



European Aviation Safety Agency
Comment-Response Document 2017-06

Appendix 1
to ED Decision 2018/005/R

RELATED NPA 2017-06 — RMT.0647 — 27.03.2018

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1. Summary of the outcome of the consultation

EASA received 84 comments from 18 stakeholders (6 aviation authorities, 9 aeroplane manufacturers or association of manufacturers, 2 airline associations, 1 flight training company) distributed as follows:

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General comments

Overall, EASA received many positive comments aimed at improving the proposal. Nevertheless, some commentators (some manufacturers, airline associations, a flight training company) explained that the proposed CS-25 amendment to address the design aspects of the go-around manoeuvre was not sufficient to prevent all go-around related occurrences, in particular the ones triggered by somatogravic illusions. EASA considers that, although it is agreed that design changes alone will not fully eliminate the risk of inadequate management of go-arounds, they will bring a safety benefit and contribute to a global strategy to fight against the identified risks. That strategy includes flight crew training improvements and recommendations for air traffic control instructions. Other potential actions are being considered and may be launched by EASA in the future.

Some comments were very focused on the assessment of the risk of somatogravic illusions. However, the EASA proposal also included the objective to assess flight crew workloads and the controllability of aeroplanes. These comments also raised the fact that the risk of a somatogravic illusion cannot be quantified scientifically, and that therefore the evaluation of an aeroplane design is going to be difficult without specific pass-fail criteria. This fact has been better reflected in the AMC material; EASA reminds applicants that several criteria are provided in AMC 25.143(b)(4), which can be used to identify when the risk is too high and mitigation action is necessary.

The aviation authorities were either supportive of the NPA or had no comment.

Specific comments

Various technical comments were received in the following main categories:

- the meaning of ‘go-around thrust or power’ when a reduced go-around function is installed,



- assessment of the flight crew workload during the go-around manoeuvre,
- proposed criteria in AMC 25.143(b)(4) to mitigate the risk during a go-around manoeuvre,
- performance data to be published in the AFM when a reduce go-around function is installed,
- cockpit indications when a reduced go-around function is installed, and
- automatic pitch trim travel limitation and longitudinal controllability.

Chapter 2 below provides detailed responses to all the individual comments.

Outcome

Following the NPA consultation, the proposed certification specifications have either remained unchanged, or have been clarified with some minor changes. The corresponding AMCs have been extensively revised, taking into account the various comments in order to improve the clarity of the AMCs and to better reflect the intent of the specifications.



2. Individual comments and responses

In responding to comments, a standard set of terminology has been applied to show EASA's position. This terminology is as follows:

- (a) **Accepted** — EASA agrees with the comment and any proposed amendment is wholly transferred to the revised text.
- (b) **Partially accepted** — EASA either agrees partially with the comment, or agrees with it but the proposed amendment is only partially transferred to the revised text.
- (c) **Noted** — EASA acknowledges the comment, but no change to the existing text is considered necessary.
- (d) **Not accepted** — The comment or proposed amendment is not agreed by EASA.

(General Comments)

-

comment

1

comment by: *Christopher Mason*

In the wake of Sochi, Kazan, Tripoli and other tragic fatal accidents something certainly needs to be done to manage the risks associated with a go-around, especially at night/IMC. We went through a similar rash of accidents and incidents with the A310/A300-600 in the '90s, before anyone had grasped the fact that at low speed and high thrust those aircraft were close to being uncontrollable in pitch. That EASA issued this NPA is commendable, but the proposed changes to design certification standards will take years to manifest themselves in the global fleet and the legacy of aircraft not meeting the standards will run for decades. Surely there should be an effort to improve procedures, training and awareness right now in order to address a known and immediate problem?

Submitted by ERA on behalf of JOTA Aviation.

response

Accepted.

As mentioned on page 23 of the NPA, other EASA rulemaking projects are on-going to address the aspects of pilot training and missed approach procedures.

RMT.0581 on 'Loss of Control Prevention and Recovery Training': one of the objectives of this RMT is to improve the pilot's competence in conducting go-around manoeuvres; the different possible configurations should be addressed from the one-engine-inoperative (OEI) to the all-engine-operative (AEO)/full thrust configurations, and also pilots should be trained to use the reduced go-around thrust function when available. Somatogravic illusions will also be included in training so that pilots are better able to recognise them and react to them.

As a result of RMT.0581, Opinion No 06/2017 'Loss of control prevention and recovery training' was published by EASA on 29 June 2017, proposing amendments of Commission Regulation (EU) No 1178/2011 to the European Commission. Additionally, new AMC and GM to ORO.FC.220&230 were introduced with ED Decision 2015/012/R (in force from 4 May 2016), addressing upset prevention and recovery training (UPRT) during the operator conversion and recurrent training.

RMT.0464 'Requirements for air traffic services': NPA 2016-09 includes the proposed AMC 21 ATS.TR.210(a)(3), which stipulates that controllers should issue instructions for missed approaches in accordance with the published missed approach procedures, in order to help to minimise the workload on the flight deck in such a critical phase of flight. Instructions with



modifications to such published procedures should be reduced to the essential minimum and should be issued only for safety reasons. This AMC material has been developed as a response to a safety recommendation (FRAN-2013-045) issued by the French Bureau d'Enquêtes et d'Analyses (BEA) to EASA, in the report on the so-called ASAGA study (Aeroplane State Awareness during Go-Around) published in August 2013. EASA is reviewing the comments received on NPA 2016-09; the publication of the EASA Opinion and of the associated CRD is expected in Q1 2018.

In addition, RMT.0599 on 'Evidence-based and competency-based training' includes some objectives that will foster go-around training improvements. These will:

- define a methodology for monitoring primary flight parameters, in particular pitch, thrust then speed,
- ensure that go-arounds with all engines operating are performed sufficiently frequently during training,
- address risks associated with dispersion and/or channelised attention during a go-around.

Other actions may be launched in the future to complement those mentioned above.

comment	2	comment by: <i>AFT Ltd</i>
	<p>I would comment that the loss of control of an aircraft is due not to aircraft design or automation but lack of practice in doing the manoeuvre. Too much emphasis is put on "checking" pilots on a regular basis and not enough on "training" or allowing for "retraining" and practice. Simulator checks on 6 monthly basis should be used as a training and checking tool with more emphasis on the training. Pilots dread the thought of going into the simulator every 6 months, when in fact they should look forward to it as a learning experience and a chance to hand fly the aircraft.</p> <p>A pilot's mental health may also be improved as he can go to work everyday knowing that he has a good understanding of the aircraft , its systems and how to fly it, rather than worrying about a sim check or the day the automatics fail.</p>	
response	<p>Noted.</p> <p>Thank you for your comment.</p> <p>Please refer to Opinion No 06/2017 'Loss of control prevention and recovery training', published by EASA on 29 June 2017. With that Opinion, EASA proposed to introduce upset prevention and recovery training (UPRT) elements at different stages of a pilot's career, with the objective to improve the professional pilot's competence to both prevent and recover from aeroplane upsets. Additionally, new AMC and GM to ORO.FC.220&230 were introduced with ED Decision 2015/012/R (in force from 4 May 2016), addressing UPRT during operator conversion and recurrent training.</p>	
comment	3	comment by: <i>DGAC France</i>
	<p>Please note that France has no specific comment on this NPA.</p>	
response	<p>Noted.</p>	
comment	8	comment by: <i>Federal Office of Civil Aviation (FOCA), Switzerland</i>
	<p>The Federal Office of Civil Aviation (FOCA) appreciates the opportunity to comment on this NPA and would like to thank the Agency for the excellent work.</p>	

response	Noted. Thank you.
comment	9 comment by: <i>UK CAA</i> Thank you for the opportunity to comment on NPA 2017-06, Loss of control or loss of flight path during go-around or other flight phases. Please be advised there are no comments from the UK Civil Aviation Authority.
response	Noted.
comment	10 comment by: <i>EUROCONTROL</i> The EUROCONTROL Agency welcomes NPA 2017-06 publication and indicates that it does not make any comments.
response	Noted.
comment	20 comment by: <i>Bombardier</i> Bombardier recommends that it should be made clear throughout the NPA when referring to go-around thrust, whether reduced go-around (RGA) or "full" go-around (GA) thrust is being considered. Specific instances are cited in later comments on CS 25.145.
response	Not accepted. By default, in CS-25, go-around thrust/power means full go-around thrust/power. When a Reduced Go-Around thrust or power function is installed, the applicant should use the most critical thrust or power within the range of available go-around thrust or power when showing compliance with the CS-25 specifications. A note has been added in AMC 25.143(b)(4) paragraph 4.
comment	52 comment by: <i>Luftfahrt-Bundesamt</i> The LBA has no comments on NPA 2017-06.
response	Noted.
comment	82 comment by: <i>GAMA</i> Comment submitted on behalf of Gulfstream: The NPA cites several instances where accidents/incidents have occurred in airplanes that include Reduced Go-Around (RGA) system capabilities. So, this design feature by itself has not been effective at eliminating loss of spatial orientation (e.g. near bottom of p.19 based on RMG review, "this shows that limiting the thrust does not necessarily allow to prevent a go-around related occurrence."). Furthermore, the NPA indicates that an automatic pitch trim system inhibit at stall warning activation provides very limited safety benefit. As such, Gulfstream recommends modifying the proposed AMC 25.143(b)(4) and 25.145(a) guidance to remove the prescribing of certain design features

or mitigations and instead focus on raising awareness of somatogravic illusion and the high workload of AEO go-arounds. This should then be followed by test procedures to evaluate the approach/go-around maneuver and associated AFM go-around procedures, as required by 25.101(g) and 25.1587(b)(4), to assure reasonable workload and safety mitigations for high T/W conditions. In addition, Gulfstream considers that improved and targeted pilot training in accordance with the AFM go-around procedures will be more effective at addressing the safety concerns related to somatogravic illusion and high workload in AEO go-around conditions than the prescribed design features.

response

Not accepted.

Although it is agreed that design changes alone will not fully eliminate the risk of inadequate management of go-arounds, they will bring a safety benefit and contribute to a global strategy to fight against the identified risks, which includes flight crew training improvements. See also our response to comment 1.

Please note that a reduced go-around thrust/power function is not mandated, but may be used as an acceptable means of mitigation. Applicants may propose other solutions.

Executive summary

p. 1

comment

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comment by: *Textron Aviation*

In the *Executive Summary*, it is stated that the NPA proposes to amend CS-25 to ensure that G/A with AEO can be safely conducted without requiring exceptional piloting skill or alertness. Risk of excessive crew load and risk of somatogravic illusion must be evaluated, and design mitigation measures put in place if those risks are too high. The choice of wording here implies that an airplane design feature is the only means to mitigate the risks. While Section 2.3 clarifies that a reduced G/A thrust feature is one possible solution, it also reiterates that ‘design solutions’ must be implemented to decrease risk of somatogravic illusion. It appears there is a preconceived conclusion that a reduced thrust GA (RGA) mode is the best solution to address concerns with somatogravic illusion, despite the fact that the NPA later references accidents/incidents involving somatogravic illusion by aircraft with these design features already incorporated. The movement to introduce regulations that limit performance to specific thresholds despite the recognition that these measures do not necessarily prevent somatogravic illusion indicates such rulemaking might be premature, and consideration of other more effective mitigating measures should be discussed.

response

Not accepted.

Although it is agreed that design changes alone will not fully eliminate the risk of inadequate management of go-arounds, they will bring a safety benefit and contribute to a global strategy to fight against the identified risks, which includes flight crew training improvements. See also our response to comment 1.

Please note that a reduced go-around thrust/power function is not mandated, but may be used as an acceptable means of mitigation. Applicants may propose other solutions.

comment

68

comment by: *The Boeing Company***THE PROPOSED TEXT STATES:**

“This NPA proposes to amend CS-25 to ensure that:



— the design of large aeroplanes is such that the G/A procedure with all engines operating (AEO) can be safely conducted by the flight crew without requiring exceptional piloting skills or alertness. Risk of excessive crew workload and risk of somatogravic illusion must be carefully evaluated, and design mitigation measures must be put in place if those risks are too high;...”

