

# Complex critical systems can LAWS be fielded?

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# Laws govern LAWS

- User of weapons are responsible for the effects, to make risk assessments and take precautions
- Requires understanding of weapons and usage
- Requires predictability within a specified context
- Requires reliability of functions

To field a weapon system all requirements need to be fulfilled

# Operation of weapon systems

- Users are required to understand how weapons are operated (to handle correctly)
- Users are required to understand of the effect of the force used (to use correctly)
- Doctrines, handbooks and manuals need to be developed and training is necessary
- Increasing complexity of systems need more analysis, planning, preparation and training

# Critical systems

- Critical systems – failure can result in significant economic losses, physical damage or threats to human life
  - Aerospace
  - Nuclear Power
  - Train signal systems
  - Autonomous Cars
  - Weapons
- Legislation, policies and standards already govern the development and use of critical systems
- Typical requirement on catastrophic failure rates is “Extremely improbable”, less likely than 1 in a billion

# Software (the heart of autonomy)

- Predictability and controllability are essential features of weapon systems
- Software is intangible, unobservable and for complex systems not testable (at system level)
- Thorough and detailed development processes need to be followed. Several standards exist.
- Difficult to design very reliable very complex systems to an affordable cost

# Conclusion

- Fielding of autonomous weapons requires
  - Reliable complex software
  - Suitable doctrines, manuals and training programs
- How to build shared confidence in complex systems?
  - Test results for weapon systems will not be shared
  - By transparency about development procedures?  
e.g. as in civil safety critical domains with agreed methods for design, validation and verification