will ensure that a test to evaluate an engine's susceptibility to rotor lock will be included in future 14 CFR Part 25 airplane certification tests. The NTSB is also pleased to note that the draft policy offers instructions for mitigating actions to address the rotor lock	No change requested.	The FAA acknowledges the commenter’s support.

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No.	Comment	Requested Change	Disposition
	condition, including operational procedures.		
2	However, the NTSB is disappointed that the proposed policy does not provide guidance that ensures that, when an engine is identified as susceptible to rotor lock, the vulnerability is included in the AFM, along with the reasons for any operational mitigation, such as maintaining a mandatory minimum airspeed.	No change requested. The FAA infers that the commenter requests that the policy include guidance to identify that an engine has been found susceptible to rotor lock in the AFM along with operational mitigation.	The intent of the policy is to identify when an installed engine is susceptible then require changes to mitigate the condition. Therefore, during operation the airplane will not have susceptibility and therefore an AFM procedure or notes is unnecessary. No changes have been made to the policy.
3	Although the NTSB is pleased with the proposed policy, the NTSB notes that it is unclear whether the FAA intends the rotor lock screening test to be a permanent requirement for compliance with 14 CFR 25.903(e).	No change requested. The FAA infers that the commenter requests that the policy include specific guidance that it is applicable to all future certification projects.	When the FAA issues policy, it is our intent that policy will apply to all future certification projects that it is applicable to unless we learn new information that leads us to change that policy. The policy includes sufficient flexibility to allow applicants to propose alternative approaches to substantiating compliance with the requirements of 25.903(e), but any alternatives would still have to demonstrate that restart capability exists following rotor lock. No changes have been made to the policy.