

Comment				Comment summary	Suggested resolution	Comment is an observation (suggestion)	Comment is substantive (objection)	EASA comment disposition	EASA response
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1	Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR)	1.3	5	Usually, the acronym “LIDAR” stands for Light Detection and Ranging	Replace “Light Imaging Detection and Ranging” by “ Light Detection and Ranging ”	yes	no	Accepted	“Light Imaging Detection and Ranging” is replaced by “ Light Detection and Ranging ”.
2	Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR)	2	5	See NR 1	See NR 1	yes	no	Accepted	“Light Imaging Detection and Ranging” is replaced by “ Light Detection and Ranging ”.
3	Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR)	2	5/6	The CDRH-limits and measurement requirements have not been changed for some time and are no longer what could be considered “state of the art”. For this reason, the classification, the design requirements and the “warning” labels of IEC 60825-1 are also accepted by the CDRH, which is stated in the Laser Notice 50 of the CDRH. Furthermore, a reference to American National Standards Institute ANSI Z136 standard series is missing.	A reference should be introduced to refer to the ANSI Z136 American National Standard for safe use of lasers. The classification scheme is similar to the one of the IEC 60825-1 since both follow the recommendations of the International Commission on Non-Ionizing Radiation Protection (ICNIRP).	yes	no	Not accepted	Only international standards are intended to be referenced throughout the document.
4	Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR)	3.1.2.	6	The issue that equipment merely CONTAINS a laser of class 3R, 3B, or 4 should not necessarily lead to classification as a major change.	According to IEC 60825-14, classification of laser products is normally done by the manufacturer of the laser product, but where this is not the case (e.g., laser components, experimental or prototype systems), then the user should ensure that the effective class of the laser is determined based on the level of its accessible emission in accordance with IEC 60825-1. An equipment thus may contain a laser of class 3R,3B, or 4 but due to housings, or similar provisions the classification according to IEC 60825-1 may result in a lower class. Therefore it is advised that an equipment should be classified as a major change if the effective laser class is 3R,3B, or 4	no	yes	Accepted	The “effective” laser class will be used in this item. A Note with the IEC 60825-14 explanation of “effective” class is added. Only emitting lasers are affected by the provisions of the Certification Memorandum.
5	Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR)	3.2.1a	8	There should be not direct or reflected laser path (..) from the laser into the cockpit or cabin.	There should be not direct or reflected laser path (..) from the laser into the cockpit or cabin exceeding the relevant exposure limits (MPE, AEL)	yes	no	Accepted	Paragraph will be updated accordingly.
6	Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR)	3.2.1f	8	Accessible Emission Limit	Typo: Accessible Emission Limit	yes	no	Accepted	Typo corrected.
7	Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR)	3.2.1h	9	Limitations should be included so that the laser is deactivated during taxi, take-off and landing.	This sentence should be replaced by: Limitations should be included so that the laser emission is deactivated during taxi, take-off and landing in case the laser operation is potentially hazardous under these conditions. Rather than deactivating the laser provisions to block the laser beam should likewise be tolerated.	no	yes	Partially accepted	Laser emission is added but the last part of the sentence is considered not appropriate. It is too open to interpretations. A blockage option is added as well.

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8	FAA	2	5	In the background it states “exposure to laser light can cause temporary blindness (only if visible). The CM does not limit airborne lasers to invisible wavelengths. If visible wavelengths are allowed, there will be issues on the ground and in the air with flash blindness from the airborne laser which would be very difficult to control. We are unaware of any civil aviation application of visible wavelength lasers.	Recommend limiting the CM to invisible spectrum lasers. AC 20-183 is limited to invisible spectrum lasers.	no	yes	Not accepted	EASA has deliberately included the visible spectrum lasers. The CM takes them into account.
9	FAA	3.2.a)	8	States: “There should be no direct or reflected path (e.g. off the skids, cargo mirror, spinner, landing gear) from the laser into the cockpit or cabin.” AC 20-183 does not preclude laser exposure to the aircraft occupants. AC 20-183 states the following: “Laser equipment malfunction resulting in an aircraft crewmember’s or passenger’s eye or skin being exposed to invisible laser radiation exceeding the MPE is considered no less than a hazardous functional failure condition and could be catastrophic if continued safe flight is not possible because of the severity of the laser damage to a pilot’s eye or skin.” AC 20-183 does not specifically prohibit a laser emission that is less than the MPE into the cockpit or cabin.	This comment highlights one of the differences between the CM and AC 20-183.	yes	no	Accepted	Paragraph will be updated accordingly.
