



European Aviation Safety Agency  
**Comment-Response Document 2017-07**

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Appendix  
to ED Decision 2018/007/R

RELATED NPA: 2017-07 — RMT.0608 — 14.6.2018

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## 1. Summary of the outcome of the consultation

The comments that were received during the consultation period were in general supportive of the proposed amendments. More detailed comments from stakeholders were taken into account to improve the certification specifications and AMC through changes in the structure of the text and additional clarifications. These included clarification of which gearboxes should be considered and refinement in the means to determine the maximum period of operation following loss of lubrication.

In response the CS-29 text and associated acceptable means of compliance was restructured to be more logical and improve the readability of the document. In addition, the methodology for the determination of the maximum period of operation following loss of lubrication was further refined based upon the comments that were received.



## 2. Individual comments and responses

In responding to comments, a standard terminology has been applied to attest 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 shared by EASA.

<b>(General Comments)</b>	-
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comment	2		comment by: <i>EUROCONTROL</i>
		The EUROCONTROL Agency does not have comments on NPA 2017-07.	
response		Noted.	

comment	9		comment by: <i>DGAC France</i>
		Please note that DGAC France has no specific comments on this NPA.	
response		Noted.	

comment	36		comment by: <i>UK CAA</i>
		<b>Page No:</b> Whole document.	
		<b>Paragraph No:</b> Whole document.	
		<b>Comment:</b> UK CAA fully supports this NPA, as it should lead to an improvement in the reliability of gearboxes and allow increased diversion margins in time to avoid ditching.	
response		Noted.	



comment	<p>95</p> <p style="text-align: right;">comment by: <i>Tim Glasspool</i></p> <p>The European Helicopter Association supports this change to Rotorcraft Gearbox certification standards. This is an area that requires improved clarity and higher certification standards.</p> <p>There are three questions that we would like to see addressed in the final version.</p> <ol style="list-style-type: none"> <li>1. Some details around the cost modelling. The 500,000 Euros seems a conservative estimate and will impact the future cost of helicopters.</li> <li>2. There is mention of retrospective implementation for existing Rotorcraft. This aspect should be clarified with clear requirements for OEMs to provide guidance or instruction to operators/owners. Particularly around the management of aircraft within an operators legacy fleet at different gearbox modification standards. There will be crew training and maintenance issues to be addressed.</li> <li>3. If the retrospective implementation is to be optional for operators/owners then some guidance as to the possible cost impacts would be helpful. Some MS may well require retrofit if available from an OEM.</li> </ol>
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response	<p>Noted.</p> <p>(1) The estimated costs stated in the NPA are subject to many assumptions regarding the need for additional testing and the additional cost to manufacture the gearbox and lubrication system. Clearly, these costs per helicopter could be significantly impacted by the number of affected gearboxes on the particular helicopter type, the design solution chosen by the applicant, i.e. whether the design utilizes an auxiliary lubrication system, and how many helicopters are sold. Accordingly, the costs indicated in the NPA should be taken in the context that the impact is still small, even if it is larger than the estimate provided.</p> <p>(2) The changes in this NPA affect CS-29 and the related AMC. Consequently this will only be applicable to new helicopter designs. Should a TCH choose to elect to comply with the revised requirements for an existing helicopter type, this would be their choice.</p> <p>(3) The cost of voluntary compliance on legacy designs is outside the scope of this NPA.</p>
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comment	<p>102</p> <p style="text-align: right;">comment by: <i>Aerossurance</i></p> <p>We are supportive of the NPA and the safety benefit it will bring.</p>
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response	<p>Noted.</p>
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comment	<p>103</p> <p style="text-align: right;">comment by: <i>Luftfahrt-Bundesamt</i></p> <p>The LBA has no comments on NPA 2017-07.</p>
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response	<p>Noted.</p>
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<b>2.1. Why we need to change the rules issue/rationale</b>	p. 4-5
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comment	3	<p style="text-align: right;">comment by: <i>NHF Technical committee</i></p> <p>2.1 Bulletpoint 1; Evaluation is supported. S-92A accident 12th March 2009 reflects this problem. (See TSB report for details: <a href="http://www.tsb.gc.ca/eng/rapports-reports/aviation/2009/a09a0016/a09a0016.asp">http://www.tsb.gc.ca/eng/rapports-reports/aviation/2009/a09a0016/a09a0016.asp</a>)</p> <p>2.1 Bulletpoint 2; Supported. In general terms testing of 30 minutes serviceability must be reflected as possible and sustainable in the emergency checklist (RFM), and not only for a certification test.</p>
response		Noted.

comment	41	<p style="text-align: right;">comment by: <i>General Aviation Manufacturers Association</i></p> <p>Page 4; section 2.1; paragraph 3 The flight time allowance listed in the RFM should be based on the OEM's determination of what is appropriate, using guidance from the available test data, but no greater than what was demonstrated per the methods outlined in AMC 29.927.</p>
response		<p>Accepted. The following text has been added to AMC 29.927 as follows; '(i) Determination of the maximum period of operation following loss of lubrication (...) The flight time allowance listed in the RFM should be based on the OEM's determination of what is appropriate, using guidance from the available test data, but it should be no greater than what is substantiated per the acceptable means of compliance (AMC) prescribed below.'</p>

comment	50	<p style="text-align: right;">comment by: <i>Bell Helicopter Textron Inc</i></p> <p>Page 4; section 2.1; paragraph 3 The flight time allowance listed in the RFM should be based on the OEM's determination of what is appropriate, using guidance from the available test data, but no greater than what was demonstrated per the methods outlined in AMC 29.927.</p>
response		<p>Accepted. The following text has been added to AMC 29.927 as follows; '(i) Determination of the maximum period of operation following loss of lubrication (...) The flight time allowance listed in the RFM should be based on the OEM's determination of what is appropriate, using guidance from the available test data, but it should be no</p>



greater than what is substantiated per the acceptable means of compliance (AMC) prescribed below.'

comment 60 comment by: Sikorsky Aircraft

Sikorsky understands the significance of the term “extremely remote” and refers EASA to the Sikorsky comment #75 for AMC 29.927 (c)(7) definition for *Extremely remote lubrication failure*.

response Accepted. The text of AMC 29.917 (d)(6) has been revised to read:  
‘Extremely remote lubrication failure: a lubrication failure where the likelihood of occurrence has been minimised, either by structural analysis in accordance with CS 29.571, laboratory testing, service experience or other means indicating a level of reliability better than one failure per 10 million hours...’

comment 61 comment by: Sikorsky Aircraft

EASA is requested to explain how “Taking into account the challenging environmental conditions associated with certain types of Category A rotorcraft operations” relates to this NPA. While acknowledging that Airworthiness Directives 2014-0188R4 and 2014-0244, coupled with CAA UK SD-2015/005, apply the requirements regarding limitation of flight over water with sea conditions above those of the helicopter ditching performance, it should be recognized that this operational mandate is not to encourage unnecessary ditching but to improve likely success of a controlled ditching when required. Thus, the environmental conditions envisaged in this NPA is mitigated and should not be referenced to endorse or inflate a safety concern.

response Noted. The reference to ‘certain types of Category A rotorcraft operations’, refers to operations in which rotorcraft spend significant amounts of time over water and where immediate landing could be hazardous.

comment 62 comment by: Sikorsky Aircraft

The NPA states, in part, “These recommendations proposed a harmonized action to ... redefine test CSs to allow substantiation of a greater endurance capability in the event of a loss of lubrication”. This NPA retains the 30 minute endurance capability requirement while prescribing additional analysis and test elements to achieve same. The term “greater” should be deleted.

response Partially accepted. A specific endurance capability post loss of lubrication is not established by the current requirement. Therefore, it is considered that the text ‘allow substantiation of a greater endurance capability’ is correct.



comment	63	comment by: Sikorsky Aircraft
	<p>Paragraph 2.2 states the overall objective of the proposal relates to rotorcraft gearboxes using pressurized lubrication systems. The CS 29.917 assessment should be clearly required for all gearboxes regardless if pressurized or not. Then, if the outcome of the assessment reveals modes that are not extremely remote on non-pressurized box, then a test shall be required.</p>	
response	<p>Accepted. The CS 29.927(c) loss of oil requirement has been applicable only to gearboxes utilising pressurised lubrication systems, as explained in the AMC. Service experience has shown that the risk of loss of oil from splash lubricated gearboxes is low. The revised CS 29.917(b) design assessment also addresses failures in splash lubricated gearboxes, and failure modes that could result in potentially hazardous or catastrophic effects should be minimised. This is deemed to adequately address this risk. In order to clarify this situation, new text is added to AMC 29.927, which states ‘The need for dedicated loss of lubrication testing for gearboxes using non-pressurised (splash) lubrication systems is determined by the design assessment carried out in accordance with CS 29.917(b).’ The test required by CS 29.927(c) remains specific to gearboxes with pressurised lubrication systems, leaving the applicant to determine an appropriate test definition for gearboxes with unpressurised (splash) lubrication systems, when determined to be necessary.</p>	

<b>2.3. How we want to achieve it overview of the proposals</b>	p. 5-6
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comment	64	comment by: Sikorsky Aircraft
	<p>Sikorsky understands and supports the concept of testing beyond 36 minutes to provide a safety margin. Sikorsky provides recommendations for a more simplistic approach in this CRD.</p>	
response	<p>Noted. See the response to comment 86.</p>	

