Engineering, Ethics and Society: Military Engineering Ethics

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Lecture 15

Lecture Contents

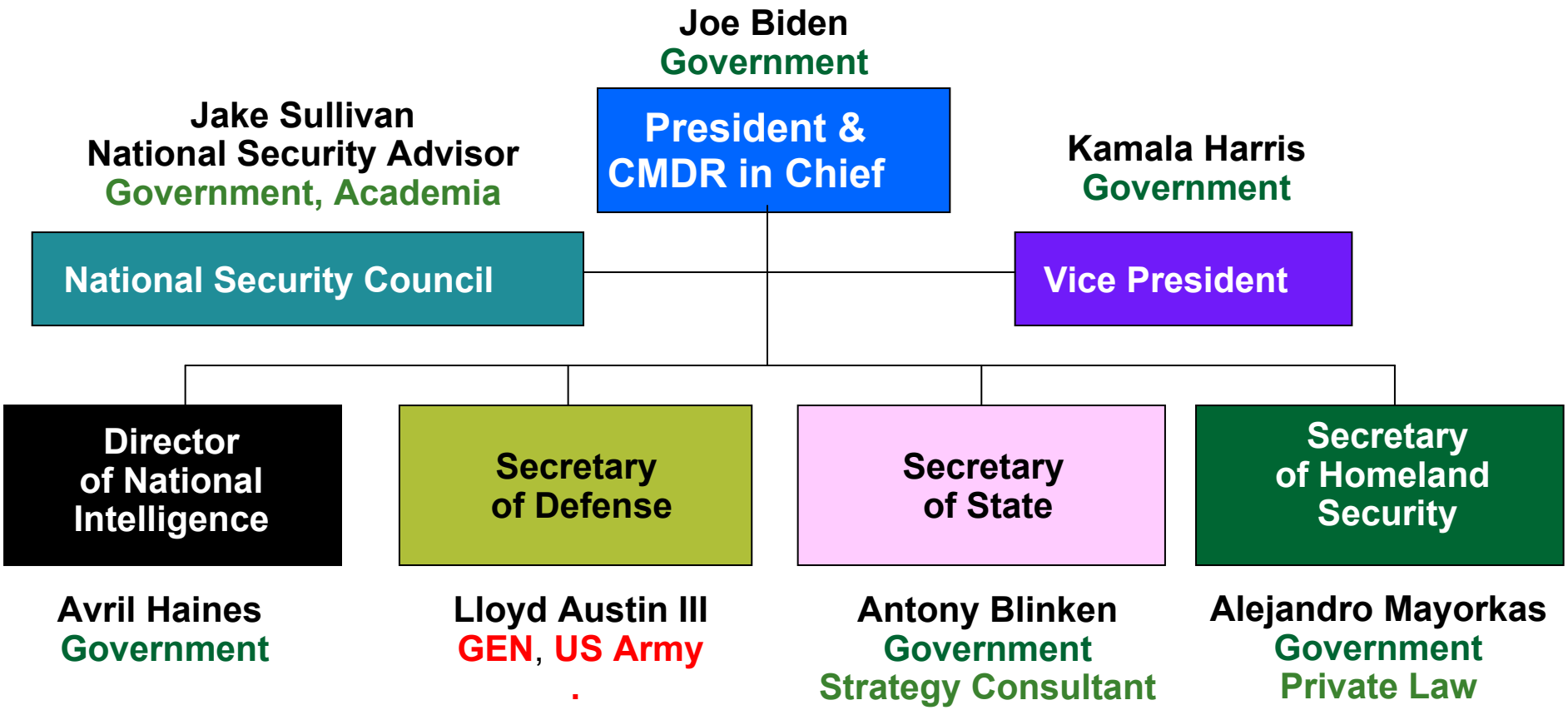
- Defense Establishment
  - The “Military-Industrial Complex”
  - DoD and DHS
- Defense Engineering Environment
  - Budgets and expenditures
  - Current policy drivers
  - Current technical thrusts
- Ethical Analysis
  - Overview
  - The “Laws of War” and “Rules of Engagement”
  - Just Wars: Purpose, Conduct, Consequences
- Current Technologies and Implications
- Robotics: Humanoid, Drones, Autonomous
- Societal Reactions to War
- Final Thoughts and Further Study

The Military-Industrial Complex

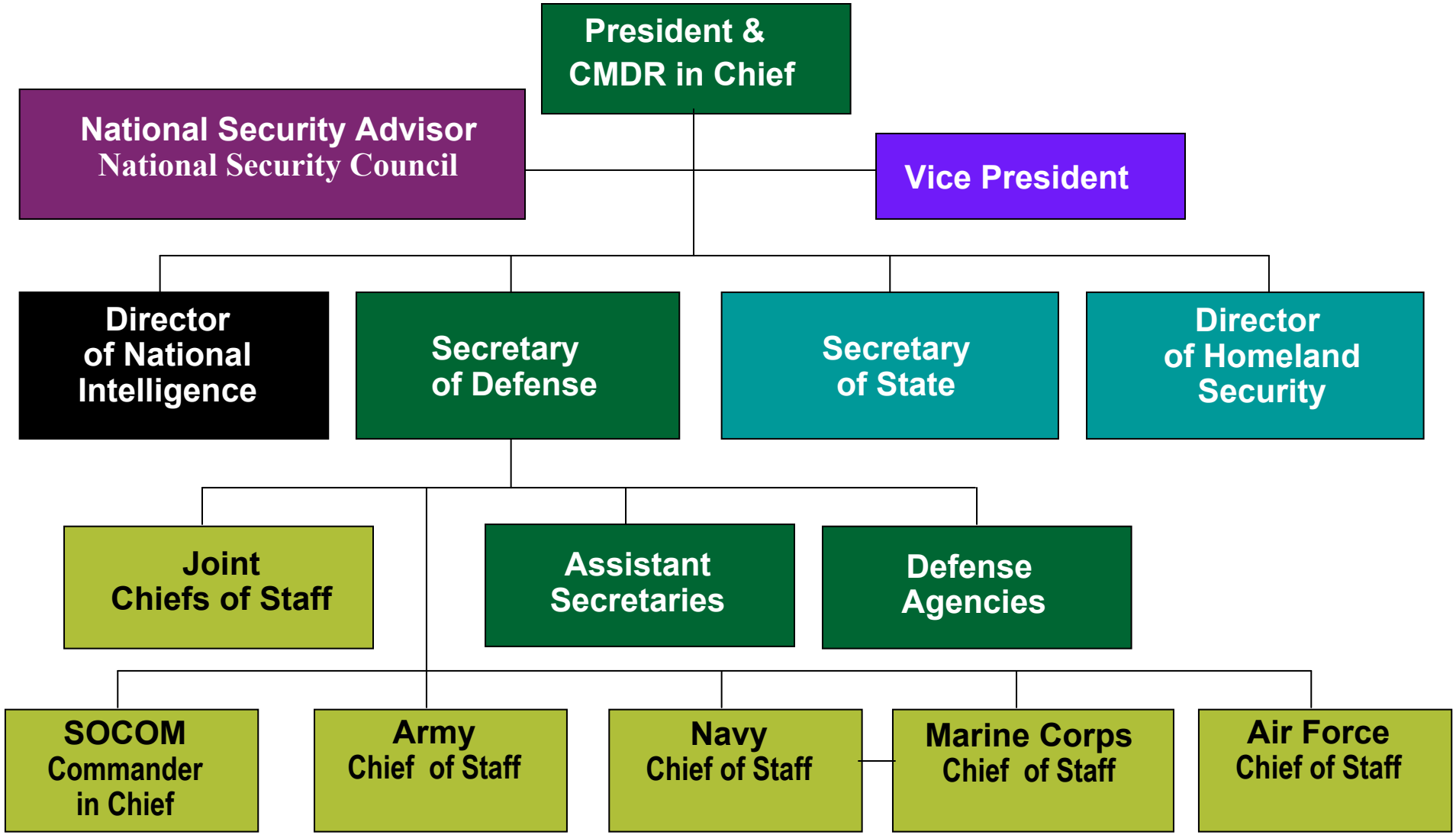
"In the councils of government, we must guard against the acquisition of unwarranted influence, whether sought or unsought, by the military-industrial complex. The potential for the disastrous rise of misplaced power exists and will persist."

President Dwight D. Eisenhower
Farewell Address to the People
January 17, 1961

Military-Industrial Complex in Government



Basic U.S. Military Establishment



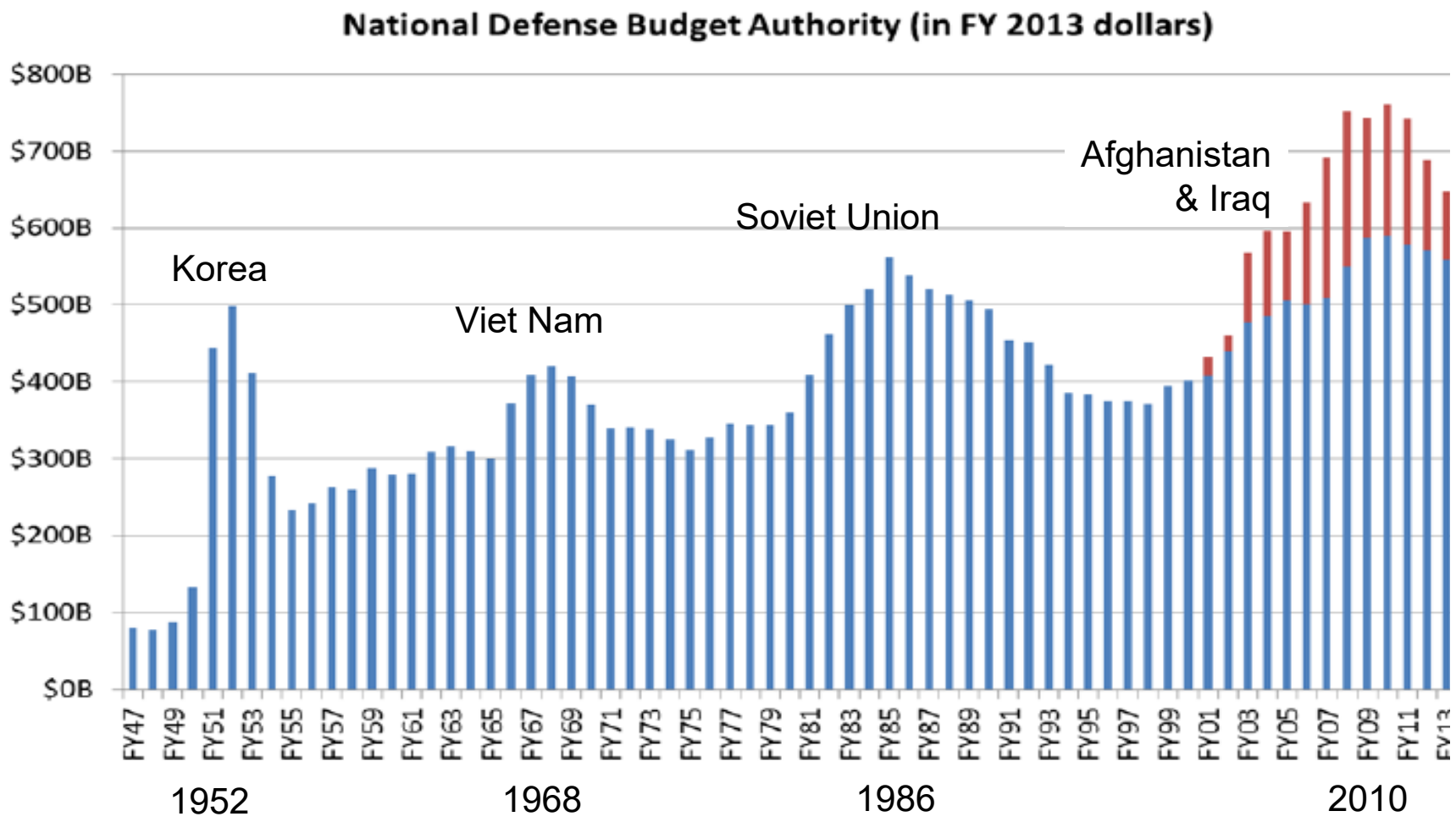
Department of Defense Headquarters

The Pentagon, Arlington, Virginia (across from Washington, DC)

New Department

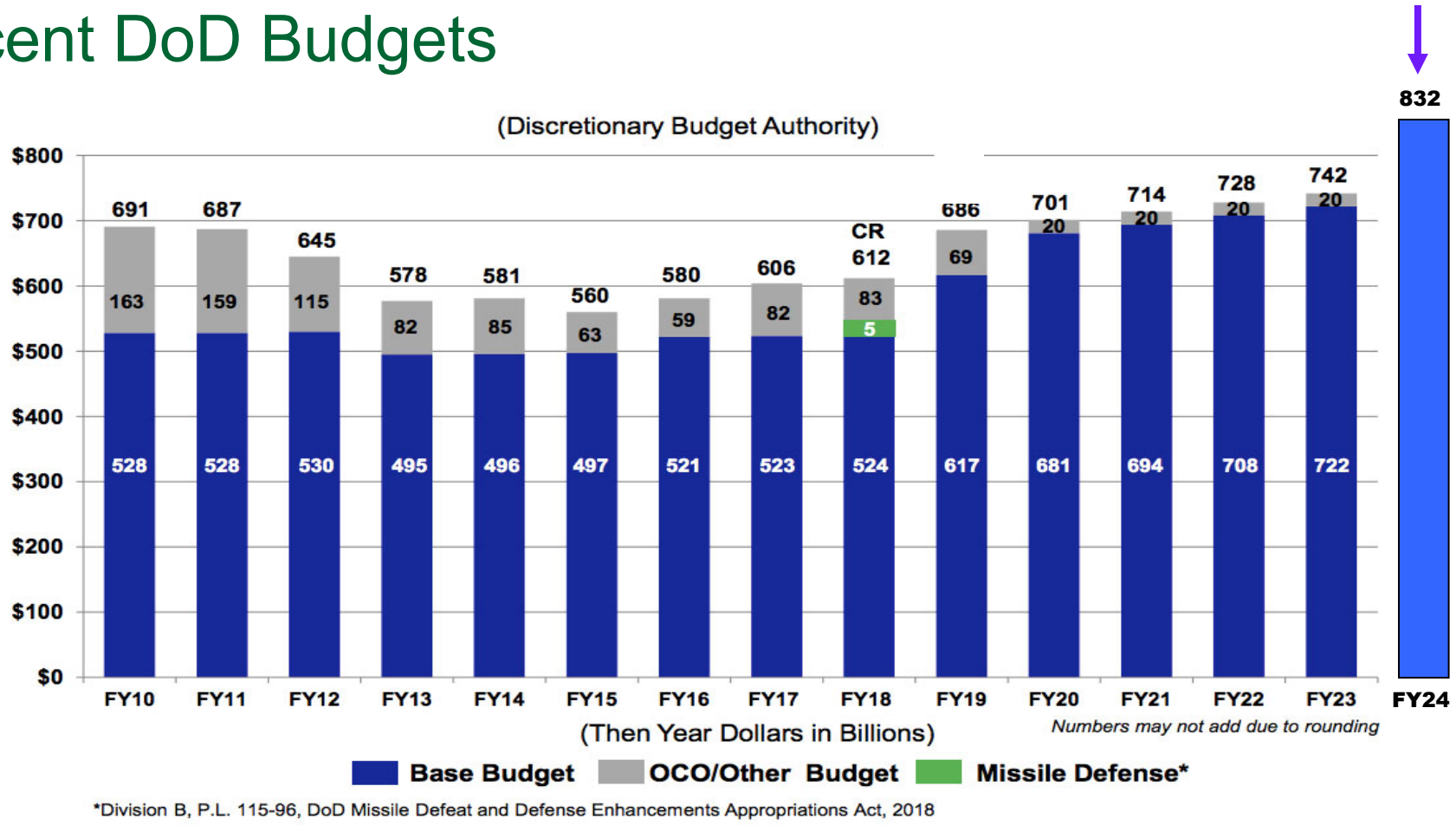
- Formed Post 9/11
- Official Mission
  - Protect the nation against further terrorist attacks. Component agencies will analyze threats and intelligence, guard our borders and airports, protect our critical infrastructure, and coordinate the response of our nation for future emergencies.
  - Protect the rights of American citizens. Enhance public services, such as natural disaster assistance and citizenship services, by dedicating offices to these important missions.
- R&D Priorities
  - Information and Infrastructure
  - Surveillance and Security

