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1	*Airbus Helicopters*	/	/	As a general comment, this CM tries to introduce complementary requirements to those defined in CS 27/29.865, whereas a CM is only supposed to provide information only and should even not be the same level as an AMC (see below the extract from cover page). "*Certification Memoranda are provided for information purposes only and must not be misconstrued as formally adopted Acceptable Means of Compliance (AMC) or as Guidance Material (GM). Certification Memoranda are not intended to introduce new certification requirements or to modify existing certification requirements and do not constitute any legal obligation.*"	Additional requirements should be removed and addressed if necessary through regulatory activity in updates of CS/FAR 27/29.865.		Yes	Partially accepted	This Certification Memorandum anticipated the publication of the results of the External Loads Sub-group on Non-Human External Cargo (NHEC). As these results are not yet published and to avoid delaying further the considerations for Human External Cargo (HEC) of the Certification Memorandum, the material related to NHEC is removed. It may be re-introduced at the time the results of the External Loads Sub-group are published.
2	*Airbus Helicopters*	Para 3.1	5	"*Furthermore, the CS 27/29.865 External Loads Sub-group came to a consensus to reaffirm that the loss of HEC is a Catastrophic event in accordance with the safety objectives in section CS 27/29.1309 of the AC material and the evaluation of the loss of NHEC should be considered to be at least a Hazardous event because of the risk of the load hitting persons on the ground. According to this consensus a new CS 27/29.865 AMC is proposed to reflect this approach in the reliability part.*"	Hazards of persons on the ground resulting from loss of NHEC are not covered by CS 27/29.865 (f) requiring **hazard for the rotorcraft** for fatigue evaluation of external load attaching means. Airbus Helicopters interprets CM-HS-004 such that the requirements for fatigue evaluation according to CS27/29.865 (f) are not affected.	Yes		Noted	Please see answer to comment #1.
3	*Airbus Helicopters*	Para 3.1	5	"*Furthermore, in accordance with the existing AC 27/29.865, all potential failure modes of the hoist system which may result in catastrophic failures, serious injuries, or fatalities should be shown to be extremely improbable. In making this assessment, the following failure modes, among others, should be addressed:* *[…]* ***- rebound (also called backlash or spring up) of the cable following rupture***"	Rebound following cable rupture is a phenomenon which has been experienced on some incidents so far. As far as known, Airbus Helicopters considers the number of such events extremely low, compared to the number of successfully performed hoist flights. Hence Airbus Helicopters does not see the necessity for short-term actions without comprehensive studies and discussion, see also remark #5. The experimental data which is currently available with the existing and certified cable-design shows that potentially catastrophic rebound behaviour cannot be reliably prevented under any foreseeable operational condition. Tests known by Airbus helicopters have been conducted with purely vertical loading and subsequent release (backlash) of the cable. Such testing however does not take into account potentially more demanding conditions with the cable being suspended at a fleet-angle being not less than 30°, as defined per CS27/29. Therefore, in order to minimize the probability of cable-rebound, the occurrence level of a cable-rupture needs to be minimized as such. This can be achieved by: 1. Cable static and fatigue strength substantiation by taking into account safety factors covering		Yes	Partially accepted	Rebound following cable rupture can result in multiple fatalities due to the loss of the aircraft. According to the existing rule, it should be considered a potential catastrophic failure mode and mitigated independently from historical frequency of occurrence. Regardless the Agency has performed a service history review and is aware of 11 incidents/accidents where the cable rebounded to the level of the airframe/rotors, stressing the relevance of this potential failure mode. The Certification Memorandum restates the rule objectives; the means of compliance should be proposed by the applicant when applying for certification. This particular failure mode could, as suggested, be addressed by a combination of a load-limiting device and cable properties. Specific tests or analysis to demonstrate compliance, including the contribution of the cable and the airframe, should be proposed within the frame of individual certification projects and tests that are more generic can be discussed, as proposed, within the frame of the hoist TSO/ETSO working group. The comment that the MIL-DTL-83140 standard may not be suitable is noted, however an immediate means to minimise rebound exists: preliminary testing has shown that for 2.5g-rated installations a 25% load reduction may be sufficient to lower the MIL-DTL-83140 cable rebound below its suspension point. A temporary measure could thus consist in reducing the rated load whilst a standard allowing compliance at the desired rated load is being identified. No change to the Certification Memorandum wording is deemed necessary because of this comment.