<b>2.4. What are the expected benefits and drawbacks of the proposals</b>	p. 6
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comment	65	comment by: Sikorsky Aircraft
	<p>The NPA states the only significant drawbacks are economic. This is misleading. Inclusion of a flight manual entry of a defined duration is intended for the “flight crew to optimize circumstances”. Clearly this duration shall be expected to be adopted. Exceedances of flight manual limitations, inadvertent or otherwise, generally include compensating provisions such as enhanced inspection or component replacement. Confidence in a published operational duration following detection of a loss of lubrication must be</p>	



response	<p>substantially higher than those limitation exceedances for which compensating maintenance activities are prescribed. A drawback of this NPA is that it will encourage flight to the maximum duration in lieu of conducting a controlled ditching as envisaged with the issuance of EASA Airworthiness Directives 2014-0188R4 and 2014-0244 and CAA UK SD-2015/005.</p> <p>Noted. AMC 29.1585 provides advice for describing the necessary actions following a loss of lubrication in the RFM emergency procedures. (See the response to comment 101).</p>
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**3.1.1. Draft resulting text:CS-27 - BOOK 1** p. 7

comment	<p>37 <span style="float: right;">comment by: UK CAA</span></p> <p><b>Page No: 7</b></p> <p><b>Paragraph No: 3.1.1, Draft Resulting Text CS-27 Book 1</b></p> <p><b>Comment:</b> This applies the CAT A requirements of CS 29 to CS 27 as the means of compliance. CS 29 aircraft are now subjected to the Maintenance Steering Group-3 (MSG-3) process as part of the certification approval of their instructions for continued airworthiness (ICA). This can develop maintenance tasks for elements of the 30 minute run dry. This may not be the case for CS 27 certified aircraft.</p>
response	<p>Noted. Maintenance requirements may affect the risk of suffering a loss of oil. Means of minimising this risk should be identified by CS 29.917. Where these means involve maintenance tasks, these should be identified by the designer independently from the MSG3 process. Then the test prescribed by CS 29.927(c) assumes a failure of the lubrication system, thus establishing a period of operation following a loss of oil.</p>

**3.1.2. Draft resulting text: CS-29 - BOOK 1** p. 8

comment	<p>66 <span style="float: right;">comment by: Sikorsky Aircraft</span></p> <p>The proposed change for CS 29.927(c)(1) requires the applicant to show compliance with the establishment of confidence. This language is vague and indeterminate. It is not appropriate for a certification standard. Further, the requirement should be predicated upon the detection of the failure. Propose the regulation state “The rotor drive system shall have a minimum in-flight operational endurance capability of 30 minutes following detection of a lubrication system failure”.</p>
response	<p>Accepted. Text has been added to CS 29.927(c)(1) stating ‘Confidence shall be established that the rotor drive system has an in-flight operational endurance capability of at least 30 minutes following failure of any one pressurised normal-use lubrication system.’</p>





The term 'confidence' is retained, as this is what is established by compliance with this requirement in accordance with the associated AMC.

**3.1.2. Draft resulting text: CS-29 - BOOK 1 - CS 29.917** p. 8

comment	11	<p style="text-align: right; margin: 0;"><i>comment by: Aerossurance</i></p> <p>CS29.917: We note the prior discussion about explicitly including the lubrication system in the definition. We would be surprised if it was not seen to be part of the RDS by all competent applicants as otherwise it would be 'equipment' under Sub-Part F, however we agree that clarity is beneficial. While the focus of this NPA is on lubrication we feel it would be worth ensuring the definition encompasses all parts necessary for the function of power transmission in normal an emergency circumstances (while avoiding extending the definition into non-RDS structure that supports the RDS or cockpit instrumentation inappropriately).</p> <p>Therefore we propose replacing 'transmit power' with 'enable the continued transmission of power' in the proposed text.</p>	
response		<p>Partially accepted. The objective 'encompasses all parts necessary for the function of power transmission in normal and emergency circumstances' is accepted, however, this definition would not necessarily include all components which have been typically considered under the general scope of rotor drive systems, such as accessory gearboxes. After further consideration, the text has been changed to state; 'lubricating systems for drive system gearboxes, oil coolers and any cooling fans that are part of, attached to, mounted on or driven by the rotor drive system.' It is considered that this revised text should address additional transmission components, including lubrication system components that are necessary for both normal and emergency conditions.</p>	

comment	12	<p style="text-align: right; margin: 0;"><i>comment by: Aerossurance</i></p> <p>CS29.917: To avoid any 'creative misinterpretations' we suggest adding at the end: "or are necessary for the continued transmission of power".</p>	
response		<p>Partially accepted. The objective 'To avoid any 'creative misinterpretations' is accepted. The text has been changed to state 'lubricating systems for drive system gearboxes, oil coolers and any cooling fans that are part of, attached to, mounted on or driven by the rotor drive system.' It is considered that this revised text should clearly identify all components intended to be considered as belonging to the rotor drive system.</p>	

**3.1.2. Draft resulting text: CS-29 - BOOK 1 - CS 29.927** p. 8-9



comment	<p>26</p> <p style="text-align: right;">comment by: Airbus Helicopters</p> <p><u>CS 29.927(c)</u></p> <p><b>Comment</b> It is not clearly indicated in CS 29.927 that the confidence of operational endurance capability following lubrication system failure as the well as the associated demonstration test only apply to pressurised lubrication systems. However, this is clearly stated in AMC 29.927(a)(2).</p> <p><b>Suggestion</b> We suggest modifying the initial sentence of CS 29.927(c) as follows: “Lubrication system failure. For <b>pressurised</b> lubrication systems required for proper operation of rotor drive systems, the following apply:”</p>
response	<p>Accepted. The word ‘pressurised’ has been added to the first sentence of CS 29.927(c).</p>

comment	<p>38</p> <p style="text-align: right;">comment by: UK CAA</p> <p><b>Page No:</b> 8 and 9</p> <p><b>Paragraph No:</b> 3. Amend CS 29.927, sub-paragraphs (c) (1), (c) (2), (c) (3) and (c) (4)</p> <p><b>Comment:</b> The final format of revised text intends that the amendments of 29.927 (c) (1) and (2) are both applicable to Category A, although only “Category A” is specified in subparagraph (c) (1), and similarly for 29.927 (c) (3) and (4) regarding “Category B “ It would be more explicit if the accompanying texts of 29.927 (c) (2) and (c) (4) respectively said “Demonstration of capability for Category A must include ...,” and “Demonstration of capability for Category B must include ....,” .</p> <p><b>Justification:</b> Clarity.</p> <p><b>Proposed Text:</b> Amend as follows:</p> <p>(c)(2) Demonstration of capability for Category A must include a test...</p> <p>(c)(4) Demonstration of capability for Category B must include a test...</p>
response	<p>Accepted. A new structure for CS 29.927(c) and the AMC has been incorporated.</p>

comment	<p>42</p> <p style="text-align: right;">comment by: General Aviation Manufacturers Association</p>
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	<p>Page 8; section CS 29.927 Additional tests; paragraph (c)(1)                  Recommend changing "rotor drive system" to "rotorcraft", since the intention is for the aircraft as a whole to have operational endurance capability. Same comment applied to paragraph (3) below.</p>
response	<p>Not accepted. CS 29.927 should only relate to a test of the rotor drive system. However, the AMC to 29.927(c) states in the definitions section;                  ‘(1) Maximum period of operation following loss of lubrication: The maximum period of time following a loss of oil pressure warning, within which the rotorcraft should land. This period should be stated in the RFM emergency procedures.’                  which relates specifically to a capability of the rotorcraft.</p>

comment	<p>43 <span style="float: right;">comment by: <i>General Aviation Manufacturers Association</i></span></p> <p>Page 8; section CS 29.927 Additional tests; paragraph (c)(1)                  Recommend changing to "following failure of any one independent lubrication system."                  Do not want to imply multiple independent lubrication system failures must be demonstrated. Same comment applied to paragraph (3) below.</p>
response	<p>Accepted. The text has been changed to ‘failure of any one pressurised normal-use lubrication system.’</p>

comment	<p>44 <span style="float: right;">comment by: <i>General Aviation Manufacturers Association</i></span></p> <p>Page 8; section CS 29.927 Additional tests; paragraph (c)(2)                  This section should be a subset of (1) or else identified as Cat A specific.</p>
response	<p>Accepted. The paragraph structure has been modified.</p>

comment	<p>45 <span style="float: right;">comment by: <i>General Aviation Manufacturers Association</i></span></p> <p>Page 8; section CS 29.927 Additional tests; paragraph (c)(2)                  See revised wording below for all of .927 (c).                  (c) Lubrication system failure. For lubrication systems required for proper operation of rotor drive systems, the following apply:</p> <p>(1) Category A. Confidence shall be established that the rotor drive system aircraft has an in-flight operational endurance capability of at least 30 minutes following lubrication system failure of any one pressurized rotor drive system gearbox.                  (i) For each rotor drive system gearbox required for continued safe flight, a test following simulation of the most severe failure mode of the normal-use lubrication system as determined by the failure analysis of CS 29.917(b) shall be conducted. The test duration shall be dependent upon the number of tests and component condition after test. The</p>
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test shall be conducted such that it begins upon the indication to the flight crew that a lubrication failure has occurred and its loading is consistent with one minute at maximum continuous power followed by the minimum power needed for continued flight at rotorcraft maximum gross weight. The test shall end with a 45-second out of ground effect (OGE) hover to simulate a landing phase. Test results must substantiate an acceptable positive margin against the 30-minute requirement by means of an extended test duration, multiple test specimens, or other approach prescribed by the applicant and accepted by EASA, and must support the procedures published in the rotorcraft flight manual (RFM). Flight duration longer than 30 minutes may be demonstrated by means of a correspondingly longer test with appropriate margin and substantiation.

