Template for comments and secretariat observations

Date:2020-04-02	Document:	Project:

MB/ NC[1]	Line number	Clause/ Subclause	Paragraph/ Figure/Table	Type of comment[2]	Comments	Proposed change	Observations of the secretariat
ES -001					Other requirements for the electrical system	There must be a master switch or switches arranged to allow ready disconnection of all electric power sources.	
ES-002				General	This standard has a lack of order as a patchwork that make almost impossible to follow it. It should be considered to organize it by systems in a manner similar to airworthiness standards. The terminology used is not always aeronautical as it should be the logical .		
IT-003	Last sentence		Introduc.	te	**Proposed text:** This standard does not cover technical requirements for the design and manufacturing for UAS components. **Comment:** The text should also clarify that this standard does not apply to passenger carrying UAS.	This standard does neither cover passenger carrying UAS, nor technical requirements for the design and manufacturing for UAS components.	
ES-004		1			Typo error: “control station”	Delete: “control station”	
JISC2 -005		1	1	te	The scope doesn’t depend on UAS weight and operations on this current draft document. However, we should consider “ConOps” to develop this. For example; - Isn’t MTBF on 5.1.2 necessary for all UAS including micro drones and small UAS as same as large UAS? - Shall not all UAS have a function which diagnostic testing points are readily accessible on 5.2? - Isn’t it necessary for all UAS to document the testability factors on 5.3? - Don’t all UAS need list of spare parts on 5.6?	1 Scope This International Standard specifies requirements for ensuring the quality and safety of the design and manufacture of heavier than air unmanned aircraft systems (UAS) whose lifting devices are fixed or rotary wings. control station. This standard does not cover technical requirements for the design and manufacturing for UAS components. Manufactures should decide requirements which are described on this standard with reasonable reasons depending on ConOps. The standard is intended for UAS designed for use where a State aviation authority has determined a certificate of airworthiness is not required.	

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					- Etc. Example on 3.9 of ISO/TR 17427-3:2015; Concept of operations ConOps document describing the characteristics of a proposed system from the viewpoint of an individual who will use that system Note 1 to entry: It is used to communicate the quantitative and qualitative system characteristics to all stakeholders. ConOps is described on ISO/TR 17427-3:2015, ISO/IEC/IEEE 24765:2017, ISO/IEC/IEEE 29148:2018, ISO/IEC 26561:2019, ISO 15638-21:2018, ISO 15638-6:2014, ISO 15638-22:2019, ISO/TR 17427-9:2015, etc.		
IT-006		3. Definitions		te	A second additional definition for Safety Margin (see JARUS CS-UAS) would also be useful	Add a new definition based on the content of JARUS CS-UAS GM-UAS.2102 Approved Flight Envelope.	
IT-007		3. Definitions		te	An additional definition should be provided for Flight Envelope/Design Envelope (referred to typical flight mechanics) and Operational Flight Envelope, stating that this include all flight mechanics limits (including Gusts and Load Factor limitations), all environmental limits and any other operational limit.	Add a new definition based on the content of JARUS CS-UAS GM-UAS.2102 Approved Flight Envelope.	
ES-008		3.5			This is the definition of hovering (maneuver), more than hover that is a flight condition.	Proposed change: hovering: a maneuver in which the VTOL aircraft is	

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						maintained in nearly motionless flight over a reference point at a constant altitude and on a constant heading or hover: flight condition in which the VTOL aircraft is maintained in nearly motionless flight over a reference point at a constant altitude and on a constant heading	
ES-009		3.5			VTOL-capable crafts are also aircrafts	Proposed to use “VTOL aircraft” instead of “VTOL-capable crafts”	
JISC43-010	2	3.5		ed	Duplicated periods ‘‘a constant heading..”	To delete a period “a constant heading.”	
IT-011		3.8		te	**Proposed text:** operator’s manual: document that contains specifications and information for safety, operation, maintenance, storage or assembly of a UAS **Comment:** Chapter 7 of ISO 21384-3 speaks about “operations manual”. The same term should be used. Even more important, the difference between the Flight Manual (under responsibility of the designer) and the Operations Manual (under the responsibility of the Operator). Flight Manual is defined in 3.28 of 21384-4. Operations Manual is defined in 3.49 of same standard. So it is not necessary to define either of these manuals in 21384-2	DELETE 3.8 since covered by 21384-4.	
ES-012		3.11			In the definition for fixed-wing UA, it is requested to climb up to an altitude of 50 feet (15m). This altitude is taken from manned aircraft standards and could not be realistic for light fixed-wing UA for which there is no need to climb up to this altitude	Proposed text: Phase of flight from the application of take-off power, through rotation and to an altitude of 50 feet above runway elevation, or attain controlled flight,	

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					to be in a controlled forward flight. For rotorcrafts, the end of the take-off phase is not linked to be out of ground effect (OGE), that is an altitude of approximately the diameter of the main rotor. it should be also considered that It is needed to attain a controlled flight. In rotorcrafts, the take-off ends when an effective translational lift and a normal climb are reached; not just when are OGE. Additionally, take-off from elevated platforms (heliports) could even conduct to a descent just after leaving in-ground effect (IGE).	or until gear up selection, whichever occurs first. For rotorcrafts – the phase of the flight where transitions from the surface (or a hover in ground effect) into an out of ground-effect controlled flight condition	
JISC3-013		3.14		te	"Product system" is defined in other ISOs, such as ISO 14045:2012, ISO/IEC TS 19249:2017, ISO 14040:2006, etc. When we want to use another meaning, it should be re-defined on this standard.	3.14 product system collection of unit processes with elementary and product flows, performing one or more defined functions, to be an unmanned aircraft.	
ES-014		4			VTOL should be included in the list of abbreviated terms	Proposed to include: VTOL – Vertical Take-Off and Landing	
JISC44-015		4		ed	Incorrect abbreviations BRLOS: Beyond Ratio Line of Sight HUMS: Health and Monitoring System IEC: Inertial Navigation System INS: International Electrotechnical Commission PWM: Pulsed Width Modulation	 To be "Beyond Radio Line of Sight" To be "Health and Usage Monitoring Systems" To be "International Electrotechnical Commission" To be "Inertial Navigation System" To be "Pulse Width Modulation"	
JISC4-016		4		ed	DoD means "United States Department of Defence" exactly, but actually, DoD shall not be limited to only United States.	DoD ~~United States~~ Department of Defence	
ES-017		5			Function (or functioning) requirements must be included, not only in testability	Proposed text 5.1 Function (or functioning) and reliability In 5.1.1, "function (or functioning) and reliability"	