10	FAA	3.2.a)	8	States: The direct exposure of occupants, pilot, crew, passengers or the non-flying public to laser emissions Class 3R, 3B and 4 is considered a hazardous failure condition and could be catastrophic if continued safe flight is not possible because of the severity of the laser damage to the pilot’s eye or skin in the sense of CS XX.1309.” This CM is applying CS XX.1309 to people outside of the aircraft. AC 20-183 relies on the FDA rules to protect people outside of the aircraft and on the FAA airworthiness standards to protect the aircraft and its occupants.	This comment highlights one of the significant differences between the CM and AC 20-183.	yes	no	Noted	
11	FAA	3.2.c)	8	States: “To prevent unintentional ground emission and to minimise any hazards to non-flying public, the installation should include a safety ‘firing’ interlock, such as altitude and direction limiters. The ‘firing’ interlock can use a radio altimeter or other means to prevent laser emission while on the ground or below a prescribed height above the terrain (e.g., 1,000ft above ground level). The interlock system design should optimally control power to the laser emitter.” A radio altimeter may not be an effective interlock since it is not forward looking and may fail to protect the public on the ground when the public is at a higher terrain elevation than the terrain elevation being measured by rad altimeter.	Recommend adding the following sentence: If a radio altimeter safety interlock is used, an analysis should be provided that demonstrates the safety interlock will protect the non-flying public for all terrain types to include cities with tall buildings.	yes	no	Accepted	Paragraph will be updated accordingly.

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12	FAA	3.2.b)	8	States: "The laser installation should include safety interlock, remote interlock connector, key control and an emissions indicator. In addition, the laser installation should comply with the laser labelling requirements." What are the requirements for the safety interlock, remote interlock connector, key control and emissions indicator, and labels?	For these requirements, AC 20-183 references 21 CFR 1040 . Recommend including an industry standard reference (e.g. ANSI Z136.) or FDA 21 CFR 1040 reference for these requirements.	yes	no	Accepted	Paragraph will be updated to reference IEC 60825.
13	FAA	3.2.1.d)	8	States: "The installation may be either an intrinsically flight-safe laser system or a design-mitigated flight-safe laser system as defined in SARP 5674 "Safety Considerations for Aircraft-Mounted Lasers Projected Into the Navigable Airspace". It is unclear whether or not all the ARP5674 guidance in section 4.2 applies to intrinsically flight-safe laser system and a design-mitigated flight-safe laser system. For example, would procedural control measures be prohibited for design mitigated flight safe laser system?	Clarify what SARP 5674 guidance applies to the two categories: <ul style="list-style-type: none"> 1. intrinsically flight-safe laser system 2. design-mitigated flight-safe laser system 	yes	no	Partially accepted	Reference to those SARP categories are eliminated. No need to refer to these categories is considered.
14	THALES Avionics	1.3	5	The construction of LIDAR acronym differs from the commonly accepted one. Oxford English Dictionary states: "Etymology: < li- (in light n.) + -dar (in radar n.)". as it also states for radar : "Etymology: Acronym < the initial letters of radio detection and ranging" we obtain the commonly accepted acronym for lidar	LIDAR : Light Detection and Ranging	yes	no	Accepted	"Light Imaging Detection and Ranging" is replaced by " Light Detection and Ranging ".
15	THALES Avionics	3.1.2	6	The classification as major change for the installation of a Class 1, 1M, 2 or 2M laser system containing Class 3R, 2B or 4 lasers seems over constraining. For instance a blu-ray drive contains at least class 3R laser diode and is a class 1 product (nothing is emitted outside of the case) and would mean a major change approval for installation.	Systems designed to emit class 1, 1M 2 and 2M radiation should not require a major change approval for installation. The absence of failure mode leading to emitting higher class beam should be demonstrated according to standard processes	no	yes	Accepted	The "effective" Class laser is clarified in the paragraph. See comment NR 4.
16	THALES Avionics	3.1.4	7	Even if the mitigation strategies are not limited to the written ones, it could be interesting to add scanning and divergence of the beam in the list		yes	no	Accepted	Item is amended.
17	THALES Avionics	3.2.1 b)	8	The inclusion of safety interlock, interlock connector, key control and emission indicator can be unnecessary constraining for systems that are designed to ensure the laser safety by their own.	Indicate some occurrence where these features are not required. For instance, a class 4 laser system that is designed to emit only if the ground speed is sufficient to ensure that the whole aircraft can be considered as a class 1M or 2M system	yes	no	Not accepted	The CM aims at focussing on general guidance, other than specific cases. The content of the CM is considered acceptable by EASA but not the only one. Applicants are welcome to present their designs and solutions in line with the CM proposals.
