sUAS Operations Over People
Challenges and Opportunities

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Background

- FAA UAS COE published three reports since 2015 for Task A4, A11 and A14
  - Task A4 UAS Ground Collision Severity Evaluation (2015-2016)
    - Identified the most significant threats to the public and crews operating sUA platforms: Blunt force trauma and lacerations
    - Began development of ATD-based impact test methods to assess sUA injury potential (hypothesis was formed)
  - Task A11 Part 107 Waiver Request Case Study (2015-2016)
    - Explored the data requirements and analysis needed to submit a Part 107 waiver for flight over people.
    - Exercised the FAA approval process and defined standards that might be used to improve the waiver process
    - Successfully submitted of a Part 107 waiver for flight over people for the Phantom 3 Standard and Advanced, for flight over a graduation ceremony
    - Included new methodologies for determining safety thresholds other than those used by the Range Commanders Council (RCC)
  - Task A14 UAS Ground Collision Severity Evaluation (2017-2019):
    - Provided recommended path for applicants to prove safety as part of a Part 107 “flight over people waiver”
    - Recommended methods were incorporated with ASTM 3389 and included both ATD and PMHS test data
    - 91 flight test points, 155 simplified impact tests, 133 full ATD impact tests 41 PMHS tests, FEA simulations
    - 16 different aircraft and objects were used in impact tests ranging from 0.75-13.2 lbs

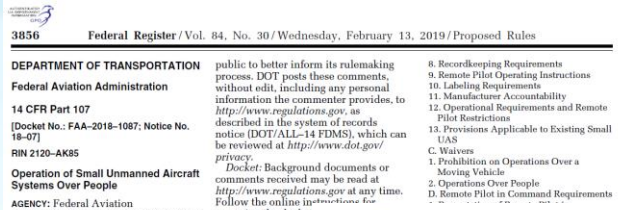
Research Impact

- ASTM F3389 *Standard Test Method for Assessing the Safety of Small Unmanned Aircraft Impacts* Published in June 2020
  - Test data from Task A14 informed the test methods and methodology
- Transport Canada published Standard 922 and Draft AC 922-001 *RPAS Safety Assurance*
  - Very similar to the ASTM F3389 methods and test methods consistent with Task A14
- EASA Published *Easy Access Rules for Unmanned Aircraft Systems(Regulations (EU) 2019/947 and (EU) 2019/945)*
  - Weight based (Maximum Takeoff Mass [MTOM]) methodology informed by Task A4 and Task A14 research data
- FAA Published Operations Over People Final Rule for 14 CFR Part 107 based upon NPRM published in 2018
  - FAA funding a contract effort to establish a Method of Compliance Framework consistent with the NPRM consistent with Task A14 methodologies
  - ASTM F3389 being revised to add a Method D for Energy Transfer Testing Methodology

Commonality Among CAA Rules

- Common Aspects of the CAA Rules
  - All CAA Rules identify the following hazards:
    - Blunt force trauma impacts
    - Blade lacerations resulting from collisions
    - Loss of control drones/operator error
  - Common altitude restrictions
  - Consistently apply terms like assembly of people
  - Established Declaration of Compliance from OEMs for aircraft for types of sUAS operations
  - Least risk drones at 250g = 0.55 lbs
- Difference among the CAA Rules
  - Inconsistency in the application of injury metrics used for declaration of compliance
  - Inconsistency in the application of A14 principles associated with impact KE (mass and speed)
  - Inconsistency in OOP categories
  - Inconsistency in the operator responsibility for separation from non-participants
  - Flight over people and near people is used differently
  - Definitions for methods of compliance to various rules are applied differently
  - Inconsistent use of operational risk assessments to support certain operations

EASA, Transport Canada and FAA OOP Comparison



3856 Federal Register / Vol. 84, No. 30 / Wednesday, February 13, 2019 / Proposed Rules

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 107

[Docket No.: FAA–2018–1087; Notice No. 18–07]

RIN 2120–AK85

Operation of Small Unmanned Aircraft Systems Over People

AGENCY: Federal Aviation Administration (FAA) and Office of the Secretary of Transportation (OST), Department of Transportation (DOT).