Long Term U.S. Defense Expenditures



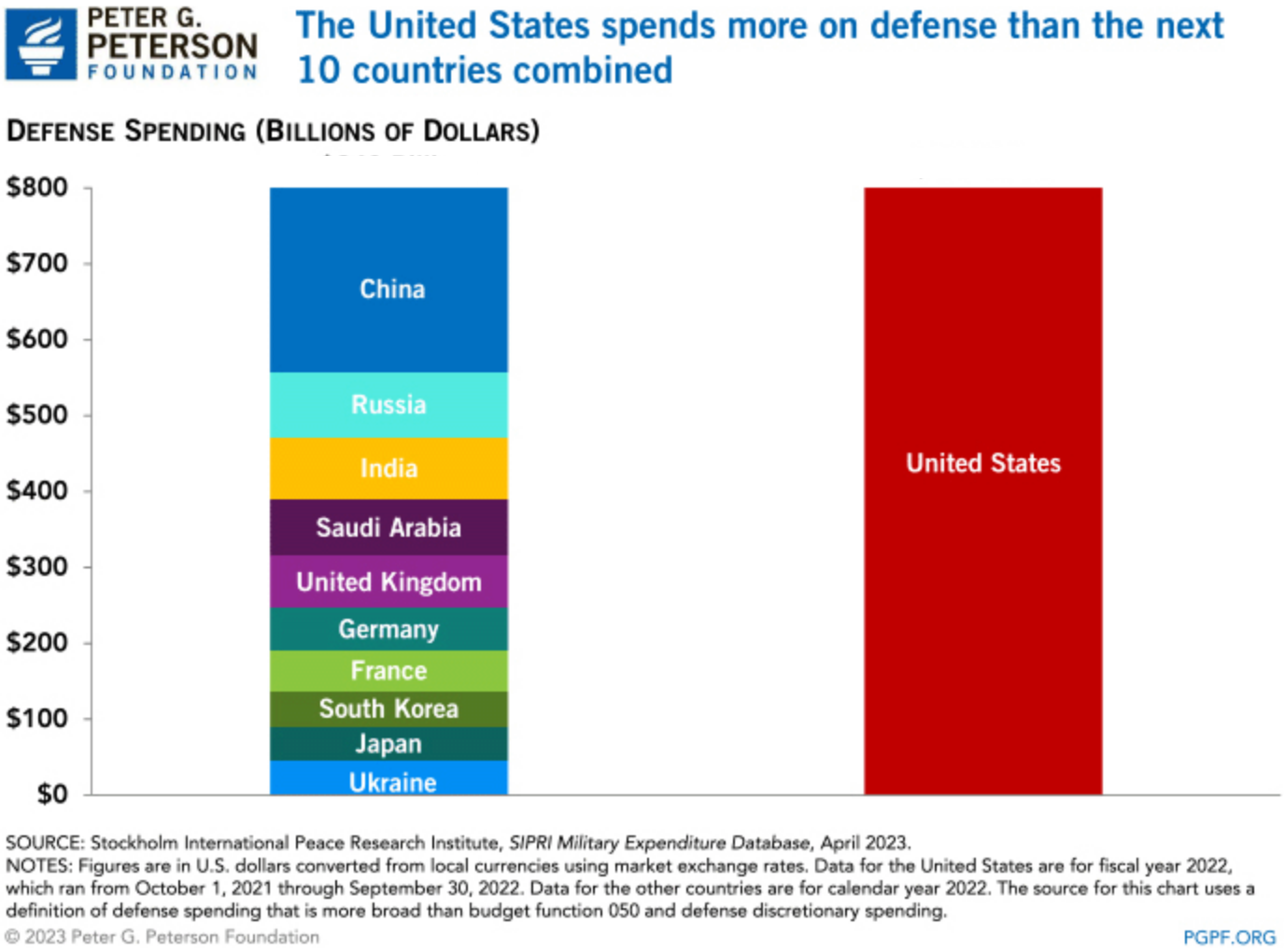
Center for Strategic and Budgetary Assessments, www.CSBAonline.org, August 2012

Recent DoD Budgets



Defense spending decreased during the Obama administration as a result of both presidential and congressional priorities. But in the Trump and Biden administrations it increased again, with the budget for FY2024 over $830 billion. The next several years' budgets are likely to continue increasing as the US is very active internationally.

FY 2023 Spending Compared to Other Militaries

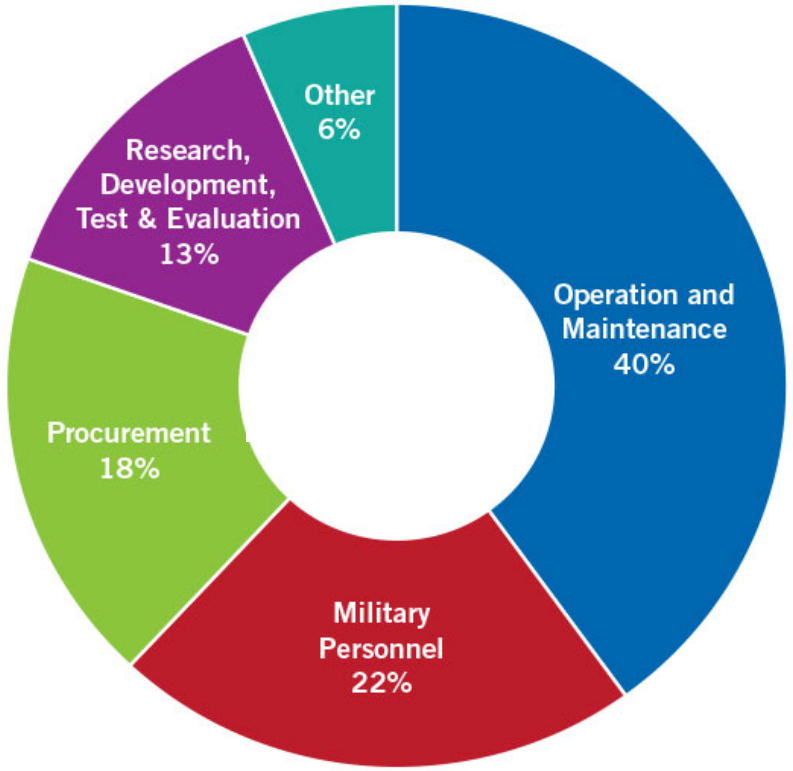


Defense Budget Categories

PETER G. PETERSON FOUNDATION

Defense spending covers a wide range of activities

Science & Engineering ~31%

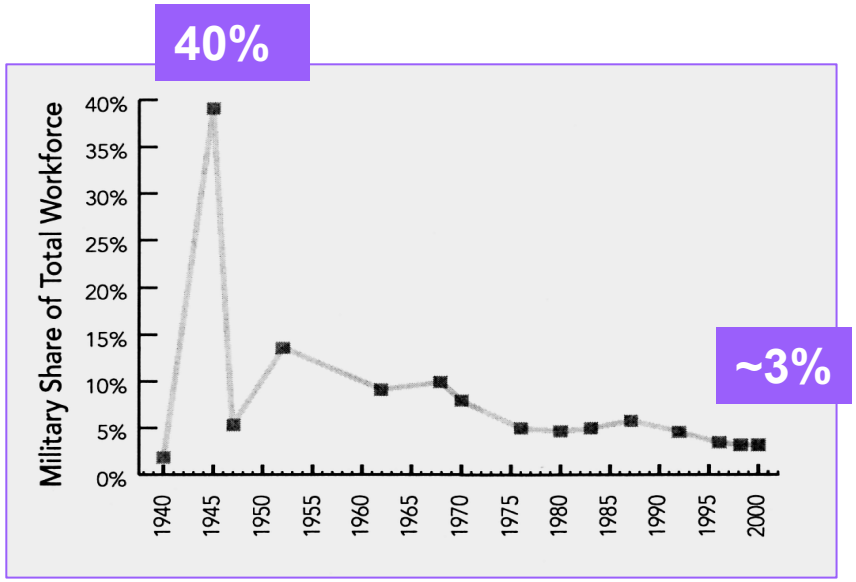


SOURCE: Office of Management and Budget, *Public Budget Database, Budget of the United States Government: Fiscal Year 2021*, February 2020.
NOTES: Numbers may not sum to 100 percent due to rounding. The data presented above are for defense discretionary spending. Other includes atomic energy defense activities, FBI salaries and expenses, cybersecurity activities of the Department of Homeland Security, and smaller miscellaneous outlays.

PGPF.ORG

U.S. Defense Personnel (Approximate)

COMPONENT	NUMBER
Active Duty	1,330,000
Reserve Forces	800,000
Total Military Strength	2,130,000
DOD Civilian Personnel	~ 750,000
Defense Industry	~ 2,000,000
Total Defense Related	4,880,000



Comparison of Active Military (Approximate)

COUNTRY	NUMBER
Peoples Rep China	2,285,000
India	1,435,000
United States	1,300,000
Russia	866,000
North Korea	690,000
South Korea	640,000
Pakistan	617,000
Iran	545,000
Iran	545,000
Algeria	512,000
Indonesia	476,000
Egypt	468,000
Columbia	444,500
Vietnam	412,000

[1]Data from http://www.globalfirepower.com

Leading U.S. Defense Companies

Defense Company	2021 Revenues ($ Billion)	2022 Revenues ($ Billion)	Main Products
Lockheed Martin Corp.	67.0	66.0	Aircraft, Simulators, Miscellaneous
Boeing Company	62.3	66.6	Aircraft, Command Systems
Northrop Grumman Corp.	35.7	36.6	B-2 Bomber, Electronics
General Dynamics Corp.	38.5	39.4	Submarines, Ships, Air Defense
Raytheon Company	64.4	67.1	Missiles, Electronics
Total	267.9	275.8	
SAIC	7.1	7.4	Science/Engineering Support
Apple	378.4	394.3	Electronic Devices & S/W
Amazon	469.8	514.0	Merchandise/Web Services

Top 20 Contractors get about 50% of total DOD procurements!

DOD's Current Policy Drivers

- Conventional Threats
  - Regional Conflicts
  - Rogue States
- Asymmetrical Threats
  - Worldwide Terrorist Movements
  - Local Insurgent Forces
- New Strategic Requirements
  - Stable and Friendly Governments
  - Force Composition (Women, LGT personnel)
  - Limited Size and Duration Missions
  - *Multi-Domain Operations*

Multi-Domain Operations refer to Land, Air, Maritime, Space, and Cyber.
The idea is that conflict always exists as a world-wide competition that can transition to extremely fast-paced and lethal engagement, and then revert back to competition.

DOD's Current Policy Drivers

- Conventional Threats
  - Regional Conflicts
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  - Worldwide Terrorist Movements
  - Local Insurgent Forces
- New Strategic Requirements
  - Stable and Friendly Governments
  - Force Composition (Women, LGT personnel)
  - Limited Size and Duration Missions
  - *Multi-Domain Operations*
- New Tactical Requirements
  - Rapid Projection of Overwhelming Force
  - Minimal Casualties (Civilian and Military)
  - Attention to Cultural and Political Factors
  - Skilled Use of Social Media (Offense and Defense)
  - Benefits from Advanced Technologies

DOD's Technology Trusts

- Netcentric Warfare
- Defeating Asymmetric Threats
- Information Operations
- Missile and Satellite Defense
- Electronic Warfare
- Remote Targeting
- Unmanned & Autonomous Systems
  - Robots Land, Sea and Air
  - Artificial Intelligence
  - Lethal Autonomous Weapons (LAWS)

Ethical Analysis: Overview of Warfare

Historical Perspective (Oversimplified)

- Military conflicts reach back to first recorded history
- Technology has historically supported military affairs
- Military imperatives have likewise driven technology

Moral Perspectives (Oversimplified)

- War *is always* an Immoral Undertaking
  - Killing is basically immoral - War is based on killing
  - War violates fundamental human rights
- War *is sometimes* a Moral Undertaking
  - Some principles and/or rights are worth fighting for to preserve
  - "If a person comes to kill you, it is permitted to kill him first"

A Reasonable Hypothesis

- "Just Wars" are possible -- both in purpose and in conduct

Ethical Analysis: The Law of War (LoW)

1. Military Necessities and Objectives

   There must be valid military needs, objectives and resulting targets

2. Avoidance of Unnecessary Suffering

   Military actions should encompass humanitarian concerns

3. Distinction and Discrimination

   Combatants should be considered distinct from non-combatants

4. Proportionality

   Loss of life and damage should be in line with with valid military necessities and objectives

5. Honor

   Forces should act with fairness and mutual respect

Mission-specific Rules of Engagement (RoE) should generally adhere to the LoW and interpret these in terms of the specific military situation at hand.

Ethical Analysis: Purpose of Just Wars

- National Defense – We fight back aggressively when attacked
- Projection of Power – We stay strong to exert positive influence and deter hostile actions by others
- Support of Allies – We act to honor defense alliances such as NATO and to support and protect friends outside of alliances
- Humanitarian Intervention – We act to prevent such crimes against humanity as genocide, ethnic cleansing, etc.
- Regime Change – We act to remove despots or to protect our military, our territory or our societal and economic interests
- Preventive or Preemptive Action – We act first to *prevent or preempt* enemy actions in wars involving WMDs, or wars with extra-national enemies such as terrorists

Ethical Analysis: Conduct of Just Wars

- Collateral Damage:
  - How critical is it?
  - How much is avoidable?
- Weapons of Mass Destruction
  - Who obtains?
  - What are the conditions for use?

A Case in Point

AFP via Getty Images

VEHICLES DESTROYED by a cluster missile strike in Ukraine's Donetsk region last week.