18	THALES Avionics	3.2.1 c)	8	The ground speed can also ensure that the whole aircraft including the laser system can be considered as a class 1M or 2Msystem. The height above terrain can ensure that non flying public is within the NOHD of the emitter considered as non-moving but the NOHD can be reduced by the scanning effect induced by the aircraft motion. Furthermore, if the NOHD is less than the wingspan, it is very unlikely that non flying public is within this distance of the laser system while the aircraft is moving.	Clearly indicate that laser system could use ground speed or other information to limit the emitted power so that the whole aircraft can be considered as a class 1M or 2M system	yes	no	Partly accepted	Speed per se does not guarantee the safety of the non-flying public. Otherwise, applicants are welcome to present their designs and solutions in line with the CM proposals.

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19	THALES Avionics	3.2.1 h)	9	The ground speed can ensure that the whole aircraft including the laser system can be considered as a class 1M or 2M system. Thus the reference to taxi, take-off and landing is not necessarily appropriate.	Clearly indicate that laser system could use ground speed or other information to limit the emitted power so that the whole aircraft can be considered as a class 1M or 2M system. In such case deactivation of the system is not necessary. Deactivation of a class 3R, 3B or 4 laser is not necessary when it is very unlikely that anyone is within the NOHD of the system.	yes	no	Not accepted	The CM aims at focussing on general guidance, other than specific cases. The content of the CM is considered acceptable by EASA but not the only one. Applicants are welcome to present their designs and solutions in line with the CM proposals.
20	Diamond Aircraft Industries GmbH	3.1.2	6	<p>Integration of Equipment that complies with accepted standards (e.g. IEC 60825) shall be exempted from being classified as a Major Change.</p> <p>Background: Diamond's multi purpose platform concept (Type DA 42 M, EASA.A.513) success is mainly based on the advantage, that operator's or specialized shops/companies (e.g. Diamond Airborne Sensing GmbH) can install equipment as a Minor Change by following the approved installation requirements. A large number of those equipment installations include lasers, typically the equipment is highly qualified (e. g. IEC 60825 compliant or similar Police and Military accepted standards). So far, there have been no issues by installing them as Minor Changes.</p> <p>By default classification of certain laser class product installation as major changes will have a huge time impact for delivery because of the additional administrative procedures and in case of deliveries outside of EASA countries the requirement to validate major changes with the NAAs.</p> <p>The requirement to validate major changes will be a large competitive disadvantage for European installer. Based on our experience with validations as a TC holder, we expect it being almost impossible to validate major changes for small companies or even individuals.</p>	3.1.2 Due to the hazardous effect of laser systems installations that contain Class 3R, 3B and 4 lasers (with or without an internal diffuser feature) should be classified as a major change to a type certificate in accordance with Part 21.A.91, <u>unless the system complies with an accepted industry standard (e. g. IEC 60825) and the guidelines of this CM are met (ref. 3.2).</u>	no	yes	Not accepted	The proposed amendment would be against Part 21.A.91. See Appendix A to the Guidance Material 21.A.91.
21	Diamond Aircraft Industries GmbH	3.2.1 (a)	8	Requiring formal S/W DAL levels acc. CS xx.1309 may prevent the use of any software stops	Determine acceptable safety standards which are already in use for non-aviation applications of the LASER category products in question and allow those in parallel to DO 178.	no	yes	Partially accepted	The AC 23.1309.1E is applicable. It allows downgrading of the SW DAL in respect to failure classifications. Text is partially changed in order to avoid mentioning specific SW levels.
22	SAE G-10T Laser Safety Hazards Committee			Members of the SAE G-10T Laser Safety Hazards committee, consisting of individual subject matter experts, and as a matter of SAE International policy representing neither their employers nor SAE International, have completed review, discussion, and prepared comment presented herein to EASA Proposed CM No. CM-AS-006 Issue 01 "Notification of a Proposal to issue a Certification Memorandum Certification of airborne systems using Light Amplification by Stimulated Emission of Radiation (LASER) with high energy."				Accepted	CM is updated to include visual interference levels in 3.2.1.a) and reference to the ICAO Doc. 9815 in 3.2.1.f).

