

May 29, 2019

To whom it may concern:

My name is Patrick Murphy. I am widely regarded as an expert on laser pointer safety and legality, having been invited to present on the topic in places such as England, Japan, and Washington D.C. (for the Air Line Pilots Association and for the FBI). I also am editor of a 300+ page website devoted solely to this topic, LaserPointerSafety.com. My detailed expertise is listed at the end of this document.

Summary: Why expulsion is disproportionate

Quinn Mulcahy's father, Paul, discussed with me the circumstances of his son's situation. I understand Quinn is facing expulsion from school for using a laser pointer. According to his father, Quinn aimed the laser in a hallway during school, but it was not aimed at a person, and it was not used to threaten, intimidate or injure.

Assuming this account is true, in my professional opinion a penalty of expulsion is far too severe and is not warranted by the facts:

- The laser pointer appears to be low-powered and is thus safe
- The laser pointer is legal in the U.S., Virginia and Virginia Beach.
- The laser pointer was not used as a "weapon" as defined in the Virginia Beach City Public Schools Code of Conduct
- Possession of a laser pointer by students is not prohibited by the Code of Conduct – only misuse to threaten, intimidate, or injure, which did not appear to occur in this case.

For these reasons, I believe not only that expulsion is not warranted, but also that the several-day suspension pending a school hearing was not justified under the Code of Conduct.

I have listed key information in boldface, and have put technical details in footnotes.

Laser pointer is safe

The laser pointer was described as a 4-in-1 pen, stylus, LED flashlight and red laser pointer similar to the one below.



From the size, beam color, battery power, and type of laser described to me, the laser pointer in question is probably a Class 2 laser (under 1 mW), possibly up to Class 3R (FDA IIIa) which is under 5 mW. **Lasers of this power are considered safe** by the U.S. regulatory authority, the Food and Drug Administration.^{1, 2}

Note that the laser device in this pen is similar or identical to the one used in bullet-shaped lasers commonly sold in pet stores for playing with dogs and cats:



Laser pointers are legal in U.S., Virginia, and Virginia Beach

Because they are safe, laser pointers up to and including Class 3R are **legal under U.S. FDA regulations and federal law.**^{3, 4}

¹ Class 2 is considered hazardous only if the beam is viewed directly for long periods of time. It will not cause eye injury for accidental, incidental or unwanted exposures where a person blinks or turns away from the beam. For Class 3R lasers, FDA notes “Depending on power and beam area, can be momentarily hazardous when directly viewed or when staring directly at the beam with an unaided eye.” See FDA’s web page <https://www.fda.gov/radiation-emitting-products/home-business-and-entertainment-products/laser-products-and-instruments>.

² As of April 2012 FDA has said they have never received a report of eye injury from momentary exposures to Class 2 or 3R laser pointers. Given that Class 2 and 3R power has remained unchanged since that time, and that eye functions have not changed, the statement is likely still true as of 2019. (Eye injuries have occurred to children who have deliberately stared into the direct or reflected beam of a Class 2 or 3R laser. Also, more powerful Class 3B and 4 lasers have caused injuries from momentary exposures. However, the laser pointer in question is probably Class 2 which would not cause an injury from an accidental, incidental or unwanted exposure.)

³ The laser pointer is legal under U.S. federal regulations 21 CFR 1040.10 and 1040.11 as interpreted by the Food and Drug Administration’s Center for Devices and Radiological Health. The one I saw online does appear to be missing a label required by FDA. I do not know if Quinn’s laser pointer also is missing a label. If it is, the laser pointer would be violating a FDA requirement. But that would not impact Quinn since any FDA penalty would be against the manufacturer or seller, not against a person possessing a laser pointer without a label. Also, the missing label would not affect the maximum power of the laser which for a laser of that size, beam color, and battery power is probably Class 2 and possibly Class 3R.

⁴ By “legal” this means that Class 1, 2 and 3R lasers may be sold, distributed, marketed etc. by a maker or seller as a “pointer” or for pointing applications. There is no U.S. law against possessing lasers – anyone can own any laser

Lasers and laser pointers are **legal under the Code of Virginia.**⁵

Laser pointers are **legal under Virginia Beach regulations.**⁶

Under Virginia code, regulations about use or possession of laser pointers in a school are required to be set by individual school boards.⁷ This was done in the Virginia Beach City Public Schools Code of Student Conduct.

Use did not violate Code of Student Conduct

Quinn Mulcahy's use, as described to me by his father, **does not appear to violate any part of the Code of Student Conduct** prohibition on Weapons/Explosives/Fireworks (Prohibited Conduct, paragraph 24).⁸ Under this section, a laser pen is considered a weapon when used to threaten, intimidate or injure. My understanding is **none of these three acts occurred.**

Speaking of "injuries," **Quinn's laser pen could not injure a person.** A Class 2 laser as this appears to be cannot injure a non-cooperative person (e.g. a person would have to deliberately stare into the beam before any eye injury might occur).

of any power. But only Class 1, 2 or 3R lasers may legally be sold etc. as "pointers" or for pointing applications. This means any violations would be enforced against the manufacturer or seller — not against an owner.