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					strength reduction by damages and/ or ageing to be reasonably encountered in-service 2. Providing a load-limiting device which would limit the load on the cable to: a. Limit the load on the cable well below its breaking strength, and b. Limit the load on the cable and thus the potential energy stored by the cable to limit cable-rebound as far as reasonably practicable 3. Establishing proper operational procedures and limitations, including a limitation in the flight manual to forbid any operational condition that would result in a cable sang. 4. Establishing proper cable maintenance instructions and intervals Point 1 requires definition of appropriate safety factors which would be adequate to cover strength reduction by damages and/ or ageing to be reasonably encountered in-service. In order to facilitate substantiation acceptable for EASA, guidance should be provided in the respective AMC material. Point 2 describes a design-solution not necessarily applicable not to the cable itself. While hoist-installations featuring cables with poor rebound characteristics would certainly benefit from such a device, it is conceivable that such with good rebound characteristics (limited rebound) would not require such a device. Points 3 and 4 are regarded to be already implemented on the right level, except for the limitation related to cable snag. Conclusion: With above said CM-HS-004 in its current form in conjunction with CS27/29 and applicable AMC does not provide acceptable means of compliance for certifying new hoist-installations as some parameters like minimum cable-strength safety factors and minimum cable rebound characteristics are not defined. With the data at hand, the cable standard MIL-DTL-83140 being the only widely certified cable-standard for hoist-installations is deemed not suitable in order to fulfill the cable rebound requirement per CM-HS-004. Hence it would have to be replaced by another design the development and qualification of which is expected to take minimum two years after issuance of the certification memorandum. In case the cable rebound requirement is too demanding, there is a risk that cable development would require even longer or,				

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					at worst, is deemed being impossible by industry with existing technologies. In addition, with regard to cable rebound characteristics, the properties of the cable are not the only determining factor for the level of rebound. Compliance of the hoist and its suspension means in conjunction with rotorcraft structure might add considerable potential energy storage capabilities hence increasing total rebound. Further discussions among EASA and TC-holders are necessary in order to reach consensus about the technical requirements and their means of verification. The discussions in the frame of SAE G-26 "TSO for helicopter hoists" are considered to be the appropriate platform for these discussions. In this regards, please refer also to comment #5, related to the external load-factor.				
4	*Airbus Helicopters*	Para 3.1	5	"*Quick Release Systems alone are not considered to be sufficient to prevent an overload due to the delay induced by pilot/operator reaction times, e.g. if an entanglement is not immediately recognized or if entangled on a heaving ship.*" Quick Release Systems are defined in CS-27/29.865(b) as a means required as part of the external load attaching means "*for jettisonable rotorcraft-load combinations*". The proposed CM states that such a device is not considered sufficient to prevent an overload.	If Quick Release Systems as specified by the certification specification is not considered sufficient, a rulemaking task should be launched to re-open CS 27/29.865 and FAR 27/29.865. The designated purpose of the prescribed overload protection device should be made clear. In case it is designated in order to compensate for the potential catastrophic effects from a cable rebound, compensating means, e.g. like a hoist-cable with non-hazardous cable rebound characteristics, should be allowed.		Yes	Not accepted	The Quick Release System is foreseen in the current rule and advisory material as the means to jettison the load in an emergency situation, for example a tail rotor failure (See AC29-2C definitions, e.g. "Primary Quick-Release Subsystem (PQRS). The primary or "first choice" subsystem used to perform a normal or emergency jettison of external cargo.") While it may also be effective in preventing some overload failures, in particular in some cases of entanglements, it does not address all of them , as evidenced for example by the multiple cases of entanglement on heaving ships resulting in cable rupture. As per the current rule all potential catastrophic failure modes, such as may be caused by overload, need to be mitigated. It is thus not deemed necessary to launch a rulemaking task on CS 27/29.865 and FAR 27/29.865 for this purpose, as nothing needs to be changed in the current rule or advisory circular. An overload protection device is not prescribed but rather the high-level objective of the rule of mitigating catastrophic failure modes, as may be caused by overload, is re-emphasized. The applicant is free to propose means by which a potential catastrophic failure mode will be mitigated. Exact values of overload are not prescribed in the Certification Memorandum but rather high-level descriptions of common potential overload causes, such as entanglement or shock load. Values should be proposed by the applicant on individual projects and the Agency is willing to work within the frame of the TSO/ETSO working group with the Industry to define acceptable generic values.