REQUESTED CHANGE: We suggest changes to the text in the Executive Summary and Section 2.2 (objectives) as follows:

“This NPA proposes to amend CS-25 to ensure that:

— the design of large aeroplanes is such that the G/A procedure with all engines operating (AEO) can be safely conducted by the flight crew without requiring exceptional piloting skills or alertness. **The risk** Risk of excessive crew workload **associated with flight path control** and **the** risk of somatogravic illusion must be **considered** ~~carefully evaluated~~, and design mitigation measures must be put in place if those risks are too high;...”

JUSTIFICATION: Assessing the risk of excessive crew workload without any clarification goes beyond the focus on controllability. CS-25 Appendix D lists six broad workload functions. The NPA should be focusing solely on the first of these functions, namely flight path control. Extending the focus to all elements of crew workload potentially overlaps coverage with 25.1523 and brings unrelated factors into scope because workload is such a broad construct.

Reference to assessing the risk of somatogravic illusion and putting measures into place if the risk is too high requires that there be a rigorous, practical, and accepted means of measuring this risk and establishing an acceptable threshold for this risk. EASA is requested to consult further with industry to develop guidance and clarification on how this is expected to be accomplished.

response

- Proposal to limit the crew workload assessment to ‘flight path control’ and rely on Appendix D for the other aspects: Not accepted. The assessment should consider other elements; a reference has been added to the basic workload functions of Appendix D to CS-25 in Chapter 2.2 of AMC 25.143(b)(4);
- Proposal that the risk of a somatogravic illusion is ‘considered’ instead of ‘carefully evaluated’: Not accepted; ‘considered’ is a vague term and does not convey the intended meaning, i.e. that it must be subject of high attention and seriously evaluated.

2.2. Objectives

p. 4

comment 47

comment by: IATA

IATA General Comment: The technical functionality of the aircraft systems is only one part of



the issue, the second being the design of the go around flight path. Until there will be available only go around vertical and lateral paths that reflect the performance of modern aircraft the issues stated in the NPA will remain, the most obvious being low capture altitudes after the go around.

response

Noted.

In addition to the regulatory activities in the context of RMT.0464 'ATS requirements' as represented in the response to comment #1, EASA is working on rulemaking task RMT.0445 'Airspace and procedures design'; for the time being, the proposed set of rules does not deal with the details of the design of missed approach procedures, and it makes reference to provisions in PANS-OPS Volume II Chapter 6. Both sets of rules will amend, and will be included in, the so-called ATM/ANS Common Requirements Regulation 2017/373.

EASA is considering the possibility of launching a study to review the constraints for the design of missed approach procedures, and to collect statistical information on the ability/inability of aircrews to follow the instructions/clearances for the missed approach procedures.

comment

70

comment by: *The Boeing Company***THE PROPOSED TEXT STATES:**

"This NPA proposes to amend CS-25 to ensure that:

— the design of large aeroplanes is such that the G/A procedure with all engines operating (AEO) can be safely conducted by the flight crew without requiring exceptional piloting skills or alertness. Risk of excessive crew workload and risk of somatogravic illusion must be carefully evaluated, and design mitigation measures must be put in place if those risks are too high;..."

REQUESTED CHANGE: We suggest changes to the text in the Executive Summary and Section 2.2 (objectives) as follows:

"This NPA proposes to amend CS-25 to ensure that:

*— the design of large aeroplanes is such that the G/A procedure with all engines operating (AEO) can be safely conducted by the flight crew without requiring exceptional piloting skills or alertness. **The risk** of excessive crew workload **associated with flight path control** and **the risk** of somatogravic illusion must be **considered** ~~carefully evaluated~~, and design mitigation measures must be put in place if those risks are too high;..."*

JUSTIFICATION: Assessing the risk of excessive crew workload without any clarification goes beyond the focus on controllability. CS-25 Appendix D lists six broad workload functions. The NPA should be focusing solely on the first of these functions, namely flight path control. Extending the focus to all elements of crew workload potentially overlaps coverage with 25.1523 and brings unrelated factors into scope because workload is such a broad construct.

Reference to assessing the risk of somatogravic illusion and putting measures into place if the risk is too high requires that there be a rigorous, practical, and accepted means of measuring this risk and establishing an acceptable threshold for this risk. EASA is requested



to consult further with industry to develop guidance and clarification on how this is expected to be accomplished.

- response
- Proposal to limit the crew workload assessment to ‘flight path control’ and rely on Appendix D for the other aspects: Not accepted. The assessment should consider other elements; a reference has been added to the basic workload functions of Appendix D to CS-25 in Chapter 2.2 of AMC 25.143(b)(4);
 - Proposal that the risk of a somatogravic illusion is ‘considered’ instead of ‘carefully evaluated’: Not accepted; ‘considered’ is a vague term and does not convey the intended meaning, i.e. that it must be subject of high attention and seriously evaluated.

2.3. Overview of the proposals

p. 4-5

comment 62 comment by: *Gulfstream Aerospace Corporation*

The NPA cites several instances where accidents/incidents have occurred in airplanes that include Reduced Go-Around (RGA) system capabilities. So, this design feature by itself has not been effective at eliminating loss of spatial orientation (e.g. near bottom of p.19 based on RMG review, “this shows that limiting the thrust does not necessarily allow to prevent a go-around related occurrence.”). Furthermore, the NPA indicates that an automatic pitch trim system inhibit at stall warning activation provides very limited safety benefit. As such, Gulfstream recommends modifying the proposed AMC 25.143(b)(4) and 25.145(a) guidance to remove the prescribing of certain design features or mitigations and instead focus on raising awareness of somatogravic illusion and the high workload of AEO go-arounds. This should then be followed by test procedures to evaluate the approach/go-around maneuver and associated AFM go-around procedures, as required by 25.101(g) and 25.1587(b)(4), to assure reasonable workload and safety mitigations for high T/W conditions. In addition, Gulfstream considers that improved and targeted pilot training in accordance with the AFM go-around procedures will be more effective at addressing the safety concerns related to somatogravic illusion and high workload in AEO go-around conditions than the prescribed design features.

response

Not accepted.
 Although it is agreed that design changes alone will not fully eliminate the risk of inadequate management of go-arounds, they will bring a safety benefit and contribute to a global strategy to fight against the identified risks, which includes flight crew training improvements. See also our response to comment 1.
 Please note that a reduced go-around thrust/power function is not mandated but may be used as an acceptable means of mitigation. Applicants may propose other solutions.

comment 71 comment by: *The Boeing Company*

THE PROPOSED TEXT STATES:



“... — Upgrade the assessment of the G/A manoeuvre and its procedure. The objective is to evaluate if the G/A with AEO can be managed without creating excessive workload on the crew and without an excessive risk of somatogravic illusion. When an unacceptable level of risk is identified, the applicant has to implement design solutions to decrease this risk to an acceptable level.”

REQUESTED CHANGE: We suggest changes to the text as follows:

“... — Upgrade the assessment of the G/A manoeuvre and its procedure. The objective is **that to evaluate if** the G/A with AEO can be managed without creating excessive **flight path control** workload on the crew and without an excessive risk of somatogravic illusion. When an unacceptable level of risk is identified, the applicant has to implement design solutions to decrease this risk **to an acceptable level.**”

JUSTIFICATION: Assessing the risk of excessive crew workload without any clarification goes beyond the focus on controllability. CS-25 Appendix D lists six broad workload functions. The NPA should be focusing solely on the first of these functions, namely flight path control. Extending the focus to all elements of crew workload potentially overlaps coverage with 25.1523 and brings unrelated factors into scope because workload is such a broad construct.

Reference to assessing the risk of somatogravic illusion and putting measures into place if the risk is too high requires that there be a rigorous, practical, and accepted means of measuring this risk and establishing an acceptable threshold for this risk. EASA is requested to consult further with industry to develop guidance and clarification on how this is expected to be accomplished. The AMC material establishes levels of performance that should be mitigated but not a specific risk of excessive workload or excessive somatogravic illusion.

response

- Proposal to delete ‘evaluate if’: Not accepted. An ‘evaluation’ is expected, therefore the initial wording is found appropriate;
- Proposal to limit the crew workload assessment to ‘flight path control’ and rely on Appendix D for the other aspects: Not accepted. The assessment should consider other elements; a reference has been added to the basic workload functions of Appendix D to CS-25 in Chapter 2.2 of AMC 25.143(b)(4);
- Proposed action to ‘consult industry to develop guidance and clarification on how this is expected to be accomplished’: Not accepted. The AMC provides in Chapter 2.3 some performance parameters thresholds, beyond which the risk is considered to be too high, implying that below these thresholds, the risk should be ‘acceptable’, hence the wording used ‘decrease this risk to an acceptable level’. This has been better stated in Chapter 2.3. In addition to these criteria, according to AMC Chapter 3, flight tests should also be conducted to complete the assessment of the go-around manoeuvre. The elements provided in the AMC are considered to be adequate to mitigate the risk to an adequate level. The AMC also provides in Chapter 2.3 some flexibility to the

applicant to propose a justification for exceeding any of the provided criteria.

2.4. What are the expected benefits and drawbacks of the proposals

p. 5

comment

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comment by: *Textron Aviation*

In Section 2.4 *What are the expected benefits and drawbacks of the proposals*, the NPA states that the non-recurring costs of developing a mitigation means like a RGA system is substantial for manufacturers, but adds that this cost is not significant when included in the development cost of an airplane. Textron Aviation disagrees with this statement. Development costs of such a system, both with monetary and schedule considerations, could be quite high due to impacts on cockpit design, FADEC and avionics system changes, and development of AFM procedures and training requirements. These issues are considerable when recognizing that many product development programs are derivatives within a family of aircraft with similar cockpit design philosophy, training requirements, and software functionality. Section 2.4 also fails to identify drawbacks related to added complexity and pilot workload in an already-critical flight phase (related to additional hardware, pilot actions, monitoring of annunciations and alerts, and additional failure modes of such a system). Additionally, there is concern of unintended consequences associated with the implementation of such a system. It may be noted that some of the incidents described in the NPA might not have had successful recoveries if G/A thrust had been reduced below that which was available and used. It has also been recognized that full TOGA thrust is a benefit in situations such as terrain avoidance and windshear, and must still be selectable by the crew.

response

Partially accepted.

This new rule will essentially apply to new Type Certification projects (i.e. new aeroplane developments), and it might also be applied on a case-by-case basis to significant changes determined through Changed Product Rule (CPR) Part 21.A.101.

We disagree that a reduced go-around thrust/power function would add complexity and pilot workload. On the contrary, such a function provides the benefit of standardising the go-around procedure, and reduces the workload and stress on the pilot during the manoeuvre. To our knowledge, pilots welcome this function on existing aeroplanes where it is available. Some applicants have already developed this function and were successful in smartly integrating it in their existing cockpit without changing the philosophy.

Additional failure modes must indeed be considered under CS 25.1309. Loss of function should not be a concern, as the consequence is a return to a normal full thrust/power go-around manoeuvre. Erroneous functioning is more problematic, and indeed needs to be carefully addressed. Given the actual low probability of having to conduct a go-around, a combination with a failure of the reduced go-around thrust/power function should be easily found to be acceptable. Overall, it is considered that this function brings more benefits than drawbacks.

It is agreed that full TOGA thrust/power must always remain available. This is already identified in the proposed AMC 25.143(b)(4) Chapter 4.4.



3. Proposed amendments

p. 6

comment

65

comment by: *Textron Aviation*

Textron Aviation supports the intent of a requirement to demonstrate safe controllability and maneuverability during all-engine operating go-arounds as proposed in CS 25.143(a)(5).

Textron Aviation believes that a requirement to specifically evaluate somatogravic illusion as proposed in CS 25.143(b)(4) is not necessary. A requirement that the aeroplane be safely controllable and maneuverable during a go-around, as proposed for CS 25.143(a)(5), is sufficient for a rule. Concerns to address the risk of somatogravic illusion are appropriately addressed in associated guidance for CS 25.143(a)(5). However, Textron Aviation believes the methods to evaluate susceptibility to somatogravic illusion proposed as AMC 25.143(b)(4) are not sufficiently developed to identify aeroplanes that require specific somatogravic illusion risk mitigation. The proposed AMC language states that risk of somatogravic illusion is high when combining high pitch attitude, pitch rate, and longitudinal acceleration with a loss of outside visual reference. The proposed mitigation means, consisting of multiple unsubstantiated performance-based limits, then attempts to state that an exceedance of any single one of these limits is high risk. In reality, the relation between somatogravic illusion and aircraft performance is not well defined and there are no industry-accepted thresholds for when such illusion can occur. This assertion is supported by information provided in the NPA that states somatogravic illusion can occur even when a RGA system which meets the proposed performance-related limits has already been employed. Somatogravic illusion and loss of spatial awareness can happen with very little acceleration, and other means should be investigated to combat its effects (training, procedures, displayed information, etc.) As mentioned in comments to Section 2.4 with respect to RGAs, Textron Aviation believes that the system and operational complexity introduced by RGA systems has the potential to introduce a net negative safety benefit. Furthermore, the proposed CS/AMC material could lead to introduction of those systems into classes of airplanes that have not been associated with somatogravic illusion events. It is important to clearly identify the characteristics that necessitate a RGA system to reduce somatogravic illusion susceptibility but those items need much more thorough substantiation.