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				<p>The G-10T Laser Safety Hazards Committee provides a neutral industry/government forum to identify laser safety issues and generate aerospace recommended design practices and aerospace standards that consider the interaction of systems, humans, and the environment in which they operate. While the key deliverables of the Committee are industry guidance, standards, and information documents, the Committee also seeks to provide a neutral forum for roundtable discussions and understanding of laser hazards and their mitigation within the aerospace industry.</p> <p>G-10T comments to Proposed CM-AS-006 Issue 01 follow:</p> <p>It is our joint opinion that, although we recognize the need for the CM-AS-006 proposed Certification Memorandum, the draft CM may require significant revision to align with other standard laser safety terminology and philosophy. We welcome the opportunity to help with this task, if such help is desired. However, as the draft is currently written, we express concern that its publication may create more confusion than it intends to dismiss. Initial comments and observations include:</p> <ul style="list-style-type: none"> The draft CM reflects decision criteria in terms of laser class thus the applicable accessible emission limit for classification. However, it does not address visible lasers and the related consideration of visual interference levels to critical tasks such as aircraft or ground vehicle operation. Information on visual interference levels is reflected in various standards including ANSI Z136.6 "Safe Use of Lasers Outdoors" and ICAO Doc. 9815, "Manual on Laser Emitters and Flight Safety." 					
23	SAE G-10T Laser Safety Hazards Committee			<ul style="list-style-type: none"> The draft CM includes Class 3R lasers in the same broad category as Class 3B and Class 4 lasers. Although Class 3R lasers may be potentially hazardous under some direct and specular reflection viewing conditions if the eye is appropriately focused and stable, the likelihood of an actual injury is small. Class 3R is more closely associated with the lower hazard risk associated with the use of Class 1/1M/2/2M laser products. 				Accepted	Class 3R lasers will be removed from the CM direct purpose.

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24	SAE G-10T Laser Safety Hazards Committee			<ul style="list-style-type: none"> A distinction should be made between laser exposure vs. emission. The draft CM reflects certification rigor as a function of laser emission, which is a characteristic of the laser product output near the laser product aperture. For operational exposures in the context of the draft CM, this should more accurately consider potential laser exposure such as irradiance at anticipated exposure distances, expected reflection characteristics, and other physical considerations such as window transmittance at operational laser wavelength(s). 				Partially accepted	The concept of operational exposure is introduced in the CM. However, EASA does not see the need to define more precise guidance when using the concept.
25	SAE G-10T Laser Safety Hazards Committee			<ul style="list-style-type: none"> Paragraph 3.2.1(d) reference to “SARP 5674” should be corrected to SAE ARP5674. 				Noted	Reference not applicable anymore.
26	Dassault Aviation	§3.2.1.a	8	Sentence “There should be no direct or reflected path (e.g. off the skids, cargo mirror, spinner, landing gear) from the laser into the cockpit or cabin” should be revised to add : “with exposure levels greater than the permissible levels according to IEC 60825-1.”			yes	Partially accepted	The sentence has been updated according to the comments received, but not exactly as suggested.
27	Elbit systems			<p>In Par. 3.2.1 a) of the Proposed CM-AS-006 Issue 1 a sentence appears stating that “there should be no direct or reflected path (e.g. off the skids, cargo mirror, spinner, landing gear) from the laser into the cockpit or cabin.”</p> <p>Elop suggests modifying the sentence to state that “any laser beam that may follow a possible direct or reflected path (e.g. off the skids, cargo mirror, spinner, landing gear) into the cockpit or cabin shall be shown, taking into account the length of such path and the effects of intervening transparencies, not to result in exposure levels to the flight crew or others on board greater than the permissible levels according to IEC 60825-1.”</p> <p>Elbit Systems, Intelligence and Electro-optics – Elop wishes to make this comment based on Elop’s experience with civil certification of Directed, Infra Red Counter Measures Systems (DIRCMS) on Transport Category airplanes. Our experience suggests that above mentioned sentence should be modified to take into account both the distance of any possible direct or reflected path and the effect of the passage of the laser beam through any intervening transparencies.</p> <p>DIRCMS laser beams are, by definition, not visible and have no possible effects on the vision of flight crew or others on board an aircraft. Their only possible negative effects on persons would be possibility of injury to eye or skin. The ability of the laser beam to cause injury decreases with the distance of the person from the laser source, so that any direct or</p>				Partially accepted	The sentence has been updated according to the comments received, but not exactly as suggested.