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						instead of “realiability”	
JISC5-018		5		ed	In accordance with Clause 22.3.3 of Part 2 on ISO/IEC Directives, hanging paragraphs shall not be used on standards.	5 General design requirements for unmanned aircraft systems 5.1 General The product systems related to the design of an unmanned aircraft system consists of the unmanned aircraft, communication system, mission payloads, control station and maintenance support equipment.	
IT-019		5.1.1		te	**Proposed text:** None **Comment:** Similarly to FAR/CS-23/25 reference to gust loads should be added	Add: l) Establish specific design approach and references to evaluate gust loads, whenever UA configuration leads to extremely severe loads,	
IT-020		5.1.1		te	**Proposed text:** None **Comment:** Some text to protect structures from excessive loads should be added	Add: k) Establish manoeuvre safe operation provisions or limitations, in case of manual commands or semi-automatic commands, to ensure Operational Flight Loads limit to be respected.	
CN01-021		5.1.1		te	1.Lack of requirements and explanations for reliability work items, 2.Lack of requirements and explanations for safety.	1. add ‘the reliability design analysis method shall be adopted to analyze and evaluate the potential risks of the product.’ 2. add the requirements and explanations for safety.	
JISC6-022		5.1.1		ed	In accordance with Clause 23 of Part 2 on ISO/IEC Directives, semicolon shall be used for that list. Please check the other lists.	a) Simplify the design criteria to reduce the product complexity.; b) Apply redundancies to key safety functions.; c) Minimize stress to the components and mechanical parts.; d) Identify the critical components.; e) Apply environmental protection design and materials to limit the environmental effects on	

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						critical components.; f) Establish thermal design criteria throughout the components selection, circuit design and structural design to enable reliability over a wide temperature range.; g) Conduct EMC design to avoid electromagnetic radiation.; h) Adopt software reliability design and analysis tools.; and i) Apply protections designed to avoid harm during the packaging, handling, transportation and storage.	
JISC7-023		5.1.1	e)		Need more information to know reasons.	e) Apply environmental protection design and materials to limit the environmental effects on critical components to avoid injured and handle its body.	
US-024		5.1.1	g)	te	g) Conduct EMC design to avoid electromagnetic radiation. EMC is Electro-magnetic Compatibility and does not help you “avoid” EM radiation. I think you mean EMI for that. Either way, both EMI and EMC should be considered. Section 8.2 alludes to this, although it does not specifically say EMI/EMC.	g) Conduct EMI/EMC evaluation and design mitigations for harmful effects of electromagnetic radiation from the operational environment as well as those produced by other components on the UA.	
JISC8-025		5.1.1	i)		Need more information to know reasons.	i) Apply protections designed to avoid harm during the packaging, handling, transportation and storage to be packed in a container.	
IT-026		5.1.1	Letter b)	te	**Proposed text:** b) Apply redundancies to key safety function **Comment:** Text could be more accurate	b) check safety and reliability of the UAS into the whole Operational Flight Envelope, ensuring safety margins and redundancy for safety systems and components.	
ES-027		5.1.1 d) and e)			Critical component should be clarified	Proposed text d) Identify the critical components for the safety of flight	

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						e) Apply environmental protection design and materials to limit the environmental effects on critical components for the safety of flight.	
ES-028		5.1.1 g)			EMI should also be considered	Proposed text g) Conduct EMC/EMI design to avoid electromagnetic radiation and be protected from electromagnetic disturbances	
JISC9-029		5.1.2		te	If we don't consider ConOps, this content shall be used for all UAS.	The manufacture shall document risk assessment result for each component which needs reliability. ~~The manufacturer shall document the following minimum component reliability factors:~~ ~~a) mission time between fatal failures;~~ ~~b) mean time between failures or failure rate;~~ ~~c) mean time between maintenance; and~~ ~~d) cumulative failure rate.~~	
US-030		5.1.2	05.1.2	te	"manufacturer shall document the following minimum component reliability factors" – to what level? Of what components? Every individual component is not necessary or feasible.	"manufacturer shall document the following minimum component reliability factors for those components identified as "critical" in 5.1.1 d)."	
JISC10-031		5.2		te	If we don't consider ConOps, this content shall be used for all UAS.	The manufacturer ~~shall~~ should document the maintenance requirements and make them available to the operator. The following factors ~~shall~~ should be included: a) mean repair time or repair rate; b) maximum repair time; c) mean maintenance time; d) propulsion system replacement time; e) mean preventive maintenance time; f) direct maintenance cost per flight hour; and so on.	
US-032		5.2	Second paragraph b)	te	"maximum repair time" is irrelevant. I can damage a UA such that maximum repair time is infinite	Delete b)	

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US-033		5.2	Second paragraph f)	te	How can the UA manufacturer determine “direct maintenance cost per flight hour” without explicit knowledge of the Operator’s personnel skill, rates, etc.? Also “; and so on” is an open-ended requirement. Delete or specify exactly what “and so on” means	Delete f)	
CN02-034		5.2 b)		te	It’s not possible that all parts can meet this requirement	Change to “detachable parts cannot be incorrectly assembled”	
ES-035		5.2 e)			The manufacturer shall ensure the presentation of the document in a manner to be understandable; but not that is understood.	Proposed text e) maintenance and support requirements document is presented in a clear, consistent and unambiguous manner.	
JISC11-036		5.3		te	“Testability” is used for keeping reliability, so that it isn’t always so necessary to keep reliability. In another word, it needs testability to keep reliability, but testability doesn’t always make reliability.	Delete.	
US-037		5.3	All	te	Are you referring to Built in Test? This is not clear	Rewrite section	
JISC12-038		5.4		te	If we don’t consider ConOps, this content shall be used for all UAS. “Fatigue durability” is important exactly, but it will take many time to perform it for all parts. So that, some important parts which a result of risk assessment is decided bJISCanufacture shall need “Fatigue durability”.	The manufacturer shall document the UAS fatigue durability requirements for some important parts which are needed with a result of risk assessment bJISCanufacture and make them available to the operator. The following factors for the UAS and the key components should ~~shall~~ be included: a) total life; b) service life; c) first renovation period; d) storage life; and so on.	

