Lethal Autonomous Weapons Systems (LAWS):
Offering a Framework and Suggestions

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Note: The views and opinions of authors expressed herein do not necessarily state or reflect those of the U.S Navy or the United States Government

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Challenge: Reconciling Conflicting Demands

- Militaries must succeed **today**… *autonomous* machine & LAWS combat is already at Sea and in the Air…but…

- But future LAWS may threaten civil society
  - Arms controls now might enhance human security of future generations
Why LAWS is Different...this Framework will explain.

- We are in the midst of a strategic ‘paradigm change’ in how we see warfare.

- Caution: distinguish between incremental technological change and the strategic change happening now. (i.e., the “crossbow and the pope” are unhelpful comparisons)

- What indication this is REALLY big?
Calm before the Storm: consider the wide range of debate this week in Geneva Room XIX…

Disputes over basic terminology, categories, ethics of LAWS… what would Kuhn Say? Signs of something big….
What theories of Technology and War help you put LAWS in perspective?

1. Life Cycle Theory of technological change
2. Cybernetic Theory of Warfare: Sense-Think-Act
3. The New Change: Emergence of a Third Realm of war

Image credit: permanentculturenow.com
Theory 1: Tech Change is three stage, and “late stage” changes are dangerous

- **Early**: society exerts most influence. Change is easy.

- **Middle**: momentum accumulates around the invention (e.g., capital, labor, political)… change is harder.

- **Late**: technology appears “beyond social control”, or “technology out of control”…change all but precluded…

- Change in “Late Stage” can come with Near Disaster
  - Cuban Missile Crisis energized Arms talks
  - Fukushima stopped nuclear power trajectory in Japan
Theory 2: Across History, military innovation seeks to improve the “Sensing-Thinking-Acting” cycle (or loop)

- **Sensing**
  - Human Senses
  - Machine sensing: Radar, Sonar, Infrared etc

  (COMMUNICATION LINKS)

- **Thinking**
  - Human Commander
  - Computer/Computation (early analog, now digital)

  (COMMUNICATION LINKS)

- **Acting**
  - Human
  - Human-Machine integration
  - Machine
Theory 3: the Big Change...the Emergence of the Third Realm of Warfare...

- In pursuit of S-T-A advantage, third Realm emerges
  - 1st: Social-Human Realm
    - (approx 10,000 BC-
  - 2nd: Integrated Human-Machine Realm
    - (approx 1588AD-
  - 3rd: autonomous Machine Realm
    - (approx 2014-??)
Why I ask you to consider history…it will show “it is different this time”.
“… because our teachers … focus their attention only on the present or at the most on the very recent past, they find the present more and more difficult to explain. They are like oceanographers who refuse to look at the stars because they are too remote from the sea, and consequently are unable to discover the causes of the tides.” Marc Bloch, French historian, veteran of WWI & WW2
At first…there existed one Realm of warfare…
the Social-Human Realm of S-T-A

- Most of history, the social-human factor was **decisive**:
  - Humans dominated **sensing, thinking, and acting**, (S-T-A).
  - Tools leveraged human **Action (A)**, or protected the human body.
Unclassified

Waves of Innovation increases Human-Machine S/T/A integration in war...evolving the 2\textsuperscript{nd} Realm

Increasing Role of Machine Factors in S-T-A Functions

Pre-Industrial Age

Industrial Age

Time (not to scale)

1400-1500s: Gunpowder, magnetic compass…shift between Lepanto and Armada 1588

500-300 BC: Catapult and Galley

Social-Human Realm

Integrated Realm

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Social-Human Realm: 1571 Battle of Lepanto dominated by mass infantry battles fought on/across fleets of **galleys**…. 

To Integrated Realm: 1588 Battle of Armada the English embark **ZERO INFANTRY**, fight artillery duel from new kinds of ships
Waves of Innovation... Machines Assume Increasing Share of the Sense-Think-Act Function

Increasing Role of Machine Factors in S-T-A Functions

Pre-Industrial Age

Industrial Age

Time (not to scale)

1400-1500s: Gunpowder, magnetic compass...shift between Lepanto and Armada 1588

500-300 BC: Catapult and Galley

1840-1860s: Ironclad steam ship, Telegraph comms

WWI: Machine Gun, Submarine

WWI: Tank, Aircraft

Integrated Realm

Social-Human Realm
Increased integration of Human/Machine on Land and Air. Industrial Human Slaughter

“Artillery men with their cold blooded mathematics seemed subversive of all that made a soldiers life heroic, admirable, worthy.” William McNeill, Pursuit of Power
Two Realms of warfare co-exist at sea on land in the air...

Increasing Speed of Process (sensing/thinking/acting)

Technical limits combine with Ethics/Law/Policy/Empathy, to determine the boundaries between human and machine...
Human engineers imbue the Machine with the capacity to Sense, Think, Act without the human operator… the ‘MACHINE Realm’ emerges.

“...modern warfare is more a matter of machines than of men.” Thomas Edison
Waves of Innovation create the Third Realm…Artificial Intelligence and possible Autonomous Machine Warfare

Pre-Industrial Age  Industrial Age  Information Age…and beyond?