Giving Ukraine cluster munitions is morally defensible

JONAH GOLDBERG

THE CONTROVERSY over the Biden administration's decision to supply Ukraine with cluster munitions reminded me of my old boss William F. Buckley's famous rejoinder to claims that the United States and the Soviet Union were morally equivalent because both possessed nuclear weapons and spent a lot on defense. His phrasing varied, but here's the gist: If to describe both as the sort of men who push old ladies around.

be killed or maimed. Farmers, sometimes years after a conflict, have been killed by them.

More than 100 nations have banned them. The United States, Russia, China and Ukraine have not. The American rationale for keeping them is that there are circumstances in which they are superior — both in military effectiveness and in limiting civilian deaths — to the alternatives. Still, in 2008, then-Secretary of Defense Robert Gates signed an order to phase out cluster munitions with a work on reducing the dud rate.

This is where the false moral

So yes, cluster bombs are awful. But the moral status of *all* weapons, like all wars, depends on context. Using a gun to attempt rape or murder is not the same as using a gun to defend yourself.

Ukraine has promised to use cluster munitions as sparingly and precisely as possible. Russia is still lying about using them at all. Ukraine uses them to repel invaders on its soil. Russia uses them as a tool of conquest. And, most relevant, Ukraine has every incentive to limit civilian casualties — because the civilians in question *are Ukrainians*.

Progressive Democrats, including Rep. Barbara Lee (D-Oakland), oppose Biden's decision. "Cluster bombs should never be used. That's crossing a line," Lee told CNN. She says this will cost America its "moral leadership."

I agree it's crossing a line. But the whole point of leadership is knowing when an action is necessary and justified. If Russia hadn't invaded Ukraine, sending them getting away with it.

"It took me a while to be con-

The fact that Goldberg is making an ethical argument implies a counter argument exists

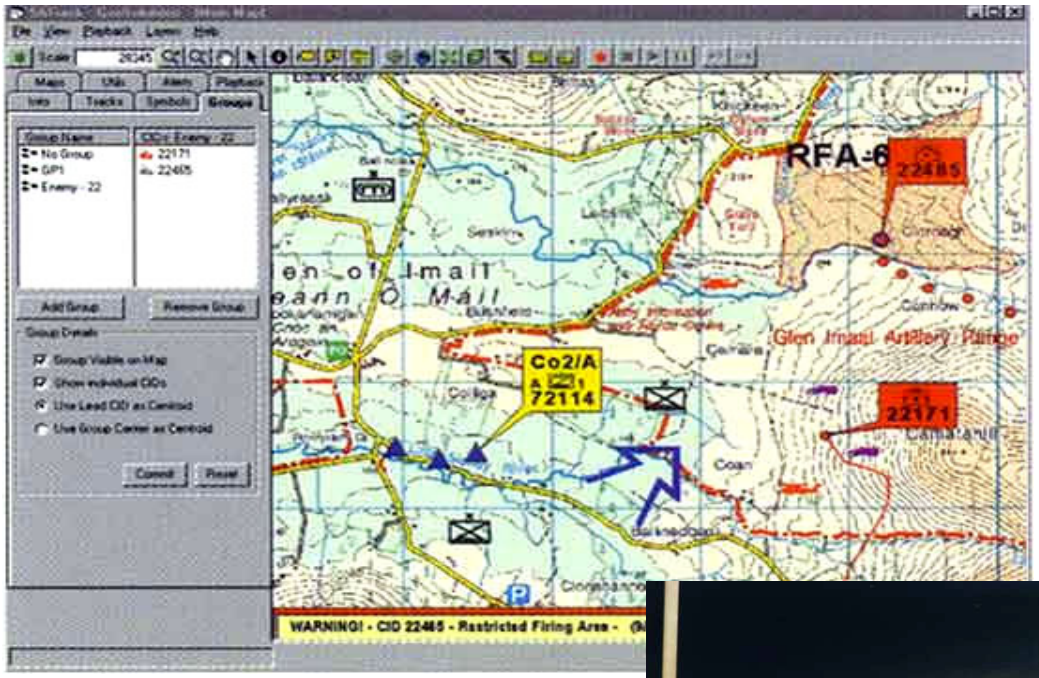
Ethical Analysis: Conduct of Just Wars

- Collateral Damage:
  - How critical is it?
  - How much is avoidable?
- Weapons of Mass Destruction
  - Who obtains?
  - What are the conditions for use?
- Terror and Suicide Bombing
  - Morally wrong
  - Or Just another weapon?
- Targeted Assassination
  - Justification…if any?
  - Rules, agencies and command structures?
- Treatment of Prisoners
  - Legal status of “stateless” terrorists?
  - Conditions of detention and trial?
  - Torture: Justification…if any?

Ethical Analysis: Consequences of Just Wars

- Occupation and Peacekeeping
  - Obligations
  - Objectives and Methodology
- Nation Building and Guidance
  - Cultural factors and acceptance
  - Who is in charge, and of what?
  - Does one system fit all?
- Counterterrorism and Counterinsurgency
  - Strategy and tactics
  - What is victory?
  - Are we in Orwell's "1984" continuous war?

Netcentric Communications: Components

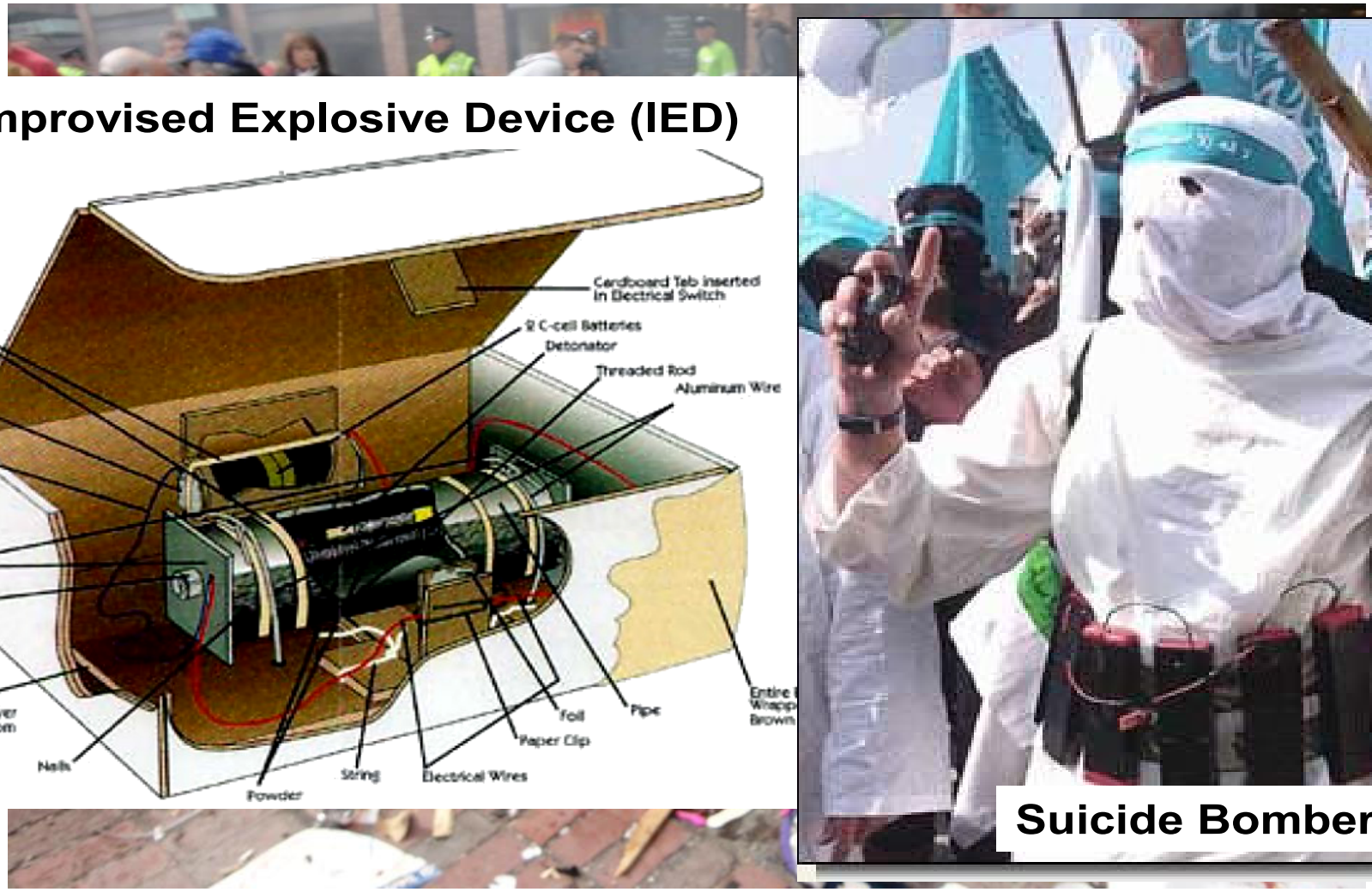


Unit Level Displays

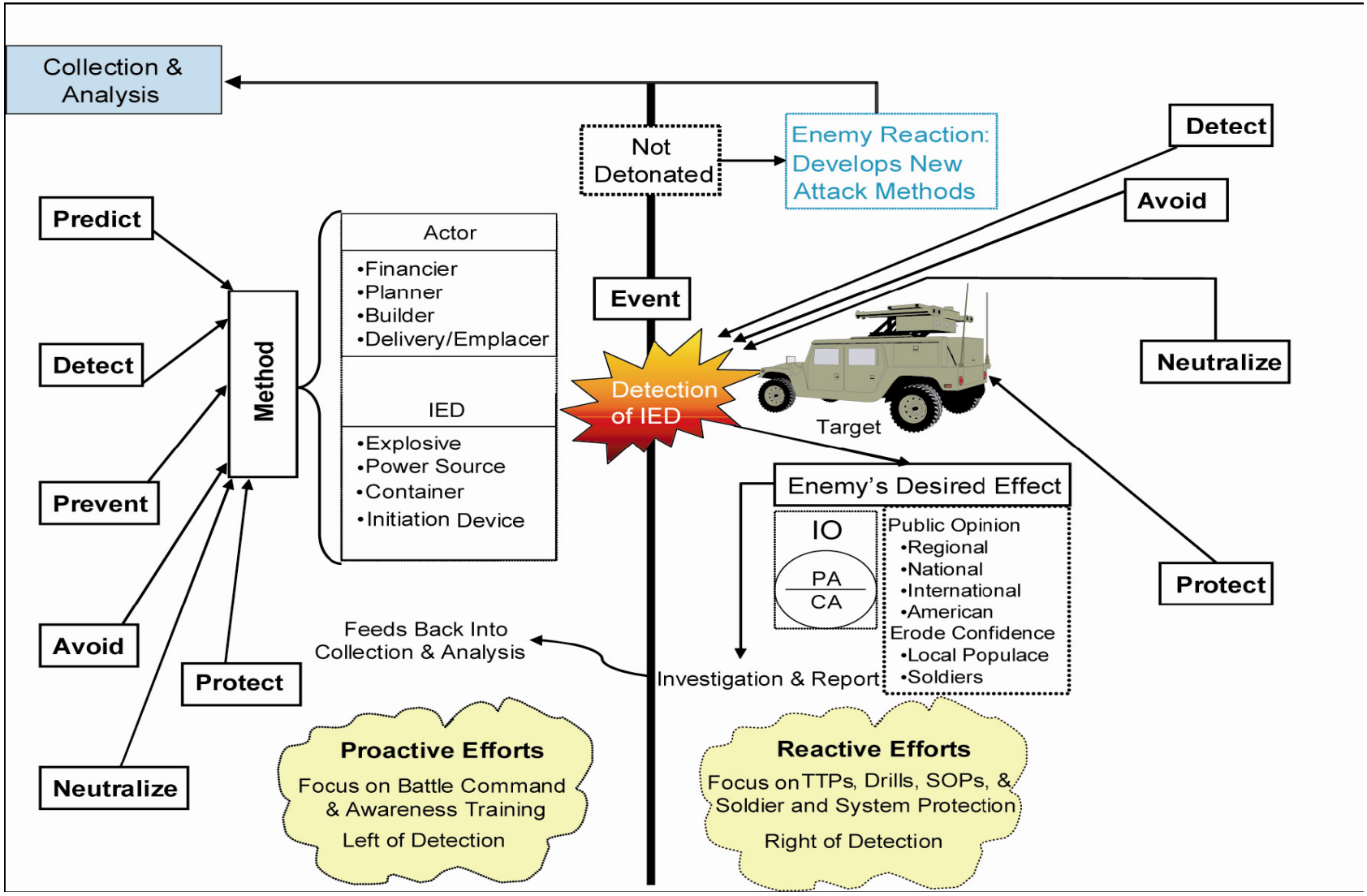
Field Radios

Satellite Links

Asymmetric Warfare: Terror Weapons



Asymmetric Counter: IED Defeat Framework



Information Operations

CORE CAPABILITIES

Psychological Operations
Military Deception
Operations Security
Electronic Warfare
Computer Network Operations

SUPPORTING CAPABILITIES

Information Assurance
Physical Security
Physical Attack
Counterintelligence
Combat Camera

RELATED CAPABILITIES

Public Affairs
Civil-Military Operations
Defense Support to Public Diplomacy

INFORMATION OPERATIONS DEFINITION

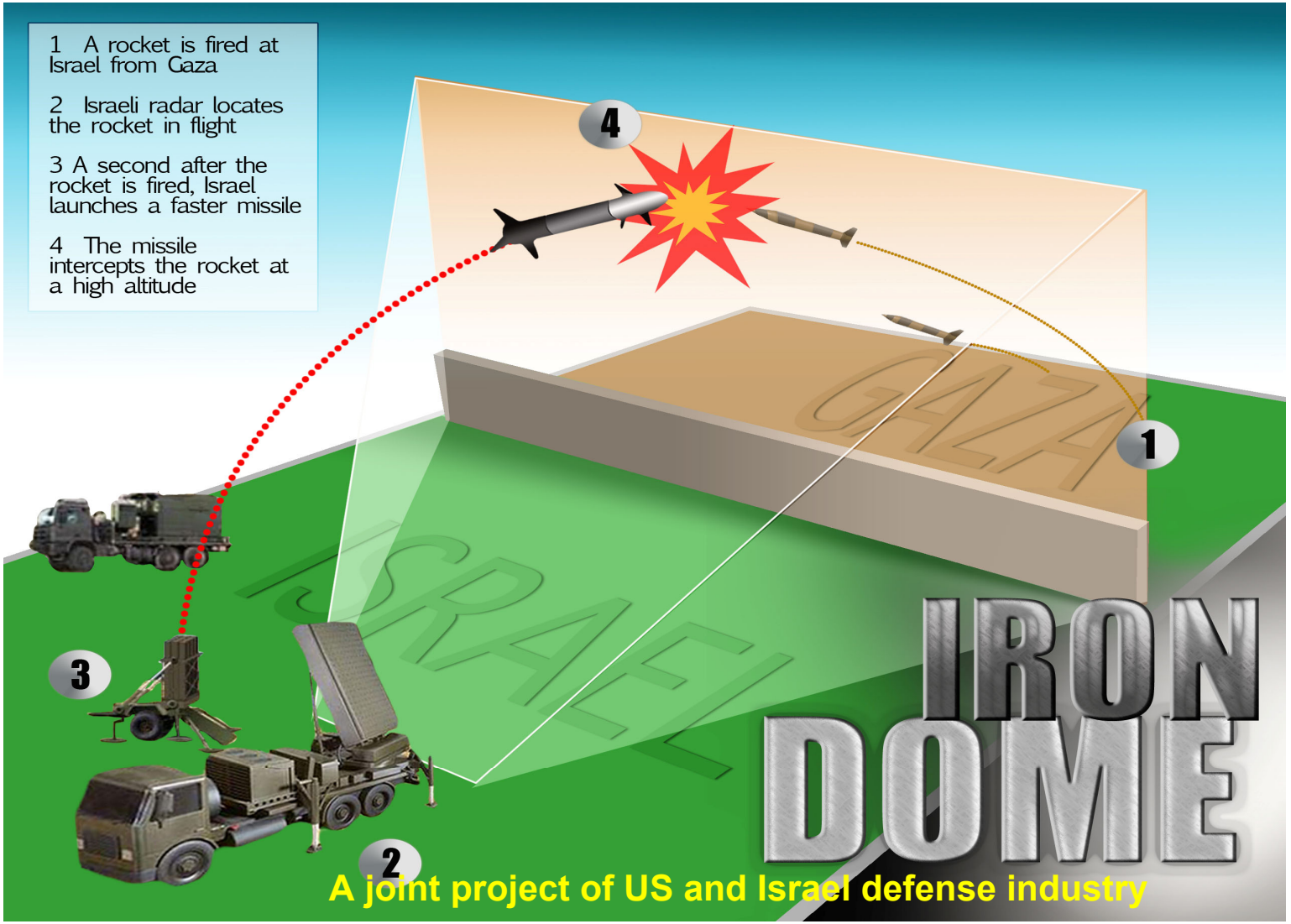
"The integrated employment of the core capabilities of electronic warfare, computer network operations, psychological operations, military deception, and operations security, in concert with specified supporting and related capabilities, to influence, disrupt, corrupt or usurp adversarial human and automated decision-making, while protecting our own."