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						If exceed the storage life, test the UAS according to the items in Technical Parameters, and the UAS can still be used where in conformity with technical requirements.	
US-039		5.4		te	Expected flight envelope must be defined in order for any of these requirements to be relevant	Add a new a) Expected flight envelope Also, remove “and so on” from d)	
CN03-040		5.4	2nd paragraph	te	“If exceed the storage life, test the UAS according to…” who is going to do the test? The sentence lacks a subject. If the subject is the manufacturer, it’s ridiculous that the manufacturer should ensure a product can still be used exceeding its storage life.	delete 2nd paragraph	
JISC13-041		5.5		te	If this clause is considered for packaging such as container, this content isn’t necessary because this standard is used for quality and safety.	Delete 5.5	
CN04-042		5.6		ge	The first paragraph of 5.6 is duplicated with 5.2 and the second paragraph should be merged into 5.2.	delete 5.6 and merge the second paragraph to 5.2	
JISC14-043		5.6		te	If we don’t consider ConOps, this content shall be used for all UAS. Because “list of spare parts” isn’t always necessary for all UAS.	The manufacturer should ~~shall~~ document the maintenance requirements and make them available to the operator.	
ES-044		6.1			For rotorcrafts, these requirements should also be applicable to the vertical lifting elements and components (e.g. rotors, blades, transmissions, drive shafts, gearboxes) that are considered as flying structure.	Proposed text is to include after h) a paragraph specific for rotorcrafts. 6.1 General requirements h) structural testing… safety of flight For rotorcrafts, these requirements are also applicable to the vertical lifting elements and components (e.g. rotors, blades, transmissions, drive shafts, gearboxes)	

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ES-045		6.1 a)			The design must ensure the structural integrity must be ensured for the operational envelope (flight and ground operations); but also for the operational life, to take into account effects of cyclic loading, environmental and operational degradation.	Proposed text a) airframe design shall assure structural integrity throughout the operational envelope (flight and ground operations) for the operational life	
ES-046		6.1 b)			The design should meet the defined environmental conditions, better than limitations, expected in service. Some limitations could also arise after, once the environmental conditions cannot be met. “Wind” is included in the example due to its importance	Proposed text b) airframe design shall meet the UA operating environmental conditions expected in service (i.e. temperature, electromagnetic, humidity, altitude, wind)	
ES-047		6.1 d)			Materials shall be consistent in strength properties and durability with the design values	Proposed text d) the material used in the manufacture of the airframe shall be consistent in strength/durability with the design values	
ES-048		6.1 i) new			Manufacturing/fabrication processes should be also considered in the design	Proposed text i) The manufacturing processes and materials used in the construction of the UA must result in known and reproducible structural properties	
ES-049		6.1.1			It is proposed to use in “Fatigue evaluation” instead of “damage tolerance”, even if it is requested, because it could be used a safe-life evaluation There are structural components for which the damage tolerance assessment is shown to be impractical; then, it must be shown by fatigue test, or analysis supported by tests. The effects of operational and environmental degradation, accidental and discrete source damage must not reduce the structural integrity.	Proposed text 6.1.1 Fatigue evaluation and damage tolerance **The effects of operational and environmental degradation (on material properties), accidental and discrete source damage must not reduce the structural integrity.** 6.1.1.1 Damage tolerance assessment Damage tolerance assessment shall be performed to ensure that aircraft are protected from catastrophic **failure** over their lifetime due to:	

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						a) fatigue; b) corrosion; c) manufacturing defects, **including material variability**; or d) accidental damage. **For the structural components for which the damage tolerance assessment is shown to be impractical; then, it is required a fatigue safe-life evaluation, where it must be shown by analysis supported by test evidence that are able to withstand its service life without detectable damage**	
IT-050		6.1.2		te	**Proposed text:** Conspicuity Aircraft shall make use of painting, lighting, or other methods to enhance its conspicuity. **Comment:** A small UA is very hard to be seen from neighbouring manned traffic. Much more effective would be to use electronic cooperative identification systems. Therefore, this requirement should not be worded as being always mandatory.	Conspicuity When required by the aviation authority, by the intended operation or by the risk assessment carried out by the operator, the Aircraft shall make use of electronic identification means, painting, lighting, or other methods to enhance its conspicuity.	
ES-051		6.1.3			It is proposed to use “Construction” (or Manufacturing) instead of “Machinability”, that is how easy a material can be cut	Proposed text 6.1.3 Construction Manufacturing processes and materials used in the construction of the structure (airframe, moving and attached parts, landing gear and other components) shall ensure the functionality and consistency over the design service life of the UA	
JISC15-052		6.1.3		te	If we don’t consider ConOps, this content shall be used for all UAS.	6.1.3 Machinability The machinability of the aircraft airframe, rotor arms, landing gear and other components, which	

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						are needed with a result of risk assessment bJISCanufacture, shall ensure the functionality and consistency over the design service life of the UA.	
ES-053		6.1.4			Considering ES comment to include in 6.1 the vertical lifting elements and components for rotorcrafts, moving parts will be other than included in the vertical lifting elements and components	Proposed text The design and use of moving parts (other than included in the vertical lifting elements and components in rotorcrafts, such as rotating shafts, bushings, bearings, sliding rail sliders shall ensure the parts can sustain the functionality over the design service life of the UA.	
JISC16-054		6.1.4		te	If we don't consider ConOps, this content shall be used for all UAS.	6.1.4 Moving parts The design and use of moving parts, such as rotating shafts, bushings, bearings, sliding rail sliders, which are needed with a result of risk assessment bJISCanufacture, shall ensure the parts can sustain the functionality over the design service life of the UA.	
JISC17-055		6.1.5		te	If we don't consider ConOps, this content shall be used for all UAS.	6.1.5 Attached parts For all parts, which are needed with a result of risk assessment bJISCanufacture, ~~affecting the safety of the UA~~ that are attached or mounted to the airframe; a) threaded parts shall have a locking mechanism; b) quick release parts shall meet the corresponding mechanical precision, strength, and fatigue resistance requirements; and c) electrical connections shall be secure and comply with the appropriate standard for type of connection used.	
CN05-056		6.2		ge	6.2 is the same with 5.2 and nothing special for airframe.	delete 6.2	
JISC1		6.2		te	Regarding "d) diagnostic testing points are readily	Note: "diagnostic testing point" is an interface to get	