The list of performance-based mitigation means in the proposed AMC 25.143(b)(4) is also intended to limit the risk of pilot workload, yet there is no consideration of various G/A procedures, airplane configurations, or use and architecture of autopilot/autotrim systems currently in use throughout the industry. The performance-based criteria appear to be a one-size-fits-all approach, based on issues highlighted in the large commercial transport operations. These issues often appear to be exacerbated in the listed accidents/incidents by high pitch-up moments from underwing mounted engines, pitch authority issues related to autopilot/autotrim automation and subsequent failures, and crew saturation and confusion dealing with misunderstood autopilot modes. These issues are not present in all Part 25 aircraft. Textron Aviation favors a more qualitative evaluation of G/A performance and procedures.

response

Partially accepted.

CS 25.143(a)(5) addresses controllability aspects, but not the other risk factors that can contribute to the inadequate management of go-arounds.

In addition to controllability, the goal of CS/AMC 25.143(b)(4) (see Chapters 2.3 and 3) is to



also evaluate the risk of excessive flight crew workloads and somatogravic illusions and decide when mitigation means should be put in place. Some flexibility is available to the applicant, and the mitigation means is not necessarily, or not only, the implementation of a reduced go-around thrust/power function. Clarifications have been made in this regard. Although it is agreed that some aeroplane architectures may be more at risk, no aeroplane is immune and, given the history of accidents and serious incidents, an evaluation of all aeroplanes is deemed necessary.

comment

66

comment by: *Textron Aviation*

It is unclear if the proposed regulations adequately consider the differences between conventional aircraft and FBW designs with full time auto-trim functions. For conventional aircraft using automatic stabilizer or elevator trim only as part of a flight guidance system (FGS), proper function of those systems is already addressed via 25.1329. Adding rules and guidance related to FGS to Subpart B is confusing and potentially redundant. The NPA references experimental analysis based on simulation of somatogravic illusion during G/A scenarios with autopilot engaged. For some Part 25 aircraft, all landing and G/A procedures include disengaging the AP. It might be suggested that manually flying the G/A (with manual control of both pitch trim and elevator) to a fixed and directed pitch attitude might be less likely to result in somatogravic illusion compared to an aircraft where the autopilot and autotrim systems are expected to perform at least some of these functions. Confusion over the state of the autopilot modes, and therefore the position and control of pitch systems, is much less likely to occur when the pilot has full control.

response

Noted.

The Rulemaking Group had extensive discussions on where to best place the provisions on controllability, and found it more appropriate to place them in Subpart B. Concerning your statement on potential confusion created by automation, it may be true in some situations; however, the support of automation also brings safety benefits and it is not the aim of this NPA to ban some forms of automation, like automatic pitch trim functions. The aim is to ensure that these functions do not bring the aeroplane into a configuration where the pilot does not have enough authority to control the aeroplane, and this then leads to an increased risk of an upset or a loss of control situation.

3. Proposed amendments - CS 25.143

p. 6

comment

55

comment by: *Gulfstream Aerospace Corporation*

The proposal to amend CS-25 to add the approach and go-around maneuver to 25.143(a) and 25.143(b)(4) is reasonable to show safe characteristics, pilot workload and adequate pitch controllability during a go-around with simultaneous rapid thrust advance.

response

Noted.

comment

67

comment by: *GAMA*

Comments submitted on behalf of Gulfstream:

1) The proposal to amend CS-25 to add the approach and go-around maneuver to 25.143(a) and 25.143(b)(4) is reasonable to show safe characteristics, pilot workload and adequate



- pitch controllability during a go-around with simultaneous rapid thrust advance.
- 2) Much of the BEA study referenced in the NPA focuses on low, wing-mounted engine designs and the included historical data indicate the noted safety concerns are primarily associated with this configuration. Although Gulfstream is not opposed to safe demonstration of all-engine go-arounds at critical high thrust conditions, the proposed criteria and mitigation design features to constrain go-around performance as described in the proposed AMC 25.143(b)(4) Chapter 2.3 should only be applied to configurations prone to generating large nose-up pitching moment with go-around power application.
- 3) The limitation on nose-up automatic pitch trim application at stall warning may be good design practice, but shouldn't be prescribed by an AMC. This guidance, supported by the BEA study, seems to reflect a concern with a particular implementation of automatic pitch trim. It should be understood by EASA that some EFCS airplanes with automatic stabilizer trim retain conventional speed stability and do not seek to "fair" the elevator during airspeed deviations away from the trim speed. Rather than prescribe a system design feature be implemented for airplanes with automatic pitch trim, the accepted MOC should be to demonstrate adequate nose-down pitch recovery from a high thrust and high AOA condition, taking account of the position the stabilizer will attain under normal operation. This is already required by CS 25.145(a) and its associated guidance (with proposed changes in this NPA), where flight test demonstrates that prompt recovery to a normal trim condition can be achieved from a high thrust condition at the stall warning or at the High AOA Limiting Function AOA limit, if so equipped.
- 4) The criteria established in proposed AMC 25.143(b)(4) Chapter 2.3 are seemingly inconsistent. An equivalent N_x (longitudinal load factor) for a 20 deg pitch attitude at constant speed is approximately 0.34g, while the 2 kt/sec acceleration is approximately 0.1g. If each of the criteria of Chapter 2.3 is to be independently assessed, it is unclear whether the 2 kt/sec acceleration it is to be applied as a level flight acceleration. If so, it seems overly restrictive as this is not an excessive level acceleration at low airspeed. If the 2 kt/sec acceleration is to be considered excessive only while at the 20 deg pitch condition or where 22% climb gradient is achieved, as inferred in Chapter 2.1, this is not clearly explained in Chapter 2.3.
- 5) The AMC 25.143(b)(4) Chapter 4.6 title and included guidance indicate that it is necessary to provide approach and landing climb AFM performance for reduced go-around thrust. This would be a significant increase in complexity to AFM content and FMS functionality, and seems inconsistent with Chapters 4.4 and 4.5. Those sections indicate that it is necessary to assure full thrust is available for critical performance conditions (automatically or by crew action to select full go-around thrust). As such, the AFM approach and landing climb performance should only reflect the full go-around thrust otherwise available in accordance with 25.119 and 25.121(d).
- 6) Regarding the proposed AMC 25.145(f), paragraph 1 indicates that adequate pitch control includes "no overshoot of the level off altitude". Some test/system performance tolerance should be permitted consistent with normal piloting skill and auto-flight performance tolerances.
- 7) Regarding the proposed change to CS25 Appendix Q (SAL) 25.5(e), "the all-enginesoperating approach climb configuration" is not defined. "Approach climb" is normally associated with CS 25.121(d) and the associated minimum climb gradients with one engine inoperative. It is recommended that this be changed to reflect the flap deflection associated with the normal go-around procedure, or to "an all-engine operating climb in the approach climb configuration".
- 8) The NPA cites several instances where accidents/incidents have occurred in airplanes that include Reduced Go-Around (RGA) system capabilities. So, this design feature by itself



has not been effective at eliminating loss of spatial orientation (e.g. near bottom of p.19 based on RMG review, "this shows that limiting the thrust does not necessarily allow to prevent a go-around related occurrence."). Furthermore, the NPA indicates that an automatic pitch trim system inhibit at stall warning activation provides very limited safety benefit. As such, Gulfstream recommends modifying the proposed AMC 25.143(b)(4) and 25.145(a) guidance to remove the prescribing of certain design features or mitigations and instead focus on raising awareness of somatogravic illusion and the high workload of AEO go-arounds. This should then be followed by test procedures to evaluate the approach/go-around maneuver and associated AFM go-around procedures, as required by 25.101(g) and 25.1587(b)(4), to assure reasonable workload and safety mitigations for high T/W conditions. In addition, Gulfstream considers that improved and targeted pilot training in accordance with the AFM go-around procedures will be more effective at addressing the safety concerns related to somatogravic illusion and high workload in AEO go-around conditions than the prescribed design features.

response

Item 1: Noted.

Item 2: Not accepted. Although it is agreed that some aeroplane architectures may be more at risk, no aeroplane is immune and, given the history of accidents and serious incidents, an evaluation of all aeroplanes is deemed necessary.

Item 3: Noted. The AMC does not prescribe an automatic pitch trim design, but for some of the designs, it recommends that excessive pitch trim should not be commanded.

Item 4: Accepted. The introductory sentence of paragraph 2.3 has been completely updated, along with the criteria provided for the evaluation of a go-around. The change should address this comment because the new criteria do not mention a longitudinal acceleration limit, but rather an energy level with a corresponding level flight longitudinal acceleration capability.

Item 5: Partially accepted. Chapter 4.6 has been updated to provide clarifications on what is expected in the AFM, in agreement with the existing CS 25.119 and CS 25.121(d) rules, and while taking into account that when an RGA function is implemented, it has to be part of the standard go-around procedure. For the OEI case, the new text is flexible. It considers both the cases where there is thrust or power recovery action and those where there is none, and the recovered thrust or power may be the full value or other acceptable values that allow an adequate performance level to be reached.

Item 6: Accepted. The word 'excessive' has been added to the sentence to leave some flexibility in the evaluation and accept some limited level of altitude overshoot.

Item 7: Accepted. The wording has been updated to read 'go-around as per standard procedure'.

Item 8: Not accepted. Although it is agreed that design changes alone will not fully eliminate the risk of inadequate management of go-arounds, they will bring a safety benefit and contribute to a global strategy to fight against the identified risks, which includes flight crew training improvements. See also our response to comment 1.

Please note that a reduced go-around thrust/power function is not mandated but may be used as an acceptable means of mitigation. Applicants may propose other solutions.



comment	72 comment by: <i>The Boeing Company</i>
	<p><u>THE PROPOSED TEXT STATES:</u></p> <p><i>“CS 25.143 General</i> ... <i>(b)...</i> <i>(4) Go-around manoeuvres with all engines operating. The assessment must include, in addition to controllability and maneuverability aspects, the flight crew workload and the risk of somatogravic illusion (See AMC 25.143(b)(4)).”</i></p> <p><u>REQUESTED CHANGE:</u> We suggest changes to the text as follows:</p> <p><i>“CS 25.143 General</i> ... <i>(b)...</i> <i>(4) Go-around manoeuvres with all engines operating. The assessment must include, in addition to controllability and maneuverability aspects, the flight crew workload and the risk of somatogravic illusion (See AMC 25.143(b)(4)).”</i></p> <p><u>JUSTIFICATION:</u> Reference to assessing the risk of excessive crew workload goes beyond the focus on controllability. The NPA should be focusing on controllability with the presumption that manageable crew workload will result from manageable controllability. Extending the focus to workload potentially brings unrelated factors into scope because workload is such a broad construct.</p> <p>Reference to assessing the risk of somatogravic illusion and putting measures into place if the risk is too high requires that there be a rigorous, practical, and accepted means of measuring this risk and establishing an acceptable threshold for this risk. EASA is requested to consult further with industry to develop guidance and clarification on how this is expected to be accomplished.</p>
response	<p>Partially accepted.</p> <p>CS 25.143(b) already requires ‘without exceptional piloting skill, alertness, or strength’ which implies that the assessment is not limited to controllability considerations only.</p> <p>We do not agree to delete the text as proposed, because it would remove the key elements that must be present when assessing a go-around manoeuvre.</p> <p>It is agreed that there is no ‘rigorous, practical, and accepted means of measuring this risk’, however the AMC provides some clear criteria to be used for mitigating the risk.</p>