ACTION: Notice of proposed rulemaking.

SUMMARY: The FAA proposes to amend its rules applicable to the operation of small unmanned aircraft systems (UAS). This rulemaking would allow operations of small unmanned aircraft over people in certain conditions and operations of small UAS at night without obtaining a waiver. It would also require remote pilots in command to present their remote pilot in command certificate as well as identification to certain Federal, State, or local officials, upon request, and proposes to amend the knowledge testing requirements in the rules that apply to small UAS operations to require training every 24 calendar months. This proposal would be the next phase in integrating small UAS using a risk-based approach. These amendments would allow expanded small UAS operations and reduce the knowledge testing burden on remote pilot in command certificate holders.

DATES: Send comments on or before April 15, 2019.

ADDRESSES: Send comments identified by docket number [FAA–2018–1087] using any of the following methods:

- *Federal eRulemaking Portal:* Go to *http://www.regulations.gov* and follow the online instructions for sending your comments electronically.
- *Mail:* Send comments to Docket Operations, M–30; U.S. Department of Transportation (DOT), 1200 New Jersey Avenue SE, Room W12–140, West Building Ground Floor, Washington, DC 20590–0001.
- *Hand Delivery or Courier:* Take comments to Docket Operations in Room W12–140 of the West Building Ground Floor at 1200 New Jersey Avenue SE, Washington, DC, between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays.
- *Fax:* Fax comments to Docket Operations at 202–493–2251.

Privacy: In accordance with 5 U.S.C. 553(c), DOT solicits comments from the public to better inform its rulemaking process. DOT posts these comments, without edit, including any personal information the commenter provides, to *http://www.regulations.gov*, as described in the system of records notice (DOT/ALL–14 FDMS), which can be reviewed at *http://www.dot.gov/privacy*.

Docket: Background documents or comments received may be read at *http://www.regulations.gov* at any time. Follow the online instructions for accessing the docket

Operations in Room
West Building Grou
New Jersey Avenue
DC, between 9 a.m.
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FOR FURTHER INFORM
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this proposed rule,
Hassig, Aviation Saf
General Aviation an
Division, Flight Stan
Federal Aviation Ad
Street SE, 8th Floor,
20003; telephone 1–
email: *UAS-OverPeo*

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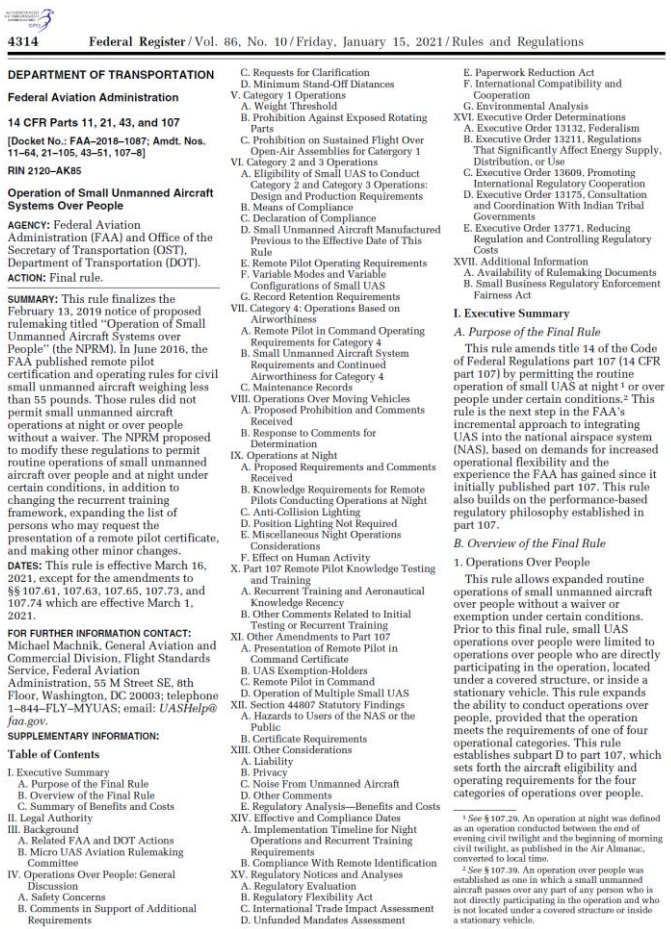