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8-057					accessible", what does "diagnostic testing point" mean?	any information, such as error information.	
US-058		6.2		ed	Seems to be a repeat of 5.2	Delete 5.2. The topic fits better here.	
JISC19-059		6.3		te	If we don't consider ConOps, this content shall be used for all UAS. All UAS doesn't always need these requirements. This clause depends on ConOps.	d) other sensors that assist surveillance such as Automatic dependent surveillance — broadcast (ADS–B) when operationally intended for flight in airspace where those sensors are required. If fitted they shall be compatible with applicable ITU-R Radio Regulations and TSOs.	
IT-060		6.3.d)		ed te	**Proposed text:** If fitted they shall be compatible with applicable ITU-R Radio Regulations and TSOs. **Comment:** a) This sentence does not belong to letter d), but it should be a 2nd block in the paragraph; b) There are emerging standards for Electronic identification using technologies different from ADS-B c) If no CofA is required E/TSOs may not be applicable;	d) other sensors that assist surveillance such as Electronic Identification (E-Id) or Automatic dependent surveillance— broadcast (ADS–B). If fitted, the systems in c) or d) shall be compatible with ITU-R Radio Regulations and, where applicable, TSOs.	
ES-061		7			Propellers and turbine engines are not "devices" in the aeronautical terminology, but "parts,/ components". It is proposed to use propulsion system components	Proposed text Propulsion systems include engines and motors using components such as propellers and turbine engines.	
CN06-062		7.1		ge	Risk management lacks requirements for maintainability and safety.	Change the first paragraph to 'Risk management of propulsion system shall consider reliability, maintenance, testability, supportability, safety, durability and environmental adaptability.'	

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JISC20-063		7.2.1		te	e), f) and g) are not always important for combustion engines. Because some manufactures performed test in service conditions which they considered.	Additionally, for combustion engines, operational limitations should ~~shall~~ be documented and include: d) intake pressure; e) exhaust temperature; f) cylinder head temperature; g) oil pressure and temperature; and h) grade of fuel requirements.	
JISC45-064		7.2.2		ed	After e) in section 7.2.2 is a), isn't it f)?	a) → f)	
JISC21-065		7.2.5.1		te	For a user uses ESC safelJISCanufacture shall show continuous values as same as maximum values.	7.2.5.1 ESC requirements The following specifications of the ESC shall be clearly defined: a) continuous and maximum output voltage ~~power requirements~~; b) continuous and maximum output current ~~load limits~~; ~~c) frequency requirements;~~ d) operable temperature ~~limits~~; and e) fault protection systems.	
JISC22-066		7.3		te	What purpose is this clause?	To be discussed?	
ES-067		7.3.1.2			Ground resonance must be also avoid for rotorcrafts	Proposed text Rotorcrafts may have no dangerous tendency to oscillate on the ground with the rotors/fans turning.	
IT-068		8.1 and 8.4		ed	**Proposed text:** Ground electrical system The ground electrical system shall meet all power utilization requirements on the ground for the unmanned aircraft system, and shall meet the requirements in ISO 6878: 2017.	The ground electrical system powering the Remote Pilot Station shall meet all power utilization requirements on the ground for the unmanned aircraft system, and shall meet the requirements in ISO 6878: 2017.	

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					Comment: "Ground electrical systems" used at vertiports to recharge batteries should be part of the vertiport standard and not of 21384-2. It is however understood that here the proposed standard refer to power supply of the Remote Pilot Station (RPS) defined in 3.63 of 21384-4. The proposed standard should be made clearer.		
ES-069		8.2			It is proposed to use "Electrical wiring", that is the terminology used in the aeronautical world, instead of "cabling"	Proposed text 8.2 Electrical wiring	
JISC23-070		8.2		te	What purpose is in this clause? If this clause says safety, a voltage is most important. Usually, it will be dangerous if it is over SELV. SELV in IEC means "voltage not exceeding 60V d.c. between conductors and earth, the no load voltage not exceeding 60V.d.c.	8.2 Cabling Circuit in UAS airframe shall be complied with any rational standard(s) of IEC 60950 series if a voltage is over 60V d.c. ~~The following requirements shall be met within the specified frequency range, transmission and reception sensitivities:~~ ~~a) Power cable conduction emission;~~ ~~b) Power cable conduction sensitivity;~~ ~~c) Cable bundle injection conduction sensitivity;~~ ~~d) Cable bundle injection excitation conduction sensitivity;~~ ~~e) Damping sinusoidal transient conductivity of cables and power cords;~~ ~~f) Electric field radiation emission; and~~ ~~g) Electric field radiation sensitivity.~~ ~~h) Cases, cables and corresponding connectors are shielded to ensure electromagnetic compatibility;~~ ~~i) Correct lapping to ensure electrical connection inside and outside the device to reduce contact resistance; and~~	

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						~~j) The system ensures proper power and signal circuit grounding.~~	
US-071		8.2		te	Might want to reference an EMI/EMC test standard, e.g. MIL-STD 461		
ES - 072	19 and 20	8.3			As electrical motors are not considered as electrical equipment in the aeronautical terminology, and In order to avoid doubts, it should be specifically written.	Proposed text The main power supply may be provided by generators or batteries and shall have reliable power supply characteristics to adequately power the electrical equipment, **and electric motors if any** In order to consider the different types of power utilization requirements for the on-board electrical equipment, the aircraft shall be equipped with a secondary power supply. The secondary power supply shall meet the demand for voltage, current and power of all electrical equipment, **and electric motors if any,**.on the UA.	
JISC24-073		8.3		te	This clause is included in JISC23.	Delete 8.3.	
US-074		8.3		ed	"…characteristics shall controlled…"	"…characteristics shall be controlled…"	
US-075		8.3		te	Requirement for a secondary power supply, and an emergency power supply seems very much like a technical design requirement – which this standard was not supposed to address. Also, this standard is designed for a system where a State authority has said an airworthiness certification is NOT required. How then are the requirements for both a backup and emergency power supply appropriate? See below for JARUS CS-UAS (which IS intended as a basis of certification!)	Rewrite requirement to be more appropriate for a UAS that is not being required to be certified.	