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				<p>reflected path that was over a specified distance would be harmless, even if a perfect reflector is assumed to form the path.</p> <p>In addition to distance that a laser beam must travel on any direct or reflected path toward the cockpit or cabin of an aircraft, a laser beam from a source outside the aircraft skin must pass through a transparency of some sort before it can impinge upon a person within the aircraft. Our experience to date has been that all the aircraft transparencies that we have tested significantly reduce the types of IR laser energy found in typical DIRCM Systems.</p> <p>In light of the above, Elop believes that the suggested modifications to the original sentence would enable protection of flight crew and passengers from laser hazards while making certification of these systems more practical.</p>					
28	Airbus Helicopters	1.2	4	Reference materials include rotorcraft relevant equipment, systems and installation general airworthiness code. Such code for ICA and RFM is not addressed, even if in the body of the documents flight manual and maintenance manuals are mentioned.	Please include airworthiness code references for ICA and RFM, i.e. 27 and 29 1529 and 1581 in the table on page 4.	yes	no	Accepted	References added.
29	Airbus Helicopters	3.1.1	6	<p><i>“The complexity and scope of the equipment integration and installation will determine the classification of the change in accordance with Part 21.A.91.”</i></p> <p>According to 21.A.91, “A ‘minor change’ is one that has no appreciable effect on the mass, balance, structural strength, reliability, operational characteristics, noise, fuel venting, exhaust emission, or other characteristics affecting the airworthiness of the product”. Complexity of the integration is not part of the criteria of 21.A.91 or GM 21.A.91.</p>	<p>Suggest rewording of this sentence the following way:</p> <p><i>“Such a change should be classified in accordance with Part 21.A.91.”</i></p>	yes	no	Accepted	Paragraph amended.
30	Airbus Helicopters	3.2.1	8	<p>Consideration of risks to the non-flying public as hazardous in the sense of §1309 is unfeasible.</p> <p>Furthermore, there must be operational precautions to avoid inadvertent laser exposure.</p> <p>Inadvertent activation of the laser should be addressed through simple mechanisms (left to the choice of the TC/STC applicant).</p> <p>At last, § 3.2.1 is much too prescriptive.</p>	<p>Risk to the non-flying public should be treated operationally in a similar fashion to basic regulation (EC) 216/2008, ANNEX I (Essential requirements for airworthiness referred to in Article 5), item 2. (Airworthiness aspects of product operation).</p> <p>Propose to restrict § 3.2.1 to asking the TC/STC applicant to provide information about the characteristics of the laser. namely:</p> <ul style="list-style-type: none"> - item f) (except for sub-item (1)), - item h) (AFM/RFM) (except for the last sentence regarding the limitation not to activate the laser during taxi, take-off and landing, because this is too prescriptive), - item i). <p>All other items in this paragraph should be removed.</p>	no	yes	Partially accepted	<p>Section 3.2.1 is updated to include the first paragraph of the suggested resolution.</p> <p>The proposed removal in 3.2.1 is not accepted. 3.2.1 is based on the current Regulation and the International Standards referred. There is flexibility to comply with the regulation. Most of the provisions are guidance and examples not mandated to be followed.</p> <p>The concept of laser blockage during taxi, take-off and landing has been introduced. However, there could be other means to avoid inadvertent emission, like Software or electronic stops.</p>

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					A sentence should be added to state that inadvertent activation of the laser should be addressed through simple mechanisms left to the choice of the TC/STC applicant.				
31	Airbus Helicopters	3.2.2 Item a)	9	Inadvertent emission outside the laser for such lasers is only possible if a mechanical protection has been removed or broken. Software or electronic hardware design assurance level is not relevant for such an issue.	Suggestion is to remove item a).	no	yes	Partially accepted	The concept of laser blockage during taxi, take-off and landing has been introduced. However, there could be other means to avoid inadvertent emission, like Software or electronic stops.
32	Airbus Helicopters	3.2.3 Item a)	10	<i>“Transition between both configurations needs a maintenance action.”</i> The transition between both configurations may also be an action from the crew, not only a maintenance action.	Suggestion is to remove this sentence.	no	yes	Partially accepted	Text is updated to clarify the objectives of the paragraph.
33	Airbus Helicopters	3.2.3 Item d)	10	2 last sentences in item d) <i>“Procedures to transition from the EASA approved configuration to an unapproved configuration and back to the EASA approved configuration should be included in the ICA. It is highly recommended that the manufacturers establish procedures with the pertinent warnings and precautions to protect persons while operating the laser on ground.”</i> In the case that laser operation is not allowed under the remit of Regulation (EC) No 216/2008, it is not the responsibility of the TC/STC applicant to provide information about how to activate the laser and how to use it on ground.	Suggestion is to remove the last 2 sentences.	no	yes	Not accepted	EASA considers first sentence is in the remit of Regulation (EC) No 216/2008. Second sentence states “It is highly recommended”, thus just a recommendation.