4314 Federal Register / Vol. 86, No. 10 / Friday, January 15, 2021 / Rules and Regulations

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Parts 11, 21, 43, and 107

[Docket No.: FAA–2018–1087; Amdt. Nos. 11–64, 21–105, 43–51, 107–8]

RIN 2120–AK85

Operation of Small Unmanned Aircraft Systems Over People

AGENCY: Federal Aviation Administration (FAA) and Office of the Secretary of Transportation (OST), Department of Transportation (DOT).

ACTION: Final rule.

SUMMARY: This rule finalizes the February 13, 2019 notice of proposed rulemaking titled "Operation of Small Unmanned Aircraft Systems over People" (the NPRM). In June 2016, the FAA published remote pilot certification and operating rules for civil small unmanned aircraft weighing less than 55 pounds. Those rules did not permit small unmanned aircraft operations at night or over people without a waiver. The NPRM proposed to modify these regulations to permit routine operations of small unmanned aircraft over people and at night under certain conditions, in addition to changing the recurrent training framework, expanding the list of persons who may request the presentation of a remote pilot certificate, and making other minor changes.

DATES: This rule is effective March 16, 2021, except for the amendments to §§ 107.61, 107.63, 107.65, 107.73, and 107.74 which are effective March 1, 2021.

FOR FURTHER INFORMATION CONTACT: Michael Machnik, General Aviation and Commercial Division, Flight Standards Service, Federal Aviation Administration, 55 M Street SE, 8th Floor, Washington, DC 20003; telephone 1–844–FLY–MYUAS; email: *UASHelp@faa.gov*.

SUPPLEMENTARY INFORMATION:

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I. Executive Summary

A. Purpose of the Final Rule

This rule amends title 14 of the Code of Federal Regulations part 107 (14 CFR part 107) by permitting the routine operation of small UAS at night [1] or over people under certain conditions.[2] This rule is the next step in the FAA's incremental approach to integrating UAS into the national airspace system (NAS), based on demands for increased operational flexibility and the experience the FAA has gained since it initially published part 107. This rule also builds on the performance-based regulatory philosophy established in part 107.

B. Overview of the Final Rule

1. Operations Over People

This rule allows expanded routine operations of small unmanned aircraft over people without a waiver or exemption under certain conditions. Prior to this final rule, small UAS operations over people were limited to operations over people who are directly participating in the operation, located under a covered structure, or inside a stationary vehicle. This rule expands the ability to conduct operations over people, provided that the operation meets the requirements of one of four operational categories. This rule establishes subpart D to part 107, which sets forth the aircraft eligibility and operating requirements for the four categories of operations over people.

[1] *See* § 107.29. An operation at night was defined as an operation conducted between the end of evening civil twilight and the beginning of morning civil twilight, as published in the Air Almanac, converted to local time.

[2] *See* § 107.39. An operation over people was established as one in which a small unmanned aircraft passes over any part of any person who is not directly participating in the operation and who is not located under a covered structure or inside a stationary vehicle.

- **Category 1 eligible** small unmanned aircraft must weigh less than 0.55, including everything on board or otherwise attached, and contain no exposed rotating parts that would lacerate human skin. No FAA-accepted Means of Compliance (MOC) or Declaration of Compliance (DOC) required.
- **Category 2 eligible** small unmanned aircraft must not cause injury to a human being that is equivalent to or greater than the severity of injury caused by a transfer of 11 foot-pounds of kinetic energy upon impact from a rigid object, does not contain any exposed rotating parts that could lacerate human skin upon impact with a human being, and does not contain any safety defects. Requires FAA-accepted means of compliance and FAA-accepted declaration of compliance.
- **Category 3 eligible** small unmanned aircraft must not cause injury to a human being that is equivalent to or greater than the severity of injury caused by a transfer of 25 foot-pounds of kinetic energy upon impact from a rigid object, does not contain any exposed rotating parts that could lacerate human skin upon impact with a human being, and does not contain any safety defects. Requires FAA-accepted means of compliance and FAA-accepted declaration of compliance.
- **Category 4 eligible** small unmanned aircraft must have an airworthiness certificate issued under Part 21 of FAA regulations. Must be operated in accordance with the operating limitations