(ii) For each rotor drive system gearbox which is not essential for continued safe flight and which may be isolated from the remainder of the rotor drive system, a test following simulation of the most severe failure mode of the normal-use lubrication system as determined by the failure analysis of CS 29.917(b) sufficient to demonstrate acceptable CSFL of the aircraft for a minimum of 30 minutes shall be conducted. The test shall be conducted such that it begins upon the indication to the flight crew that a lubrication failure has occurred and its loading is consistent with one minute at maximum continuous power followed by the procedures prescribed by the applicant and acceptable by EASA and in accordance with the procedures published in the rotorcraft flight manual (RFM).

(2) Category B. Confidence shall be established that the rotor drive system aircraft has an in-flight operational endurance capability to complete an autorotation descent and landing following a lubrication system failure of any one pressurized rotor drive system gearbox.

(i) For each rotor drive system gearbox required for continued safe flight, a test of at least 15 minutes and 30 seconds following the most severe failure mode of the normal-use lubrication system as determined by the failure analysis of CS 29.917(b) shall be conducted. The test shall be conducted such that it begins upon the indication to the flight crew that a lubrication failure has occurred and its loading is consistent with 15 seconds at maximum continuous power after which input torque should be reduced to simulate autorotation for 15 minutes. The test shall be completed by application of an input torque to simulate minimum power landing for approximately 15 seconds.

(ii) For each rotor drive system gearbox which is not essential for continued safe flight and which may be isolated from the remainder of the rotor drive system, a test following simulation of the most severe failure mode of the normal-use lubrication system as determined by the failure analysis of CS 29.917(b) sufficient to demonstrate acceptable CSFL of the aircraft for a minimum of 15 minutes shall be conducted. The test shall be conducted such that it begins upon the indication to the flight crew that a lubrication failure has occurred and its loading is consistent with 15 seconds at maximum continuous power followed by the procedures prescribed by the applicant and acceptable by EASA and in accordance with the procedures published in the rotorcraft flight manual (RFM).

response Accepted: the modified text proposed has been incorporated and has been subject to further revisions related to other comments.

comment 46 comment by: *General Aviation Manufacturers Association*

Page 9; section CS 29.927 Additional tests; paragraph (c)(4)  
Should be a subset of (3) or else identified as Cat B specific.



response Accepted. The modified structure of CS 29.927(c) addresses this comment.

comment 51 comment by: *Bell Helicopter Textron Inc*  
 Page 8; section CS 29.927 Additional tests; paragraph (c)(1)  
 Recommend changing "rotor drive system" to "rotorcraft", since the intention is for the aircraft as a whole to have operational endurance capability. Same comment applied to paragraph (3) below.

response Not accepted. CS 29.927 should only relate to a test of the rotor drive system. However, the AMC to 29.927(c) states in the definitions section;  
 '(1) Maximum period of operation following loss of lubrication: The maximum period of time following a loss of oil pressure warning, within which the rotorcraft should land. This period should be stated in the RFM emergency procedures.'  
 which relates specifically to a capability of the rotorcraft.

comment 52 comment by: *Bell Helicopter Textron Inc*  
 Page 8; section CS 29.927 Additional tests; paragraph (c)(1)  
 Recommend changing to "following failure of any one independent lubrication system."  
 Do not want to imply multiple independent lubrication system failures must be demonstrated. Same comment applied to paragraph (3) below.

response Accepted. The text has been changed to 'failure of any one pressurised normal-use lubrication system.'

comment 53 comment by: *Bell Helicopter Textron Inc*  
 Page 8; section CS 29.927 Additional tests; paragraph (c)(2)  
 This section should be a subset of (1) or else identified as Cat A specific.

response Accepted. The paragraph structure has been modified.

comment 54 comment by: *Bell Helicopter Textron Inc*  
 Page 8; section CS 29.927 Additional tests; paragraph (c)(2)  
**See revised wording below for all of .927 (c).**  
 (c) Lubrication system failure. For lubrication systems required for proper operation of rotor drive systems, the following apply:  
 (1) Category A. Confidence shall be established that the rotor drive system aircraft has an in-flight operational endurance capability of at least 30 minutes following lubrication system failure of any one pressurized rotor drive system gearbox.  
 (i) For each rotor drive system gearbox required for continued safe flight, a test following



simulation of the most severe failure mode of the normal-use lubrication system as determined by the failure analysis of CS 29.917(b) shall be conducted. The test duration shall be dependent upon the number of tests and component condition after test. The test shall be conducted such that it begins upon the indication to the flight crew that a lubrication failure has occurred and its loading is consistent with one minute at maximum continuous power followed by the minimum power needed for continued flight at rotorcraft maximum gross weight. The test shall end with a 45-second out of ground effect (OGE) hover to simulate a landing phase. Test results must substantiate an acceptable positive margin against the 30-minute requirement by means of an extended test duration, multiple test specimens, or other approach prescribed by the applicant and accepted by EASA, and must support the procedures published in the rotorcraft flight manual (RFM). Flight duration longer than 30 minutes may be demonstrated by means of a correspondingly longer test with appropriate margin and substantiation.

(ii) For each rotor drive system gearbox which is not essential for continued safe flight and which may be isolated from the remainder of the rotor drive system, a test following simulation of the most severe failure mode of the normal-use lubrication system as determined by the failure analysis of CS 29.917(b) sufficient to demonstrate acceptable CSFL of the aircraft for a minimum of 30 minutes shall be conducted. The test shall be conducted such that it begins upon the indication to the flight crew that a lubrication failure has occurred and its loading is consistent with one minute at maximum continuous power followed by the procedures prescribed by the applicant and acceptable by EASA and in accordance with the procedures published in the rotorcraft flight manual (RFM).

(2) Category B. Confidence shall be established that the rotor drive system aircraft has an in-flight operational endurance capability to complete an autorotation descent and landing following a lubrication system failure of any one pressurized rotor drive system gearbox.

(i) For each rotor drive system gearbox required for continued safe flight, a test of at least 15 minutes and 30 seconds following the most severe failure mode of the normal-use lubrication system as determined by the failure analysis of CS 29.917(b) shall be conducted. The test shall be conducted such that it begins upon the indication to the flight crew that a lubrication failure has occurred and its loading is consistent with 15 seconds at maximum continuous power after which input torque should be reduced to simulate autorotation for 15 minutes. The test shall be completed by application of an input torque to simulate minimum power landing for approximately 15 seconds.

(ii) For each rotor drive system gearbox which is not essential for continued safe flight and which may be isolated from the remainder of the rotor drive system, a test following simulation of the most severe failure mode of the normal-use lubrication system as determined by the failure analysis of CS 29.917(b) sufficient to demonstrate acceptable CSFL of the aircraft for a minimum of 15 minutes shall be conducted. The test shall be conducted such that it begins upon the indication to the flight crew that a lubrication failure has occurred and its loading is consistent with 15 seconds at maximum continuous power followed by the procedures prescribed by the applicant and acceptable by EASA and in accordance with the procedures published in the rotorcraft flight manual (RFM).

response

Accepted. The modified text proposed has been incorporated and has been subject to further revisions related to other comments.

comment

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comment by: *Bell Helicopter Textron Inc*

response	<p>Page 9; section CS 29.927 Additional tests; paragraph (c)(4) Should be a subset of (3) or else identified as Cat B specific.</p> <p>Accepted. The modified structure of CS 29.927(c) addresses this comment.</p>
comment	<p>100 <span style="float: right;">comment by: <i>Aerossurance</i></span></p> <p>29.1521(k): The proposed text is “For gearboxes which utilise a pressurised lubrication system...” whereas 29.927(c) states “For lubrication systems required for proper operation of rotor drive systems”. Recommend aligning both. Suggest using as a basis “Each gearbox lubricated by a pressurised system that is essential for continued safe flight and safe landing should be tested.”</p>
response	<p>Accepted. The following text has been selected for CS 29.927(c); ‘For rotor drive system gearboxes required for continued safe flight or safe landing which have a pressurised normal use lubrication system, the following apply’. The revised text for CS 29.1585 now makes reference to CS 29.927(c) therefore the definition of applicability does not need to be repeated.</p>
comment	<p>104 <span style="float: right;">comment by: <i>Transport Canada Civil Aviation Standards Branch</i></span></p> <p><a href="#">Attachment #1</a></p> <p><b>Subject: Transport Canada comments concerning EASA NPA 2017-07 – Rotorcraft gearbox loss of lubrication</b></p> <p>Dear EASA Colleagues,</p> <p>The European Aviation Safety Agency (EASA) invited interested persons to submit their comments regarding the subject NPA. Transport Canada (IC) has reviewed the document and would like to offer the following comments for your consideration.</p> <p><b><u>Comment – The 45 sec HOGGE power requirement used to test the approach phase (page 8 and page 13)</u></b></p> <ul style="list-style-type: none"> <li>· A Category A certified helicopter, whether or not facing a MGB oil pressure malfunction, should be able to conduct an approach following the Category A horizontal (runway landing) or vertical (oil rig, heliport) profiles provided in the RFM.</li> <li>· The conduct of these Category A profiles with AEO require a lot less power than a 45 second OGE hover.</li> <li>· With MGB oil pressure issues, some OEMs recommend minimizing power changes to reduce strains on the MGB. Consequently, varying power after the cruise test period is complete could be a worst case test condition than a fixed higher power setting.</li> <li>· The power required and duration identified by EASA following the cruise test are not substantiated by the profile which will be used by pilots to conduct emergency landing.</li> </ul>



Following the cruise period at Vy, the pilot will need to reduce power to initiate a descent from the minimum enroute altitude to a point where the Category A profile can be intercepted.

Towards the completion of the Category A profile, power will need to be increased to arrest the descent and cushion the landing. The approach/landing test following the cruise test should mimic such profile.

Consequently, it is recommended that the last 6 minutes of the cruise test and the 45 second HOGÉ power test be replaced by:

- 4 minutes at the power required at Maximum GW to descend at 1000 fpm (to simulate a descent from 5000 ft AGL to 1000 ft AGL).
- 2 minutes at the power required at Maximum GW to descend at 500 fpm (to simulate a descent from 1000 ft AGL to TDP).
- 15 seconds at MCP.