3. Proposed amendments - AMC 25.143(b)(4)

p. 6-9

comment	4 comment by: <i>Dassault-Aviation</i>
	<p>Page 6</p> <p>1. Background:</p> <p>"Other accidents resulting in loss of control were due to excessive pitch attitudes combined</p>



	with a lack of crew awareness"	
	<p>DA comment: Considering human factors, the awareness of a situation is characterized by the <u>perception</u> of that situation and how this perception is analyzed and <u>understood</u> by the pilot. So, it is not correct to speak about a "lack of awareness", because anyway, something is detected and analyzed... but maybe not well.</p> <p>Proposition: We suggest changing the sentence as following: "Other accidents resulting in loss of control were due to excessive pitch attitudes combined with a not adapted crew awareness"</p>	
response	Partially accepted. The sentence is amended to read 'combined with inadequate flight crew awareness of the situation'.	
comment	5	comment by: <i>Dassault-Aviation</i>
	<p>Page 8 3. Go-around scenarios to be evaluated ...</p> <ul style="list-style-type: none"> • the risk of somatogravic illusion <p>...</p> <p>Da comment: How this risk can be evaluated ? We suggest that a GM should develop this point namely because:</p> <ul style="list-style-type: none"> • there is a great dispersion of individual reaction in a situation of potential spatial disorientation (SD); • SD depends on what the eyes are fixing before and during the evolution; • SD depends on head movement before and during the evolution; <p>So it is important to give an idea of acceleration thresholds beyond which SD could appear.</p>	
response	Partially accepted. It is true that there is some variability in the sensitivity of pilots to spatial disorientation. Paragraph 2.3 of the AMC provides performance parameter thresholds beyond which it is considered that the risk is high enough for a normal pilot so that a mitigation means should be considered to ensure that these parameters remain below the indicated thresholds.	
comment	6	comment by: <i>Dassault-Aviation</i>
	<p>Page 7 2.3 Mitigation means " Accordingly, the applicant should propose a specific mitigation means in case any of the following conditions can be encountered during a go-around manoeuvre:</p>	

- pitch rate value above 4 degrees per second;
- pitch-up attitude above 20 degrees;
- longitudinal acceleration above 3.7 km/h (2 kt) epr second;
- vertical speed above 3000 ft/min; and
- climb gradient above 22 %.

Note: Exceptions may be made for emergency scenarios"

DA comment:

Could the RMT group substantiate all those conditions, for having an idea where do the figures come from and what is the associated level of risk to develop a somatogravic illusion ?

response

Accepted.

The RMT.0647 Rulemaking Group estimated these parameter thresholds, taking into account:

- the studies performed on somatogravic illusions and the identified key parameters that play a role,
- the opinions of the flight test pilots and commercial pilots involved, who made recommendations based on their assessment of operational needs and workload,
- the performance required during missed approach procedures.

comment

11

comment by: AIRBUS

COMMENT :

Page 7/82. Section 3.1. AMC 25.143 (b) (4).

Paragraph 1. Background

Add at the end of 2nd paragraph : “... with reduced visibility conditions and lack of parameter monitoring through instruments.”

RATIONALE :

This is to be consistent with the commonly shared understanding of spatial disorientation.

response

Accepted.

The sentence is amended to read ‘with reduced visibility conditions and lack of monitoring of primary flight parameters, such as pitch attitude’.

comment

12

comment by: AIRBUS

COMMENT :

Page 7/82. Section 3.1. AMC 25.143 (b) (4).

Paragraph 1. Background

Add at the end of Paragraph 1 (Background) :

“... on other types of aeroplane. The risk also increases in case of a large operational range of Thrust over Weight ratio (i.e Long Range and Freighter aircraft may be more exposed to this risk)”.



	<p>RATIONALE : Self-explanatory</p>
response	<p>Partially accepted. The text has been updated based on this proposal, although with different wording.</p>
comment	<p>13 comment by: AIRBUS</p> <p>Page 7/82. Section 3.1. AMC 25.143 (b) (4). Paragraph 2.3. Mitigation means.</p> <p>COMMENT: It is proposed to replace “conditions” by “orders of magnitude” in the first sentence as follows : “Accordingly, the applicant should propose a specific mitigation means in case any of the following <u>orders of magnitude</u> can be encountered ...”</p> <p>RATIONALE : This proposal is to make sure that applicants, by making their assessment based on various operational cases, do not consider any hard limit which would be meaningless regarding the risk to be addressed.</p> <p>COMMENT : It is proposed to insert the following words in the first sentence : “... can be encountered during <u>the initiation and climb phases of a standard go-around manoeuvre</u>”.</p> <p>RATIONALE : This modification is proposed to exclude the final phase (level-off acceleration at the targeted thrust reduction altitude), for which those parameters will be either much lower than these values (pitch rate, pitch, climb rate, vertical speed) or may exceed it (acceleration).</p>
response	<p>Partially accepted. The sentence commented has been completely updated, along with the criteria provided for the evaluation of a go-around. The change should address this comment because the new criteria do not mention a longitudinal acceleration limit, but rather an energy level with a corresponding level flight acceleration capability.</p>
comment	<p>14 comment by: Bombardier</p> <p>AMC 25.143(b)(4), paragraph 2.3 - Mitigation means:</p> <p>NPA Text 2.3 Mitigation means Accordingly, the applicant should propose a specific mitigation means in case any of the following conditions can be encountered during a go-around manoeuvre: — pitch rate value above 4 degrees per second;</p>

	<p>...</p> <p>Bombardier Recommendation: We recommend the pitch rate point be changed as follows: - pitch rate value above 4 degrees <u>5 degrees</u> per second;</p> <p>Justification The NPA proposes specific mitigation means where the pitch rate value is above 4 degrees per second. Bombardier recommends that this pitch rate threshold be increased to 5 degrees per second. In our experience, a pitch rate of 4 degrees per second is often encountered during take-off manoeuvres, is not considered excessive, and therefore does not need to be mitigated.</p>
response	<p>Not accepted.</p> <p>It is considered that a limit pitch rate value of 4 degrees per second is a reasonable operational limit. It corresponds to approximately a 1.5 g vertical acceleration. Nevertheless, paragraph 2.3 of AMC 25.143(b)(4) has been updated to add a flexibility provision for applicants: as an alternative, exceeding any one of the provided criteria should be duly justified by the applicant and accepted by EASA.</p>
comment	<p>15 comment by: <i>Bombardier</i></p> <p>AMC 25.143(b)(4), paragraph 2.3 - Mitigation means:</p> <p>NPA Text 2.3 Mitigation means Accordingly, the applicant should propose a specific mitigation means in case any of the following conditions can be encountered during a go-around manoeuvre: — pitch rate value above 4 degrees per second; — pitch-up attitude above 20 degrees; ...</p> <p>Bombardier Recommendation: For clarity, we recommend restating this condition as "pitch attitude above 20 degrees nose-up".</p>
response	<p>Accepted.</p>
comment	<p>16 comment by: <i>Bombardier</i></p> <p>AMC 25.143(b)(4), paragraph 3: Go-around scenarios to be evaluated</p> <p>NPA text: It is recommended to perform in flight a go-around manoeuvre with all-engines-operating (AEO) as per the standard procedure...</p> <p>Bombardier Recommendation: It is recommended to perform in flight a go-around manoeuvre with all-engines-operating (AEO) <u>and for each approved landing configuration</u> as per the standard procedure...</p>

response	<p>Justification: This addition is recommended to ensure that aircraft performance is evaluated for all approved landing configurations.</p> <p>Accepted.</p>
comment	<p>17 comment by: <i>Bombardier</i></p> <p>AMC 25.143(b)(4) paragraph 4 - Implementation of a reduced go-around (RGA) thrust or power function:</p> <p>NPA text: A RGA thrust or power function may be provided such that, when a go-around is initiated with any practicable combination of Flight Guidance/Autothrust-throttle/Autopilot modes, including manual, the engine thrust or power applied is limited to maintain the performance of the aeroplane (in particular its rate of climb) at a level which is compatible with the flight crew workload during this phase, and in order to reduce the risk of somatogravic illusion for the flight crew. This thrust or power reduction function may be available either through aircraft systems automatism or manually. In any case, an acceptable procedure should be available in the Aeroplane Flight Manual (AFM).</p> <p>Bombardier recommendation Bombardier recommends clarifying whether it is acceptable to have different GA procedures when some aspect (e.g. auto-throttle) is not working.</p>
response	<p>Accepted.</p> <p>The text of the AMC mentions in Chapter 4 that if an RGA function is selected by the applicant, then it should also be available when automation is not available or used ('including manual modes'). The AFM procedure may indeed take into account the availability of the automation. The last sentence has been amended to reflect that several procedures may be provided in the AFM.</p>
comment	<p>18 comment by: <i>Bombardier</i></p> <p>AMC 25.143(b)(4) sub-paragraph 4.6: Performance published in the AFM for RGA thrust or power</p> <p>NPA Text: It is reminded that approach climb (one-engine-inoperative) performance and landing climb (all-engines- operating) performance tables published in the AFM shall take into account the actual behaviour of thrust or power management in go-around.</p> <p>Bombardier Recommends adding the following text to this paragraph: The climb performance required by CS 25.119 and CS 25.121 must be based on the thrust available at go-around, as specified by the normal go-around procedure. If RGA thrust is required in the normal go-around procedure (all engines or with engine failure) then the climb performance shall be based on this RGA thrust level. For systems that includes an automatic thrust increase to the full go-around thrust or a manual thrust increase triggered by an aural warning in case of engine failure, the approach climb may be based on</p>

the full go-around thrust levels.

Justification:

Approach climb gradients, landing climb gradients and associated landing WAT limitations in the AFM are based on the actual thrust level used in the go-around manoeuvre.

There is a defined thrust level for the OEI and for the AEO cases (for OEI, automatic thrust augmentation or ``APR``(Automatic Power Reserve) has been used on some programs).

The introduction of RGA for go-around means that the performance data in the AFM needs to be based on thrust associated with the go-around procedures, including RGA thrust since use of RGA is part of normal operations.

The text in 4.6 gives the impression that the applicant can provide in the AFM, at their choice, both RGA and "full go-around" thrust performance.

This would mean two different sets of performance charts in the AFM and can lead to confusion for the pilot since for normal procedures, they will use the RGA thrust and NOT the "full go-around" thrust. In fact, the "full go-around" thrust would be applied after an undetermined delay since the windshear or TCAS alerts must first be posted and recognized by the pilot i.e. the aircraft will have achieved the reduced performance levels for several seconds in the go-around.

response

Accepted.

Chapter 4.6 has been updated to provide clarifications on what is expected in the AFM, in agreement with the existing CS 25.119 and CS 25.121(d) rules, and while taking into account that when an RGA function is implemented, it has to be part of the standard go-around procedure. For the OEI case, the new text is flexible and considers both the cases where there is thrust or power recovery action and those where there is none, and the recovered thrust or power may be the full value or other acceptable values that allow an adequate performance level to be reached.

comment

28

comment by: AIRBUS

COMMENT :

Page 7/82. Section 3.1. AMC 25.143 (b) (4).

Paragraph 3. Go-around scenarios to be evaluated

It is proposed to modify the third line of this paragraph as follows:

“... with the most unfavourable and practicable combination of flaps configuration, centre of gravity position and ...”

RATIONALE :

This is to make sure that the most critical cases relative to flaps position are covered.

response

Partially accepted.

The sentence has been modified based on another comment (16) so that it now reads “It is recommended to perform in flight a go-around manoeuvre with all engines operating (AEO) and for each approved landing configuration as per the standard procedure:”.