5	*Airbus Helicopters*	Para 3.1	5	"*Any overload protection system is considered to be part of the rotorcraft external load attaching means for compliance with CS 27/29.865 (a)* ***and thus should not allow the hoist to unspool below 2.5 times the rated load.***"	In case an overload protection system is provided, the maximum potential energy which can be stored in the cable shall be limited to avoid potential catastrophic effects from cable rebound. As such the threshold at which the overload protection system acts shall be adjusted to the design of the hoist-cable. Taking into account the discussion of cable rebound (see comment #3), the current cable standard MIL-DTL-83140 being the only widely certified cable-		Yes	Partially accepted	It is agreed that the threshold at which an overload protection system activates can be adjusted depending on individual designs. The Certification Memorandum does not prescribe an overload protection system or a given activation level. It however re-emphasizes the current rule stating that the rotorcraft external load attaching means and corresponding personnel carrying device system for rotorcraft load combinations to be used for human external cargo applications must withstand a limit static load factor not less than 2.5. This is considered

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					standard for hoist-installations requires setting of the overload-protection considerably lower than 2.5, the precise threshold being not determined yet due to missing technical data. There are hoist installations which are certified to a limit load factor of 2.5. Due to manufacturing tolerances a lower minimum load factor should be defined in order to have a margin to which the overload protection device can be adjusted. Experience from flight testing has shown that exceeding a load factor of 2 during hoisting operations is extremely remote, depending on the operational limitations established for hoist operations. The requirement per *CS 27/29.865 (a) "…and thus should not allow the hoist to unspool below 2.5 times the rated load.*" is, according Airbus Helicopters to be understood such that unspooling <u>due to failure of the hoist</u> is not allowed. However, temporary triggering of the overload-protection device shall not be considered as "failure of the hoist" if the triggering cannot be reasonably expected within the hoist-envelope to be certified. In fact, since the purpose of currently implemented overload-protection devices is to avoid/ limit permanent deformation to the complete hoist-installation, the overload-protection shall actually be set to a value below 2.5 (or the limit load-factor being applicable for the particular installation) times the rated load. <u>Conclusion</u> Airbus Helicopters considers the requirements currently in place per CS27/29 together with the interpretation of proposed CM-HS-004 not being fully consistent. The term undesired "unspooling" is not properly defined. In addition, the requirements and substantiation means for "acceptable" cable rebound characteristics are not in place yet. It is expected that in order to limit cable rebound to an "acceptable" value under any foreseeable operational condition with the (only) available existing cable technology, the admissible hoist payload needs to be limited to one person only. This would render rescue hoist operations impracticable. Alternative solutions like stronger metallic cables in accordance with MIL-DTL-83140 or completely new cable-designs would constitute major design-efforts which will not be available in the short-term. It is therefore proposed to set a rulemaking task in place in order to establish clarity about the definitions, the requirements to be met and their associated substantiation means. Further, due to the lack of existing design solutions, industry should be provided with a minimum preparation time before				to include the whole hoist system with any overload protection system if present. It is agreed that some movement of the drum, or cable, can be allowed for dynamic loads below 2.5g , for example to dampen turbulence and provide a more comfortable ride to the person(s) on the hook, but this movement should be of limited amplitude and duration. The drum should not continuously unspool under a static load factor less than 2.5. The particular case of entire hoist installations approved for 2.5g will necessitate particular attention in future certifications if an overload protection system is proposed, as either this system will need a very precise activation band and/or the structural provisions will need to be certified for an higher load factor to provide sufficient margins to the overload activation. A rulemaking task to provide better definitions of the terms from the existing advisory circular or to provide means of compliance for the existing requirements is not deemed necessary. Means of compliance can be proposed and discussed within the frame of individual projects and the Agency is willing to work within the frame of the TSO/ETSO working group with the Industry to define acceptable generic tests. Please also see answer to comment #3. No change to the Certification Memorandum wording is deemed necessary because of this comment.