This profile would be more representative and the variation in power may result in more demanding test conditions, thus further improving safety.

Should you require further information, please contact Lisa Lanthier, Senior Advisor, International Aviation, by email at [lisa.lanthier@tc.ga.ca](mailto:lisa.lanthier@tc.ga.ca) or by phone at 613-993-9583.

response Partially accepted. It is agreed that the proposal may be representative of some typical flight scenarios. However, should a loss of oil event occur at low altitude, there would be no reduced power condition from descending. Accordingly, the text has not been changed, as the existing text is considered to be more conservative.

**3.1.2. Draft resulting text: CS-29 - BOOK 1 - CS 29.1521** p. 9

comment 15 comment by: *Aerossurance*

29.1521(k): delete "red" as CS 29.1322 specifies that warnings should be red and defines the warning, caution and advisory light philosophy (or reference 29.1322).

response Accepted. The text has been changed as proposed.

comment 47 comment by: *General Aviation Manufacturers Association*

Page 9; section CS 29.1521 Powerplant limitations; paragraph (k) replace "demonstrated" with "substantiated". The certification test (i.e. demonstrated) is purposefully longer than the substantiated time to allow some margin.

response Accepted. The text has been changed as proposed, and it which is now moved to CS 29.1585.





comment	56	comment by: <i>Bell Helicopter Textron Inc</i>
	Page 9; section CS 29.1521 Powerplant limitations; paragraph (k) replace "demonstrated" with "substantiated". The certification test (i.e. demonstrated) is purposefully longer than the substantiated time to allow some margin.	
response	Accepted. The text has been changed as proposed, and has now been moved to CS 29.1585.	

comment	67	comment by: <i>Sikorsky Aircraft</i>
	CS 29.1521 Powerplant limitations states in paragraph (a) that the “powerplant limitations prescribed in this paragraph must be established so that they do not exceed the corresponding limits for which the engines are type certified”. The published operational duration following detection of a loss of lubrication is not established in relation to any corresponding limit for which the engines are type certified. Further, CS 29.1583(b)(1) requires the flight manual operating limitations to include the limitations required by CS 29.1521. This NPA introduces new paragraph CS 29.1521(k), thus requiring the maximum operational duration to be specified as a flight manual limitation. This is in conflict with the NPA stated objective in the Executive Summary on page 1, the second bullet in paragraph 2.1 on page 4 and the objective in paragraph 2.2 on page 5. Each of these entries highlight the NPA objective to require the maximum period of continued operation to be included in the RFM emergency procedures. EASA should withdraw proposed changes to CS 29.1521 and consider a corresponding entry for CS 29.1585 Operating procedures.	
response	Accepted. The powerplant limitations of CS 29.1521 address the limits to be used in the normal operations section of the flight manual, whereas CS 29.1585 addresses the RFM, including the Emergency Procedures Section. Accordingly, CS 29.1521 has been removed and the following text has been added to CS 29.1585;  ‘(h) The maximum duration of operation after a failure resulting in rotor drive system gearbox loss of lubrication and oil pressure warning must be furnished and must not exceed the maximum period substantiated in accordance with CS 29.927(c).’	

comment	68	comment by: <i>Sikorsky Aircraft</i>
	EASA should consider a requirement to ensure that a means is provided to alert the pilot when the aircraft is operating within the published maximum period of continued operation following detection of a loss of lubrication, when the event begins and when the published time interval expires.	
response	Not accepted. A counter is not necessary for such an emergency procedure limitation of this duration. In addition, the procedure is Land As Soon As Possible. The time period is referred to in the RFM only for circumstances where landing immediately is likely to be hazardous or catastrophic. Care should be taken not to provide instructions that may encourage the crew to continue a flight when doing so is not absolutely necessary in the interest of safety. (See comment 101.)	



comment	<p>99</p> <p style="text-align: right;">comment by: <i>Aerossurance</i></p> <p>29.1521(k): The proposed text is “For gearboxes which utilise a pressurised lubrication system.....” whereas 29.927(c) states “For lubrication systems required for proper operation of rotor drive systems”. Recommend aligning both. Suggest using as a basis “Each gearbox lubricated by a pressurised system that is essential for continued safe flight and safe landing should be tested.”</p>
response	<p>Partially accepted. It is agreed that the definition of gearbox/lubrication systems defining the applicability of 29.927(c) should be consistent throughout CS-29. However, CS 29.1521 has been deleted, and a new paragraph, CS 29.1585, has been added. This revised text is as follows and reflects the applicability defined in CS 29.927(c). ‘The maximum duration of operation after a failure resulting in rotor drive system gearbox loss of lubrication and oil pressure warning must be furnished and must not exceed the maximum period substantiated in accordance with CS 29.927(c).’</p>

comment	<p>101</p> <p style="text-align: right;">comment by: <i>Aerossurance</i></p> <p>29.1585(h): RFM instructions need to be worded such they discourage a crew from deciding to remain airborne flight (for example to reduce the time until a SAR asset is on-station) and increasing the risk of a catastrophic in-flight failure. We suggest adding to 1585(h) or creating AMC for 1521 to emphasise that 29.927(a)(5) states; “This AMC provides guidance for completion of the loss of lubrication test and on how to demonstrate confidence in the margin of safety associated with the maximum period of operation following loss of lubrication, as defined in the RFM emergency procedures. This margin of safety is intended to substantiate a period of operation that has been evaluated as likely to be safer than making a forced landing over hostile terrain.”</p> <p>And</p> <p>“Accordingly, this does not constitute a safe period of operation, but a period that has been evaluated as likely to be safer than making a forced landing over hostile terrain.”</p>
response	<p>Accepted. A new AMC 29.1585 paragraph has been added stating; ‘AMC 29.927(c) provides guidance for completion of testing to simulate loss of lubrication and on how to demonstrate confidence in the margin of safety associated with the maximum period of operation following loss of lubrication. This margin of safety is intended to substantiate a period of operation that has been evaluated as likely to be safer than making a forced landing over hostile terrain. Accordingly, the need to ‘Land as Soon as Possible’, which may include ditching where circumstances permit, should be reflected in the associated RFM emergency procedures.’</p>

<b>3.1.2. Draft resulting text: CS-29 - BOOK 2 - AMC 29.917</b>	p. 10
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comment	<p>4</p> <p style="text-align: right;">comment by: <i>NHF Technical committee</i></p>
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63

	Point (c): Auxiliary system should be designed in such way, if activated it will not prevent or inhibit operation of the normal-use lubrication system.
response	Accepted. The following text has been added to the AMC to 29.917(b). ‘The effects of inadvertent operation of the auxiliary lubrication system should also be considered.’ Accordingly, this failure mode will be considered in the failure analysis and should be addressed either by its low likelihood of occurrence or by showing that it will not result in a hazardous or catastrophic effect.

comment	16 <span style="float: right;">comment by: <i>Aerossurance</i></span>
	AMC 29.917(a): To ensure appropriate consideration of maintenance human factors and human centred design recommend adding to sentence 1: "...including any foreseeable errors made during assembly or maintenance that cannot be readily detected during specified functional checks".
response	Partially accepted. A separate sentence has been added to AMC 29.917(a) stating ‘The safety assessment should also consider potential assembly or maintenance errors that cannot be readily detected during specified functional checks’

comment	19 <span style="float: right;">comment by: <i>Aerossurance</i></span>
	AMC 29.917 contains defined terms that are only defined in AMC29.927(c). There needs to be a clear linkage. We suggest moving those definitions of terms used first in AMC 29.917 from AMC 29.927(c) to AMC 29.917 and adding a reference in AMC 29.927(c) that this list supplements terms defined in AMC 29.917. Alternatively simply add a note in AMC 29.917 that definitions can be found in AMC 29.927(c).
response	Accepted. Some of the definitions have been moved to AMC 29.917.

comment	27 <span style="float: right;">comment by: <i>Airbus Helicopters</i></span>
	<u>AMC 29.917(c), page 10</u>
	<b>Comment</b> “ <i>extremely remote</i> ” is used but not defined in AMC 29.917. It is only defined in AMC 29.927.
	<b>Suggestion</b> We suggest introducing also the definition of “ <i>extremely remote</i> ” in AMC 29.917 or making a reference to the definition in AMC 29.927.
response	Accepted. The definition of ‘Extremely remote lubrication failure’ has been moved to AMC 29.917.