Flaps/slats configuration should be addressed.



comment	<p>29</p> <p>COMMENT : Page 8/82. Section 3.1. AMC 25.143 (b) (4). Paragraph 3. Go-around scenarios to be evaluated</p> <p>It is proposed modify the fifth line of this paragraph as follows: “... with any practicable combination of Flight Guidance/Autothrust-throttle/Autopilot to be approved <u>for operations</u>, including manual <u>modes</u>”</p> <p>RATIONALE : This change is proposed to make sure that all ways to operate the airplane will be covered by the go-around demonstration.</p>	comment by: AIRBUS
response	Accepted.	
comment	<p>30</p> <p>COMMENT : Page 8/82. Section 3.1. AMC 25.143 (b) (4). Paragraph 3. Go-around scenarios to be evaluated</p> <p>It is proposed to delete the line “the risk of somatogravic illusion” at the end of this paragraph 3.</p> <p>RATIONALE : We believe that the proposed evaluation scenarios will not allow to assess the risk of somatogravic illusion, in the absence of measurable physiological criteria. For the time being, we do not see any reliable means to detect a risk of somatogravic illusion. Nevertheless, we know that academic research studies are on-going, which might be used in the future for certification by industry.</p>	comment by: AIRBUS
response	<p>Partially accepted.</p> <p>Although the scientific understanding of somatogravic illusions may improve in the future and be used for certification projects, this key point should appear right now in the assessment of go-around manoeuvres in flight tests. Flight test crews should be able to make a judgment on the level of risk of a particular aeroplane. Please note that the line commented has been deleted, but not as a result of this comment.</p>	
comment	<p>31</p> <p>COMMENT : Page 9/82. Section 3.1. AMC 25.143 (b) (4). Paragraph 4.6 Performance published in the AFM for RGA thrust or power.</p> <p>It is proposed to modify the sentence as follows : “...performance tables published in the AFM shall take into account the <u>fully representative</u> behaviour of thrust or power management in go-around.</p>	comment by: AIRBUS

	<p>RATIONALE :</p> <p>This is for clarification only. The intent here is to make sure that AFM values correspond to the power delivered by the RGA function, if this design feature has been selected by the applicant.</p>
response	<p>Partially accepted.</p> <p>The term ‘actual’ used in the initial proposal appears to meet the intent of this comment, the proposed change is not considered to bring a better meaning. Nevertheless, please note that this Chapter has been fully amended and that the new text should also meet the intent of this comment.</p>
comment	<p>48 comment by: Embraer S.A.</p> <p>Embraer understands that an AEO go-around AFM procedure can be considered an adequate mitigation means to address the somatogravic illusion in manual flight.</p> <p>Embraer suggests to include this guidance in the item 4 of the new AMC 25.143(b)(4).</p>
response	<p>Not accepted.</p> <p>The AMC already clearly states that an RGA function is only an acceptable means of mitigation (see 2.3). There is no need to repeat that in the guidance provided in Chapter 4 for the development of this function.</p>
comment	<p>49 comment by: Embraer S.A.</p> <p>Section 2.3 criteria in the AMC 25.143(b)(4) seems too stringent if understood as any individual parameter.</p> <p>Embraer recommends rephrasing section 2.3:</p> <p><i>“...Accordingly, the applicant should propose a specific mitigation means in case a combination any of the following conditions can be encountered during a go-around manoeuvre: “</i></p>
response	<p>Not accepted.</p> <p>The proposal in this comment departs from the initial intent, which considers that exceeding any one of the listed thresholds is already a signal that the risk is high, and that a mitigation means should be considered.</p>
comment	<p>51 comment by: Embraer S.A.</p> <p>Use of ATTCS for go around can facilitate the mitigation of somatogravic illusion by allowing a reduction of AEO go around thrust while maintaining the automatic capability of recovering full rated thrust in the subsequent event of an engine failure. The existing special conditions for use of ATTCS in go around typically limit the OEI thrust increase to 11 percent of the all-engine limited thrust, which limits amount of thrust reduction permitted and will limit the level of mitigation for somatogravic illusion in high thrust-to-weight conditions. EASA should include a revision to the policy for ATTCS for Go Around special conditions to be compatible with the thrust reduction necessary to address the safety issue being addressed by this NPA. To maintain harmonization, this change should be coordinated</p>

	with the other affected airworthiness authorities prior to publication of the decision from this NPA.
response	<p>Noted.</p> <p>Although this situation has not yet been encountered on certification projects to date, EASA, together with other Authorities, will investigate any interactions between these special conditions and the implementation of a reduced go-around function in order to ensure that the benefit of the RGA is maintained. Please note that there is no rule that mandates the requirements of Appendix I to CS-25 (ATTCS) for go-arounds.</p>
comment	<p>53 comment by: FAA</p> <p>Section 4.5, page 8-9</p> <p>This text should be re-worded:</p> <p>“When an engine failure occurs during a go-around performed with active RGA thrust or power and if the required thrust or power from the remaining engine(s), to achieve adequate performance level cannot be applied automatically, a warning alert to the flight crew is required to trigger the thrust or power recovery action.”</p> <p>As written, this is incompatible with current ATTCS requirements, which mandate that credit cannot be taken for pilot action during this critical phase of flight. In theory, the warning alert would never be needed, since RGA thrust should not be used in circumstances where minimum regulatory climb gradients are a concern.</p> <p>Suggested text:</p> <p>“When an engine failure occurs during a go-around performed with active RGA thrust or power, the required thrust or power from the remaining engine(s), to achieve adequate performance level, must be applied automatically.”</p>
response	<p>Not accepted.</p> <p>EASA certified some RGA functions with special conditions which accepted the use of an alert combined with an operational procedure requiring a pilot action to apply full thrust. The paragraph 4.5 of AMC 25.143(b)(4) is consistent with these special conditions.</p>
comment	<p>56 comment by: Gulfstream Aerospace Corporation</p> <p>1) Much of the BEA study referenced in the NPA focuses on low, wing-mounted engine designs and the included historical data indicate the noted safety concerns are primarily associated with this configuration. Although Gulfstream is not opposed to safe demonstration of all-engine go-arounds at critical high thrust conditions, the proposed criteria and mitigation design features to constrain go-around performance as described in the proposed AMC 25.143(b)(4) Chapter 2.3 should only be applied to configurations prone to generating large nose-up pitching moment with go-around power application.</p>
response	<p>Not accepted. Although it is agreed that some aeroplane architectures may be more at risk, no aeroplane is immune and, given the history of accidents and serious incidents, an evaluation of all aeroplanes is deemed necessary.</p>

comment	<p data-bbox="359 235 391 280">58</p> <p data-bbox="877 235 1484 280" style="text-align: right;">comment by: <i>Gulfstream Aerospace Corporation</i></p> <p data-bbox="359 291 1484 616">The criteria established in proposed AMC 25.143(b)(4) Chapter 2.3 are seemingly inconsistent. An equivalent N_x (longitudinal load factor) for a 20 deg pitch attitude at constant speed is approximately 0.34g, while the 2 kt/sec acceleration is approximately 0.1g. If each of the criteria of Chapter 2.3 is to be independently assessed, it is unclear whether the 2 kt/sec acceleration it is to be applied as a level flight acceleration. If so, it seems overly restrictive as this is not an excessive level acceleration at low airspeed. If the 2 kt/sec acceleration is to be considered excessive only while at the 20 deg pitch condition or where 22% climb gradient is achieved, as inferred in Chapter 2.1, this is not clearly explained in Chapter 2.3.</p>
response	<p data-bbox="359 638 478 672">Accepted.</p> <p data-bbox="359 683 1484 817">The introductory sentence of paragraph 2.3 has been completely updated, along with the criteria provided for the evaluation of a go-around. The change should address this comment because the new criteria do not mention a longitudinal acceleration limit, but rather an energy level with a corresponding level flight longitudinal acceleration capability.</p>
comment	<p data-bbox="359 873 391 918">59</p> <p data-bbox="877 873 1484 918" style="text-align: right;">comment by: <i>Gulfstream Aerospace Corporation</i></p> <p data-bbox="359 929 1484 1220">The AMC 25.143(b)(4) Chapter 4.6 title and included guidance indicate that it is necessary to provide approach and landing climb AFM performance for reduced go-around thrust. This would be a significant increase in complexity to AFM content and FMS functionality, and seems inconsistent with Chapters 4.4 and 4.5. Those sections indicate that it is necessary to assure full thrust is available for critical performance conditions (automatically or by crew action to select full go-around thrust). As such, the AFM approach and landing climb performance should only reflect the full go-around thrust otherwise available in accordance with 25.119 and 25.121(d).</p>
response	<p data-bbox="359 1243 582 1276">Partially accepted.</p> <p data-bbox="359 1288 1484 1534">Chapter 4.6 has been updated to provide clarifications on what is expected in the AFM, in agreement with existing rules CS 25.119 and CS 25.121(d), and while taking into account that when an RGA function is implemented, it has to be part of the standard go-around procedure. For the OEI case, the new text is flexible and considers both the cases where there is thrust or power recovery action and those where there is none, and the recovered thrust or power may be the full value or other acceptable values that allow an adequate performance level to be reached.</p>
comment	<p data-bbox="359 1590 391 1635">69</p> <p data-bbox="1212 1590 1484 1635" style="text-align: right;">comment by: <i>GAMA</i></p> <p data-bbox="359 1646 1484 1937">Comments submitted on behalf of Gulfstream: 2) Much of the BEA study referenced in the NPA focuses on low, wing-mounted engine designs and the included historical data indicate the noted safety concerns are primarily associated with this configuration. Although Gulfstream is not opposed to safe demonstration of all-engine go-arounds at critical high thrust conditions, the proposed criteria and mitigation design features to constrain go-around performance as described in the proposed AMC 25.143(b)(4) Chapter 2.3 should only be applied to configurations prone to generating large nose-up pitching moment with go-around power application.</p>
response	<p data-bbox="359 1960 526 1993">Not accepted.</p> <p data-bbox="359 2004 1484 2027">Although it is agreed that some aeroplane architectures may be more at risk, no aeroplane is</p>

immune and, given the history of accidents and serious incidents, an evaluation of all aeroplanes is deemed necessary.

comment

74

comment by: *The Boeing Company***THE PROPOSED TEXT STATES:**

“... high values of pitch-up angle ...”

REQUESTED CHANGE: We suggest changes to the text in Section 2.1 and Section 2.3 as follows:

“... high values of **pitch** ~~pitch-up~~ angle ...”

JUSTIFICATION: Editorial to change “pitch-up angle” to “pitch angle”

response

Partially accepted.

Considering also comment #15 the text is amended as follows:
‘high values of **pitch attitude (nose-up)**’.

comment

75

comment by: *GAMA*

Comment submitted on behalf of Gulfstream:

4) The criteria established in proposed AMC 25.143(b)(4) Chapter 2.3 are seemingly inconsistent. An equivalent Nx (longitudinal load factor) for a 20 deg pitch attitude at constant speed is approximately 0.34g, while the 2 kt/sec acceleration is approximately 0.1g. If each of the criteria of Chapter 2.3 is to be independently assessed, it is unclear whether the 2 kt/sec acceleration it is to be applied as a level flight acceleration. If so, it seems overly restrictive as this is not an excessive level acceleration at low airspeed. If the 2 kt/sec acceleration is to be considered excessive only while at the 20 deg pitch condition or where 22% climb gradient is achieved, as inferred in Chapter 2.1, this is not clearly explained in Chapter 2.3.

response

Accepted.

The introduction sentence of paragraph 2.3 has been completely updated along with the criteria provided for the evaluation of the go-around. The change should address this comment because the new criteria do not mention a longitudinal acceleration limit but an energy level with a corresponding level flight longitudinal acceleration capability.

comment

76

comment by: *GAMA*

Comment submitted on behalf of Gulfstream:

5) The AMC 25.143(b)(4) Chapter 4.6 title and included guidance indicate that it is necessary to provide approach and landing climb AFM performance for reduced go-around thrust. This would be a significant increase in complexity to AFM content and FMS functionality, and seems inconsistent with Chapters 4.4 and 4.5. Those sections indicate that it is necessary to assure full thrust is available for critical performance conditions (automatically or by crew action to select full go-around thrust). As such, the



	AFM approach and landing climb performance should only reflect the full go-around thrust otherwise available in accordance with 25.119 and 25.121(d).
response	<p>Partially accepted.</p> <p>Chapter 4.6 has been updated to provide clarifications on what is expected in the AFM, in agreement with existing rules CS 25.119 and CS 25.121(d), and while taking into account that when an RGA function is implemented, it has to be part of the standard go-around procedure. For the OEI case, the new text is flexible and considers both the cases where there is thrust or power recovery action and those where there is none, and the recovered thrust or power may be the full value or other acceptable values that allow an adequate performance level to be reached.</p>
comment	<p>77 comment by: <i>The Boeing Company</i></p> <p><u>THE PROPOSED TEXT STATES:</u></p> <p>“... in order to assess the following:</p> <ul style="list-style-type: none"> · Pitch controllability (see also CS25.145(f) and related AMC); · Speed control capability; · Flight crew workload (task management in a changing environment); and · The risk of somagravatic illusion” <p><u>REQUESTED CHANGE:</u> We suggest removing the indent to start a new statement and making the following text changes:</p> <p>“... <i>In</i>in order to assess/<i>consider</i> the following:</p> <ul style="list-style-type: none"> · Pitch controllability (see also CS25.145(f) and related AMC); · Speed control capability; · Flight crew workload (task management in a changing environment);and · <i>The risk of somagravatic illusion</i>” <p><u>JUSTIFICATION:</u> Remove the indent as these assessments apply to the whole of section 3, and are not just a subset of the bullet on level-off altitude.</p> <p>Reference to assessing the risk of excessive crew workload goes beyond the focus on controllability. The NPA should be focusing on controllability with the presumption that manageable crew workload will result from manageable controllability. Extending the focus to workload potentially brings unrelated factors into scope because workload is such a broad construct.</p> <p>Reference to assessing the risk of somatogravic illusion and putting measures into place if the risk is too high requires that there be a rigorous, practical, and accepted means of measuring this risk and establishing an acceptable threshold for this risk. EASA is requested to consult further with industry to develop guidance and clarification on how this is expected to be accomplished.</p>

response Noted.
Paragraph 3 has been updated and the 4 last bullets have been deleted. Therefore the proposed deletion does not apply any more.

comment 80

comment by: *The Boeing Company*

The proposed text states:

“4.2 Cockpit indications

The following information should be indicated to the flight crew:

— the active thrust or power mode (RGA or full thrust or power); and

— in RGA mode, the level of thrust or power targeted by the system.