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					similar requirement. **CS-UAS.2525 UAS power supply, generation, storage, and distribution** (see GM-UAS.2525) The on-board generation, storage, distribution and supply of power to each system must be designed and installed to: (a) supply the power required for operation of connected loads during all approved operating conditions (b) ensure no single failure or malfunction will prevent the system from supplying the essential loads required for continued safe flight and landing or emergency recovery; and (c) have enough capacity, if the primary source fails, to supply essential loads, including non-continuous essential loads for the time needed to complete the function, required for safe flight and landing or emergency recovery		
JISC25-076		8.4		te	All ground electrical system is not always used near/in sea water, and its clause should be shown if the year of ISO 6878:2017 is described. Usually, ground electrical system is supplied by outlet powers. So that, it shall be comply with IEC.	8.4 Ground electrical system It shall be complied with any rational standard(s) of IEC 60335 series if ground electrical system is powered by outlet. If not, it shall be complied with other rational standards which manufacture decides by his/her risk assessment. ~~The ground electrical system shall meet all power utilization requirements on the ground for the unmanned aircraft system, and shall meet the requirements in ISO 6878: 2017.~~	
CN07-077		8.4	1	te	Cannot find any info about ISO 6878: 2017. Regarding to the content, the referred standard should be ISO 6858:2017, Aircraft – Ground support electrical supplies – General requirements. And, it's better to list the title of the	Change 'ISO 6878: 2017 'to ' ISO 6858:2017' , and it's better to list the title of the standard in Chapter 2.	

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					standard in Chapter 2.		
JISC26-078		8.5		te	Labelling shall be complied with the national regulations in the country where the ground electrical system is marketed, and actually, this clause is included in JISC25 In the other word, necessary information is described in country regulations and IEC standards.	8.5 Labelling Labelling of ground electrical system shall be complied with the national regulations in the country where it is marketed, because it will usually be powered by outlet. ~~All ground power facilities shall be fitted with a metal or pressure-sensitive data plate~~ ~~displaying the following minimum information:~~ ~~a) manufacturer's name, part or model number, serial number, and revision status;~~ ~~b) electrical supply requirements;~~ ~~c) nominal output voltage or voltages;~~ ~~d) output rating of the facility, including "Type" definition of an AC supply and maximum cable~~ ~~length for which performance tests were successfully completed;~~ ~~e) environmental restrictions (including non-overlap of requirements); and~~ ~~f) number of this document or unique specification.~~ ~~ISO 21384-2:20xx(E)~~ ~~© ISO #### – All rights reserved 21~~ ~~All instruments and controls shall be suitably identified. Adequate operating instruction~~ ~~placards shall be permanently affixed in proximity to all control panels.~~ ~~Electric cables should be fitted with a name and connection label to distinguish each cable and~~ ~~indicate the use purpose. The connection label shall describe the connection point (the socket~~ ~~on the equipment panel) corresponding to the different connection ports of the cable.~~	

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						~~A warning label shall be permanently affixed to each relevant service panel where high voltages are present.~~ ~~If used, fuses and circuit breakers shall be suitablJISCarked as to circuit designation.~~	
JISC27-079		8.6		te	If we don't consider ConOps, this content shall be used for all UAS. Especially, rational EMC requirements of IEC shall be decided with a result of risk assessment which manufacture performed.	8.6 EMC Fittings Rational EMC requirements of IEC shall be decided with a result of risk assessment which manufacture performed. ~~The cable used shall meet the whole unmanned aircraft system electromagnetic compatibility requirements in section 14.2.7.~~ ~~The electrical system grounding and shielding shall meet the requirements in section 14.2.7.~~	
JISC28-080		8.7		te	What purpose is in this clause?	To be discussed.	
ES-081		9.1			Other requirements to be considered for batteries	The battery installation must be able to withstand the applicable inertial loads. A low battery warning must be provided in order to alert the operator that the battery has discharged to a level which requires immediate recovery actions Information concerning battery storage, operation, handling, maintenance, safety limitations and battery health conditions must be provided in the operators manuals	
JISC29-082		9.1		te	Safety requirements depend on a type of batteries and voltage. The requirements of this clause seem for Li-ion battery. If our proposal is not enough for other type of batteries, show any safety requirements for them.	9.1 Batteries Nickel or Lithium batteries for UA system shall comply with IEC 62133 series. In other case, the batteries shall be designed in order to avoid risk of fire and mechanical deterioration resulting from abnormal use.	

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						~~For each of the following conditions, a battery's performance and environmental precautions shall be clearly defined and included in an operator's manual:~~ ~~a) operating;~~ ~~b) charging; and~~ ~~c) storage.~~	
JISC30-083		9.3		te	Let's discuss "Fuel cell" for the next version after publishing this standard.	Deleted 9.3.	
IT-084	Last block	1 Scope		te	**Proposed text:** The standard is intended for UAS designed for use where a State aviation authority has determined a certificate of airworthiness is not required. **Comment:** Actually, nothing prevents to use some paragraphs of this standard to build the certification basis, also in the case that a certificate of airworthiness issued by the competent aviation authority is required. Or to use some paragraphs as alternative Means of Compliance. These three cases should be clarified.	The standard is intended for: a) UAS designed for use where a State aviation authority has determined a certificate of airworthiness (CofA) is not required; or b) Where a CofA is required, to complement technical standards published by the aviation authority for the purposes of building the certification basis; or c) As Alternative Means of Compliance (AltMOC) is acceptable to the aviation authority.	
IT-085	3 and 4	1 Scope	Last sentence in 1st block	te	**Proposed text:** This standard does not cover technical requirements for the design and manufacturing for UAS components. **Comment:** The text should also clarify that this standard does not apply to passenger carrying UAS.	This standard does neither cover passenger carrying UAS, nor technical requirements for the design and manufacturing for UAS components.	
ES-086		10			Avionics equipment wiring requirements are not included		