Information Operations: Social Media

Missile Defense: Medium Range Protection

The Patriot is a US mobile surface-to-air missile and antiballistic missile system that can shoot down incoming missiles before they hit their intended targets. Patriot batteries can also shoot down aircraft.

Missile Defense: Short Range Protection



Electronic Warfare: A New Battlefield

"The Electronic Warfare Planning and Management Tool (EWPMT) will allow for greater control and enhancement of electronic warfare capabilities. The tool will tightly integrate EW as a form of *non-kinetic fires* with existing *kinetic capabilities* that will enable the Army to achieve *spectrum dominance* through an *effects-based joint operations plan*."

Remote Targeting: 2001 Afghanistan Origins

General Abdul Rashid Dostum

US Special Forces A-Team

Remote Targeting: Afghanistan Operations

Guided Bomb or Missile

Guidance Signal

GPS Coordinates

Laser Designator

Remote Targeting: Scaling Up

Guided Missile

Firing Commands
Control Signals

Video Feed
GPS Coordinates

Remote Targeting: Public Reaction

Time Magazine, May 7, 2013

Remote Targeting: Varying Opinions

OPINION

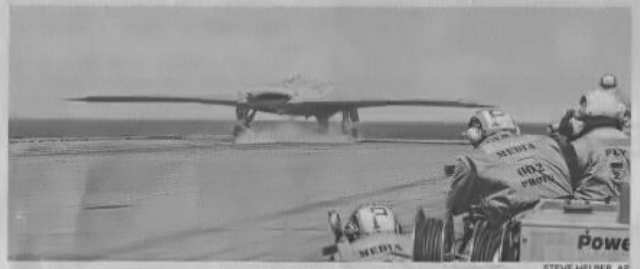
TODAY'S DEBATE **NATIONAL SECURITY**

Our view

Rein in the drones, but keep them flying

For all the success and domestic popularity of America's drone warfare against terrorists abroad, the program carries some major downsides: It kills innocent civilians. It radicalizes survivors against the United States. It enrages politicians in countries such as Pakistan who bristle at the encroachment on their sovereignty. And it raises uncomfortable moral and legal questions, particularly about the targeting of U.S. citizens.

Yet, as President Obama argued convincingly in a speech Thursday, all the other options are worse. Rely on local governments to root out terrorists? Not realistic. Send in U.S.



STEVE HELBER, AP

A Navy drone launches off the nuclear-powered aircraft carrier USS George H.W. Bush off the coast of Virginia. It will help develop other unmanned, carrier-based aircraft.

Obama strikes a sound balance

ground troops? Even more risky. Employ conventional airstrikes? Far more dangerous to civilians. Ignore the threat? Ridiculous.

The conclusion is obvious: As long as terrorists continue to plot attacks against America, drones remain an important part of the fight.

Obama's unusual openness about the controversial assassination program was part of his larger attempt to reframe the war on terror he inherited from George W. Bush. To the dismay of supporters who thought he would ground the drones, Obama has overseen nearly 400 attacks to Bush's 50. The victims, the administration als, including one who repeatedly shouted him down for what she said was a betrayal of American values, and from conservatives such as Sen. Saxby Chambliss, R-Ga., who said the speech "will be viewed by terrorists as a victory."

In our view, the president's rules for using drones represent a practical, effective middle ground: No strikes when a target can be captured. Targets must "pose a continuing and imminent threat" to the American people. And there must be "near certainty" that a strike will not kill or injure civilians.

Though the president did not explicitly say so, the administration is shifting at least some of the program from the CIA — which by law cannot admit or describe drone attacks — to the Pentagon, which can act more

He acknowledged demands for more oversight of the drone program but failed to endorse one of the most useful suggestions: providing judicial review, in non-imminent situations, when U.S. citizens are targeted for assassination overseas, much as the Foreign Intelligence Surveillance Court oversees domestic wiretapping of terror suspects.

And while Obama rightly renewed his call to shut down the trouble-plagued terrorist prison at Guantanamo Bay, Cuba, and announced administrative steps in that direction, he applied wishful thinking to the single hardest issue: what to do with detainees too dangerous to let go but impossible to try. "I am confident that this legacy problem can be resolved," he said, without saying how.

On balance, though, Obama

Opposing view

Drones drain USA's moral might

Michael Shank

Armed drones, at first blush, are a boon to America's military toolkit, as President Obama reinforced in his counterterrorism speech on Thursday. Drones, in the short run at least, could mean fewer U.S. troops deployed and fewer American lives lost.

Unsurprisingly, the appeal is mounting for unmanned killing

World faces rapid spread of killer robots

machines that know no national boundary, need no permit for deployment and go unnoticed by enemies. More than 75 nations have remotely piloted aircraft. Drones are merely the latest in military innovation; all countries will want one shortly.

Another innovation, happening simultaneously, is more sinister. We are disposing of past precedent and throwing conventions to the curb with our willingness to kill Americans outside the court of law with little prosecutorial evidence, our secret White House kill list, and our erroneous belief that strikes are strategic.

Signature strikes rely on ambiguous behavioral patterns of unwith technology or jurisprudence and more to do with something softer: America's moral might and the goodwill it garners globally. Having worked in Pakistan in the early 2000s, when public opinion was more pro-American, I've witnessed over the past decade the deterioration of goodwill toward America, exhausted through our use of drones.

Tabling serious sovereignty concerns, America is killing humans it will never know or look in the eye — all from a joystick in Texas. We have no skin in the game. There is no white flag for adversaries, no opportunity for surrender. The once-regarded American beacon of justice is now as inhumane and robotic as our drones.

There are more effective ways of winning hearts and minds and creating livelihoods worth living, not sacrificing. We must innovate our way toward that task and broaden our diplomatic tools because if the trajectory of arms flow is any indication, we face a rapid proliferation of killer robots.

Easier means of engaging in conflict and violating sovereignty lead to more wars that will pull in America.

And when the rules governing the international system break down or are ignored, all hell breaks loose. Meaning, more troops on the ground and more American lives lost.

Remote Targeting: Operator Stress

Good Kill is the fictional story of a former F-16 pilot, currently assigned as a drone operator, who is severely psychologically disturbed by the ethical ambiguity of remote killing.

But stress and PTSD are in fact serious problems affecting real-life drone operators.

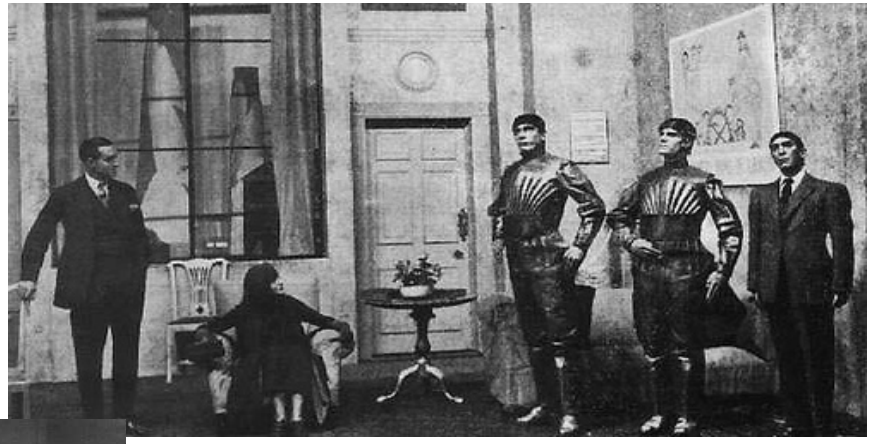
http://www.bing.com/images/

Robotic Military Systems

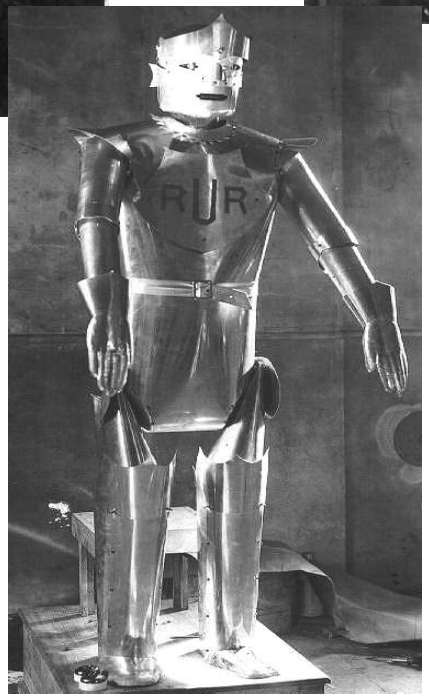
- Humanoid Robots
- Remotely Controlled Land, Air, and Sea Robots
- Autonomous Lethal Weapons (LAWS)

Fictional Humanoids

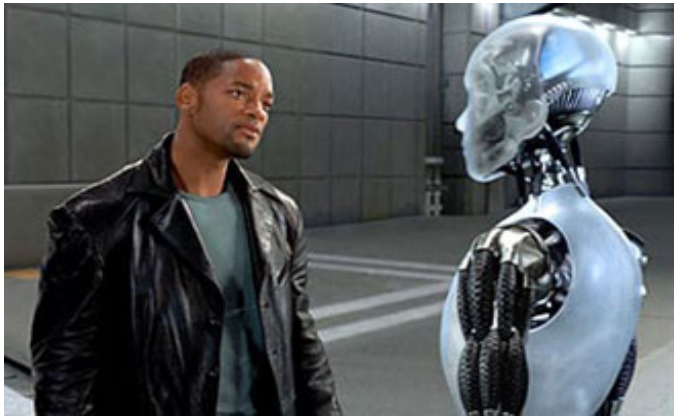
1847 “Folktale –The Golem of Prague”



1921 “Movie–RUR”



1920 Play “R.U.R.”
(Rossum’s Universal Robots)
by Karel Capek



1950 Book – “I Robot” by Isaac Asimov -
2008 Movie – Will Smith, James Cromwell

Early Humanoid Robot

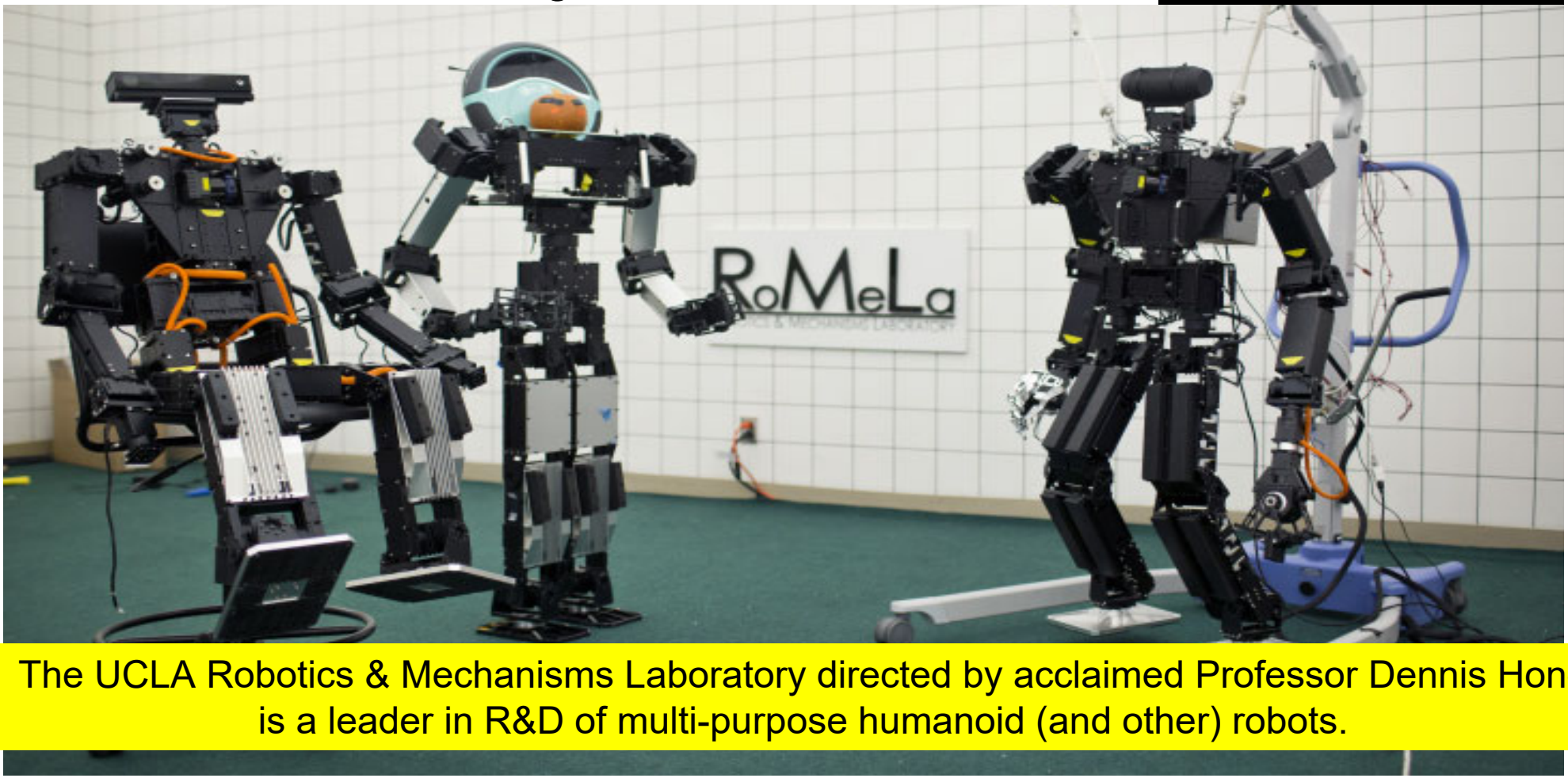
~1495, Leonardo da Vinci designed a “mechanical knight”