Thrust level tables should be provided in the AFM for manual go-around.”

REQUESTED CHANGE: We suggest making the following text changes:

“4.2 Cockpit indications

The following information should be indicated to the flight crew:

— the active thrust or power mode (RGA or full thrust or power); and

— in RGA mode, the level of thrust or power targeted by the system.

Thrust level tables should be provided in the AFM for manual go-around.”

Information that thrust or power is reduced in the RGA mode should be indicated to the flight crew.”

JUSTIFICATION: The NPA guidance language is too prescriptive of a design. There simply needs to be sufficient information for the flight crew to know that the thrust or power is reduced. The intent of our suggestion is to be a performance based requirement.

response Accepted.

3. Proposed amendments - CS 25.145

p. 9-10

comment 19

comment by: *Bombardier*

CS 25.145 Longitudinal control, sub-requirement (a)(4):

NPA Text

It must be possible at any point between the trim speed prescribed in CS 25.103(b)(6) and stall identification (as defined in CS 25.201(d)), to pitch the nose downward so that the acceleration to this selected trim speed is prompt with –

...

(4) Engines thrust or power (i) off and (ii) at go-around setting.

Bombardier Recommendation

As mentioned in our general comments, it is not clear which go-around setting is required:



	<p>reduced go-around (RGA), or full go-around (GA).</p> <p>Bombardier recommends this paragraph be clarified by emphasizing that full go-around power be used: (4) Engines thrust or power (i) off and (ii) at full go-around setting.</p>	
response	<p>Not accepted.</p> <p>By default, in CS-25, go-around thrust/power means full go-around thrust/power. When a reduced go-around thrust or power function is installed, the applicant should use the most critical thrust or power within the range of available go-around thrust or power when showing compliance with the CS-25 specifications. A note has been added in AMC 25.143(b)(4) paragraph 4.</p>	
comment	<p>21</p> <p style="text-align: right;">comment by: <i>Bombardier</i></p> <p>CS 25.145 Longitudinal control, subrequirement (f)(1):</p> <p>NPA Text</p> <p>(f) It must be possible to maintain adequate longitudinal and speed control under the following conditions without exceptional piloting skill, alertness, or strength, and without danger of exceeding the aeroplane limit-load factor and while maintaining adequate stall margin throughout manoeuvre:</p> <p>(1) Starting with the aeroplane in each approved approach and landing configuration, trimmed longitudinally, and with thrust or power setting per CS 25.161(c)(2), perform a go-around, transition to the next flight phase and make a smooth level-off at the desired altitude:</p> <p>(i) with all engines operating and the thrust or power controls moved to the go-around power or thrust setting;</p> <p>Bombardier Recommendation</p> <p>As in subrequirement (a)(4), it should be made clear whether reduced (RGA) or full (GA) go-around thrust/power is expected. Bombardier understands this subrequirement to be referring to full go-around thrust/power:</p> <p>(i) with all engines operating and the thrust or power controls moved to the full go-around power or thrust setting;</p>	
response	<p>Not accepted.</p> <p>By default, in CS-25, go-around thrust/power means full go-around thrust/power. When a reduced go-around thrust or power function is installed, the applicant should use the most critical thrust or power within the range of available go-around thrust or power when showing compliance with the CS-25 specifications. A note has been added in AMC 25.143(b)(4) paragraph 4.</p>	
comment	<p>32</p> <p style="text-align: right;">comment by: <i>AIRBUS</i></p> <p>COMMENT :</p> <p>Page 9/82. Section 3.1. CS 25.145 Longitudinal control Paragraph (a) (4)</p>	

	<p>It is proposed to insert the following word in paragraph (4): “(4) Engines thrust or power (i) off and (ii) at <u>maximum</u> go-around setting”</p> <p>RATIONALE : It should cover the maximum thrust that the systems or the pilot can order.</p>	
response	<p>Not accepted. By default, in CS-25, go-around thrust/power means full go-around thrust/power. When a reduced go-around thrust or power function is installed, the applicant should use the most critical thrust or power within the range of available go-around thrust or power when showing compliance with the CS-25 specifications. A note has been added in AMC 25.143(b)(4) paragraph 4.</p>	
comment	<p>33</p> <p style="text-align: right;">comment by: <i>AIRBUS</i></p> <p>COMMENT : Page 9/82. Section 3.1. CS 25.145 Longitudinal control Paragraph (f) (1) (i)</p> <p>It is proposed to modify as follows : “(i) With all engines operating and the thrust or power controls moved to the <u>maximum</u> go-around power or thrust setting”</p> <p>RATIONALE : It should cover the maximum thrust that the systems or the pilot can order for go-around.</p>	
response	<p>Not accepted. By default, in CS-25, go-around thrust/power means full go-around thrust/power. When a reduced go-around thrust or power function is installed, the applicant should use the most critical thrust or power within the range of available go-around thrust or power when showing compliance with the CS-25 specifications. A note has been added in AMC 25.143(b)(4) paragraph 4.</p>	
comment	<p>34</p> <p style="text-align: right;">comment by: <i>AIRBUS</i></p> <p>COMMENT : Page 9/82. Section 3.1. CS 25.145 Longitudinal control Paragraph (f) (1) (iii)</p> <p>It is proposed to modify as follows : “(iii) with any practicable combination of Flight Guidance/Autothrust-throttle/Autopilot to be approved <u>for operations</u>, including manual <u>modes</u>”</p> <p>RATIONALE : This is to make sure that all ways to operate the airplane will be covered by the go-around</p>	

	demonstration.
response	Accepted.
comment	<p>35 comment by: AIRBUS</p> <p>COMMENT : Page 10/82. Section 3.1. CS 25.145 Longitudinal control Paragraph (f) (2)</p> <p>It is proposed to modify Paragraph (f) (2) as follows : <u>“Reasonably expected variety of operational scenarios while applying the go-around approved procedures must not result in unsafe flight characteristics. Misuse of the procedures by the crew is excluded from this instruction”.</u></p> <p>RATIONALE :</p> <ul style="list-style-type: none"> - To avoid out-of-scope discussions, we propose to remove “approach, landing” from the sentence, to keep only expected variations on Go-Around scenarios. - About the wording “variation from procedure” : the initial intent was probably to address expected diversity of operational cases but not to address the operations outside the procedure. - It must be made clear enough that we should not consider the misuse of the procedure by the crew. Such misuse could lead, for instance, to limit load factor exceedance.
response	<p>Not accepted.</p> <p>The wording used in the proposed CS 25.145(f)(2)text has been compiled by analogy with CS 25.107(e)(4) (see also AMC No. 1 to CS 25.107(e)(4)).</p> <p>The change proposed in this comment would limit the variations to the approved go-around procedures. However, a go-around may be the result of a non-stabilised approach or landing, or may be initiated after approach or landing phases that were performed with some variations compared with the approved procedures. Hence the intent of the specification is to address these possible variations in the approach, landing and go-around procedures, while limiting the assessment to ‘reasonable’ cases. The proposed AMC 25.145(f)(4) provides explanations on how compliance should be shown.</p>
comment	<p>54 comment by: FAA</p> <p>Proposed CS 25.145(a)(4) page 9</p> <p>Is “go-around setting” the maximum go-around setting or is there the option of using RGA setting?</p> <p>Specify “maximum go-around setting”.</p>
response	<p>Not accepted.</p> <p>By default, in CS-25, go-around thrust/power means full go-around thrust/power. When a reduced go-around thrust or power function is installed, the applicant should use the most</p>



critical thrust or power within the range of available go-around thrust or power when showing compliance with the CS-25 specifications. A note has been added in AMC 25.143(b)(4) paragraph 4.

comment

81

comment by: *The Boeing Company***The proposed text states:**

“CS 25.145 Longitudinal control

...

(a)...

(4) Engines thrust or power (i) off and (ii) at go-around setting.”

REQUESTED CHANGE: We suggest making the following text changes:

“CS 25.145 Longitudinal control

...

(a)...

*(4) Engines thrust or power (i) off and (ii) at **the maximum setting appropriate to the airplane and flap configuration**~~go-around setting~~.”*

JUSTIFICATION: CS 25.145(a) covers flaps up settings as well as takeoff

response

Not accepted.

By analogy with other paragraphs (e.g. CS 25.119, CS 121(d)(1)(i), CS 145(b)(3)), it is not deemed required to specify the flap configuration, but the thrust or power setting.

comment

83

comment by: *The Boeing Company***The proposed text states:**

“CS 25.145 Longitudinal control

...

(f)...

(1) Starting with the aeroplane in each approved approach and landing configuration, trimmed longitudinally, and with thrust or power setting per CS 25.161(c)(2), perform a go-around, transition to the next flight phase and make a smooth level-off at the desired altitude:

REQUESTED CHANGE: We suggest making the following text change:

“CS 25.145 Longitudinal control

...

(f)...

(1) Starting with the aeroplane in each approved approach and landing configuration, trimmed longitudinally, and with thrust or power setting per CS 25.161(c)(2), perform a go-around, transition to the next flight phase and make a ~~smooth~~ level-off at the desired altitude:



JUSTIFICATION: CS 25.145(f) is covering the extreme condition of full thrust versus the 25.143 additions of reduced thrust which is intended to be “smooth”

response Accepted.

comment 84

comment by: *The Boeing Company*

The proposed text states:

“CS 25.145 Longitudinal control

*...
(f)...*

(1)...

(iii) with any practicable combination of Flight Guidance/Autothrust-throttle/Autopilot to be approved, including manual.

REQUESTED CHANGE: We recommend adding a reference to AMC No 1 to CS 24.1329, section 14.1.3.3

JUSTIFICATION: AMC No. 1 to CS 25.1329, section 14.1.3.3 provides guidance related to the demonstration of the Flight Guidance System Go-around function, including weight, CG, landing configuration, automatic and manual thrust control, thrust settings, pitch response, speed performance, and transition to the Missed Approach Altitude.

response Accepted.
A reference to AMC No. 1 to CS 25.1329 has been added in the proposed AMC 25.145(f).

comment 85

comment by: *The Boeing Company*

The proposed text states:

“CS 25.145 Longitudinal control

*...
(f)...*

(2) Reasonably expected variations in service from the established approach, landing, and go-around procedures for the operation of the aeroplane (such as under or over-pitch angle target during the go-around and adverse trim positions) may not result in unsafe flight characteristics.

REQUESTED CHANGE: We recommended removing the test from the CS requirement and move it to the AMC material.

“CS 25.145 Longitudinal control

*...
(f)...*



(f)...

(2) Reasonably expected variations in service from the established approach, landing, and go-around procedures for the operation of the aeroplane (~~such as under or over pitch angle target during the go-around and adverse trim positions~~) may not result in unsafe flight characteristics.

