

OUT OF THE LOOP?
Toward Autonomy of Combat Robots

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A robot is:

a machine that

- senses
- thinks
- acts

a composition of

- sensors
- computer
- effectors

1. Independence
2. Assertiveness
3. Adaptability

STEP 0 Remote controlled system

radio-controlled guided bombs (Fritz X) / 1st generation of antitank missiles (SS.10, Cobra, 3M6)

STEP 1 Assisted system („human in the loop”)

armed drones (Predator, Reaper)

STEP 2 Supervised system („human on the loop”)

anti-aircraft systems (Aegis) / anti-missile systems (Iron Dome) / CIWS systems (Phalanx, Goalkeeper) / C-RAM systems (Skyshield, Centurion)

STEP 3 Fully autonomous system („human out of

the loop”) mines, fire&forget missiles, antitank artillery systems with homing seekers (SMArt, Bonus)

Ability to engage preselected targets

preprogrammed cruise missiles, homing missile operated in lock on before launch mode (air-to-air missiles)

Ability to select targets

defensive anti-aircraft, anti-missile and C-RAM systems;
sentry robots (Samsung SGR-1A)

Reactive systems

mine, homing missiles, less sophisticated anti-aircraft and anti-missile systems (like CIWS)

Reflective systems

more complex defensive systems (Iron Dome, Aegis), able to distinguish between various types of objects

CRITERIA OF AUTONOMY

Criteria				
INDEPENDENCE	Remote controlled	Assisted	Supervised	Fully autonomous
ASSERTIVENESS	Engaging preselected targets		Selecting targets	
ADAPTABILITY	Reactive		Reflective	

1. Lack of adequate sensors
2. Lack of adequate computer program
3. Lack of clarity of international humanitarian law
4. Lawfare

Top-down

- robot – tool
- operates under the predefined rules
- universal rules
- algorithm

Bottom-up

- robot – agent
- learns guiding principles
- particular rules
- artificial neural network

CONDITIONS OF ROBOT TAKEOVER

- machines are independent
- machines are more intelligent than humans
- machines have survival instinct & own interests
- humans have no control over the machines' decision-making