Humanoid Robots Today

DARPA envisions humanoid robots able to carry out a broad variety of tasks, such as demolition or rescue, in environments too dangerous for humans,

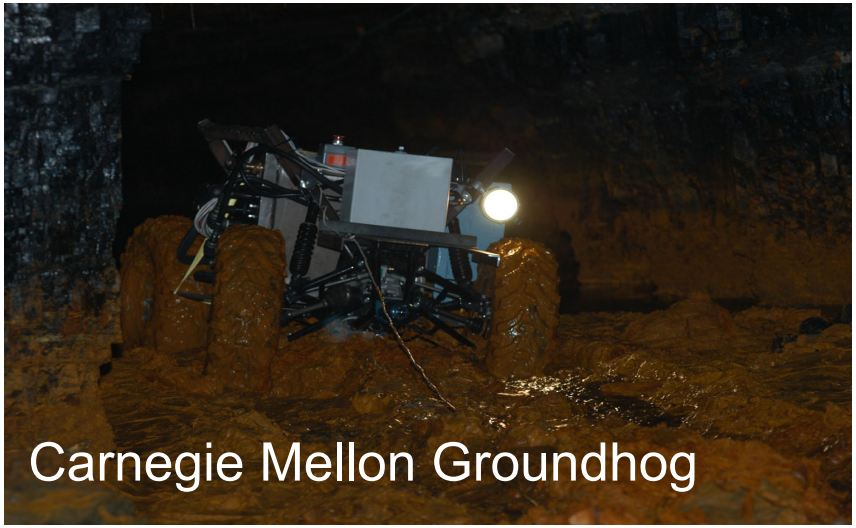
Humanoid Robots Today

UCLA Professor Dennis Hong, Ph.D.



The UCLA Robotics & Mechanisms Laboratory directed by acclaimed Professor Dennis Hong is a leader in R&D of multi-purpose humanoid (and other) robots.

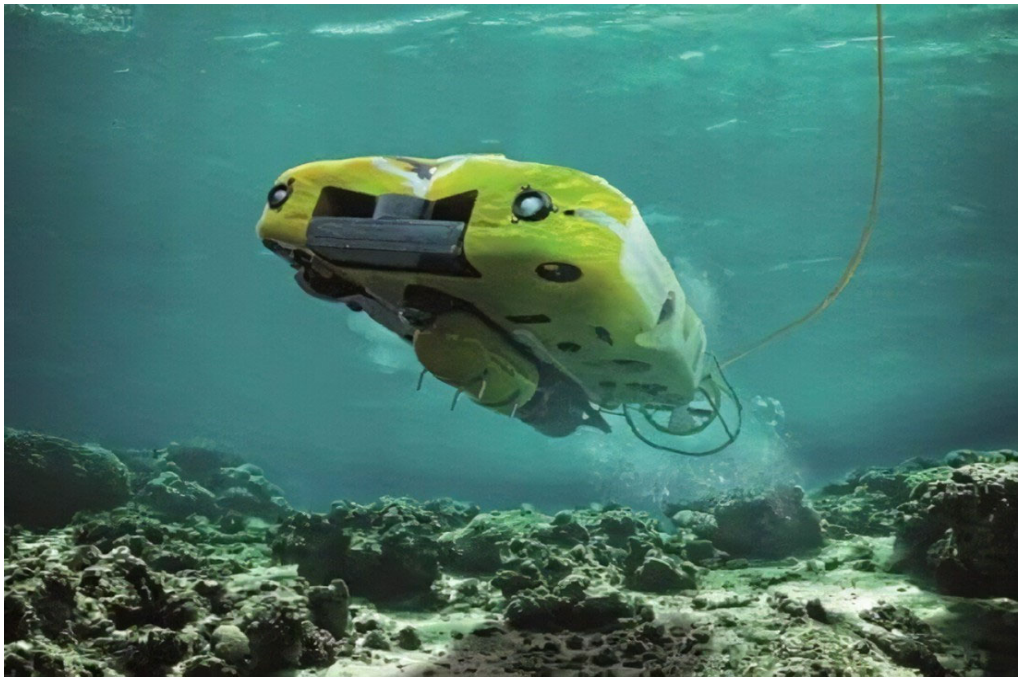
Unmanned Ground Robots Today



Activmedia P2DX Small Robots

Unmanned Ocean Robots Today

US Navy Unmanned Underwater Vehicle



SAAB Unmanned Underwater Vehicle

Unmanned Aerial Vehicles (UAVs) Today

Unmanned Aerial Vehicles (UAVs) Today

Aerovironment Raven

Boeing X-45 UCAV

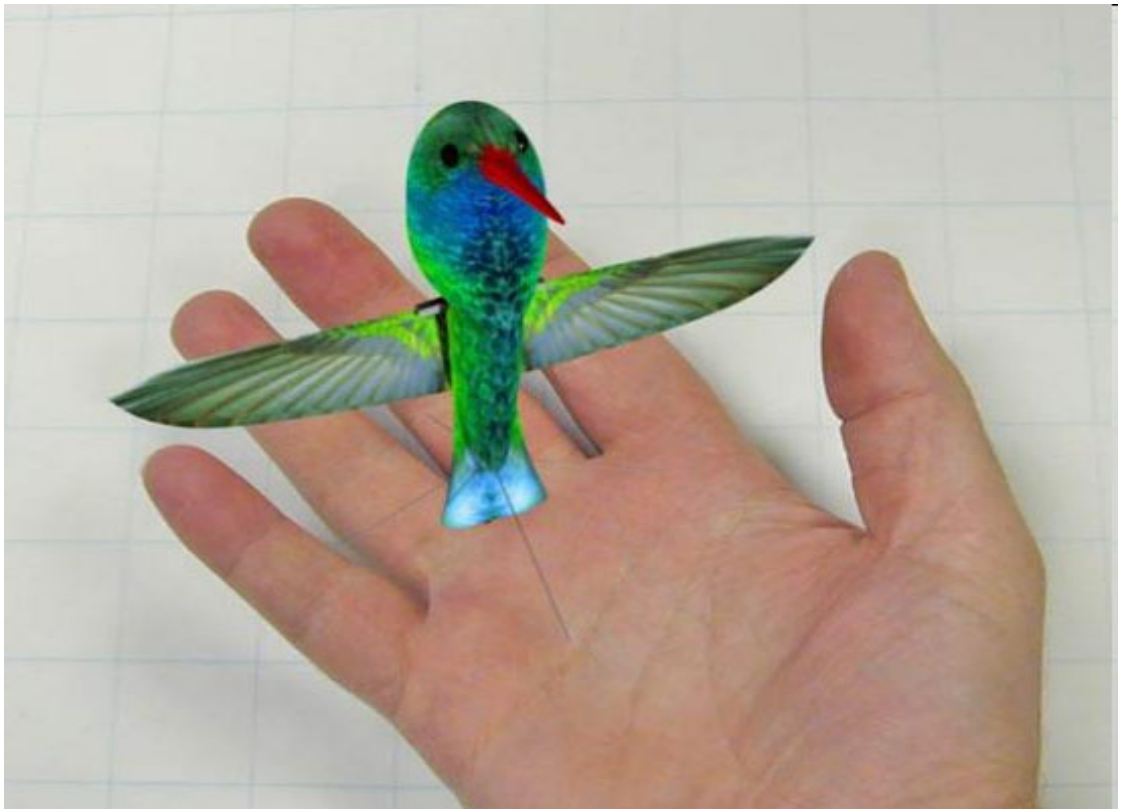
Carnegie Mellon
Helicopter UAV

Honeywell
Ducted Fan UAV

Small UAVs

Black Hornet Nano produced by Norwegian company Prox Dynamics flies like a helicopter and was used operationally by British Forces in Afghanistan

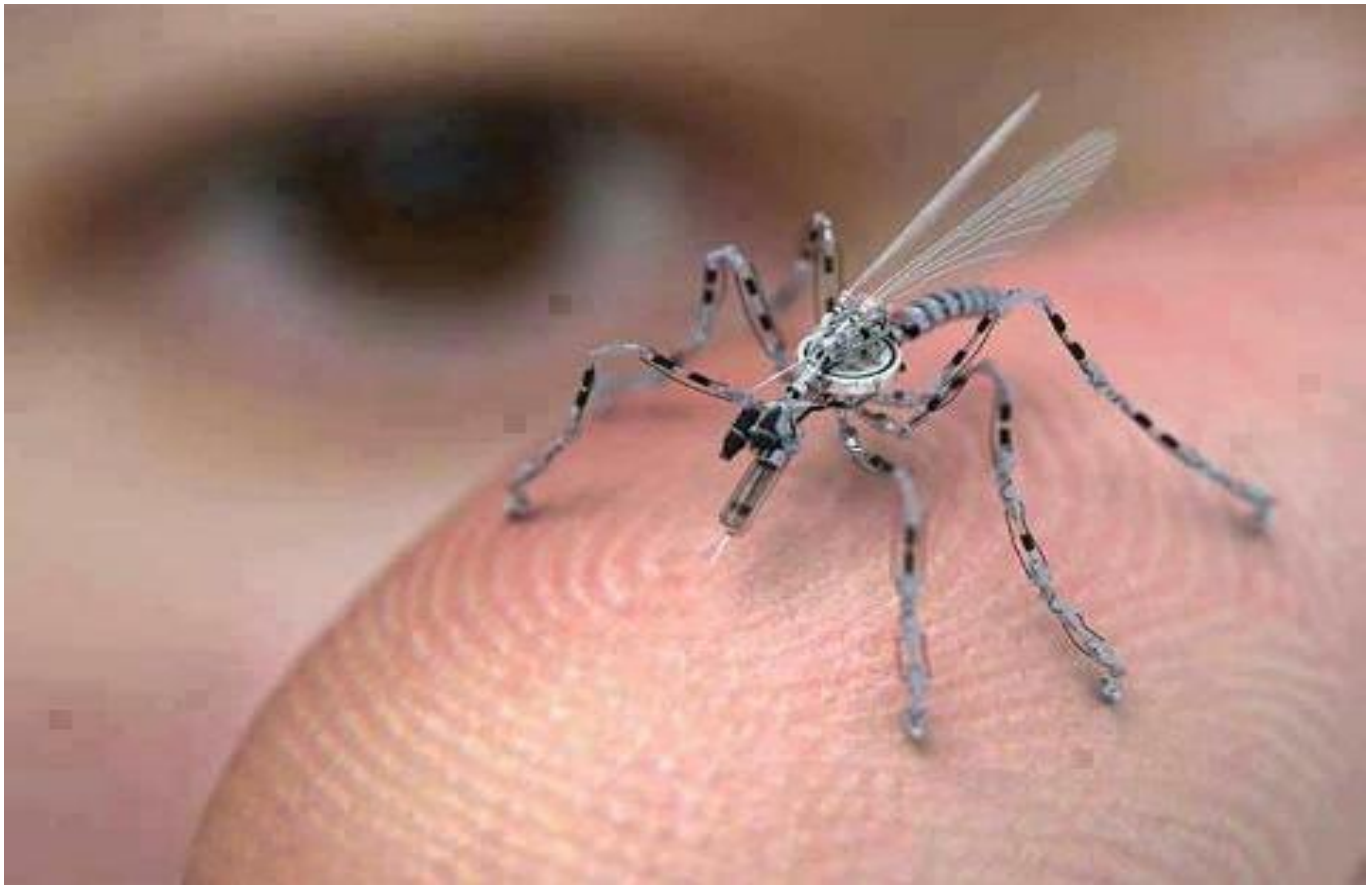
VERY Small UAVs



Nano Hummingbird developed for DARPA by local company Aerovironment weighs less than AA battery and can fly observation missions up to 8 minutes

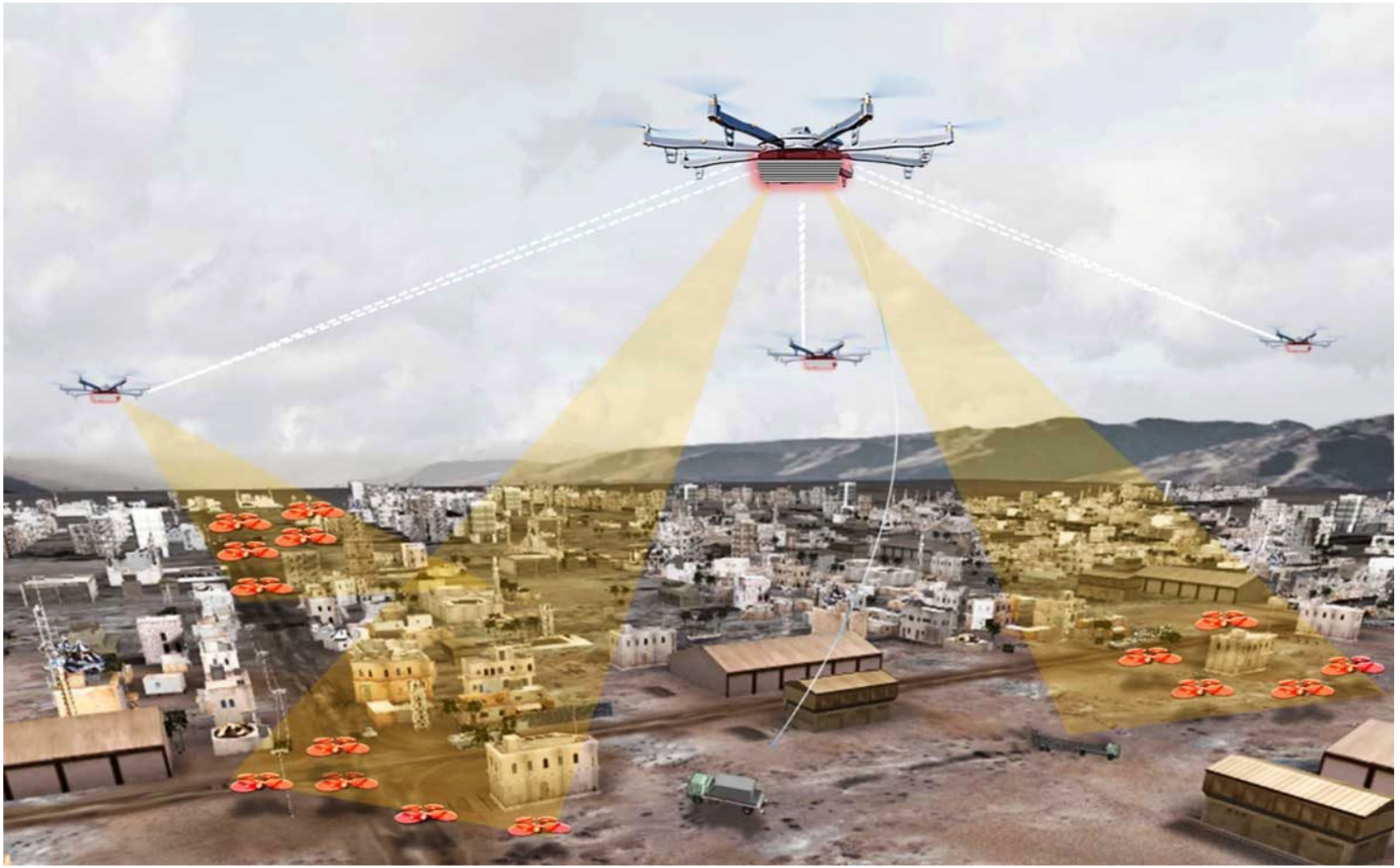
W.J. Hennigan, “It’s a bird! It’s a spy! It’s both.” Los Angeles Times, February 17, 2011

VERY VERY Small UAVs



The Insect Drone is only a concept today, but the technology is not impossible

Drone Dragnet Today



Drone Swarms Tomorrow?