Move the following to AMC 25.145(f) section 2
(such as under or over-pitch angle target during the go-around and adverse trim positions)

JUSTIFICATION: Items in parentheses are guidance material. Also the AMC material provides the direct link to identify the intent of adverse trim position.

response Accepted.

3. Proposed amendments - AMC 25.145(a)

p. 10

comment 24 comment by: *Bombardier*

AMC 25.145(a) Longitudinal Control – Control Near the Stall, paragraph 1:

Typographical correction: "engine" instead of "engines".

1. CS 25.145(a) requires that there be adequate longitudinal control to promptly pitch the aeroplane nose down from at or near the stall to return to the original trim speed. The intent is to ensure sufficient pitch control for a prompt recovery if the aeroplane is inadvertently slowed to the point of the stall. Although this requirement must be met with engines thrust or power off and ...

response Accepted.
The same correction is made in CS 25.145(a)((4)).

comment 25 comment by: *Bombardier*

AMC 25.145(a) Longitudinal Control - Control Near the Stall, paragraph 3:

NPA Text:

3. For aeroplanes with an automatic pitch trim function (either in manual control or automatic mode), the nose-up pitch trim travel should be limited before or at stall warning activation to prevent excessive nose-up pitch trim position such that it is possible to command a prompt pitch-down of the aeroplane for control recovery.

The applicant may account for certain flight phases where this limit is not appropriate and provide rationale supporting these exceptions to EASA for consideration.

The applicant should demonstrate this feature by flight test or with a validated simulator.



Normal and degraded flight control laws resulting from failure cases should be considered for this evaluation in conjunction with CS 25.1309 and CS 25.671.

Bombardier Recommendation

Bombardier recommends deleting the final sentence in this new paragraph:

~~Normal and degraded flight control laws resulting from failure cases should be considered for this evaluation in conjunction with CS 25.1309 and CS 25.671.~~

By definition, compliance to requirements 25.145 cannot include assessment of failure cases. This requirement is intended to address the aircraft in conditions for normal operations only. Assessment with failure conditions should only be addressed by 25.1309 and 25.671 and should not be related to 25.145.

The inclusion of the statement about failure cases in AMC 25.145(a) can lead to confusion and wrongly associates failure case assessment with the requirements of 25.145.

response

Partially accepted.
The sentence commented on has been replaced by a note which recommends that the behaviour of an automatic pitch trim function in degraded flight control laws should be evaluated under CS 25.1309 and CS 25.671.

comment

36 comment by: AIRBUS

COMMENT :

Page 10/82. Section 3.1.
AMC 25.145(a). Longitudinal Control – Control Near The Stall
Paragraph 1.

It is proposed to insert the word “maximum” in the 4th line of Paragraph 1.
“... with engines thrust or power off and at maximum go-around setting ...”

RATIONALE :

It should cover the maximum thrust that the systems or the pilot can order for go-around.

response

Not accepted.
By default, in CS-25, go-around thrust/power means full go-around thrust/power. When a reduced go-around thrust or power function is installed, the applicant should use the most critical thrust or power within the range of available go-around thrust or power when showing compliance with the CS-25 specifications. A note has been added in AMC 25.143(b)(4) paragraph 4.

comment

37 comment by: AIRBUS

COMMENT :

Page 10/82. Section 3.1.
AMC 25.145(a). Longitudinal Control – Control Near The Stall
Paragraph 1.



	<p>It is proposed to insert the word “maximum” in the 7th line of Paragraph 1. “ Instead of performing a full stall at <u>maximum</u> go-around thrust or power setting, ...”</p> <p>RATIONALE : It should cover the maximum thrust that the systems or the pilot can order for go-around.</p>
response	<p>Not accepted. By default, in CS-25, go-around thrust/power means full go-around thrust/power. When a reduced go-around thrust or power function is installed, the applicant should use the most critical thrust or power within the range of available go-around thrust or power when showing compliance with the CS-25 specifications. A note has been added in AMC 25.143(b)(4) paragraph 4.</p>
comment	<p>38 comment by: AIRBUS</p> <p>COMMENT : Page 10/82. Section 3.1. AMC 25.145(a). Longitudinal Control – Control Near The Stall Paragraph 2.</p> <p>It is proposed to insert the word “maximum” in the 7th line of Paragraph 2. “For tests at <u>maximum</u> go-around thrust or power setting, the manoeuvre does not need ...”</p> <p>RATIONALE : It should cover the maximum thrust that the systems or the pilot can order for go-around.</p>
response	<p>Not accepted. By default, in CS-25, go-around thrust/power means full go-around thrust/power. When a reduced go-around thrust or power function is installed, the applicant should use the most critical thrust or power within the range of available go-around thrust or power when showing compliance with the CS-25 specifications. A note has been added in AMC 25.143(b)(4) paragraph 4.</p>
comment	<p>39 comment by: AIRBUS</p> <p>COMMENT: Page 10/82. Section 3.1. AMC 25.145(a). Longitudinal Control – Control Near The Stall Paragraph 3.</p> <p>It is proposed to modify the Paragraph 3 as follows:</p> <p><u>“3. For aeroplanes with an automatic pitch trim function (in all cases where this function is operative), recovery should be demonstrated at the most critical nose-up pitch trim deflection achievable during the manoeuvres prescribed in paragraphs 1 and 2.</u> <u>The applicant may account for certain flight phases or failure conditions (for which the</u></p>

scenarios for demonstration shall be indicated in accordance with CS25.1309 and CS25.671), by providing rationale supporting these assumptions to the Agency for consideration.
The applicant should demonstrate this feature in flight test or through an approved simulator.

Furthermore, we propose to delete the last sentence of paragraph 3 : “Normal and degraded flight control laws resulting from failure cases should be considered for this evaluation in conjunction with CS 25.1309 and CS 25.671.”

RATIONALE :

1. The intent of the regulation should be to ensure recovery from all practical THS position but not to prescribe any design on THS travel.
2. “...(either in manual control...)” is not clear, because it might be understood as “manual THS control”. Using “...(in all cases where this function is operative)...” will allow to cover all cases including some failure conditions.
3. "validated simulator" has probably a doubtful meaning that needs clarification. "approved simulator" should be a better wording.

response

Not accepted.

Some clarifications have been made in the first sentence of this paragraph in line with the recommendation of the FTHWG.

Although EASA agrees with this description of the intent of the specification, paragraph 3 of the AMC is specific to aeroplanes equipped with an automatic pitch trim function. Its intent is that, in any case, such functions should stop commanding pitch up positions that would prevent or degrade the recovery capability of the aeroplane. This intent is valid both in automatic and manual modes. EASA is aware of occurrences where such functions commanded pitch up trim positions after the stall warning and therefore jeopardised the pitch down authority.

The term ‘validated simulator’ is deemed appropriate. The term ‘approved simulator’ would create confusion with approved flight simulation training devices (FSTD).

The last sentence of paragraph 3 has been replaced by a note which recommends that the behaviour of automatic pitch trim functions in degraded flight control laws should be evaluated under CS 25.1309 and CS 25.671.

comment

45

comment by: AIRBUS

This comment is sent on behalf of the FTHWG

AMC 25.145 (a) paragraph 3

Please add the below text underlined:

Quote

3. For aeroplanes with an automatic pitch trim function (either in manual control or automatic mode), the nose-up pitch trim travel should be limited **(e.g., by prohibiting further nose-up trim** before or at stall warning activation **or stall buffet onset, or before reaching the AOA limit if a High Angle-of-Attack Limiting Function (HALF) is installed** to prevent excessive nose-up pitch trim position such that it is possible to command a prompt pitch-down of the aeroplane for control recovery



The applicant may account for certain flight phases where this limit is not appropriate and provide rationale supporting these exceptions to EASA for consideration. The applicant should demonstrate this feature by flight test or with a validated simulator. Normal and degraded flight control laws resulting from failure cases should be considered for this evaluation in conjunction with CS 25.1309 and CS 25.671.

Unquote

Rationale: The FTHWG proposes these comments to capture their current Phase 2 activities linked to aircraft fitted with High Angle of Attack limiting functions. The FTHWG Phase 2 report was accepted at TAE level on 6 July 2017.

response

Partially accepted.

The proposed change is adopted, except the proposed example in the bracket ('e.g. by prohibiting further nose-up trim') which does not help to clarify the meaning of the sentence.

comment

50

comment by: *Embraer S.A.*

Embraer would like to emphasize the change proposed by the FTHWG:

"The proposed AMC 25.145(a) changes in paragraph 1 and 2 shouldn't conflict with the FTHWG Phase2 Topic 1 (addressing High Angle-of Attack Limiting Function) proposed changes. But, the new paragraph 3 refers to stall warning activation. If this paragraph is going to be retained (prescribing a design feature to inhibit nose-up trim), it should be modified (by red underlines words) to say:"

3. For aeroplanes with an automatic pitch trim function (either in manual control or automatic mode), the nose-up pitch trim travel should be limited (e.g., by prohibiting further nose-up trim before or at stall warning activation or stall buffet onset, or before reaching the AOA limit if a High Angle-of-Attack Limiting Function (HALF) is installed) to prevent excessive nose-up pitch trim position such that it is possible to command a prompt pitch-down of the aeroplane for control recovery.

The applicant may account for certain flight phases where this limit is not appropriate and provide rationale supporting these exceptions to EASA for consideration.

The applicant should demonstrate this feature by flight test or with a validated simulator.

Normal and degraded flight control laws resulting from failure cases should be considered for this evaluation in conjunction with CS 25.1309 and CS 25.671.

response

Partially accepted.

The proposed change is adopted, except the proposed example in the bracket ('e.g. by prohibiting further nose-up trim') which does not help to clarify the meaning of the sentence.

comment

57

comment by: *Gulfstream Aerospace Corporation*

1) The limitation on nose-up automatic pitch trim application at stall warning may be good design practice, but shouldn't be prescribed by an AMC. This guidance, supported by the

	<p>BEA study, seems to reflect a concern with a particular implementation of automatic pitch trim. It should be understood by EASA that some EFCS airplanes with automatic stabilizer trim retain conventional speed stability and do not seek to “fair” the elevator during airspeed deviations away from the trim speed. Rather than prescribe a system design feature be implemented for airplanes with automatic pitch trim, the accepted MOC should be to demonstrate adequate nose-down pitch recovery from a high thrust and high AOA condition, taking account of the position the stabilizer will attain under normal operation. This is already required by CS 25.145(a) and its associated guidance (with proposed changes in this NPA), where flight test demonstrates that prompt recovery to a normal trim condition can be achieved from a high thrust condition at the stall warning or at the High AOA Limiting Function AOA limit, if so equipped.</p>
response	<p>Noted. The AMC does not prescribe an automatic pitch trim design, but for some of the designs, it recommends that they avoid commanding excessive pitch trim.</p>
comment	<p>73 comment by: GAMA</p> <p>Comments submitted on behalf of Gulfstream: The limitation on nose-up automatic pitch trim application at stall warning may be good design practice, but shouldn't be prescribed by an AMC. This guidance, supported by the BEA study, seems to reflect a concern with a particular implementation of automatic pitch trim. It should be understood by EASA that some EFCS airplanes with automatic stabilizer trim retain conventional speed stability and do not seek to "fair" the elevator during airspeed deviations away from the trim speed. Rather than prescribe a system design feature be implemented for airplanes with automatic pitch trim, the accepted MOC should be to demonstrate adequate nose-down pitch recovery from a high thrust and high AOA condition, taking account of the position the stabilizer will attain under normal operation. This is already required by CS 25.145(a) and its associated guidance (with proposed changes in this NPA), where flight test demonstrates that prompt recovery to a normal trim condition can be achieved from a high thrust condition at the stall warning or at the High AOA Limiting Function AOA limit, if so equipped.</p>
response	<p>Noted. The AMC does not prescribe an automatic pitch trim design, but for some of the designs, it recommends that they avoid commanding excessive pitch trim.</p>
comment	<p>86 comment by: The Boeing Company</p> <p>The proposed text states: “...go-around setting...” “...go-around thrust or power setting...”</p> <p>REQUESTED CHANGE: We recommend the following text changes.</p> <p>“...go-around setting the maximum setting appropriate to the flap configuration...” “...go-around thrust or power setting the maximum thrust or power setting appropriate to the flap configuration ...”</p>

JUSTIFICATION: Maintain consistency with the proposed change to 25.145(a)(4), that 25.145(a) covers flaps up settings as well as takeoff

response Not accepted.
By analogy with other paragraphs (e.g. CS 25.119, CS 121(d)(1)(i), CS 145(b)(3)), it is not deemed required to specify the flap configuration, but rather the thrust or power setting.