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					implementing amended regulations in order not to completely block new hoist-installation certifications.				
6	*Airbus Helicopters*	Para 3.1	5	"In addition this Certification Memorandum seeks to improve future designs of external load attachment means by recommending that the use of single load paths which, after failure, could have a Catastrophic or Hazardous effect is minimised. Some current designs have a high number of such load paths which should be reduced in future applications to a minimum necessary to fulfil the intended function. An appropriate level of rigour should be applied in the design of external load attachment means, commensurate with the quantitative and qualitative safety objectives."	While the intention of the requirement is clear, there are no objective criteria defined which reliably can be specified at the time of development of a new hoist-installation which puts such a development at risk until EASA approves the design-concept. This is considered to be a not very practicable approach. In case EASA intends to re-formulate the requirement, the following should be considered: Structural redundancy by nature can be provided much more easily for static structures, while dynamic (rotating) ones render generally a considerably bigger challenge. • Existing designs feature several parts with single load-path only which are considered to be safe as they come with high margins of safety/ damage tolerance/ infinite life. Such parts/ features should not be subject to design evolvement if the in-service experience has turned out to be satisfactory.		Yes	Partially accepted	The word minimise is used in a number of rules and associated guidance material to provide a high-level objective. It is expected that systems be conceived so that a single failure does not lead to a catastrophic failure. While this may not always be achievable, this principle should guide the designer to solutions, which reduce critical load paths to a minimum. Only then should mitigation such as high margins of safety be considered. No change to the Certification Memorandum wording is deemed necessary because of this comment.
7	*UTC AEROSPACE SYSTEMS*	---	---	Currently, overload protection is not a mandatory requirement per regulations. Updates to regulations are recommended to change requirements, rather than through documents such as certification memorandums. This should be part of future rule-making.				Not accepted	This Certification Memorandum does not impose a requirement for overload protection but rather re-iterates the existing rule and advisory material, e.g. AC29-2C: > Reliability of the external load system. The failure of the external load system, including the PCDS where applicable, and its attachments to the rotorcraft should be shown to be extremely improbable (i.e., 1 x 10-9 failures per flight) for all failure modes that could cause a catastrophic failure, serious injury, or fatality anywhere in the total airborne system. It clarifies that if overload constitutes a potential catastrophic failure mode for a given installation it should be mitigated. No rulemaking is required as this Certification Memorandum only clarifies the existing rule.
8	*UTC AEROSPACE SYSTEMS*	---	---	The hoist industry has not evaluated the capability or performance of the system regarding rebound (or backlash), as this has not been levied as a requirement in the past. The industry understands the concern, and is actively looking into understanding current capability, as well as future improvements to address the rebound concern. However, initial indications show the current hoist cable designs do not satisfactorily meet the proposed rebound characteristics.				Not accepted	This Certification Memorandum does not impose a requirement for rebound of cables but rather re-iterates the existing rule and advisory material, e.g. AC29-2C: > Reliability of the external load system. The failure of the external load system, including the PCDS where applicable, and its attachments to the rotorcraft should be shown to be extremely improbable (i.e., 1 x 10-9 failures per flight) for all failure modes that could cause a catastrophic failure, serious injury, or fatality anywhere in the total airborne system. It clarifies that if rebound constitutes a potential catastrophic failure mode for a given installation it should be mitigated. Please also see answer to comment #3.