Military analysts have suggested that 1000s of low cost drones could defeat a city, and the US Air Force is currently experimenting with releasing swarms from aircraft.

Tomorrow's Dangers: Unintended Consequences

The Unstoppable Spread of Lethal Drones

The United States hastened the proliferation of a weapon that diminishes its relative power.

12:29 PM ET

Conor Friedersdorf
Staff writer at *The Atlantic*

Conor Friendersdorf maintains that the US promotion of deadly drone technology has given our adversaries access to new and very lethal asymmetrical weapons.

https://www.theatlantic.com/ideas/archive/2019/01/killer-drones/581722/

Tomorrow Has Arrived: Ukraine Drones Stop Russia

Ukraine drones include the relatively low cost Bayraktar drone from Turkey

Tomorrow Has Arrived: Ukraine Drones Stop Russia

Ukraine drones include Switchblade from the United States, a so-called Kamikaze drone

Tomorrow Has Arrived: Ukraine Deploys Sea Drones

Tomorrow Has Arrived: AI on the Battlefield

The Time article describes the Russia-Ukraine war as a testing ground for AI applications, and particularly those of the giant technology company Palantir.

Next Step: Autonomous Lethal Weapons (LAWS)

Should Pentagon Let Robots Kill Humans? Maybe

By Sydney J. Freedberg Jr., Monday, July 10, 2017 4:00 AM

Imagine battles unfolding faster than the human mind can handle, with artificial intelligences choosing their tactics and targets largely on their own. The former four-star commander in Afghanistan, John Allen, and an artificial intelligence entrepreneur, Amir Husain, have teamed up to develop a concept for what they call "hyperwar," rolled out in the July issue…

LAWS in Current Practice: Loitering Munitions

STM | MÜHENDİSLİK TEKNOLOJİ DANIŞMANLIK

Kargu-2 Loitering Munition

Loitering munitions are recognized as a type of LAWS, as are anti-personnel mines.

Ethics of Autonomous Lethal Weapon Systems

- Isaac Asimov postulated 3 basic laws of robotics in his 1950 science fiction novel “I, Robot:”
  1. **A Robot shall never carry out any action which will cause any injury to any human being.**
  2. **A Robot shall always obey a human being's orders, provided the first law is not violated.**
  3. **A Robot shall always try to protect itself, provided the first two laws are not violated.**

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- A later science fiction writer R. Daneel Olivan integrated and expanded the Asimov laws to:
  1. **A Robot may not harm humanity or, by inaction, allow humanity to come to harm.**

It is obvious the military today does not accept the Asimov laws, but is there a path to developing "killer robots" that adheres to accepted ethical standards for war?

Ethics of Intelligent Lethal Weapons

As military robots act with more intelligence, developers ask:

- How much autonomy should be given to robotic weapons?
- What are the *ethical and moral values* that should be programmed into intelligent and lethal robotic systems?
- What shared assumptions and values are necessary for the productive co-existence of human commanders and intelligent lethal robots?

And the overriding questions are:
Should we be developing Lethal Autonomous Weapons at all?
If so, under what conditions?

LAWS: Some Scientists/Engineers Say "No"

Autonomous Weapons: An Open Letter from AI and Robotics Researchers

Autonomous weapons select and engage targets without human intervention. They might include, for example, armed quadcopters that can search for and eliminate people meeting certain pre-defined criteria, but do not include cruise missiles or remotely piloted drones for which humans make all targeting decisions. Artificial Intelligence (AI) technology has reached a point where the deployment of such systems is — practically if not legally — feasible within years, not decades, and the stakes are high: autonomous weapons have been described as the third revolution in warfare, after gunpowder and nuclear arms.

Many arguments have been made for and against autonomous weapons, for example that replacing human soldiers by machines is good by reducing casualties for the owner but bad by thereby lowering the threshold for going to battle. The key question for humanity today is whether to start a global AI arms race or to prevent it from starting. If any major military power pushes ahead with AI weapon development, a global arms race is virtually inevitable, and the endpoint of this technological trajectory is obvious: autonomous weapons will become the Kalashnikovs of tomorrow. Unlike nuclear weapons, they require no costly or hard-to-obtain raw materials, so they will become ubiquitous and cheap for all significant military powers to mass-produce. It will only be a matter of time until they appear on the black market and in the hands of terrorists, dictators wishing to better control their populace, warlords wishing to perpetrate ethnic cleansing, etc. Autonomous weapons are ideal for tasks such as assassinations, destabilizing nations, subduing populations and selectively killing a particular ethnic group. We therefore believe that a military AI arms race would not be beneficial for humanity. There are many ways in which AI can make battlefields safer for humans, especially civilians, without creating new tools for killing people.

Just as most chemists and biologists have no interest in building chemical or biological weapons, most AI researchers have no interest in building AI weapons — and do not want others to tarnish

goal of the field should be to do so. Starting a military AI arms race is a bad idea, and should be prevented by a ban on offensive autonomous weapons beyond meaningful human control.

"Starting a military AI arms race is a bad idea, and should be prevented by a ban of offensive autonomous weapons beyond meaningful human control."

Open Letter signed by over 100 scientists and engineers, July, 2015

LAWS: Other Scientists/Engineers Say "OK, but…."

ieee spectrum

We Should Not Ban 'Killer Robots,' and Here's Why

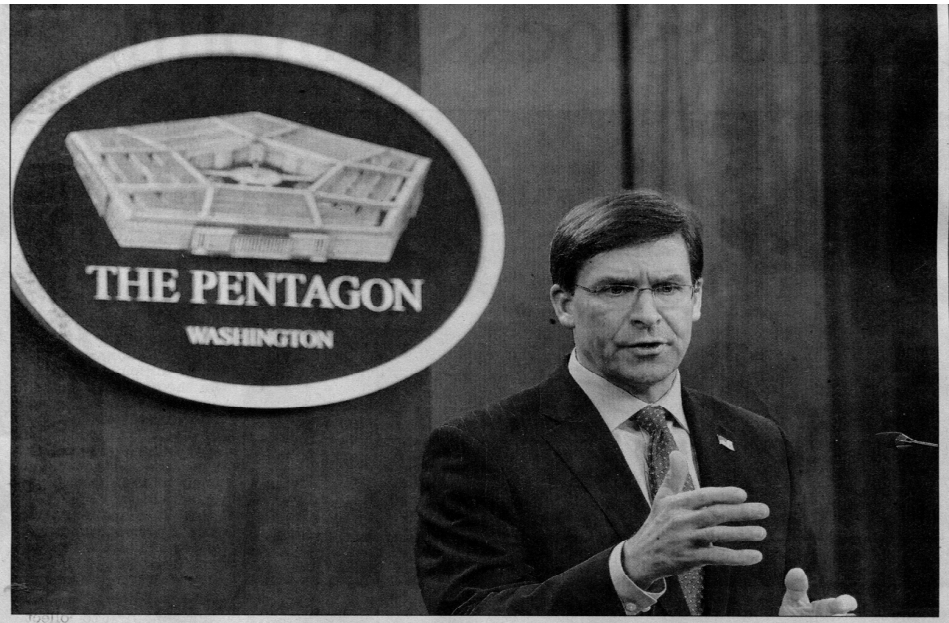
By Evan Ackerman
Posted 29 Jul 2015 | 2:25 GMT

What we really need...is a way of making autonomous armed robots ethical, because we're not going to be able to prevent them from existing. In fact, the most significant assumption that this letter makes is that armed autonomous robots are inherently more likely to cause unintended destruction and death than armed autonomous humans are. This may or may not be the case right now, and this) to determine whether or not using force is justified. For example, does your target have a weapon? Is that weapon pointed at you? Has the weapon been fired? Have you been hit? These are all things that a robot can determine using any number of sensors that currently exist….

*"What we really need...is a way of **making autonomous armed robots ethical**, because we're not going to be able to prevent them from existing."*

Military AI: DoD Offers High Level Ethical Guidelines

The Defense Department's new principles call for people to "exercise appropriate levels of judgment and care" when deploying and using AI systems, such as systems that scan aerial imagery to look for targets.



SUSAN WALSH Associated Press

THE DEFENSE Department's new principles call for people to "exercise appropriate levels of judgment and care" when deploying AI systems. Above, Defense Secretary Mark Esper talks at a news conference in 2019.

U.S. military adopts new ethics principles for AI

Move comes as the Pentagon aims to boost its battlefield use of artificial intelligence systems.

ASSOCIATED PRESS

The U.S. military is adopting new ethics principles as it prepares to accelerate its use of artificial intelligence technology on the battlefield.

The Defense Department's new principles call for people to "exercise appropriate levels of judgment and care" when deploying and using AI systems, such as systems that scan aerial imagery to look for targets.

They also say decisions made by automated systems should be "traceable"

the Pentagon's Joint Artificial Intelligence Center.

The Pentagon's push to speed up its AI capabilities has fueled a fight between tech companies over a $10-billion cloud computing contract known as the Joint Enterprise Defense Infrastructure, or JEDI.

Microsoft Corp. won the contract in October but hasn't been able to work on the 10-year project because Amazon.com Inc. sued the Pentagon, arguing that President Trump's antipathy toward Amazon and its chief executive, Jeff Bezos, hurt Amazon's chances of winning the bid.

A 2012 military directive requires humans to be in control of automated weapons but doesn't address broader uses of AI. The new U.S. principles are meant to guide both combat and non-

by the Defense Innovation Board, a group led by former Google CEO Eric Schmidt.

Although the Pentagon acknowledged that AI "raises new ethical ambiguities and risks," the new principles fall short of stronger restrictions favored by arms control advocates.

"I worry that the principles are a bit of an ethics-washing project," said Lucy Suchman, an anthropologist who studies the role of AI in warfare. "The word 'appropriate' is open to a lot of interpretations."

Shanahan said the principles are intentionally broad to avoid handcuffing the U.S. military with specific restrictions that could become outdated.

"Tech adapts. Tech evolves," he said.

The Pentagon hit a roadblock in its AI efforts in 2018

Shanahan said the principles are helping to regain support from the tech industry, where "there was a thirst for having this discussion."

"Sometimes I think the angst is a little hyped, but we do have people who have serious concerns about working with the Department of Defense," he said.

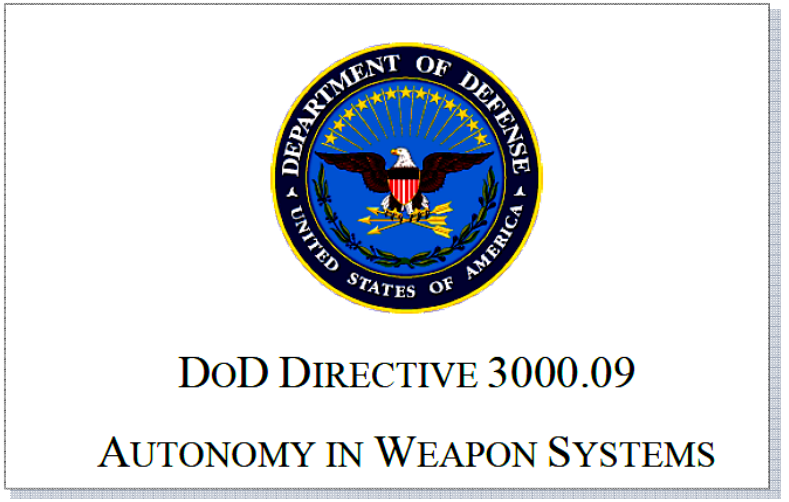
Shanahan said the guidance also helps secure America's technological advantage as China and Russia pursue military AI with little attention paid to ethical concerns.

University of Richmond law professor Rebecca Crootof said that adopting principles is a good first step, but that the military will need to show it can evaluate the huge data troves used by AI systems, as well as their cybersecurity risks.