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					It should be consider to create a general clause for Wiring (as EWIS in manned aviation)		
JISC31-087		10		Ge	Define “Avionics”, because “avionics” is broad and fuzzy.	3.15 Avionic Avionic equipment is a navigation system which is integrated from an inertial measurement unit, a magnetic compass, a global positioning system, an air speed sensor, an altimeter, an optical sensor, etc.	
ES-088		10.1			Last paragraph is not understandable	Proposed text A functional failure or function degradation of the avionics system shall not affect the safe flight.	
JISC32-089		10.1		te	The requirements shall be made according to JISC31. Additionally, if we don’t consider ConOps, this content shall be used for all UAS.	10.1 Avionic equipment – general Avionics equipment shall have two or more functions to be able to flight during one avionic failure.	
US-090		10.1		te	The last sentence of this section does not make sense.	Rewrite this sentence to be more clear.	
ES-091		10.1 a)			Operating conditions includes flight and environmental conditions. Correct functioning must be when installed	Proposed text a) function as intended when installed and under any foreseeable operating conditions	
IT-092		10.2		te	**Proposed text:** 10.2 Flight Control Systems **Comment:** ISO TC/20 SC/16 is inter alia developing ISO 24355 on FCS. This paragraph should only refer that standard	DELETE technical content and instead refer to ISO 23555 for FCS.	
ES-093		10.2.1			Control and manoeuvrability in case of engine failure in multi-rotor UA must be considered	Proposed text In multi-rotor UA, the flight control system shall be capable of providing sufficient control and	

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						manoeuvrability for safe flight in case of engine failure	
ES-094		10.2.1			The flight control system shall be capable of providing control and manoeuvrability in all operating modes in the most severe operating conditions during all flight phases	Proposed text The flight control system shall be capable of providing control and manoeuvrability in all operating modes in the most severe operating conditions during all flight phases	
JISC33-095		10.2.1		te	It is difficult for a rotorcraft to measure airspeed at low speed due to its downwash.	Automated flight control modes shall include command guidance and control settings for maintaining at least the following functions: a) altitude; b) course; c) airspeed (excepted low speed rotorcraft); and d) position hold (for rotorcraft).	
ES-096		10.2.3			From a) to g) are not requirements for the SW but for the FCS itself		
ES-097		10.2.3			FCS controls the speed, altitude and flight path, not the position	Proposed text Flight control software is the on-board navigation, guidance and control system to control the **speed**, altitude and **flight path**. The flight control software shall:	
ES-098		10.2.4			Wind velocity from all azimuths and gusts. Turbulence environment is not an appropriated term.	Proposed text a) wind velocity from all azimuths; b) gusts; and c) manual command of the UA controls.	
US-099		10.2.4		ed	"…acuracy"	"…accuracy"	
US-100		10.2.4		te	Course accuracy to what precision?	The manufacturer should define to what precision the system is capable of maintaining	

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ES-101		10.2.5.1			Fixed-wing UA	10.2.5.1 Fixed-wing UA	
US-102		10.2.5.1		te	I can't think of one UA that uses TAS. Do you mean ground speed or indicated airspeed?	Clarify	
US-103		10.2.5.2		te	The pilot needs to be made aware when the aircraft can no longer maintain a groundspeed and has switched to airspeed hold.	Add that the pilot must be alerted.	
ES-104		10.3			The text is not clear	Proposed text The flight control actuator characteristics shall be the required for flight control surfaces under expected flight loads.	
US-105		10.3		te	The statement "The flight control actuator characteristics shall be flight control surfaces under expected flight loads." Makes no sense	Clarify	
US-106		10.4		te	"alert to the following functions"? What does that mean? How is fault coverage a function? It is something we analyse the diagnostic system to determine "coverage", to "alert to" it would be unusual. And, how is "e) limit false alarms" a function in and of itself?	Rewrite this section	
IT-107		10.5.3		te	**Proposed text:** Real Time Kinematic (RTK) Augmentation The RTK satellite navigation may achieve real-time corrections with up to centimetre-level accuracy using measurements of the phase of the signal's carrier wave. RTK systems shall have the following specifications:…. **Comment:** RTK contribute to the Navigation Sensor Error (NSE), but not to the Flight Technical Error 8FTE)	Real Time Kinematic (RTK) Augmentation The RTK satellite navigation may achieve real-time corrections leading to centimetre-level accuracy for the Navigation Sensor Error (NSE) using measurements of the phase of the signal's carrier wave. RTK systems shall have the following specifications:….	

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					and therefore not to the Total System Error (TSE) as defined in ICAO Doc 9613.		
CN08-108		10.5.3		ge	RTK can also provide stable and accurate heading and attitude measurement	RTK; add recommend c):multi antenna for heading and attitude measurement	
CN09-109		10.5.4		ge	Calibration function include temperature calibration and bias and misalignment calibration are very import for imu.	IMU: a). support for power-on self-tests，fault diagnosis and calibration functions, and	
JISC34-110		10.6		te	“Attitude Sensors” is included to JISC32.	Delete 10.6.	
JISC46-111		10.6.2		te	Airspeed Sensor cannot measure “ground speed” by itself.	To delete “ground speed” or To change (4) with a supplementary explanation	
US-112		10.6.2		te	“…caused by propulsion.” Is not an adequate or correct statement.	“…caused by motion through the airmass.”	
US-113		10.6.2	a)	te	“ground speed” is not an airspeed.	Delete a)	
CN10-114		10.7		te	This clause should be deleted as a whole, due to following reasons: 1) The geo-limitation is a function, rather than a necessary part of avionics. The implementation of this function could be varied, either by ground station, by flight controller, or by LED.	Delete 10.7	

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					2) The requirements on geo-limitation are optional in this standard, and most of which are “recommendation”. This draft is already too length so we should make it simpler and more focused on critical and necessary aspects. 3) The EU has imposed a clear CE marking requirement on some categories of UAS and a specialized Geo-Awareness standard is already on the way. No need to redo the requirement in this standard given that it’s only optional. 4) The content of this clause is very confused: a) The subject of each requirement includes “remote pilot”, “UAS”, “ground station”, “service provider”, all of which are not part of avionics or even beyond the scope of this standard. b) Some requirements are actually described based on a detailed implementation example (e.g., assuming service provider exists, or describing the uploading process of a route) c) The definition is given by the first paragraph in 10.7.1 as “prevent a UA”, but the function description and requirement are “display and		