3. Proposed amendments - AMC 25.145(f)

p. 11

comment

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comment by: *Bombardier*

AMC 25.145(f) Longitudinal Control – Go-around, sub-paragraph 2.(b):

NPA Text:

2. Reasonably expected variations in service from established approach, landing and go-around procedures shall be evaluated and must not result in unsafe flight characteristics.

This should include go-arounds during certification flight and simulator test programmes with combined effects of thrust or power application and nose-up trim pitching moment. This means, for an aeroplane with low engines (i.e. installed below the aeroplane centre of gravity),:

- a) with the most unfavourable combination of centre of gravity position and weight approved for landing;
- b) all engines operating and the thrust or power controls set to the (max) go-around thrust or power setting; and

...

Bombardier Recommendation:

The term (max) go-around thrust is not clear. Does it refer to the highest thrust that can ever be obtained during a go-around or the go-around thrust available at the given flight conditions (temperature, altitude)?

BA also suggest that the definitions regarding go-around thrust be clearly defined. Only 2 terms should be used to define the go-around power or thrust level: reduced go-around thrust or power setting, and full go-around thrust or power setting. This could be defined in the AMC.

Again, Bombardier recommends consistent use of terminology in defining full go-around thrust/power:

- b) all engines operating and the thrust or power controls set to the ~~(max)~~ full go-around thrust or power setting...

response

Noted.

Paragraph 2 of AMC 25.143(f) has been amended such that the sentence commented on has been deleted.



comment	<p data-bbox="359 235 391 280">40</p> <p data-bbox="1220 235 1498 280" style="text-align: right;">comment by: AIRBUS</p> <p data-bbox="359 302 518 324">COMMENT :</p> <p data-bbox="359 336 933 436">Page 11/82. Section 3.1. AMC25.145(f) Longitudinal control – Go-around Paragraph 2.</p> <p data-bbox="359 481 1498 548">We propose to delete the whole Paragraph 2 (from “Reasonably expected variations ...” up to “... (if credit can be taken from it)”.</p> <p data-bbox="359 616 518 638">RATIONALE :</p> <p data-bbox="359 660 1498 795">From the currently proposed wording in a) b) c), it seems that we want to address the typical certification envelope cases (weight, cg, thrust, THS) but not the reasonably expected variety of operational scenarios while applying the go-around approved procedures. We therefore question the need for such details in an AMC.</p>
response	<p data-bbox="359 817 534 840">Not accepted.</p> <p data-bbox="359 862 965 884">Paragraph 2 of AMC 25.143(f) has been amended.</p> <p data-bbox="359 896 1498 1176">A go-around may be the result of a non-stabilised approach or landing, or may be initiated after approach or landing phases that were performed with some variations compared with the approved procedures. Hence the intent of the specification is to address these possible variations in the approach, landing and go-around procedures, while limiting the assessment to ‘reasonable’ cases. The proposed AMC 25.145(f)(4) provides explanations on how compliance should be shown. Paragraph 2 has been revised to better explain what the expected variations are: non-stabilised speed conditions prior to go-around initiation, adverse pitch trim positions.</p>
comment	<p data-bbox="359 1198 391 1243">60</p> <p data-bbox="893 1198 1498 1243" style="text-align: right;">comment by: Gulfstream Aerospace Corporation</p> <p data-bbox="359 1288 1498 1433">Regarding the proposed AMC 25.145(f), paragraph 1 indicates that adequate pitch control includes “no overshoot of the level off altitude”. Some test/system performance tolerance should be permitted consistent with normal piloting skill and auto-flight performance tolerances.</p>
response	<p data-bbox="359 1456 486 1478">Accepted.</p> <p data-bbox="359 1489 1498 1556">The word ‘excessive’ has been added to the sentence to allow some flexibility in the evaluation and accept some limited level of altitude overshoot.</p>
comment	<p data-bbox="359 1590 391 1635">78</p> <p data-bbox="1228 1590 1498 1635" style="text-align: right;">comment by: GAMA</p> <p data-bbox="359 1680 917 1702">Comment submitted on behalf of Gulfstream:</p> <p data-bbox="359 1713 1498 1859">Regarding the proposed AMC 25.145(f), paragraph 1 indicates that adequate pitch control includes “no overshoot of the level off altitude”. Some test/system performance tolerance should be permitted consistent with normal piloting skill and auto-flight performance tolerances.</p>
response	<p data-bbox="359 1881 486 1904">Accepted.</p> <p data-bbox="359 1915 1498 1982">The word ‘excessive’ has been added to the sentence to allow some flexibility in the evaluation and accept some limited level of altitude overshoot.</p>

3. Proposed amendments - AMC 25.201(d)

p. 11-12

comment

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comment by: *The Boeing Company***The proposed text states:**

“AMC 25.201(d)

...

2 Unless the design of the automatic flight control system of the aeroplane protects against such an event, the stalling characteristics and adequacy of stall warning, when the aeroplane is stalled under the control of the automatic flight control system, should be investigated. (See also CS 25.1329(g).)

REQUESTED CHANGE: We recommend changing the reference from “g” to “h”.

“AMC 25.201(d)

...

2 Unless the design of the automatic flight control system of the aeroplane protects against such an event, the stalling characteristics and adequacy of stall warning, when the aeroplane is stalled under the control of the automatic flight control system, should be investigated. (See also CS 25.1329(~~g~~h).)

JUSTIFICATION: CS 25.1329(h) would be a more applicable reference for this section as it addresses flight guidance system avoidance of excursions beyond an acceptable margin from the speed range of the normal flight envelope.

response

Accepted.

3. Proposed amendments - Appendix Q

p. 12

comment

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comment by: *AIRBUS***COMMENT :**

Page 12/82. Section 3.1.

Appendix Q.

(SAL) 25.5 Safe operational and flight characteristics

Paragraph (e) (1)

We propose to replace the word “approach” by “landing”, as follows:

“(1) the all-engines-operating landing climb configuration; and

RATIONALE :

Referring to the definition in CS25.119, “approach climb” may not be the appropriate wording.

“Landing climb” corresponds to AEO condition. “AEO climb” or “AEO landing climb” appear to be more consistent.



response	Not accepted. In order to avoid confusion on the aeroplane configuration to be used during the transition, the text has been updated to reflect the actual intent, i.e. ‘the all-engines-operating go-around as per standard procedure’.
comment	61 comment by: <i>Gulfstream Aerospace Corporation</i> 1) Regarding the proposed change to CS25 Appendix Q (SAL) 25.5(e), “the all-engines-operating approach climb configuration” is not defined. “Approach climb” is normally associated with CS 25.121(d) and the associated minimum climb gradients with one engine inoperative. It is recommended that this be changed to reflect the flap deflection associated with the normal go-around procedure, or to “an all-engine operating climb in the approach climb configuration”.
response	Accepted. In order to avoid confusion on the aeroplane configuration to be used during the transition, the text has been updated to reflect the actual intent, i.e. ‘the all-engines-operating go-around as per standard procedure’.
comment	79 comment by: <i>GAMA</i> Comment submitted on behalf of Gulfstream: Regarding the proposed change to CS25 Appendix Q (SAL) 25.5(e), "the all-enginesoperating approach climb configuration" is not defined. "Approach climb" is normally associated with CS 25.121(d) and the associated minimum climb gradients with one engine inoperative. It is recommended that this be changed to reflect the flap deflection associated with the normal go-around procedure, or to "an all-engine operating climb in the approach climb configuration".
response	Accepted. In order to avoid confusion on the aeroplane configuration to be used during the transition, the text has been updated to reflect the actual intent, i.e. ‘the all-engines-operating go-around as per standard procedure’.

4.1.3. How could the issue/problem evolve

p. 21-25

comment	42 comment by: <i>AIRBUS</i> COMMENT : Page 22/82. Paragraph 4.1.3. How could the issue / problem evolve. We propose to modify the text as follows : “Safety recommendations/reminder of good practices widely communicated within airline operators. As part of it, <u>it is recommended that the applicable Go-Around strategy be part of the briefing prior to descent and approach</u> ” . a specific briefing for the G/A technique to be applied is recommended prior to each approach. RATIONALE : This is for clarification and to make it fully consistent with the article from Airbus Flight
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response	Safety magazine #23 mentioned in the footnotes. Accepted.
comment	43 comment by: AIRBUS COMMENT : Page 23/82. Paragraph 4.1.3. How could the issue / problem evolve. We propose to modify the following sentence : “The somatogravic illusion will also be trained <u>taught</u> so that pilots are better able to recognise and react to it. These activities are considered paramount to improve the safety level in the future.” RATIONALE : Beware that, as stated previously in the overall conclusion paragraph on somatogravic illusion, there is a risk of negative training if FFS is used; here it is more about teaching the phenomenon and its recognition, bringing awareness that phenomenon might reach everyone one day.
response	Accepted.

4.2. How it could be achieved — options

p. 25-26

comment	7 comment by: Federal Office of Civil Aviation (FOCA), Switzerland FOCA is in favour of Option 1 (amendment of CS-25). In our opinion, Option 1 is providing the best ratio between safety benefit versus incurring cost. Surprisingly, nowadays only 24.8% of all CS-25 certified aeroplane types are equipped with a G/A thrust reduction system, which would significantly reduce the risk of loss of control or loss of flight path during an AEO G/A. Additionally to the certification specification, it is recommended to focus and reiterate the following areas during pilot recurrent training and checking: <ul style="list-style-type: none"> • Include a possible AEO G/A into the TEM-Briefing during the approach briefing. Focus especially on low G/A altitude, plane awareness (configuration, A/C GW, etc.), MISAP flight path such as the threat of an immediate turn at or shortly after the MAPT, environmental awareness (e.g. terrain, weather, traffic, etc.). • FSTD or A/C manoeuvres and training should focus on different scenarios than the well-known OEI G/A at minimum. Emphasize should be placed on AEO G/A at different altitudes, with different A/C GW (especially low A/C GW...) and different configurations. • It should be reemphasized that there are possibly different ways according to the AFM on how to execute a G/A regarding the thrust management, depending on the A/C altitude. Engagement of basics modes instead of applying TO/GA where not required, is the much smarter and safer way in order to cope with the thrust application when faced with a G/A situation.
response	Accepted. One of the objectives of RMT.0581 on ‘Loss of Control Prevention and Recovery Training’ is



to improve the pilot's competence in conducting go-around manoeuvres; the different possible configurations should be addressed from the one-engine-inoperative (OEI) to the all-engine-operative (AEO)/full thrust configurations, and use of the reduced go-around thrust function when available. The somatogravic illusion will also be taught so that pilots are better able to recognise and react to it. As a result of RMT.0581, Opinion No 06/2017 'Loss of control prevention and recovery training' was published by EASA on 29 June 2017, proposing respective amendments of Commission Regulation (EU) No 1178/2011 to the European Commission. Additionally, new AMC and GM to ORO.FC.220&230 were introduced with ED Decision 2015/012/R (in force from 04 May 2016), addressing upset prevention and recovery training (UPRT) during the operator conversion and recurrent training.

4.3.4. Economic impact

p. 30-33

comment

44

comment by: AIRBUS

COMMENT:

Page 32/82. Paragraph 4.3.4. Economic impact. Option 2.

We propose to modify the following sentence :

"Costs created by the implementation of a risk mitigation means for the G/A manoeuvre, e.g. reduced G/A thrust function. On a modern aeroplane, such mitigation means would probably create 'negligible' or none-hardware RC, but would rather essentially be managed by software for which RC impact is ~~'null'~~ 'negligible'. Older types would face higher RC from needed hardware changes; nevertheless, such cost should be moderate and would probably fall in the 'low' or 'very low' '~~negligible~~' category for aeroplane unitary cost impact to be supported by operators/owners.

RATIONALE :

Examples can be found where 'very low' to 'low' could be encountered for hardware upgrades on reasonably small fleets (30 MSN).

response

Accepted.

4.4.1. Comparison of options

p. 33-35

comment

46

comment by: IATA

IATA supports Option 1 - forward fit only.

response

Noted.