Crootof said she also

Los Angeles Times, February 25, 2020

And Then Refines Its Definition of Lethal Autonomous Weapons

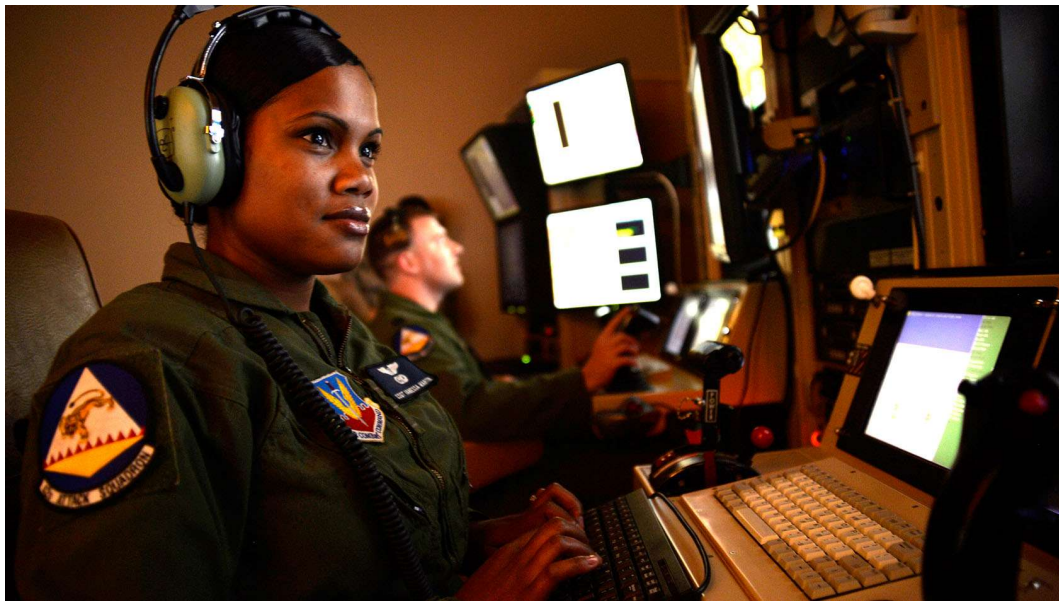


January 25, 2023 directive includes:

- All DoD Departments, Offices, Commands, Agencies, and Activities
- The design, development, acquisition, testing, fielding, and employment of *autonomous and semi-autonomous weapon systems, including guided munitions that are capable of automated target selection*."
- Identified systems will be designed to allow "**commanders and operators *to exercise appropriate levels of human judgment over the use of force.*"**

Commanders, Operators and AI: The Ethical Use Case

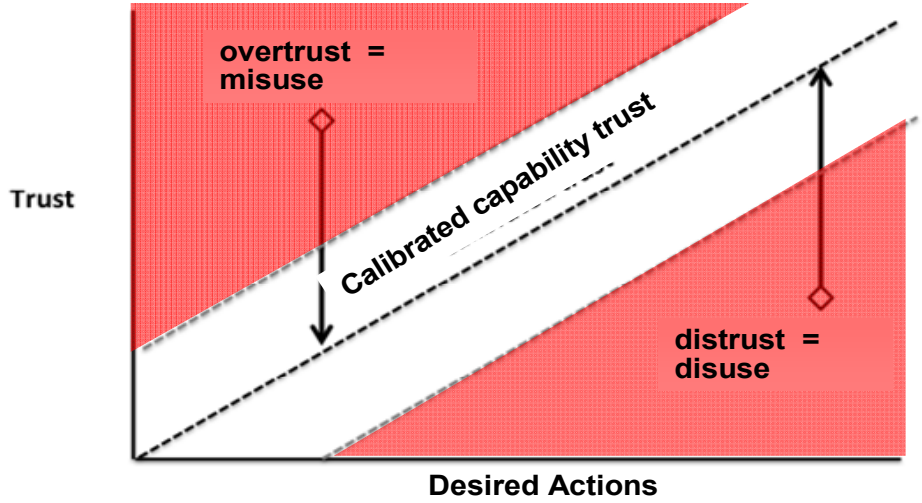
- Lethal Intelligent Weapons Systems will require commanders and operators for mission planning, operational decision making, and supervisory control.
- Humans do not have the cognitive bandwidth or processing speed to make prompt, real-time ethical decisions when such decisions are necessary.
- AI has this capacity, but its real-time ethical capabilities are currently limited.



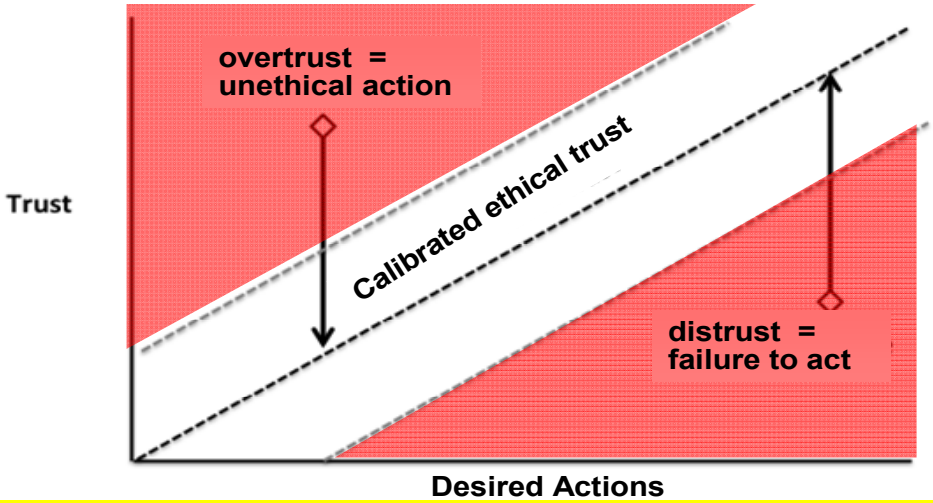
Can the operator and/or commander trust the AI to make ethical decisions and take ethical actions as intended?

DIB (2019) "AI Principles: Recommendations on the Ethical Use of Artificial Intelligence by the Department of Defense"

Case Study 4: Ethical Trust is the Issue



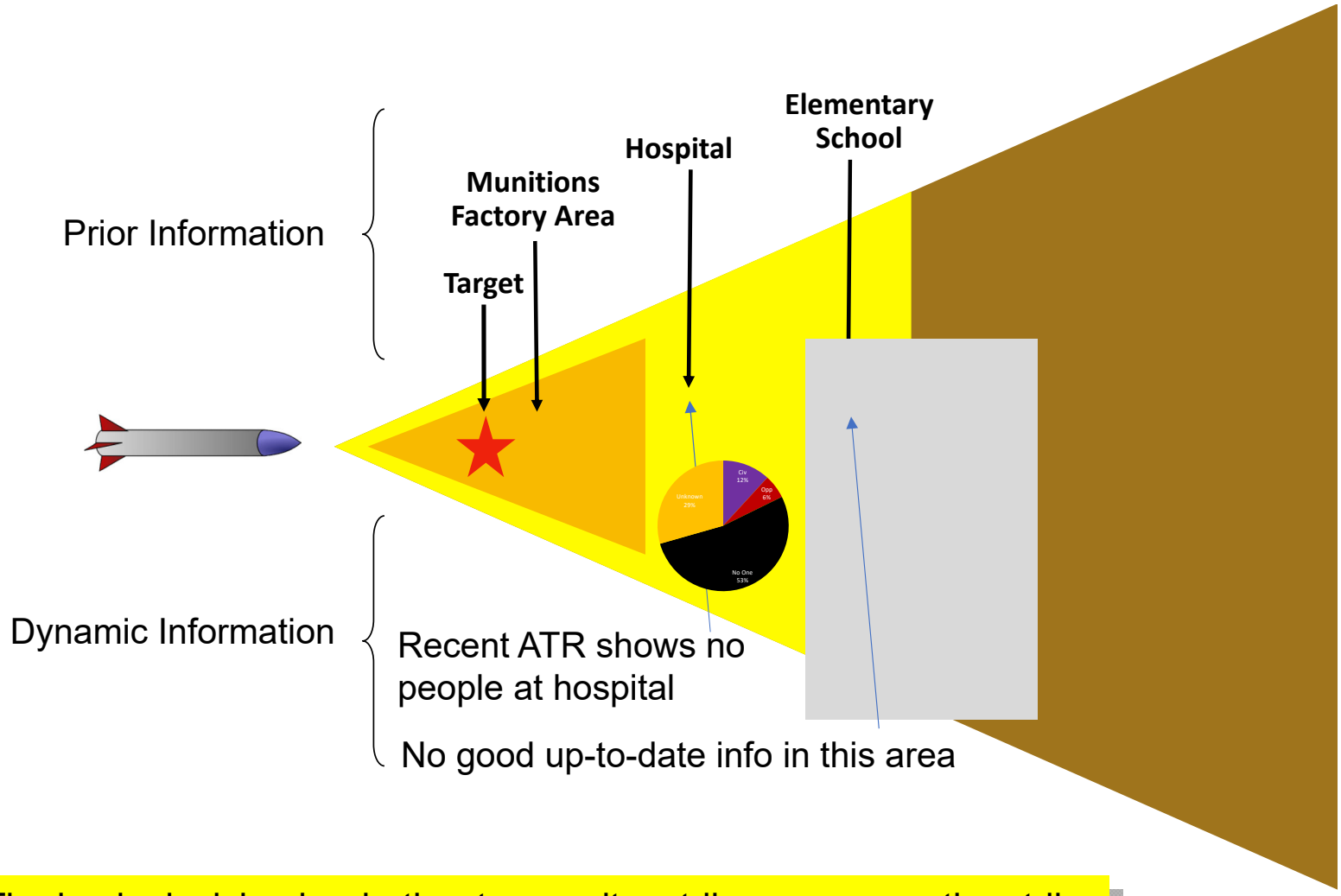
Calibrated 'Capability trust' avoids *misuse from overtrust* and *disuse from distrust* of automation capabilities.



Calibrated 'Ethical trust' is analogous:
If the operator of an autonomous lethal robot ***overtrusts***, the robot may act unethically; if the operator ***distrusts***, the robot may not be assigned a mission at all.

Current research is examining how to achieve a match between modeled and human values

Basic LAWS Scenario Paradigm



The basic decision is whether to permit a strike or supress the strike

Ethical Decision Model

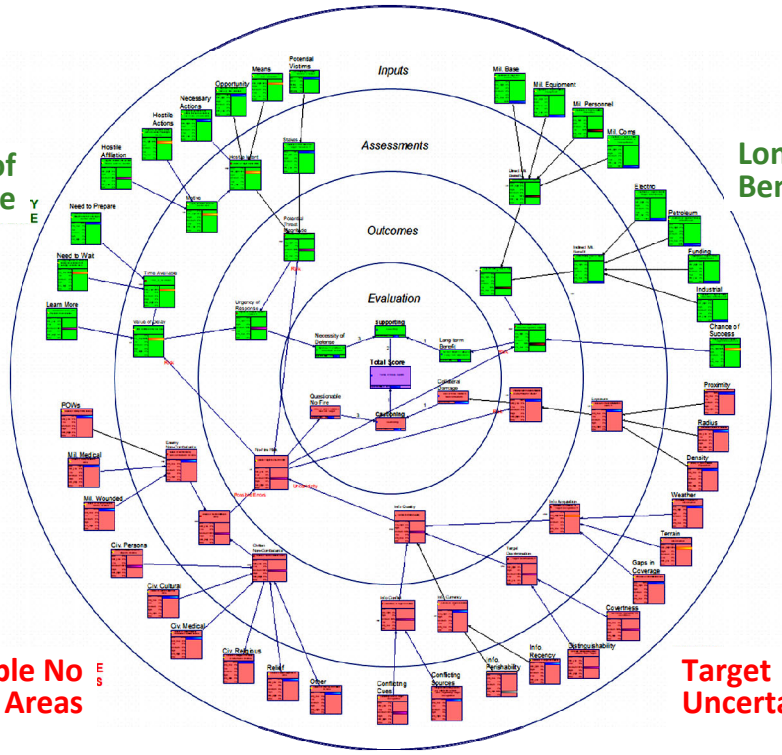
Necessity of Defense

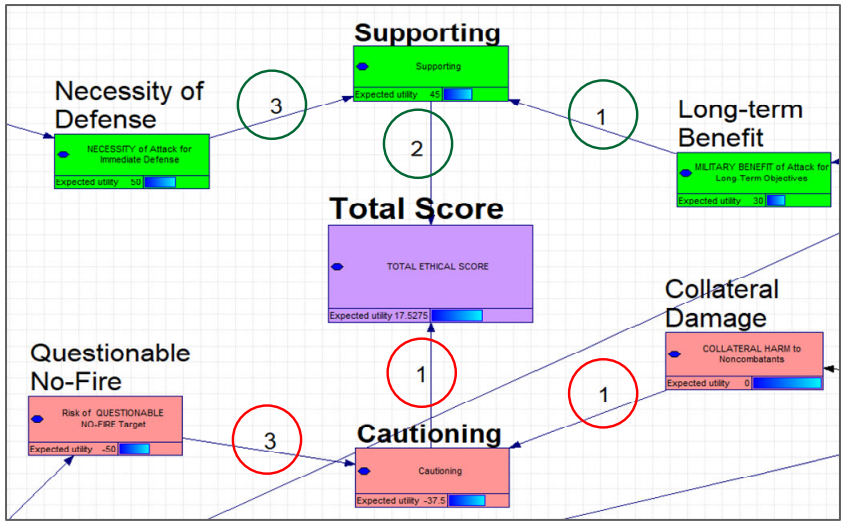
Long Term Military Benefit

Collateral Damage

Questionable No Fire Areas

Target Uncertainty





The Bayesian Model includes a variety of ethical and military factors **and uncertainties;** a positive total score supports a strike, a negative score cautions agains a strike.

A Variety of Scenarios

- **Need to Wait, Total Ethical Score -25**

  Suspicious group is remaining in place, but the convoy is approaching and will be within line of sight in several minutes. group as carrying markings identifying them as journalists; however, some members of the group are seen carrying weapons

- **Could be Journalists, Total Ethical Score -14**

  The swarm commander sees the group of men, some with rifles, some moving unknown equipment. However, human intelligence (HUMINT) has informed the operator that freelance journalists have been operating in the area. They may not identify themselves the same way major networks would; therefore, the chance of misidentification is higher than normal.

- **No New Information, Total Ethical Score -4**

  After waiting for two minutes the group begins moving away from the convoy. They will be out of the surveillance area soon, and the opportunity for a strike will vanish. However, no new information has appeared to make them appear a more significant threat.