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					warning".		
JISC35-115		10.7		te	"Geo-limitation" is included to JISC32.	Delete 10.7.	
US-116		10.8.1	c)	te	8.3 requires a secondary AND emergency power supply	Decide whether we are mandating redundancy or allowing for it – where needed and practicable.	
CN11-117		10.8.2		te	Different algorithm result cross-validation can provide software redundancy to ensure software stability.	add 'Software redundancy should also include different algorithm cross validation.'	
ES-118		10.9			The warning should be provided in the control station, not visual from the UA, as lights	Proposed text provide a warning to the remote pilot in the control station that the UA is in failure mode	
IT-119		11		ed	**Proposed text:** Data link **Comment:** The term defined in 3.18 of ISO 21384-4 is "Command and control link" alias C2 link	Please align terminology with 21384-4	
US-120		11		ed	This is a well written discussion of appropriate datalink requirements. Whoever wrote this section should be commended – and enlisted to help rewrite some others!		
IT-121		11.2		te	**Proposed text:** There are two ways to communicate with the UA from the control station. a) Line of Sight, which is usually terrestrial based antennas communicating within direct line of sight of an antenna on-board the UA; and b) Beyond line of sight, which may require use of relay equipment, such as satellite communications. **Comment:**	There are two ways to communicate between the UA from and the Remote Pilot Station for the purpose of managing the flight:. a) Radio Line of Sight, which is usually based antennas communicating within direct radio line of sight of an antenna on-board the UA and when all antennas and transceivers are under the control of the UAS operator; and b) Beyond radio line of sight, which may require use of relay equipment, such as satellite	

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					Clearly here we are not speaking about biological visual range of the remote crew, but about radio waves. Secondly, 21384-4 defines the Remote Pilot Station. Thirdly, payload communication should be out of scope of 21384-2 (except “no hazard” considerations). Finally the real difference is whether the C2 link components are directly under the control of the UAS operator, or instead offered by a C2 COM Service Provider.	communications or ground based wide area networks.	
ES-122		11.2.1			At least an automatic reacquisition process to re-establish the link in case of link loss should be included	Proposed text g) provide an automatic reacquisition process to re-establish the link in case of link loss	
IT-123		12		ed	**Proposed text:** Control Station **Comment:** 21384-4 has standardised the term Remote Pilot Station (RPS). It would be really embarrassing if two WGs of the same Sub-Committee would use different terminology	Remote Pilot Station (RPS)	
JISC36-124		12		te	“Control station” includes or is as same as “Ground electrical system”.	Delete 12.	
IT-125		12.3		te	Add one more block to functional requirements for the station concerning ergonomic aspects.	According to 5.1.1.b(1) Hardware and Software interface of the Remote Pilot Station should enable safe and stable commands, avoiding a) unchecked manoeuvre by mechanical provisions b) misleading information due to ergonomics of the systems	

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US-126		12.3.3	a)	te	Most UA accomplish higher level navigation and the GCS does not directly command attitude.	Delete a)	
IT-127		12.4		ed	**Proposed text:** Power **Comment:** Already covered in Chapter 8	DELETE 12.4 and merge, as necessary, into Chapter 8.	
US-128		12.4	b)	ed	Check indentation		
ES-129		12.5.1			Minimum propulsion system data should be included (health status, remaining fuel or battery…)	Proposed text f) Minimum propulsion system data (engine health status - rpm, oil pressure- remaining fuel or battery …)	
ES-130		13			Payload is equipment that “is not used or intended to be used in operating or controlling an aircraft in flight, and is not part of an airframe, engine, or propeller”, better than that “does not contribute to the safety of flight if not otherwise installed”. There	Proposed text This section consists of any additional items that can be carried by or attached to the UA that contributes to completion of the designated mission and interfaces with UA components, not used or intended to be used in operating or controlling an aircraft in flight, and is not part of an airframe, engine, or propeller	
JISC37-131		13		te	In accordance with Clause 22.3.3 of Part 2 on ISO/IEC Directives, hanging paragraphs shall not be used on standards. Additionally, connect to 13.1 simply.	13.1 General requirements This section consists of any additional items that can be carried by or attached to the UA that contributes to completion of the designated mission and interfaces with UA components, but does not contribute to the safety of flight of the UA if not otherwise installed. This section is not intended to address cargo delivery operations, unless there is a delivery or release mechanism that is managed by a component resident on the UA. The payload shall be designed to;	

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						-be less than its weight which UA's maximum taking off weight; -be resistant to vibration or be installed to keep UA's flying qualities; -be resistant icing and dust, and; -have any functions against some electrical short circuit.	
ES-132		13.1			The payload equipment, whether functioning properly or improperly, must not adversely affect the safe flight and control of the UA.	Proposed text The payload, whether functioning properly or improperly, must not adversely affect the safe flight and control of the UA. The payload must be electromagnetically compatible with other UAS components.	
JISC47-133	4	13.1		te	Not only vibration, icing and dust but also temperature, humidity, and other proper environmental conditions for UAV should be added.	To add proper conditions for UAV payloads	
JISC38-134		13.2 – 13.3		te	Those clauses are already described in JISC37.	Delete 13.2 to 13.3.	
JISC39-135		13.4		te	In this clause, marking samples are necessary. Labels should be shown in Annex if necessary.	Payload safetJISCarking According to ICAO and IATA, t~~T~~he necessarJISCarking shall be used for parts of the payload that: a) Cause mechanical, electrical, or electromagnetic failures b) Contain or cause exposure to toxic substances c) Generate excessive heat or noise; and d) Remind the remote flight crew and maintenance personnel to take corresponding protective measures.	
JISC4		13.5		ge	The requirements are unclear for Initialization.	To be discussed.	

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8-136							
JISC40-137		13.7		te	Why is “Radar payload” necessary?	To be discussed.	
ES-138		14			The title “System airworthiness” does not fit with the content		
CN12-139		14	1st paragraph	ge	No need to keep this paragraph for just a description. It should be deleted.	Delete this paragraph.	
IT-140	1st sentence	14.1.2 and 14.2		te	**Proposed text:** The following shall be documented in an operator’s manual **Comment:** The manufacturer is simply unable to compile the operations manual. The manufacturer in fact develops only the flight manual as defined in 3.28 of ISO 21384-4	The following shall be documented in a Flight Manual	
CN13-141		14.1.2	e)	te	It’s impossible to document all design data in the manuals and handbooks.	Change “design data” to “product specification”	
CN14-142		14.2.1	h)	te	Delete “expected”.	Delete “expected”.	
CN15-143		14.2.1	l)	te	Delete “expected”.	Delete “expected”.	
ES-		14.2.4			Wing span instead of width	Proposed text	