⁵ The Code of Virginia has a provision against pointing a laser at a law-enforcement officer (§ 18.2-57.01) and against interference with operation of aircraft (§ 5.1-22). There are some references to laser surgery, hair removal and fiber optic cables, and a provision listed in footnote 7. Other than these, there are no statutory restrictions on use or possession of lasers of any type by the Commonwealth.

⁶ The only relevant regulation I can find is a provision of the Virginia Beach City Council, passed August 25 1998, Section 21-11.3 of the City code: "It shall be unlawful and a Class 2 misdemeanor for any person to intentionally, and without good cause, direct the beam from a laser pen, flashlight or similar device into the eyes (or eye) of another person." Assuming the laser was not aimed as described (intentionally and without good cause into the eyes or eye of another person), then Quinn's use in the school building did not violate the Virginia Beach code. See http://www.mml.org/pdf/ords/lp_virginia_beach.pdf

⁷ The Code of Virginia, Title 22.1, Chapter 14, Article 3, paragraph E. says that a "A school board may regulate the use or possession of beepers or other portable communications devices and laser pointers by students on school property or attending school functions or activities and establish disciplinary procedures pursuant to this article to which students violating such regulations will be subject." This clause does not state what the disciplinary procedures should be, so that appears to be up to the school board.

⁸ For reference, this is the relevant language in the Code of Conduct: "24. Weapons/Explosives/Fireworks: A student will not distribute, handle, use, transmit, or possess a weapon or any object that is designed or used to inflict bodily injury or place a person in fear of bodily injury or any object which can reasonably be considered a weapon. Students shall not possess, distribute, discharge or participate in the discharge of fireworks or similar items. Examples of weapons and fireworks and other substances are as follows: bomb, knife/razor blade/box cutter, ammunition, metal knuckles, fireworks, small explosives such as firecrackers, caps, poppers and stink bombs, the use of any object or substance that will potentially cause harm, irritation, or bodily injury to the students or any other person. When a laser pen is used to threaten, intimidate or injure, it is considered a weapon. [S.B. Reg. 5-36.1 and 5-36.4/Rule 25]"

In addition to prohibiting weapons — and Quinn’s laser pen use was not a weapon — paragraph 24 also prohibits objects with various properties. **Quinn’s use does not fit any of these objects’ properties.** The section says a student will not distribute, handle, use, transmit or possess a weapon or any object...”:

- “...that is designed or used to inflict bodily injury...”
A Class 2 laser pointer by definition is not hazardous unless the beam is viewed directly for a long period of time, according to the U.S. FDA. Which is why FDA allows the sale of not only Class 2 lasers (up to 1 milliwatt) but also Class 3R lasers (up to 5 milliwatts).
- “...or place a person in fear of bodily injury...”
I am not aware of any person being fearful from Quinn’s laser use. Further, this is vague. If a person irrationally fears a harmless red dot, does that justify a higher penalty than if a person rationally knows it is only a cat-toy like laser pointer?
- “...or any object which can reasonably be considered a weapon.”
A Class 2 laser pointer cannot reasonably be considered a weapon. For example, if you were threatened with physical violence, a laser pointer would not be any type of effective defense. The attacker could simply move his or her head, close their eyes, etc.
A Class 2 (or 3R) beam would not harm or stop a person as for example some of the other weapons listed in the Code of Conduct: “...bomb, knife/razor blade/box cutter, ammunition [in a gun], metal knuckles, or small explosives such as firecrackers, caps, poppers and stink bombs...”

The point is that under the “Weapons/Explosives/Fireworks” paragraph, **laser pens (pointers) as used by Quinn are not weapons and are not among the other prohibited objects.**

Finally, the fact that laser pens have their own specific definition of weapon also categorizes them separately from the other weapons listed. According to the definition, use in a specific weapon-like way makes them a weapon — not the mere fact of having a laser pointer or using it harmlessly to point.

Expulsion not warranted; possession not prohibited

In my view, **expulsion would be far too strong a penalty** in this case. This assumes the laser was not deliberately aimed at any person, and was not being used to threaten, intimidate or injure anyone as defined in the School Handbook.

Further, in my view the **possession of a laser pointer by a student is legal** under the Virginia Beach City Schools Code of Student Conduct.

The last sentence of paragraph 24 states that a laser pointer is a (prohibited) weapon if used to threaten, intimidate, or injure. Otherwise it is not a weapon, and thus is not prohibited under the first sentence of paragraph 24.⁹

- This is similar to how lasers are regulated by the U.S. and most states. Anyone can own a laser of any power. It is only if the laser is misused such as being aimed at aircraft, vehicles, persons' eyes, or law enforcement that the U.S. or a state will impose a fine or jail.
- This is also similar to how many objects found in, or brought to, schools are safe when used properly but could be considered a weapon when used to threaten, intimidate or injure; for example, hardbound books, cafeteria trays, sharp pencils, baseball bats and other sports equipment, wooden pointer sticks used in lieu of laser pointers, etc.