Requirements for a Means of Compliance	For small UAS manufactured to be eligible for Category 2 or Category 3 operations, the small UAS must comply with the requirements of § 107.115(b)(1) or § 107.120(b)(1), as shown by test, analysis, or inspection, or any combination of these options that the Administrator has determined is acceptable. Requests for FAA acceptance of means of compliance must contain: (1) Detailed description of the means of compliance; and (2) Justification, including any substantiating material, showing the means of compliance fulfills the safety level set forth in § 107.115(b)(1) or § 107.120(b)(1).
Required Information for Declaration of Compliance.	14 CFR 107.125 (1) Applicant's name; (2) Applicant's physical address; (3) Applicant's email address; (4) Small UAS make/model name; (5) Small UAS serial number or range of serial numbers; (6) Whether the Declaration of Compliance is an initial or amended declaration; (7) If amended, the reasons for the re-submittal of the Declaration of Compliance; (8) Certification that the small UAS satisfies the impact kinetic energy and exposed rotating parts standards of that category through an accepted means of compliance; (9) Certification that the manufacturer has a product support and notification process; (10) Certification that the Administrator will be allowed to inspect the manufacturer's facilities, technical data, and any manufactured small UAS and witness any tests necessary to determine compliance with this subpart; and (11) Other information as required by the Administrator.

EASA, Transport Canada and FAA OOP Comparison

Advisory Circular

Subject: Remotely Piloted Aircraft Systems Safety Assurance

Issuing Office:	Civil Aviation, Standards	Document No.:	AC 922-001
File Classification No.:	Z 5000-32	Issue No.:	01
RDIMS No.:	13518324	Effective Date:	DRAFT

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Canada

Drones are listed only if they have an RPAS Safety Assurance declaration submitted by their manufacturer. If your drone isn't listed, the manufacturer may have yet to submit the declaration or the declaration is yet to be reviewed. You'll be issued a new registration certificate if the declaration is submitted. Contact your drone's manufacturer to ask if a declaration will be submitted.

Manufacturer name	Model	Type	Manufacturer RPAS (Remotely Piloted Aircraft System) safety assurance		
			Controlled airspace	Near people	Over people
Aeraccess	Hawker Q800X	Rotary wing	Yes	Yes	
Aeraccess	Hawker Q800X Tethered	Rotary wing	Yes	Yes	
Aeraccess	HAWKEYE MK1	Rotary wing	Yes	Yes	
Aerial Vehicle Safety Solutions Inc. (AVSS)	ASTM Compliant DJI M200 with AVSS Parachute Recovery System (PRS-M200)	Rotary wing	Yes	Yes	Yes
Aerial Vehicle Safety Solutions Inc. (AVSS)	ASTM Compliant DJI M210 with AVSS Parachute Recovery System (PRS-M200)	Rotary wing	Yes	Yes	Yes
Aerial Vehicle Safety Solutions Inc. (AVSS)	ASTM Compliant DJI M200 V2 with AVSS Parachute Recovery System (PRS-M200)	Rotary wing	Yes	Yes	Yes
Aerial Vehicle Safety Solutions Inc. (AVSS)	ASTM Compliant DJI M210 RTK with AVSS Parachute Recovery System (PRS-M200)	Rotary wing	Yes	Yes	Yes
Aerial Vehicle Safety Solutions Inc. (AVSS)	ASTM Compliant DJI M210 V2 with AVSS Parachute Recovery System (PRS-M200)	Rotary wing	Yes	Yes	Yes
Aerial Vehicle Safety Solutions Inc. (AVSS)	ASTM Compliant DJI M210 RTK V2 with AVSS Parachute Recovery System (PRS-M200)	Rotary wing	Yes	Yes	Yes
Aerial Vehicle Safety Solutions Inc. (AVSS)	DJI M300 RTK with AVSS Parachute Recovery System (PRS-M300)	Rotary wing	Yes	Yes	Yes