**3.1.2. Draft resulting text: CS-29 - BOOK 2 - AMC 29.927** p. 10-21

comment	5	comment by: <i>NHF Technical committee</i>
		Supported.
response		Noted.

comment	6	comment by: <i>NHF Technical committee</i>
		(g);  Auxiliary lubrication system should be designed to not endanger operation of normal lubrication system if inadvertent activation is performed. Auxiliary system must ie. not pressurize the MGB making the "normal" lubrication oil to be pushed out through MGB vents, leaving the normal system useless.
response		Accepted. The following text has been added to the AMC to 29.917(b) to address the risk of inadvertent operation of an auxiliary lubrication system. ‘The effects of inadvertent operation of the auxiliary lubrication system should also be considered.’ This failure mode will be considered in the failure analysis and should be addressed either by its low likelihood of occurrence or determination that the associated hazard severity classification is not hazardous or catastrophic.

comment	13	comment by: <i>Aerossurance</i>
		AMC 29.927(a)(4): To avoid any 'creative misinterpretations' that for example a loss of containment of oil from outside an oil cooler, pump or oil line (e.g. from the casing or component attached to the lubrication system) is not a lubrication system failure, we suggest adding to the list: casings, shaft seals, oil debris monitoring devices, sensor or access ports
response		Partially accepted. Once a list has been started which ends with ‘etc.’, it is possible to keep expanding the list with other examples. The list is caveated with ‘Failures include,...’. However, this list of examples is now redundant, as the failure analysis of CS 29.917(b) is now the formal tool to be relied upon to determine which failures can result in a loss of oil.

comment	14	comment by: <i>Aerossurance</i>
		AMC 29.927(c): To avoid any 'creative misinterpretations' that for example a loss of containment of oil from outside an oil cooler, pump or oil line (e.g. from the casing) is not a lubrication system failure, we suggest adding a definition "Lubrication System Failure: Any failure that prevents or degrades the lubrication system performance".



response	Partially accepted. The following text has been added to the definitions section of AMC 29.917: 'Lubrication System Failure: In the context of CS 29.917(b), references to failure of the lubrication system should be interpreted as any failure resulting in a loss of pressure and an associated low oil pressure warning, within the duration of one flight.'
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comment	17	comment by: <i>Aerossurance</i>
	AMC 29.927(a)(4): Typo: "eventually" should be "eventually"	

response	Accepted. This typographical error has been corrected.
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comment	18	comment by: <i>Aerossurance</i>
	29.927(b)(2): Typo: extra space before full stop.	

response	Accepted. This typographical error has been corrected.
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comment	20	comment by: <i>Aerossurance</i>
	AMC 29.927(c) Definition of Residual oil: For total clarity suggest adding a comment that: depending on the failure mode, the Residual Oil may decrease due to continued oil loss.	

response	Accepted. The following text has been added '(Note: the amount of residual oil may decrease with time and test conditions should take into account the possible effect of flight conditions where relevant).'
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comment	21	comment by: <i>Aerossurance</i>
	AMC 29.927(c)(7) Add to the list "fittings" and "oil coolers" and reconsider the use of the word 'Typically'.	

response	Accepted. The text has been modified as follows; 'Failure modes including failures of external pipes, fittings, coolers, or hoses, and any components which require periodic removal by maintainers, should not be considered as extremely remote lubrication failures.'
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comment	22	comment by: <i>Aerossurance</i>
	AMC29.927(e)(2) Typo: "provisions for" should be "provisions for"	

response	Accepted.
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comment	23	comment by: <i>Aerossurance</i>
	AMC 29.927(f)(1): Suggest adding a new third sentence: Conceivably slow initial oil loss and late warning may cause more damage than a rapid oil loss and early warning.	
response	Partially accepted The concern regarding the damage due to a particular characteristic of a loss of oil is noted, and attention is drawn to this scenario by the following text in AMC 917(e)(1)	
	(1) The determination of the most severe failure mode may not be immediately obvious, as leakage rates vary, and system performance following leaks from different areas varies as well. Thus, a careful analysis of the potential failure modes should be conducted.	
comment	24	comment by: <i>Aerossurance</i>
	AMC29.927(h)(2): Suggest adding a requirement to assess and minimise foreseeable error in assembly and maintenance.	
response	Partially accepted. The intention to consider potential maintenance and assembly errors is agreed, but is now addressed in AMC 29.917(a), which states; ‘The safety assessment should also consider potential assembly or maintenance errors that cannot be readily detected during specified functional checks.’	
comment	25	comment by: <i>Aerossurance</i>
	AMC29.927(i)(12): Suggest adding (iv): Noise and/or vibration detected by the crew should not be considered a reliable secondary indication on their own.	
response	Accepted. The following text has been added; AMC 29.927(i)11(iv): ‘Noise and/or vibration detected by the crew should not be considered a reliable secondary indication on their own.’	
comment	28	comment by: <i>Airbus Helicopters</i>
	<u>AMC 29.927 introduction, page 10</u>	
	<b>Comment</b> The introduction states: “ <i>This AMC replaces FAA AC 29.927 (Amendment 29-26)</i> ” As a matter of fact, AC 29.927A (Amendment 29-26) addresses sections 29.927(c), 29.927(d) and 29.927(f), whereas the proposed AMC is restricted to CS 29.927(c). Therefore, AC 29.927A still needs to be partly used.	
	<b>Suggestion</b>	



response	<p>We suggest:</p> <ul style="list-style-type: none"> <li>• Renaming “AMC 29.927” as “AMC 29.927(c)” in the title and where used in the AMC,</li> <li>• Replacing the introductory sentence by: “<i>This AMC replaces item a. (Section 29.927(c)) of FAA AC 29.927A (Amendment 29-26)</i>”.</li> </ul> <p>Partially accepted. AMC paragraphs do not always align with the corresponding CS-29 text. Accordingly, the heading will remain as ‘AMC 29.927’ and the text describing the change states ‘This AMC replaces item a. (Section 29.927(c)) of FAA AC 29.927 (Amendment 29-26) as proposed.’</p>
comment	<p>29 <span style="float: right;">comment by: Airbus Helicopters</span></p> <p><u><a href="#">AMC 29.927(e)(1)(ii), page 13</a></u></p> <p><b>Comment</b> There is no recommendation which would avoid any test mistake where the draining would be stopped as soon as the low oil pressure alarm lights on. In such a case the test would be performed with a pressure slightly lower than the alarm value, which might constitute a favourable condition (presence of oil).</p> <p><b>Suggestion</b> We suggest clearly stating that oil drainage should be maintained during the whole test duration.</p>
response	<p>Accepted. Text added at the end of (e)(1)(ii): ‘and the drainage should continue during the whole test duration’</p>
comment	<p>30 <span style="float: right;">comment by: Airbus Helicopters</span></p> <p><u><a href="#">AMC 29.927(e)(1)(iii), page 13</a></u></p> <p><b>Comment</b> “<i>This condition should be maintained for at least 36 minutes</i>” addresses the stabilised phase, where the torque has been reduced. This is not consistent with the definition of the test duration Tc defined as the time from low-pressure indication to the end of the test (see page 18 section (i)(5)). The minimum should be 1’ PMC + 34’15” reduced power + 45” HOGE = 36’ in total.</p> <p><b>Suggestion</b> Either change the above referenced sentence the following: “<i>This condition should be maintained for at least <del>36</del> 34 minutes and 15 seconds</i>” or remove this sentence and add a new sentence after (e)(1)(iv) to specify the minimum total duration of 36 minutes.</p>



response Noted. The comment is no longer applicable, as the reference to 36 minutes duration has been replaced with 'Test results must substantiate the maximum period of operation following loss of lubrication by means of an extended test duration, multiple test specimens, or other approach', thus the period is to be chosen by the applicant using AMC 29.927(c) to eventually determine the maximum period of operation following loss of lubrication.

comment 31 comment by: Airbus Helicopters

AMC 29.927(e)(1)(v), page 13

**Comment**

During the test, the gearbox efficiency will probably be reduced and therefore for imposed output torques the input torques have to be increased to compensate. If the piloting is made through the input torques the reaction at the outputs will not be representative of the aircraft loadings.

**Suggestion**

It should be clearly stated that the piloting loads for the test are the output torques.

response Accepted. The following text has been added in (e)(1)(v): 'As the efficiency of the gearbox may change during the test, the input loads may need to be adjusted in order to maintain the correct output shaft torque during the test.'

comment 32 comment by: Airbus Helicopters

AMC 29.927(e)(1)(v), page 13

**Comment**

The text uses either "quills" or "shafts" to designate apparently the same concept.

**Suggestion**

We suggest reviewing whether there is a reason for using 2 different words and correcting if needed.

response Accepted. The paragraph has been simplified to state: 'Test conditions: for (i) to (iv) above, the input and output shaft torques should be reacted appropriately and the corresponding input and output shaft loads should be applied.'

comment 33 comment by: Airbus Helicopters

AMC 29.927(e)(1)(vi), page 14

**Comment**







response Accepted. Changes have been made and the paragraph addressing ‘Multiple Tests’ has been removed. AMC 29.927(f)(2) now addresses the application of multiple test results to be used for determination of the Maximum Period of Operation Following Loss of Lubrication.

comment 39 comment by: UK CAA

**Page No:** 11

**Paragraph No:** AMC 29.927, sub-paragraph (a)(4), final sentence

**Comment:** It is suggested that reference is also made to input and output seals specifically.

**Justification:** These are normally the higher probable areas of leakage.

**Proposed Text:** Amend final sentence of sub-paragraph (a)(4) as follows:

“...A loss of lubrication may result from internal and external failures. Failures include, but are not limited to: oil lines, fittings, input and output seals, seal plugs, sealing gaskets, valves, pumps, oil filters, oil coolers, accessory pads, etc.”

response Partially accepted. This list of examples is now redundant, as the failure analysis of CS 29.917(b) is now the formal tool to be relied upon to determine which failures can result in a loss of oil.

comment 40 comment by: UK CAA

**Page No:** 17

**Paragraph No:** AMC 29.927, sub-paragraph (i) (3)

**Comment:** The proposed AMC 29.927 material includes text concerning a “reduction factor based on the condition of components at the end of the certification test”. Confusion could occur by calling this a “reduction factor”, as it is more precisely known as “reduction decrement” in mathematical terms, i.e. a direct subtraction of time of the certified run dry declared capability rather than a factoring. Factoring implies the multiplication or splitting into multipliers the former effecting a scaling, such as “x 1.5”. Use of the term “decrement” should reduce confusion with factoring. (Note the application of this “reduction factor” or “reduction decrement” can be seen under the formulae that are presented later in the AMC - i.e. use of the term “-T<sup>P</sup>” in the formula on page 18).

**Justification:** Clarity. To reduce confusion over use of the term “factor” which should strictly be termed a “decrement” in this particular application.