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9	*UTC AEROSPACE SYSTEMS*	---	---	Overload protection systems existing today do not meet the suggested/proposed ability to not unspool below 2.5 times the rated load. Future design improvements would be needed, which can take time, to implement design changes or upgrades to meet this requirement. This has not been the hoist industry's understanding for the requirement in the past. In fact, all of the aircraft manufacturers have historically required a minimum 2.0 times the rated load requirement.				Not accepted	The requirement for a limit static load factor of no less than 2.5 for Human External Cargo (HEC) rotorcraft external load attaching means and corresponding personnel carrying device system was introduced through FAR 27/29.865(a) in 1999 and incorporated in the initial release of CS 27/29. The reason for the introduction of this new requirement was summarized in the corresponding Notice of Proposed Rulemaking (NPRM) as follows: "Because of the need for both modernization and a higher level of safety, this proposal would address safety requirements for human external cargo (HEC)". New certifications that include in their certification basis the above rule are expected to meet this requirement.
10	*UTC AEROSPACE SYSTEMS*	---	---	While the proposed language in the Certification Memorandum seeking to improve future hoist designs by minimizing single load paths is considered a strong design approach, there is no associated requirement or details on what is considered an acceptable number of single load paths. A desire from EASA to generally reduce the current number of single load paths is noted. Clarification or examples of multiple load paths in current hoist design is requested. It would be helpful to know what is expected.				Noted	Please see answer to comment #6.
11	*UTC AEROSPACE SYSTEMS*	---	---	In general, the proposed focus on overload protection, entanglement protection, and rebound protection, is of concern to the hoist manufacturing industry. Many of the improvements required will take time to implement, and could require a significant design phase for future hoists to be certified. If future hoist certifications will be required in the short term to comply with these proposed requirements, this may limit new technology being introduced for a number of years. A suggestion would be to allow for incremental safety improvements, using a spiral development methodology to improve overall safety of hoisting operations in the future.				Noted	It is noted that some technology takes time to develop and may be introduced at a later date. Certification of a hoist installation however requires compliance to the applicable certification basis, which may include the current CS 27 or 29.865 covered by this Certification Memorandum.
12	*UTC AEROSPACE SYSTEMS*	---	---	There seems to be a general focus on design improvements to address operational concerns. It should be noted the hoisting community requires stronger operational hoist training to ensure hoist teams and aircrews are familiar with the equipment, and understand when situations could arise that increase the likelihood of hoist entanglements, unnecessary maneuvers, and shock loads.				Noted	An applicant can make use of the Operational Suitability Data (OSD) during certification of a hoist installation to propose data considered relevant for this specific type of operations.
13	*UTC AEROSPACE SYSTEMS*	---	---	With regards to the statement: "The operating limitations that may result from compliance to CS 27/29.865, e.g. weight or fleet angle, and other information necessary for safe operation must be made available to the crew members", it is understood that this may be accomplished by adding the limitations in the Rotorcraft Flight Manual (RFM), or using placards, or both.				Partially accepted	Limitations may be provided in the RFM and possibly also by placards. However, a means for the crew to respect these limitations/know when they have been exceeded must also be provided. No change to the Certification Memorandum wording is deemed necessary because of this comment.

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14	*UTC AEROSPACE SYSTEMS*	---	---	Hoist operating training and proficiency should be considered, with some type of training documentation/requirements added to Part 133 (advisory circulars, regulations, certification memorandums) established for the hoist community.				Noted	Part 133 does not exist under the EASA system. Training requirements are part of paragraph SPO.SPEC.HEC.100 of Commission Regulation (EU) No 379/2014 as well as paragraphs ORO.TC and SPA.HHO.130 of Commission Regulation (EU) No 965/2012. Additionally an applicant can propose under the Operational Suitability Data (OSD) data considered relevant for this specific type of operations.
15	*Bell Helicopter*	General	Page 3	The requirements under Cs27/29.865 and guidance in the AC provide for an acceptable level of safety. The CM does not provide any safety data to support the changes being introduced by this Certification Memo	The CM should be rescinded. Changes to CS-27/29 could be initiated through rulemaking if supported by safety data.	No	Yes	Partially accepted	Please see answer to comment #1 for NHEC. This Certification Memorandum is not deemed to introduce changes in the regulation or the AC material for HEC.