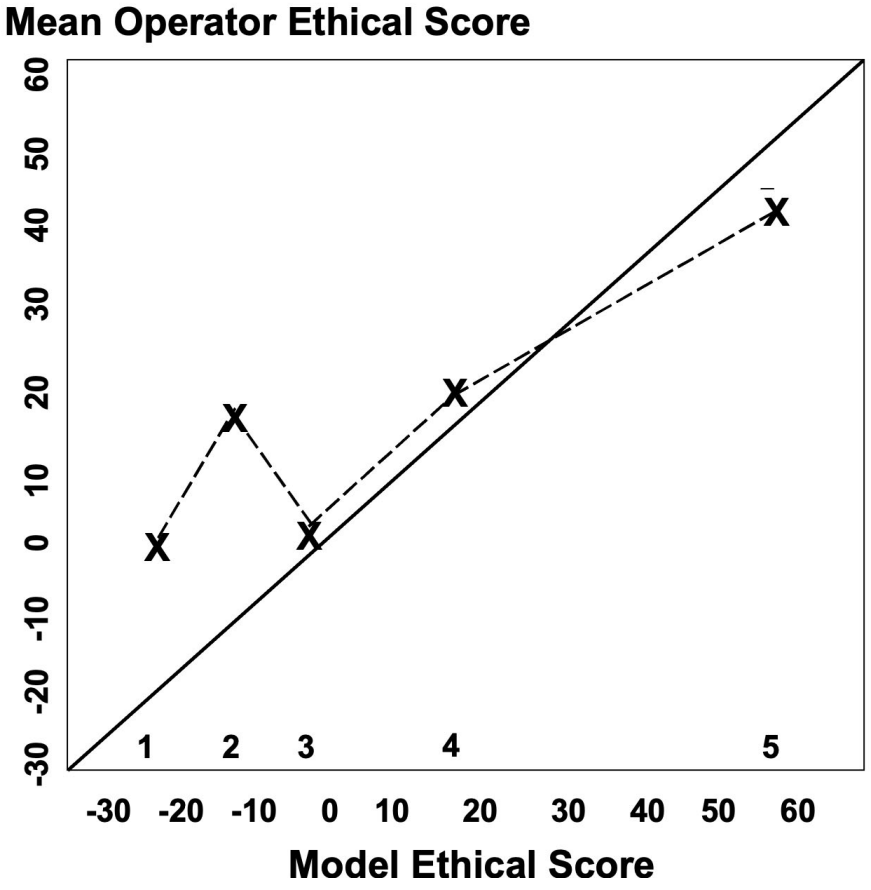
- **Suspicious Gathering of Armed Men (Original), Total Ethical Score +16.5**

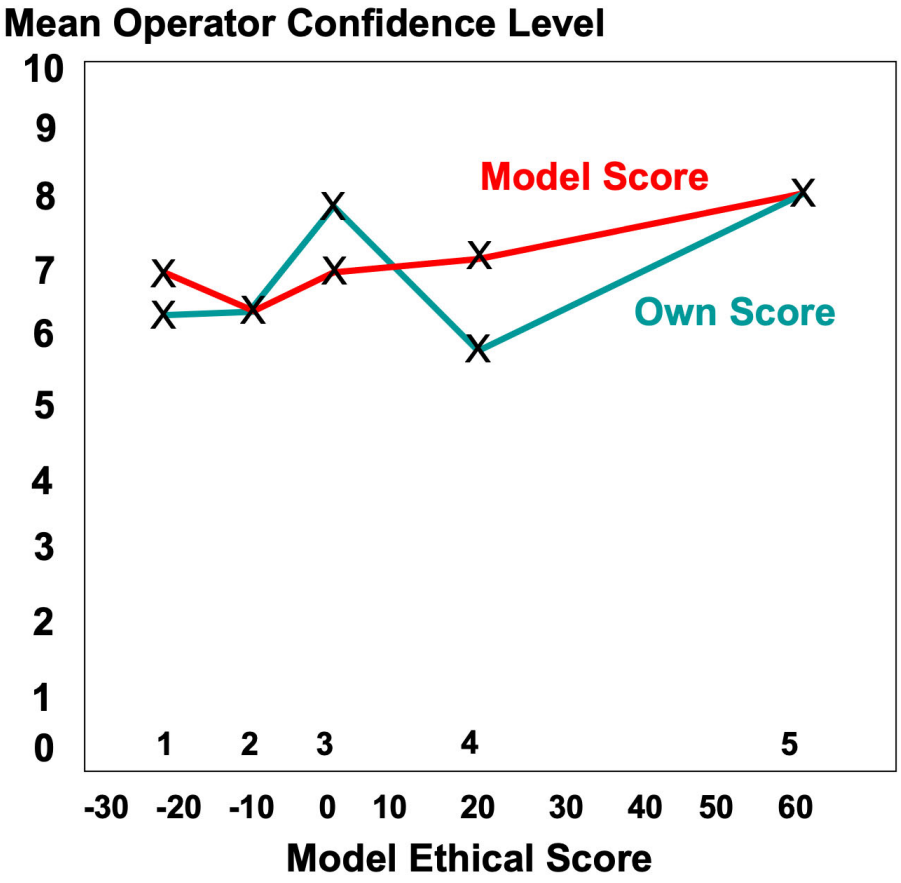
  A group of unknown armed people with unknown intent are assembling near friendly forces during a period of insurgency in Afghanistan. It is unclear if they are enemies, but they have proximity and means to attack friendly forces within a few minutes.

- **Confirmed Combatants, Total Ethical Score +56**

  The suspicious group loiters in the critical area until a quad surveillance drone arrives. New imagery shows the men are carrying rifles and the equipment is military in nature. The men are effectively confirmed to be enemy combatants.

Experimental Results

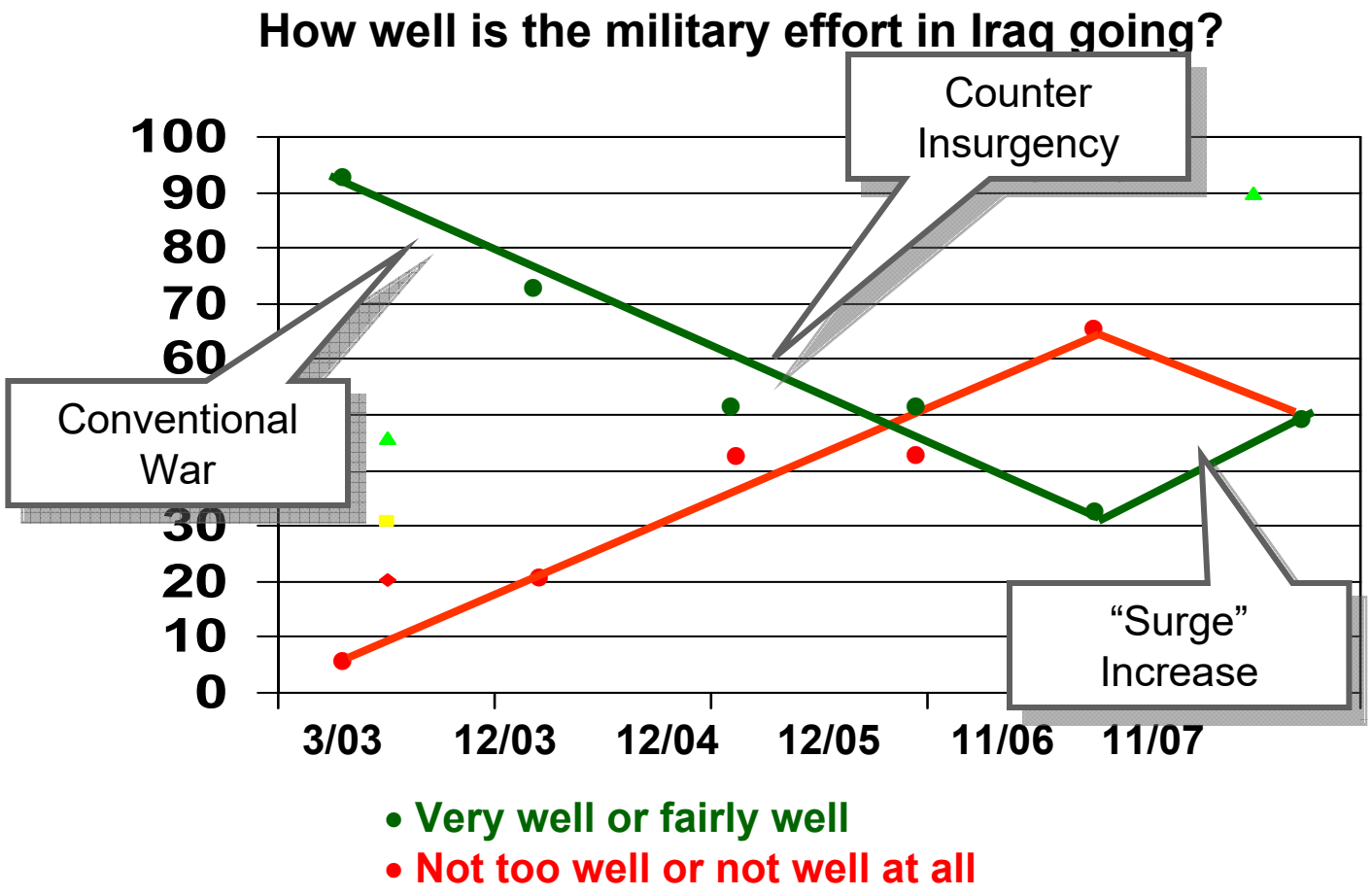


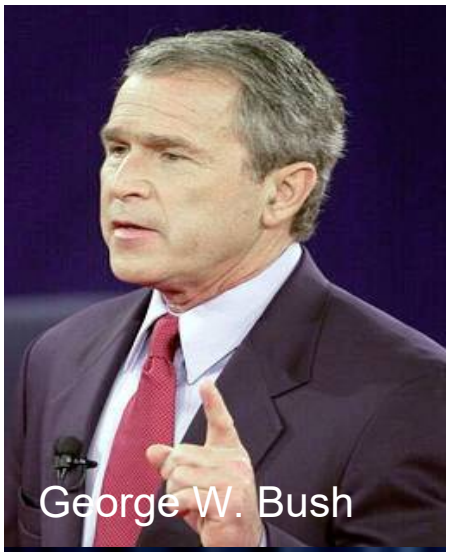


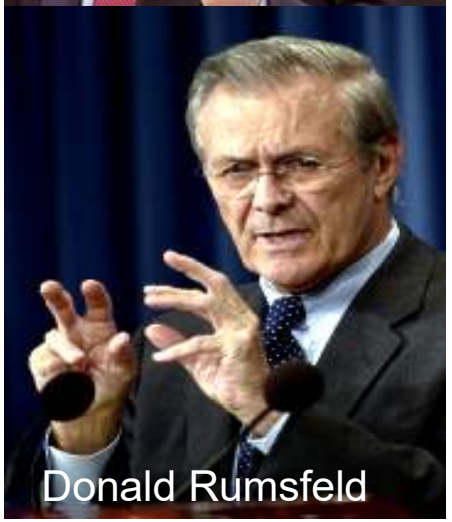
Initial Conclusions

- The Bayesian ethical decision model's features, workflow, and interface concept will be very well received by military personnel working with LAWS.
- For training, a Bayesian ethical decision model can teach commanders to understand the ethical decision-making principles and factors leading to key operational decisions
- For combat operations, a Bayesian ethical decision model can provide:
  - The on-board ethical rules by which the LAWS makes its strike/no strike decision
  - Off-board ethical analysis used to determine whether the LAWS' onboard strike/no-strike decisions are ethically correct

Case 5: Societal Reactions to War Follow Outcomes….



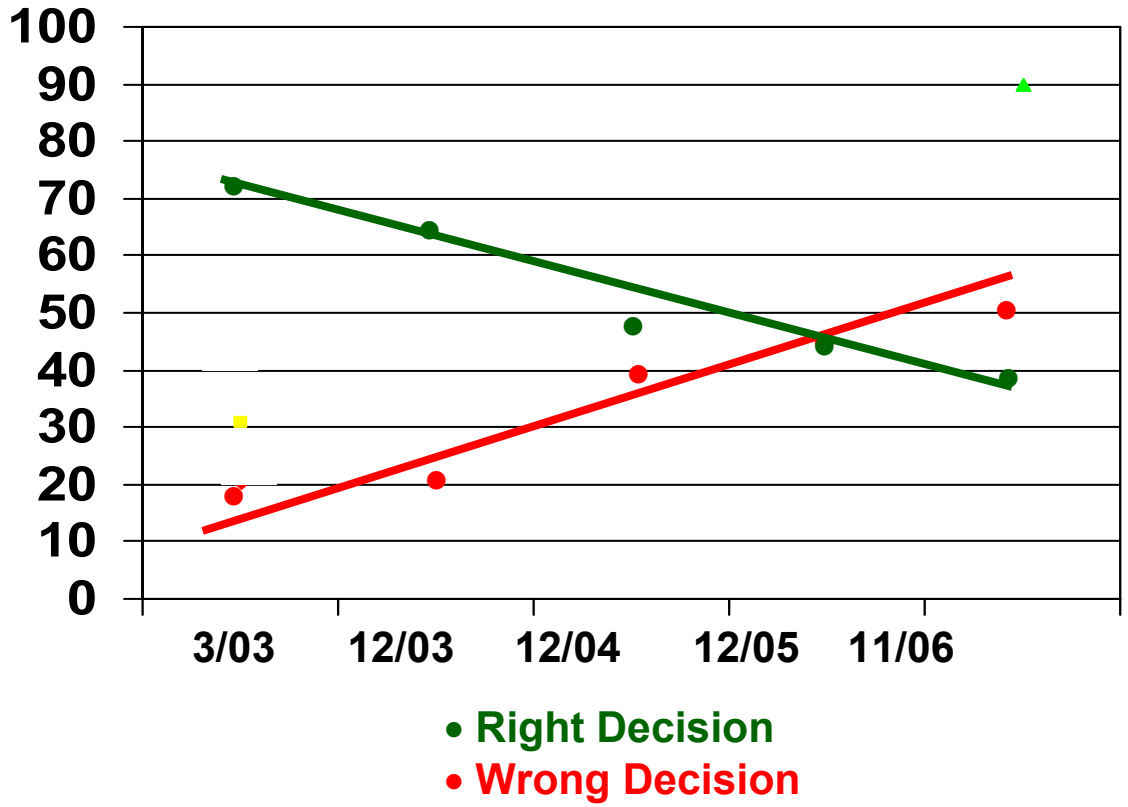




Pew Research Center for the People and Press Survey; www.pollingreport.com

….and Often Reevaluate Previous Decisions…

Did we make the right decision or the wrong decision in using military force against Iraq?



Pew Research Center for the People and Press Survey; www.pollingreport.com

…But One Event Can Tip the Balance of Opinion

Final Thoughts: A Continuing Conversation

"History teaches us that it is not possible to fight a war without making tragic decisions along the way. The time to figure out whether one is willing to accept these considerable moral costs is before making the decision to fight. President Obama's firm and unapologetic speech represents a willingness to shoulder the ***moral burden*** that war implies; in this he follows in his predecessors' footsteps. ***This realism about the cost of war is all to the good, but the conversation about right and wrong methods must continue."***

Stephen L. Carter
Professor of Law, Yale University
Newsweek, May 16, 2011

Final Thoughts: A Personal Decision

Participation in military technology is an individual decision.

Final Thoughts: A Personal Decision

Participation in military technology is an individual decision..

But you do not want to decide while believing that the military establishment is ethically unthinking or unconcerned – that is typically not the case.

Final Thoughts: Coherent Views

From a Soldier

"We can never spend too much time thinking about our profession. There is no better way to develop the sure knowledge and confidence required of our calling than a disciplined, focused commitment to a personal course of reading and study."

General Eric Shinseki (USA Ret)
Former U.S. Army Chief of Staff

From a Soldier and a President

"Only an alert and knowledgeable citizenry can compel the proper meshing of the huge industrial and military machinery of defense with our peaceful methods and goals, so that security and liberty may prosper together ."

President Dwight D. Eisenhower
Farewell Address to the People
January 17, 1961

Further Study for a Fuller Perspective

- Books – For example:
  - The Killer Angels, Michael Shaara, 1974
  - The Face of Battle, John Keegan, 1976
  - The Greatest Generation, Tom Brokaw, 1998
  - Fields of Fire, James Webb, 2001
- Movies – For example:
  - From Here to Eternity, Fred Zinnemann, 1953
  - Apocalypse Now, Francis Ford Coppola, 1979
  - Platoon, Oliver Stone, 1986
  - Full Metal Jacket, Stanley Kubrick, 1987
  - Saving Private Ryan, Steven Spielberg, 1998
  - Band of Brothers, David Frankel and Tom Hanks, 2001
  - Black Hawk Down, Ridley Scott, 2001
  - Flags of Our Fathers, Clint Eastwood, 2006
  - The Hurt Locker, Kathryn Bigelow, 2008
  - The Gatekeepers, Dror Moreh, 2012
  - Good Kill, Andrew Niccol, 2014
  - Eye in the Sky, Gavin Hood, 2015
  - 12 Strong, Nicolai Fuglsig, 2018