Showing 1 to 10 of 307 entries

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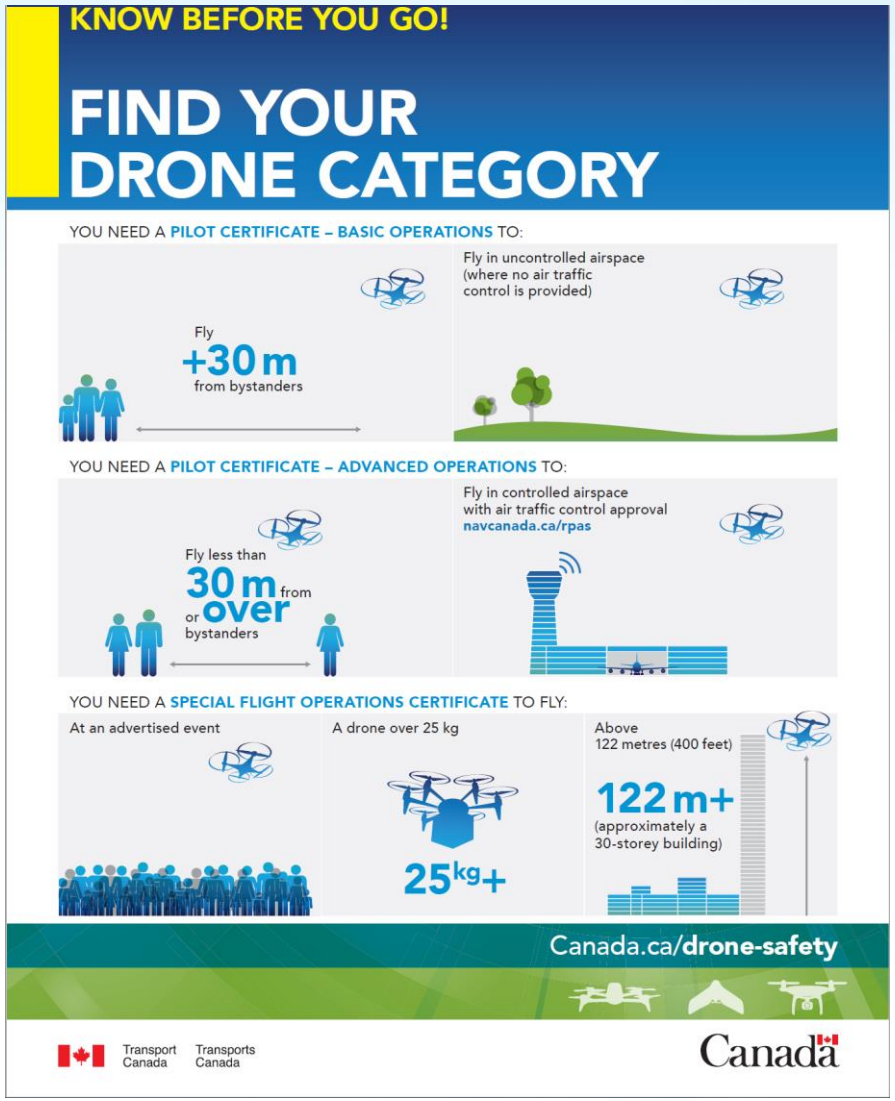
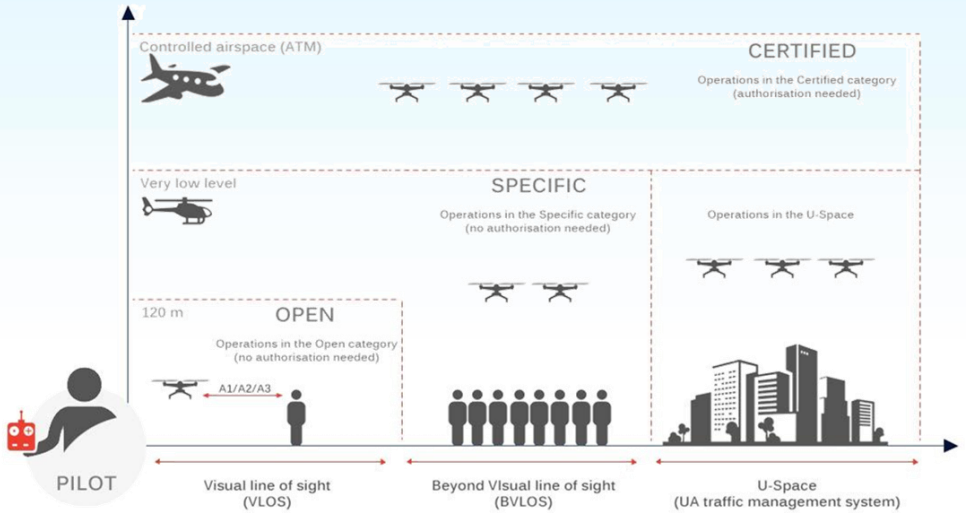
Related links