	<p><b>Proposed Text:</b> Replace “factor” by “decrement” as shown below and when applying fixed term reduction of 2, 5 or 10 minutes as applicable to the respective Class 1, (“Good”), Class 2, (“Fair”) and Class 3 (“Imminent failure”) condition of components at the end of the certification test, e.g:-</p> <p>(i)(3) Reduction <del>factor</del> <b>decrement</b> based on the condition of components at the end of the certification test</p>
response	<p>Accepted. The text has been changed as follows;</p> <p>‘3) Fixed time penalty based on the condition of components at the end of the certification test a fixed time penalty should be applied to the definitions of (4) below. This fixed time penalty should be 2 minutes for CLASS 1 (‘Good’ condition), 5 minutes for CLASS 2 (‘Fair’ condition), and 10 minutes for CLASS 3 (‘Imminent failure’ condition) <b>with the CLASS defined based upon the following criteria;</b>’</p>
comment	<p>48 <span style="float: right;">comment by: <i>General Aviation Manufacturers Association</i></span></p> <p>Page 14; section AMC 29.927 Additional tests; paragraph (e)(1)(vii) replace "for successful demonstration" with "A successful demonstration may involve limited damage to the rotor drive system; however, " similar to wording in (2) (ii)</p>
response	<p>Accepted. This change has been made as proposed.</p>
comment	<p>49 <span style="float: right;">comment by: <i>General Aviation Manufacturers Association</i></span></p> <p>Page 16; section AMC 29.927 Additional tests; paragraph (i) for each rotor drive system gearbox since each one could have a different substantiated time or in the case of non-essential gearboxes the action is different, e.g. shutting down an engine.</p>
response	<p>Accepted. The following text has been amended;</p> <p>‘(f) Determination of the maximum period of operation following loss of lubrication</p> <p>In order to enable the flight crew to determine the safest action in the event of a loss of gearbox oil, the RFM emergency procedures should include instructions defining the maximum period of time, for each gearbox subject to 29.927(c), within which the rotorcraft should land.’</p>
comment	<p>57 <span style="float: right;">comment by: <i>Bell Helicopter Textron Inc</i></span></p> <p>Page 14; section AMC 29.927 Additional tests; paragraph (e)(1)(vii) replace "for successful demonstration" with "A successful demonstration may involve</p>



	limited damage to the rotor drive system; however, " similar to wording in (2) (ii)
response	Accepted. This change has been made as proposed.

comment	58 <span style="float: right;">comment by: <i>Bell Helicopter Textron Inc</i></span>
	Page 16; section AMC 29.927 Additional tests; paragraph (i) for each rotor drive system gearbox since each one could have a different substantiated time or in the case of non-essential gearboxes the action is different, e.g. shutting down an engine.
response	Accepted. The following text has been amended;  '(f) Determination of the maximum period of operation following loss of lubrication  In order to enable the flight crew to determine the safest action in the event of a loss of gearbox oil, the RFM emergency procedures should include instructions defining the maximum period of time, for each gearbox subject to 29.927(c), within which the rotorcraft should land.'

comment	71 <span style="float: right;">comment by: <i>Sikorsky Aircraft</i></span>
	Paragraph 3.2.1 on page 10: Typographical error for proposed AMC 29.917(a). Should read "Identification of any single failure, malfunction, ...".
response	Accepted. The change has been adopted as proposed.

comment	72 <span style="float: right;">comment by: <i>Sikorsky Aircraft</i></span>
	Proposed AMC 29.927(b)(1) on page 12: The AMC states that some damage to the rotor drive system components is acceptable after completion of the lubrication system testing. However, this entry follows criteria regarding Category B rotorcraft. Please clarify that the allowance for some damage to rotor drive system components is acceptable for both Category A and B rotorcraft lubrication tests.
response	Accepted. The text has been changed as follows: '1) CS29.927(c) prescribes a test which is intended to demonstrate that no hazardous failure or malfunction will occur within a defined period, and in a specified reduced-power condition, in the event of a significant failure of the rotor drive lubrication system. The failure of the lubrication system should not impair the ability of the crew to continue safe operation of Category A rotorcraft for the defined period after indication of the failure has been provided to the flight crew. For Category B rotorcraft, safe operation under autorotative conditions should be possible for a period of at least 15 minutes. For both Category A and B rotorcraft, some damage to rotor drive system components is acceptable after completion of the lubrication system



testing. However, the condition of the components will influence the margin of confidence established for the maximum period of operation following loss of lubrication.'

comment 73

comment by: Sikorsky Aircraft

Proposed Definitions page 12: The *Maximum period of operation following loss of lubrication* should be based upon the duration after detection of a loss of lubrication condition. Furthermore, the proposed definition states that this definition is "intended to be used in conjunction to 'land as soon as possible'. EASA is requested to confirm that this period of operation is not intended to preclude a land immediately instruction as such would be expected when approaching the maximum period of operation.

response

Partially accepted. The text has been changed and AMC 29.927(f) states;

'Determination of the Maximum period of operation following loss of lubrication:

In order to enable the flight crew to determine the safest action in the event of loss of gearbox oil, the RFM emergency procedures should include instructions defining the maximum period of time for each gearbox subject to 29.927(c) within which the rotorcraft should land. This period starts at the low pressure warning.'

Regarding the comment 'to confirm that this period of operation is not intended to preclude a land immediately instruction as such would be expected when approaching the maximum period of operation', the specific reference to Land as Soon as Possible has been removed from the definition. AMC 29.1585 states 'Accordingly, the need to 'Land as Soon as Possible', which may include ditching where circumstances permit, should be reflected in the associated RFM emergency procedures. This can be supplemented with 'Land Immediately' in the event of additional conditions to that of low oil pressure being present.

comment 74

comment by: Sikorsky Aircraft

Proposed Definitions page 12: The *Most Severe Failure Mode* should exclude any mode that is determined to be extremely remote per (c)(7).

response

Accepted. The exception of extremely remote failure modes is addressed AMC 29.917(f) which states 'The determination that a failure is an *extremely remote lubrication failure*, when used to eliminate a potential failure mode from being considered as a candidate *most severe failure mode*, should be substantiated.'

AMC 29.917 (e)(2) has been changed to state 'Most severe failure mode: the failure mode of the normal use lubrication system that results in the shortest duration of time in which the gearbox is expected to operate following an indication to the flight crew.'

This clarifies the relationship of the most severe failure mode to the normal use lubrication system.



comment	75	comment by: Sikorsky Aircraft
	<p>Proposed Definitions page 12: Extremely remote lubrication failure is defined as “lubrication failures where confidence is provided that the likelihood of occurrence of the failure mode has been minimized, either by structural analysis in accordance with CS 29.571, laboratory testing, service experience or other means indicating a level of reliability better than one failure per 10 million hours”. The term “confidence is provided that” should be removed from the definition as it is ambiguous and, coupled with “minimized” is additionally confusing.</p>	
response	<p>Accepted. The text of AMC 29.917 (e)(6) has been revised to read:</p> <p>‘a lubrication failure where the likelihood of occurrence has been minimised, either by structural analysis in accordance with CS 29.571 or laboratory testing. Alternatively, service experience or other means can be used which indicate a level of reliability comparable with one failure per 10 million hours. Failure modes including failures of external pipes, fittings, coolers, or hoses, and any components that require periodic removal by maintainers, should not be considered as <i>extremely remote lubrication failures</i>’</p>	
comment	76	comment by: Sikorsky Aircraft
	<p>Proposed paragraph (g) page 15: The definition for <i>Use of an auxiliary lubrication system</i> establishes that failures of common features shared by both normal use and auxiliary lubrication systems should be shown to be an <i>extremely remote lubrication failure</i>. This definition presupposes the assessment conducted under 29.917(a) and thus presumes the common feature failure represents a catastrophic condition. This definition should ensure the rates of leakage from any failure condition is commensurate with the hazard classification established under CS 29.917(a).</p>	
response	<p>Accepted. The definition in AMC 29.917 (g), Use of an auxiliary lubrication system, has been revised to state;</p> <p>‘...Failure of any common feature shared by both the normal-use and auxiliary lubrication systems which could result in the failure of both systems and would consequently reduce the maximum period of operation following loss of lubrication should be shown to be an extremely remote lubrication failure...’</p> <p>Thus only failures resulting in oil leakage that can trigger a low oil indication within the duration of a flight would be considered as extremely remote lubrication failures.</p>	
comment	77	comment by: Sikorsky Aircraft



	Proposed paragraph (h) page 15: Sufficient independence of the auxiliary lubrication system is described as being where the failure of the pressurized portion of the normal use lubrication does not result in a subsequent failure of the auxiliary lubrication system. This criteria should be clarified as meaning a subsequent failure of the auxiliary lubrication system which prevents continued safe flight up to the published maximum period of operation following detection of a loss of lubrication event. Less than catastrophic hazards may be tolerated as established in the design assessment per CS 29.917(a).
response	Accepted. For AMC 29.917(h)(1)(ii) the text has been changed as follows:  'common failure modes shown to defeat both the normal-use and the auxiliary lubrication systems should be shown to be extremely remote lubrication failures unless it is demonstrated by testing conducted to comply with 29.927(c), that the failure mode does not compromise the "Maximum period of operation following loss of lubrication"; and'
comment	78 <span style="float: right;">comment by: Sikorsky Aircraft</span>  Sikorsky proposes replacing "Confidence shall be established ... " with "Confidence demonstrated by test shall be established ... ".
response	Partially accepted. The CS 29.927(c) text has been changed to read 'Confidence shall be established that the rotor drive system has an in-flight operational endurance capability of at least 30 minutes following failure of any one pressurised normal-use lubrication system.'  The need to reference 'by test' is considered unnecessary, as the need to test is defined by this requirement and the associated AMC.
comment	79 <span style="float: right;">comment by: Sikorsky Aircraft</span>  Sikorsky requests EASA provide further detail in proposed AMC 29.927 (c)(6) definition for <i>Independent</i> , in particular the intended classification of failure common to the normal and auxiliary lubrication system.
response	Partially accepted. The intent of the comment should be addressed by the changes that have been made to the text of AMC 29.917 (h)(1)(ii), as follows;  'common failure modes shown to defeat both the normal-use and the auxiliary lubrication systems should be shown to be extremely remote lubrication failures unless it is demonstrated by testing conducted to comply with 29.927(c), that the failure mode does not compromise the "Maximum period of operation following loss of lubrication"; and'
comment	80 <span style="float: right;">comment by: Sikorsky Aircraft</span>



