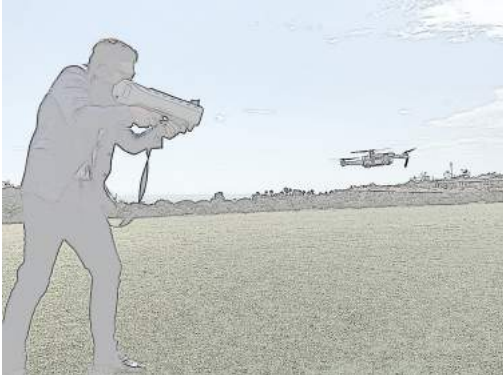


How to Shoot Down A Drone



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Is this really a thing?

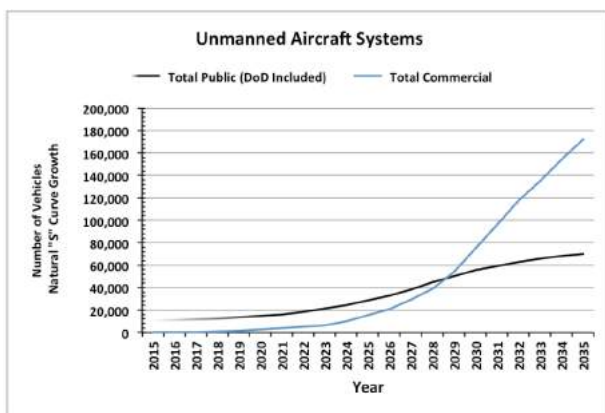


Figure ES-3 - Total UAS Forecast 2015 - 2035

2018 actual: 1.2 million

Calo, *The Drone As Privacy Catalyst*, 64
Stan. L. Rev. Online 29 (2011).

So can you shoot down a drone?

- Yes. Probably. But you'll get sued.

The screenshot shows the faculty profile for Joseph J. Vacek, J.D., an Associate Professor and Graduate Director at UND Aerospace. The page includes a navigation menu with options like 'Home', 'Mission Statement', 'Prospective Students', 'Current Students', 'Flight Operations', 'Multimedia', 'Faculty and Staff', 'Contact Us', and 'Sitemap'. It also features social media links for Facebook and YouTube, and a 'Pay-It-Forward' ribbon. The 'Educational Background' section lists a Juris Doctor from 2006, a Civil & Family Mediator role in 2004, and a Bachelor of Science with honors from 2003. The 'Professional Experience' section lists roles such as Graduate Director (2017 to present), Associate Professor of Aviation (2013 to present), Assistant Professor of Space Studies (2010 to present), Assistant Professor of Aviation (2007 to 2013), Attorney at Law (2007 to present), and Civil and Family Mediator (2004 to 2006).

How can you ~~shoot down~~ defend yourself from a drone?



Boggs v. Merideth, W.D. Ky (2016)

18 USC 32

- Whoever willfully
 - damages, destroys, disables, or wrecks any aircraft... in interstate commerce...
 - interferes with or disables...with a reckless disregard for the safety of human life...
 - communicates information, [spoofs] ...endangering the safety of any such aircraft in flight;
- shall be fined under this title or imprisoned not more than twenty years or both.

Counter UAS types

- Passive
 - Signage & Warnings (“No Drone Zones”)
 - Tracking (RF signature, audio, visual, IR)
 - Alerting (private, LEO)
- Active
 - EMP
 - Frequency jamming/spoofing
 - Physical incapacitation/destruction



Per 18 USC 32

Loopholes*

- Defense of Property
- Self Defense
- Necessity
- Always have a right to reasonable defense against wrongful conduct
 - What’s “reasonable”? (Vacek Remote Sensing article, 90 NDLR 463 (2014).
 - Depends on the Risk and Threat

*actually means “affirmative defenses”

Risk

07/22/13

5200.11 Chg 2
Appendix C

- Severity
 - Catastrophic = collision with airliner
 - Hazardous = crowd overflight
 - Major = flight over freeway
 - Minor = property damage
 - Minimal = trespass
- Likelihood
 - Geographic + demographic

Risk Matrix

Severity Likelihood	Minimal 5	Minor 4	Major 3	Hazardous 2	Catastrophic 1
Frequent A	Low Risk	Medium Risk	Medium Risk	High Risk	High Risk
Probable B	Low Risk	Medium Risk	Medium Risk	High Risk	High Risk
Remote C	Low Risk	Low Risk	Medium Risk	High Risk	High Risk
Extremely Remote D	Low Risk	Low Risk	Low Risk	Medium Risk	High Risk
Extremely Improbable E	Low Risk	Low Risk	Low Risk	Low Risk	High Risk



* Unacceptable with Single Point and/or Common Cause Failures

Threat

- Flight behavior assessment by Artificial Intelligence Algorithm

Compliant

Noncompliant-Ignorant

Noncompliant-Purposeful

Vacek Model for Active CUAS

VACEK MODEL Compliance/Risk	Low Risk	Medium Risk	High Risk
Compliant	Warn only	Return to base	Nondestructive interference
Noncompliant – Ignorant	Return to base	Nondestructive interference	Nondestructive disablement or temporary capture
Noncompliant - Purposeful	Nondestructive interference	Nondestructive disablement or temporary capture	Destruction or capture

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Application

- Passive
 - Visual
 - Audio
 - RF Spectrum
 - Database match
 - Registration
- Active
 - Return-to-base
 - EMP (temporary)
 - Capture/destroy



Photo Example: SRC, Inc's *Silent Archer*