- Flying your drone safely and legally
- Find your category of drone operation
- Submit an RPAS Safety Assurance declaration
- Register your drone
- Getting a drone pilot certificate



EASA, Transport Canada and FAA OOP Comparison



UAS		Operation		Drone Operator/pilot		
Class	MTOM	Subcategory	Operational restrictions	Drone Operator registration	Remote pilot competence	Remote pilot minimum age
Privately built	< 250 g	A1 (can also fly in subcategory A3)	- may fly over uninvolved people (should be avoided when possible) - no fly over assemblies of people	No, unless camera / sensor on board **and** a drone is not a toy	- no training needed	No minimum age
0					- read user's manual	16*, no minimum age if drone is a toy
Legacy drones (art. 20)						16*
1	< 900 g		- No expected fly over uninvolved people (if happens, should be reduced) - no fly over assemblies of people	Yes	- read user's manual - complete online training - pass online theoretical exam	16*
2	< 4 kg	A2 (can also fly in subcategory A3)	- no fly over uninvolved people - keep horizontal distance of 30 m from uninvolved people (it can be reduced to 5 m if low speed function is activated)	Yes	- read user's manual - complete online training - pass online theoretical exam - conduct and declare a self-practical training - pass a written exam at the CAA (or at recognized entity)	16*
3	< 25 kg	A3	- fly away from people - fly outside of urban area (150 m distance)	Yes	- read user's manual - complete online training - pass online theoretical exam	16*
4						
Privately built						
Legacy drones (art. 20)						

Challenges

- Safety
  - Different Methods of Compliance using different injury metrics creates inconsistencies in understanding and sharing safety data across CAAs
  - Injury metrics test data can be consistently applied and refined if a common test method is used
- Bilateral Agreements
  - Bilateral agreements for sUAS will be impossible to apply
  - Declaration of Compliance Label for FAA Category 2 and 3 Operations vs EASA CE Class Identification
    - Labels for Drones requires harmonization to grow the market space
    - CAA reciprocity of Declarations of Compliance for platforms from CAAs with fundamentally different requirements and different operational frameworks is unlikely
- Injuries due to ground collision are the same regardless of the CAA
  - Goal should be a clear standard with reasonable risk from which a professional sUAS organization can select the right platform for the operation
  - The use of Safety Assurance Levels and Operational Risk Assessments varies across the CAA but could be harmonized based upon common injury severity testing

Opportunities

- Need an international study to define injury risk values for sUAS impacts
  - A14 test methods used automotive injury risk values due to the need to move quickly
  - Development of an appropriate simple target for sUAS tests will also be helpful
  - Funding and time are required, but result will be a better understanding if injury risk
- Need common definitions and approaches to safety
  - Operation near People
  - Operation over people
  - Level of Safety for uninvolved people/non participants (What are we protecting and to what level?)
  - Common Categories for sUAS Labels/Markings (Role this approach into the operating rules)
    - 50^{th} percentile male or a one year old child?
    - Disability due to blade lacerations or is fatality the standard
    - How do we define Most Probable Worst Case for impact orientations?
    - Can an operator be responsible for following the flight manual when under VLOS rules or do all limitations need to be software limited to achieve safety?
- Industry needs to play a more active role
  - Engagement on Standards Committees
    - Refinement of F3389
    - Laceration test standard
    - Standard and test method for blade guards
  - Development of designs to reduce blunt force trauma and reduce risk of laceration injuries

Questions