	<p>Regarding the proposed AMC 29.927 (c)(7) definition for <i>Extremely remote lubrication failure</i>, Sikorsky recommends that this section be clarified to link the extremely remote language to the failures modes which have significant consequence; there must be loss of intended function of the lubrication system such that continued safe flight is not possible. For example, a failure mode that is highly unlikely but results in a forced landing is more important than a repeated failure mode that results in a small quantity of oil leakage each time but does not progress.</p>
response	<p>Accepted. To take account of low leakage rate failures, a definition of lubrication system failure has been added which states; “Lubrication System Failure: In the context of 29.917 references to failure of the lubrication system should be interpreted as any failure resulting in a loss of pressure and an associated low oil pressure warning, within the duration of one flight.”</p> <p>In addition, the definition of ‘Independent’ has been modified as follows;</p> <p>Independent: an auxiliary lubrication system should be able to function after failure of the normal-use lubrication system. Failure modes which may result in the subsequent failure of both auxiliary and normal-use lubrication systems and may prevent continued safe flight and safe landing should be shown to be extremely remote lubrication failures.</p>

comment	<p>81 <span style="float: right;">comment by: Sikorsky Aircraft</span></p> <p>Sikorsky suggests that it be made clear that use of reliability figures for failure modes is not required, but may be optionally used when sufficient data exists to substantiate the values.</p>
response	<p>Accepted. For a new design, it will usually not be possible to use existing reliability data. Where an applicant proposes the use of service data from a similar product, the regulator will need to determine the validity of such data for each individual situation.</p> <p>The definition of extremely remote lubrication failure in AMC 29.917(e)(6) has been changed, which now states ‘Extremely remote lubrication failure: a lubrication failure where the likelihood of occurrence has been minimised, either by structural analysis in accordance with CS 29.571 or laboratory testing. Alternatively, service experience or other means can be used which that indicate a level of reliability comparable with better than one failure per 10 million hours’.</p>

comment	<p>82 <span style="float: right;">comment by: Sikorsky Aircraft</span></p> <p>Regarding the proposed AMC 29.927(e) Loss of lubrication test, Sikorsky recommends adding that any normally-loaded accessory drive or power take-offs be loaded as they would be in flight as well. These will affect power distribution and loading, and flight-essential accessory drives must be shown to survive the oil out test.</p>
response	<p>Not accepted. AMC 29.927 e(1)(vi) states ‘(vi) This test may be conducted on a representative bench test rig. The test should be performed with all the accessory loads</p>





represented by a load associated with normal cruise conditions. Paragraph e(1)(vii) states that any loss of drive to essential accessories constitutes a failure of the test.

comment 83

comment by: Sikorsky Aircraft

Regarding the proposed AMC 29.927(g) Use of an auxiliary lubrication system, Sikorsky recommends that a pre-flight check is sufficient. If the health indication must be provided continually or periodically during flight then they should be clearly stated.

response

Partially accepted. The AMC 29.917(g)(2) definition now states: ' a means of verifying that the auxiliary lubrication system is functioning properly should be provided during normal operation of the rotorcraft on either a pre-flight, periodic or continual basis. Following failure of the normal use lube system and activation of an auxiliary lubrication system the flight crew should be alerted in the event of any system malfunction.'

comment 84

comment by: Sikorsky Aircraft

Regarding the proposed AMC 29.927(i)(2) Reduction factor based upon supporting data, Sikorsky requests EASA identify the bases for these factors. These are subject to interpretation and variation. Sikorsky recommends that factors be defined more precisely based upon what corroborating data exists and the number of tests which have been conducted. The reliability factors should be discrete choices (similar to that for using multiple test specimens is CS 29.571) with clear criteria provided for each option. For example, a value of 0.9 could be used if 2 or more tests have been conducted with similar results. The ability to apply company tests as a corroborating result should be permitted. Sikorsky has proposed a simpler approach for this in section (5) Calculation of the maximum period of operation following loss of lubrication.

response

Accepted. The potential for variability of Kr factors has been improved by applying discrete Kr values, and the scope of potential interpretation has been reduced. The use of development tests is also clarified. The following changes have been incorporated;

- (i) 0.6 where the certification test has no supporting data to provide understanding of the gearbox behaviour and confidence in the repeatability of the certification test data.
- (ii) 0.8 where the certification test is corroborated by one representative full scale test (certification or development test). The corroborating test results should show consistency of the temperature history, and demonstrate good correlation with the certification test.
- (iii) 0.9 where the certification test is corroborated by two or more representative full scale tests (certification or development tests) or by one representative full scale and one or more modular tests, historical data, or simulation results. The corroborating data should show consistency of the temperature history, and demonstrate good correlation with the certification test. In addition the behaviour of



the limiting design characteristics are established and supported by repeatable test data.

Note: Specific testing, simulation or representative development test data from other programmes, are examples of data that can be used to support the application of this Kr factor.

comment

85

comment by: Sikorsky Aircraft

Regarding the proposed AMC 29.927(i)(4), Post-test condition of gearbox components, Sikorsky recommends EASA ensures clarity in that these criteria apply only to the primary drive components and any accessory or other drives that are essential for continued safe flight.

response

Accepted. New text has been added to AMC 29.927(f)(3) stating:

‘(3) Fixed time penalty. Based on the condition of components necessary for continued safe flight or safe landing, at the end of the certification test, This a fixed time penalty should be applied in accordance with the definitions below. This fixed time penalty should be 2 minutes for CLASS 1 (‘Good’ condition), 5 minutes for CLASS 2 (‘Fair’ condition), and 10 minutes for CLASS 3 (‘Imminent failure’ condition) with the CLASS defined based upon the following criteria;

comment

86

comment by: Sikorsky Aircraft

Regarding the proposed AMC 29.927(i)(5) Calculation of the maximum period of operation following loss of lubrication, Sikorsky proposes the following version of the equation with more discrete and limited choices for the factors:

$$T_d = (K_c \times T_c) - T_p$$

where:

- $T_d$  is the Maximum Period of Operation Following Loss of Lubrication, for which confidence has been established and which is to be referenced in the RFM emergency procedures;
- $K_c$  is the confidence reduction factor and shall be assigned the value of 0.8, 0.9, or 1.0:

- 0.8 if only one loss of lubrication test is conducted with no corresponding development tests
- 0.9 if 2 or more tests are conducted and the results are variable (the factor would be applied to the test of shortest duration and “variable” would need to be defined)
- 1.0 if 2 or more tests are conducted with similar results (similar would need to be defined)

The objective is to give credit for confidence if a lab test or tests have been conducted that validate the certification test for credit, but to limit the choices to more discreet values. Sikorsky also recommends that the highest value of  $K_c$  only be awarded if there is



	<p>active health monitoring of the gearbox or auxiliary lube system during operation following loss of lubrication.</p> <p>— Tc is the duration of the certification test (from low-pressure indication to end of test); and</p> <p>— Tp is a fixed-time reduction factor to account for condition at the end of the test, and shall be either 5 or 15 minutes.</p> <ul style="list-style-type: none"> <li>• 5 minutes if there is no loss of drive during the entire planned test duration</li> <li>• 15 minutes if there is loss of drive during the planned test duration</li> </ul>
response	<p>Partially accepted. The potential for variability of Kr factors has been improved by applying discrete Kr values and the scope of potential interpretation has been reduced. The use of development tests is also clarified. The following changes have been incorporated;</p> <ul style="list-style-type: none"> <li>(i) 0.6 where the certification test has no supporting data to provide understanding of the gearbox behaviour and confidence in the repeatability of the certification test data.</li> <li>(ii) 0.8 where the certification test is corroborated by one representative full scale test (certification or development test). The corroborating test results should show consistency of the temperature history, and demonstrate good correlation with the certification test.</li> <li>(iii) 0.9 where the certification test is corroborated by two or more representative full scale tests (certification or development tests) or by one representative full scale and one or more modular tests, historical data, or simulation results. The corroborating data should show consistency of the temperature history, and demonstrate good correlation with the certification test. In addition the behaviour of the limiting design characteristics are established and supported by repeatable test data.</li> </ul> <p>Note: Specific testing, simulation or representative development test data from other programmes, are examples of data that can be used to support the application of this Kr factor.</p> <p>In addition, AMC 29.927(f)(2)(vi) is modified to allow the component condition to be assumed to be Class 3 (10 minute fixed time penalty) at completion of the certification test if necessary torque is being transmitted.</p>

comment

96

comment by: *Aerossurance*

AMC 29.927(i): Where a design uses super-finished bearings and gear teeth, or other degradable features these may affect a test result. Similarly different combinations of components at extremes of build tolerance may also have an effect. It would be therefore prudent to add a requirement that: Foreseeable wear and degradation of components or extreme combinations of component tolerances should be considered to determine if a difference in performance is possible between the tested configuration and an in-service gearbox, with an appropriate reduction of the maximum period of operation being made,



if necessary.