Time (not to scale)

- **500-300 BC**: Catapult and Galley
- **1400-1500s**: Gunpowder, magnetic compass…shift between Lepanto and Armada 1588
- **1840-1860s**: Ironclad steam ship, Telegraph comms
- **1914**: Machine Gun, Submarine
- **1917**: Tank, Aircraft
- **1917**: V1 V2 Missiles, first digital computer
- **1940**: V1, V2 Missiles, automated AEGIS air defense system
- **2001**: Semi-autonomous armed UAV
- **2014**: Armed autonomous vehicle?
Unclassified

Framework: Three Realms Co-Existing

Increasing Machine Autonomy (sensing/thinking/acting)

Technical barriers fall... now, Ethics, Law, Policy, Empathy, must limit machine systems

Increasing Speed of Process (sensing/thinking/acting)
Has empathy placed a check on the usage of advanced weapons when deployed against civil society?

Let's look at the Three Realms graphically.... First, with the capacity for empathy... and second, without capacity for empathy.
Unclassified

**Empathy may be the final protection of the Human Realm when military systems “legally” deploy against civilians**

Ethics, Law, Policy, Empathy, **not technical barriers, will determine the living/dying space for human and machine**
Unclassified

Technology unbounded without capacity for Empathy...because the human soldier is absent...

Increasing Machine Autonomy (sensing/thinking/acting)

Machine Realm

Increasing Speed of Process (sensing/thinking/acting)

Ethics, Law, Policy, Empathy, not technical barriers, will determine the living/dying space for human and machine
1. What is the potential magnitude of the effect of LAWS on military doctrine?

Answer: perhaps the MOST important of the last two changes in the history of military doctrine.

Why?

....the human is no longer essential to S-T-A.
2. Should Air/Sea be considered distinct from Land systems?

Answer: Yes.
- Why?
- Sea and Air environs: minimal human habitation.
- Land LAWS may operate in proximity to complex socio-human terrain.
- Note: Speed and autonomy offered by LAWS may be needed in sea/air battle... but it is hard to think of a strategic need of electronic speeding machines used against people. Why? Humans move at human speed... If complying with IHL, why should machines move so much faster?
3. Is the development of LAWS in lines with the growing tendency in military operations to improve the **control (not empathy)** of the use of force?

- **Answer:** yes, in the short term, but in long term, LAWS may degrade human control.
- **Why?**
- **Cyber attack**… which can attack each component of electronic S-T-A loop, and the **communications links** between S-T-A as well.
Question: If not banned, should Development of LAWS be slowed?

4. If we don’t “ban” LAWS, should we slow the development of LAWS?

Recommendation: Slowing the Pace of LAWS development may be beneficial.

Why: The emergence of the Third Realm will radically disrupt nation power relations.

Potential surprise: small countries or non state actors with advanced LAWS or Cyber tools may become new powers. The decoupling of military power from population base is an historic, unprecedented event.
Question: Where to prioritize future research on LAWS?

5. Where to prioritize LAWS research?

a. Priority goal: Limit the infiltration of advanced lethal robotics into “Human Realm” or what might be called “Human Space”.

b. Secondary goal: Sea & Air systems, perhaps for reasons of maintaining strategic systems stability in face of cyber hacking.
6. How best to “control” future LAWS?

Recommendation: Focus on the physical aspects of LAWS, the “Hardware”

Why? Control of computer code is almost impossible (witness cyber crime).

Focus on physical LAWS features that can be verified by visual inspection...
- limits on numbers,
- limits on size (make it illegal to create ‘smaller than human scale’, except in very limited cases)
- control fuel source (non-bio),
- outlaw human impersonation.
7. Does Cyber Insecurity erode ethical arguments in favor of Unmanned Systems?

Advocates argue Automated Systems are more discriminating than humans under stress. But which is worse: a human under stress or unmanned vehicle under systemic cyber attack?
The Third Realm of Warfare is emerging.

The challenge: reconcile competing demand between military use of LAWS in defense today, and the need to protect future generations from misuse of LAWS.

The time is now for society to shape the trajectory of LAWS.
Why future society may benefit if today’s Elder Statesmen and Youth Question LAWS today

Many middle-aged generation are jaded by early and shrill Sci-Fi…

Are fearful of being branded “luddite”…

and are *themselves* products of career momentum...they are economically/politically “captured” or disproportionately influenced by Large Technical Systems (e.g., hi-tech industry, academia, or government organizations) ...

And thus tend to inaction, and will allow momentum to propel society’s choices to ‘late stage’ change
Just War Theory/Walzer says Semi Autonomous Systems are roughly analogous to the human with a rifle

(Univ or Maryland speech, Fall 2014...??)
Will Mass Production of Semi Autonomous Systems Prove Walzer Wrong?
Broader Implications?

- Military tends to seek greater autonomy (labor saving) and speed up the S-T-A (OODA Loop) and extend the range of action.
  - LAWS offer a solution…thus military professionals will be compelled to pursue this technology… in Machine Realm.
- But LAWS a mismatch for Social-Human realm?
- Thus: where to limit/restrict the use of LAWS across Realms? Where to preserve Empathy
- In the Semi-Autonomous case, if mass production of these systems ensues, where does meaningful human control fade away??
- Expanded topic: the case of non-lethal, mass produced autonomous systems used to intimidate humans?