In this case, Quinn's laser pointer was safe when used properly. Perhaps aiming at lockers was a distraction and would thus fall under some other Code of Conduct clause – but as described to me it was not used in a weapon-like manner.

Assuming there have been no other disciplinary problems with Quinn, and that the facts are as told to me by his father, I believe that his being suspended from school pending a hearing was not justified under the Code of Conduct. Certainly no further penalties or punishment should be imposed (again, assuming the case is as was told to me).

Expertise in laser safety and legality

I appreciate school officials, the School Board, or discipline committee taking the time to review this information.

My experience in this area is summarized below. If you should wish to contact me on this matter, or any future issues involving laser safety in schools, I can be reached at mail@laserpointersafety.com or 407-797-7654.

- Patrick Murphy holds a B.A. degree in Laser Art and Technology from Oberlin College (1981) and an MBA degree from the Keller Graduate School of Management (2006). In 1986 he founded Pangolin Laser Systems, which became a leader in the field of software for laser light shows and displays. He served as President of the International Laser Display Association (ILDA) during 1996, was Airspace Issues Coordinator for ILDA from 1996 to 1999, received the ILDA Career Achievement Award in 2004, and has served as executive director of ILDA since 2006.

⁹ This opinion that possession is legal unless misused as a weapon, is based on a clear reading of the Code of Conduct. Some schools and public places such as stadiums and concert halls ban laser pointer possession. There may be valid reasons for banning laser pointers in such places. If Virginia Beach City Schools were to revise the Code of Conduct to ban student possession of laser pointers, I could understand this (although expulsion would not be warranted unless the laser is misused or is clearly a high-powered Class 3B or 4 laser).

- He is editor of LaserPointerSafety.com, “an independent resource for users, regulators, pilots, media, law enforcement and others concerned with handheld portable lasers.”
- He is a representative from ILDA to the SAE G10T Laser Safety Hazards Committee, the primary group working on laser/aircraft safety issues. In this capacity, he has helped to write regulations and forms used by the U.S. Federal Aviation Administration for evaluating outdoor laser shows. In 2000 he received an Award of Recognition from SAE G10T for this work, and an ILDA Certificate of Commendation.
- He is a member of three ANSI Z136 laser safety committees; specifically the American National Standard for Safe Use of Lasers (.1), for Safe Use of Lasers Outdoors (.6) and for Entertainment and Trade Show Lasers (.10).
- PAPERS AND PRESENTATIONS: He has presented papers at the International Laser Safety Conference, in 1997, 2009, 2011, 2015 and 2019, on the topics of laser/aircraft safety and audience-scanned laser shows. In 2009 he was the invited guest speaker at the 14th Annual Laser Safety Forum at Loughborough University in the U.K. In 2011, he received a Certificate of Appreciation from SAE G10T for work on Aerospace Standard 6029, “Performance Criteria for Laser Control Measures Used for Aviation Safety.” In October 2011, he was invited by the Air Line Pilots Association to speak at a major Washington D.C. conference held to publicize laser illumination hazards. In July 2012, he was invited by the Airborne Law Enforcement Association to speak at their annual conference in Reno, NV. During 2013, he helped write the FAA’s Laser Beam Exposure Questionnaire and an FAA document (in draft) summarizing laser hazards and mitigation for pilots. He was invited to speak at the July 2015 Health Physics Society annual meeting, on the topic of laser/aviation safety. In 2016 he worked on the SAE G10-OL Operational Laser committee, helping to draft a document on pilot education and protective eyewear, including running tests on pilots with lasers and bright lights in cockpits. He co-authored a paper with Capt. Daniel Hewett of the U.S. FDA about “FDA’s Proposed Change to the Regulation of Laser Pointers,” which was presented March 21 2017 at the International Laser Safety Conference. In 2017 he became co-chair of the SAE G10-OL Operational Laser committee, which in June 2018 published SAE ARP6378, a guide to help pilots with procedures, education/training and protective eyewear. In June 2018 he was an invited speaker to the NASA Occupational Health Meeting at Kennedy Space Center, on the topic of “Laser Illumination of Pilots: Health Consequences, Current Status, and Mitigation.” He contributed two chapters, on pilot visual interference and pilot eye safety, to the book *Understanding Laser Accidents* published in September 2018. In January 2019 he was an invited speaker to a symposium in Tokyo on improving Japanese laser safety regulations. In January 2019, he received a Certificate of Appreciation from SAE G10T for work on Aerospace Recommended Practice 6378, "Guidance on Mitigation Strategies Against Laser Illumination Effects." In March 2019, he presented “Reducing Hazards of Laser Pointer Misuse” at the International Laser Safety Conference in Orlando.