response Partially accepted. New text has been added to AMC 29.917, stating that the safety assessment should identify any specific design features which are subject to variability in manufacture or wear/degradation in service and which could have an appreciable effect on the maximum period of operation following loss of lubrication. The purpose of identifying these features is so that they can be accounted for when determining the configuration of test articles. Text has also been added to AMC 29.927 para (d) ‘Certification test configuration’ stating that these identified features should be accounted for when determining the configuration of the test articles.

comment 97 comment by: *Aerossurance*

AMC 29.927(e): To avoid unrepresentative testing add: Where a gearbox design relies small quantities of residual oil in specific parts of the MGB after an oil loss, the test should be conducted with a minimum quantity of residual oil or less, in each critical area of the MGB. An assessment is made of the effect of flight conditions on the local retention of residual oil.

response Accepted. It is understood that when relying on residual oil, as now defined in AMC 29.927(c)(2), the aircraft attitudes and flight conditions may modify this quantity of residual oil. This parameter, which is critical for the success of the test, should be taken into account when establishing the ‘most severe failure mode’

The following text has been added in AMC 29.927(c)(2): *‘Residual oil: the oil present in the gearbox after experiencing the most severe failure mode, beginning at the time the pilot receives an indication of the failure. (Note: the amount of residual oil may decrease with time, and test conditions should take into account the possible effects of flight conditions where relevant.’*

comment 98 comment by: *Aerossurance*

AMC 29.927(e)(1)(iv): Is it realistic to assume that real life lubrication system failure won’t also result in higher T/R torque, prior to reduction of power by the crew? For example when manoeuvring for landing / ditching.

response Noted: flight manual emergency procedures will instruct an immediate reduction of power, which will consequently reduce tail rotor torque. The remaining flight at Vy is envisaged to need minimal tail rotor torque in forward flight. In addition, the flight manual should advise the crew to minimise the power usage for yaw control and accessories.

comment 105 comment by: *Transport Canada Civil Aviation Standards Branch*

**Subject: Transport Canada comments concerning EASA NPA 2017-07 – Rotorcraft**



**gearbox loss of lubrication**

Dear EASA Colleagues,

The European Aviation Safety Agency (EASA) invited interested persons to submit their comments regarding the subject NPA.

Transport Canada (IC) has reviewed the document and would like to offer the following comments for your consideration.

**Comment – The 45 sec HOGE power requirement used to test the approach phase (page 8 and page 13)**

- A Category A certified helicopter, whether or not facing a MGB oil pressure malfunction, should be able to conduct an approach following the Category A horizontal (runway landing) or vertical (oil rig, heliport) profiles provided in the RFM.
- The conduct of these Category A profiles with AEO require a lot less power than a 45 second OGE hover.
- With MGB oil pressure issues, some OEMs recommend minimizing power changes to reduce strains on the MGB. Consequently, varying power after the cruise test period is complete could be a worst case test condition than a fixed higher power setting.
- The power required and duration identified by EASA following the cruise test are not substantiated by the profile which will be used by pilots to conduct emergency landing.

Following the cruise period at  $V_y$ , the pilot will need to reduce power to initiate a descent from the minimum enroute altitude to a point where the Category A profile can be intercepted.

Towards the completion of the Category A profile, power will need to be increased to arrest the descent and cushion the landing. The approach/landing test following the cruise test should mimic such profile.

Consequently, it is recommended that the last 6 minutes of the cruise test and the 45 second HOGE power test be replaced by:

- 4 minutes at the power required at Maximum GW to descend at 1000 fpm (to simulate a descent from 5000 ft AGL to 1000 ft AGL).
- 2 minutes at the power required at Maximum GW to descend at 500 fpm (to simulate a descent from 1000 ft AGL to TDP).
- 15 seconds at MCP.

This profile would be more representative and the variation in power may result in more demanding test conditions, thus further improving safety.

Should you require further information, please contact Lisa Lanthier, Senior Advisor, International Aviation, by email at [lisa.lanthier@tc.ga.ca](mailto:lisa.lanthier@tc.ga.ca) or by phone at 613-993-9583.

response

Partially accepted. It is agreed that the proposal may be representative of some typical flight scenarios. However, should a loss of oil event occur at low altitude, there would be no reduced power condition from descending. Accordingly, the text has not been changed, as the existing text is considered to be more conservative.



**4. Impact assessment - 4.1.2. Who is affected**

p. 23-24

comment 87

comment by: Sikorsky Aircraft

This section addresses **Who is affected** and, in doing so, specifies a fleet of 682 existing helicopters as of February 2016. This NPA does not apply to currently fielded aircraft and such explanation is misplaced if not misleading. **Who is affected** is determined by the certification basis for new applicants only. There is no retroactive component in this NPA. EASA should remove from this section the inappropriate reference to the existing fleet of aircraft.

response

Not accepted. There is no intention to retrospectively apply the proposed changes to CS-27 and CS-29. However, the intention of this section is to estimate the number of potential future aircraft that could be affected by this NPA. Typically, this is based on historical data, though it is understood that this may not be representative of predicted future behaviour. There is no intention to republish the RIA.

**4. Impact assessment - 4.1.3. How could the issue/problem evolve**

p. 24-25

comment 88

comment by: Sikorsky Aircraft

EASA states the issue relates to the increased number of helicopters currently in service for offshore work. This NPA does not apply to those aircraft and such reference or inferences that the NPA applies should be removed. EASA should clarify this NPA is about certification of new products whose certification basis will include these proposed amendments.

response

Not accepted. The increase in demand for long range offshore operations was an observation at the time of the NPA and is not significant in relation to the decision to publish the proposed changes in the NPA. There is no intention to retrospectively apply these changes to existing aircraft. There is no intention to republish the RIA.

**4. Impact assessment - 4.3. How it could be achieved**

p. 25

comment 89

comment by: Sikorsky Aircraft

As an amendment to CS 29, the implementation of Changed Product Rule and/or the certification basis for new applications will determine the applicability of this revised set of regulations. EASA should clarify the intent of the phrase “not applicable to variants



	unless there is an amendment to 21.A.101”, or remove the phrase altogether.
response	Partially accepted. The intent of the NPA was to acknowledge that where changes to existing designs are considered as ‘significant’ with respect to 21.101 then the changed requirements of this NPA could become applicable. This was not clear from the NPA text. 21.A.101 provides an explanation of the factors affecting whether a change is classified as significant, and for which the current certification standards would be applicable.

#### 4. Impact assessment - 4.4. Methodology and data

p. 26

comment	90	comment by: Sikorsky Aircraft
	Paragraph 4.4.1 page 26; EASA is requested to define IA.	

response Noted. IA stands for ‘Impact Analysis’.

comment	91	comment by: Sikorsky Aircraft
	Paragraph 4.4.1 page 26: The EASA data collection used to assess the economic impact of this NPA is based upon an assessment of the number of aircraft in the current helicopter fleet. This NPA does not apply to those aircraft and such reference or inferences that the NPA applies should be clarified.	

response Not accepted. The intention of this section is to estimate the number of potential future aircraft that could be affected by this NPA. The assessment of the economic impact is based on the development cost per new type compared to the annual revenue per manufacturer. There is no intention to republish the RIA.

comment	92	comment by: Sikorsky Aircraft
	The offshore industry has changed dramatically in the period since the data was collected for the basis for this assessment, including the quantity, types and their certification bases of aircraft both entering and leaving service. EASA should reconcile such recent significant changes with the conclusions drawn thereon.	

response Noted: although there has been a reduction in CS-29 helicopter CAT flying in recent years, a preliminary assessment shows that the number of CS-29 helicopters operated by EASA Member States has actually increased. Historically, the CS-29 helicopter CAT volume of operation has been cyclic and the RIA is still considered to be justified. In addition, the sensitivity of the analysis to a decrease in flying is low. There is no intention to re-publish the RIA.



**4. Impact assessment - 4.5. What are the impacts** p. 26-29

comment	<p>93 <span style="float: right;">comment by: Sikorsky Aircraft</span></p> <p>EASA states that the assessment include 9 rotorcraft occurrences or accidents, further breaking them into 1 fatal accident, 2 non-fatal accident, 2 serious accidents and 4 incidents. Seven of these reportedly involve the loss of oil or the loss of oil pressure. EASA should specify the actual events which lead to these summations. Further, EASA should explain how this NPOA would affect or otherwise mitigate the conditions and events used to substantiate this NPA.</p>
response	<p>Not accepted. The purpose of referring to these events that involve a loss of oil is to illustrate the potential benefit of improving the provisions relating to gearbox lubrication. This NPA introduces improvements to both the safety analysis of these systems as well as improved capability in the event of loss of oil. It is anticipated that the proposed changes to CS-27 and CS-29 will help to address either partially or fully the factors that contribute to these events.</p>

**4. Impact assessment - 4.6. Conclusion** p. 29-30

comment	<p>1 <span style="float: right;">comment by: Helispot.be</span></p> <p>We're in favor of Option1.</p>
response	<p>Noted.</p>

**4. Impact assessment - 4.7. Monitoring and evaluation** p. 30

comment	<p>94 <span style="float: right;">comment by: Sikorsky Aircraft</span></p> <p>The offshore industry has changed dramatically in the period since the data was collected for the basis for this assessment, including the quantity, types and their certification bases of aircraft both entering and leaving service. EASA should reconcile such recent significant changes with the conclusions drawn thereon.</p>
response	<p>Noted: although there has been a reduction in CS-29 helicopter CAT flying in recent years, a preliminary assessment shows that the number of CS-29 helicopters operated by EASA Member States has actually increased. Historically, the CS-29 helicopter CAT volume of</p>





operation has been cyclic and the RIA is still considered to be justified. In addition, the sensitivity of the analysis to a decrease in flying is low. There is no intention to re-publish the RIA.



### 3. Appendix A — Attachments



[Letter EASA.PDF](#)

Attachment #1 to comment [#104](#)