16	*Bell Helicopter*	General	Page 3	The consensus of the external loads subgroup does not represent consensus by industry nor does it draw from the extensive experience of external loads operators. The changes to the AC material that will be proposed will be subject to public comments that may change the conclusions of the external loads subgroup	EASA should wait until the AC changes have been formally vetted through the public consultation process.	No	Yes	Noted	Please see answer to comment #1.
17	*Bell Helicopter*	Section 2 Para 5	Page 4	Personnel who are involved in the external load operation are highly trained to properly use cargo hooks. The risk to these trained personnel is low and does not warrant increasing the hazard level associated with external load operations.	The hazard level for inadvertent loss of NHEC load should remain as Major.	No	Yes	Noted	Please see answer to comment #1.
18	*Bell Helicopter*	Section 3.1 Para 1 & 2	Page 5	The requirements for persons other than aircraft occupants are addressed in the operations regulations: EASA Air Operations Regulation SUBPART E: SPECIFIC REQUIREMENTS, SECTION 1, Helicopter external sling load operations (HESLO) includes requirements to ensure external load operations are conducted with the highest level of safety. Subpart SPO includes requirements for personnel training and experience, equipment, standard operating procedures, abnormal and emergency procedures and helicopter performance. The requirements account for exposure and specific environmental considerations that also take into consideration personnel on the ground. The operational requirements stated for these types of operations account for the statement in the EASA Basic Regulation Essential Requirements. This is also why the EASA operating regulation has accounted for different CAT regimes based on the number of engines and aircraft performance.	The basic regulation statements are to be interpreted based on the entire regulatory structure and should not focus on specific design requirements. Design requirements for NHEC combined with the safety objectives of the operational regulations provides an adequate level of safety. The hazard level for inadvertent loss of NHEC load should remain as Major.	Yes	Yes	Noted	Please see answer to comment #1.
19	*Bell Helicopter*	Section 3.1 Para 2	Page 5	It has been universally established that turbine engine failure rates are in the order of 10-5 equating to a major hazard level. In the EU, the operating environment for single engine rotorcraft has been restricted to Performance Class 3 operations in non-congested environments due to this statistic. This CRI	The hazard level for inadvertent loss of NHEC load should remain as Major to be commensurate with the hazard level associated with single engine rotorcraft.	No	Yes	Noted	Please see answer to comment #1.

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				proposes to expand the failure rate associated with loss of NHEC loads to a probability which equates to 10-7 whereas the probability of a single engine failure is much higher. The increase in hazard from major to severe major (hazardous) for single engine applications is not commensurate with the level of safety expected for either CS-27 single engine helicopters or the operating environment that has been established in the EASA Air Operations Regulation.					
20	*Bell Helicopter*	Section 3.1 Para 4	Page 5	EASA has stated that "Quick Release Systems alone are not considered to be sufficient to prevent an overload due to the delay induced by pilot/operator reaction times, e.g. if an entanglement is not immediately recognized or if entangled on a heaving ship." The requirements of 865(b) for a primary and backup quick release system were included in the regulation to provide an acceptable level of safety for the hazards that have been identified.	If changes to the design requirements are deemed necessary they should be accomplished through an amendment to CS-27/29.865(b) and not changed through policy.	No	Yes	Not accepted	Please see answer to comment #4.
21	*Bell Helicopter*	Section 3.1 Para 7	Page 5	The EASA position also talks to minimizing the use of single load paths which after failure could have a catastrophic or hazardous effect. It needs to be pointed out that there are many single load paths in rotorcraft including fixed flight controls designed based on CS-27 and 29, in which the failure of any link in the system could lead to a catastrophic event. The failure modes for single load path structure are mitigated by design rigour and applied loads to achieve the required level of structural integrity. Likewise external load attachment means are designed considering load applications to make sure the structure integrity and its intended function to achieve the appropriate level of safety is well maintained though its service life.	The statements concerning single load paths are not necessary.	No	Yes	Not accepted	Please see answer to comment #6.