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144						c) wing span; and	
CN16-145		14.2.7	3rd paragraph	te	It is unclear for the aft part sentence" between on-board and off-board sources to personnel and fuel sources."	Change " between on-board and off-board sources" to " between on-board and off-board radiation sources"	
ES-146		14.2.8			"Noise", that is the word use in the aeronautical terminology, instead of "acoustics"	14.2.8 Noise	
CN17-147		14.2.8		te	The distance for safe operation shall also be documented.	Add this sentence: " The distance for safe operation shall also be documented."	
ES-148		14.4			These requirements are already or should be included in point 6 Airframe/structure. Meanwhile it is should be requested a complete System Safety Assessments for the whole UAS with risks associated a failure conditions.		
CN18-149		14.4.2.1	c)	te	Corrosion is a factor in the environment, and the environment has been mentioned above.	Delete c) corrosion	
CN19-150		14.4.2.1	f)	te	Change "load placement" to "load mounting location""	Change "load placement" to "load mounting location""	
CN20-151		14.4.6		te	Safe separation shall also be used in the following situations: radiation, toxic materials, equipment heat release, etc. So this is also suggested to include in this section.	Add a paragraph: If necessary, safe separation shall also be used in the following situations: radiation, toxic materials, equipment heat release,	

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						etc.	
ES-152		16			Catapults, nets… should not be considered as Ground Support Equipment (GSE), that is a term normally used for maintenance equipment, but non-installed equipment required for the operation and are part of the UAS.	16.1 Non-installed equipment required for the operation	
JISC41-153		16.2		te	Regarding the sentence after “Additionally”, what is the purpose?	To be discussed	
CN21-154		16.2	c)	ed	Miss a comma	Add a comma before ”and alert”.	
CN22-155		16.2	d)	ed	Change “all UA” into ‘each UA’	Change “all UA” each UA’	
JISC42-156		17		te	What are differences among “Automation”, “Avionics” and “Ground system”?	To be discussed.	
IT-157	First sentence	2 Normative references		te	**Proposed text:** The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. **Comment:** Honestly, stating that ICAO Doc 10019 is “indispensable” to design UAS when no CofA is required is too much, because: a) The ICAO RPAS Manual is actually not necessary to develop a technical basis to design a UAS; b) If no CofA is required, these UAS are out of scope of ICAO.	The following documents, in whole or in part, are normatively referenced in this document and may be useful for its application.	

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					The sentence needs to be adapted.		
ES-158		6			It should be better renamed it as “Structure”, as moving parts and landing gear are included in the text. Additionally, for rotorcrafts, the vertical lifting elements as rotors, blades, hubs, mechanical controls, hinges…) are considered as flying structure. There are requirements for design and construction, as design requirements are included.	Proposed text 6. **Structure** This section details the requirements for **design and** construction of rotorcraft and fixed-wing UA **structures**	
UA-159		Clause 1 “Scope”	1st sentence	ed	Clarify the text of the 1st sentence clause 1, for the reason: – The recommendations of the standard are equally suitable for aircraft heavier than air and lighter than air. Aircraft heavier than air have a more complex structure, and therefore the volume of requirements for them is greater than the volume of requirements for aircraft lighter than air. The requirements for aircraft heavier than air, usually, are identical and already contain the requirements for aircraft lighter than air. There is no need to narrow the scope of the standard, excluding aircraft lighter than air. It can be noted out that the standard considers “predominantly unmanned aircraft (UA), whose lifting devices are fixed or rotating wings”. – if the lifting devices of the aircraft are fixed or rotating wings, then this aircraft is a priori heavier than air. And this clarification in the text of the proposal can be excluded.	To state 1st sentence clause 1 as follows: "This International Standard specifies requirements for ensuring the quality and safety of the design and manufacture of unmanned aircraft systems (UAS), including predominantly unmanned aircrafts (UA), whose lifting devices are fixed or rotary wings control station”	
US-160		General			Needs more review and discussion.		
ES-161		Introduction and 1			ES278 comment was partially accepted as “UAS whose lifting devices are fixed primary wing structures, rotating components of vertical lifting	Text in Introduction and 1 as accepted: “UAS whose lifting devices are fixed primary wing structures, rotating components of vertical lifting	

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					elements, or both", but the text has not been modified.	elements, or both"	
UA-162		Subclause 10.2.1	last paragraph (last sentence) after subclause c)	te	Add after subclause c) last paragraph (last sentence) subclause 10.2.1 a new subclause "d) ground speed", for the reason: – without knowledge of ground speed (speed relative to the earth's surface) it is impossible to navigate. (Air speed knowledge is provided only by UA piloting.) – A GPS receiver is required for the "hold position" referred to in the last subparagraph. Its presence allows you to determine ground speed.	To state last paragraph (last sentence) subclause 10.2.1 as follows: "Automated flight control modes shall include command guidance and control settings for maintaining at least the following functions: a) altitude; b) course; c) airspeed; d) ground speed and; d) position hold (for rotorcraft)"	
UA-163		Subclause 10.5.2	2nd sentence subclause a)	te	Clarify the text of subparagraph a) 2nd sentence clause 10.5.2, for the reason: support for several satellite systems will significantly complicate the design and software of the control system, which is not always justified, especially for short flights.	To state clause subclause a) 2nd sentence subclause 10.5.2 as follows: "a) support for multiple satellite systems, if necessary;"	
UA-164		Subclause 10.6.2	2nd sentence	te	Clarify the text of the 2nd sentence subclause 10.6.2 by deleting subparagraph a) for a reason. Ground speed does not apply to airspeeds and is not measured by an airspeed sensor. Ground speed is measured using ground stations or GPS data.	To state subclause 10.6.2 as follows: "At least one of the following airspeeds shall be provided: a) indicated airspeed; b) calibrated airspeed; or	

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						c) true airspeed”	
UA-165		Subclause 14.2.1		ed	Delete subclause k) or a) subclause 14.2.1, for the reason they have the same meaning.	To state subclause 14.2.1 as follows: «14.2.1 Flight performance a) Maximum climbing speed; b) Maximum descent speed; c) Maximum flying speed; d) Optimum cruise speed; e) Take-off and landing speed; f) Service ceiling; g) Maximum working altitude; h) Maximum expected flight time; i) Flight range; j) Maneuvering characteristics and limitations; and k) expected operating radius”	

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