

“From Rifled Muskets to Killer Robots”

The Nineteenth Century Military Discontinuities aka “RMAs”

1815 → 1914

OLLI Lecture #1
Peter A. Wilson
March 9, 2022

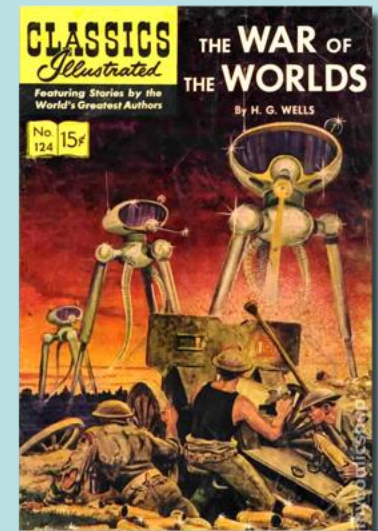
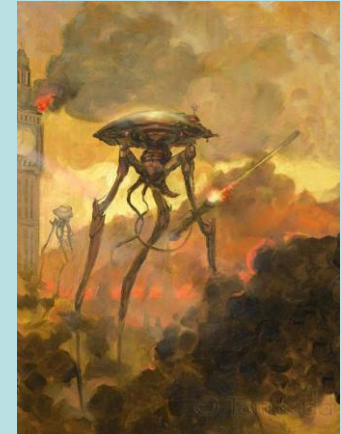
Appreciating the Future of War

"No one would have believed in the last years of the nineteenth century that human affairs were being watched keenly and closely by intelligences greater than man's and yet as mortal as his own; that as men busied themselves about their affairs they were scrutinized and studied perhaps almost as closely as a man with a microscope might scrutinize the transient creatures that swarm and multiply in drop of water.

With infinite complacency men went to and fro over this little globe about their affairs, dreaming themselves the highest creatures in the whole vast universe, and serene in their assurance of their empire over matter. It is just possible that the infusoria under the microscope do the same.

...minds as ours are to those of the beasts that perish, intellects vast and cool and unsympathetic, regarded this earth with envious eyes, and slowly and surely drew their plans against us. And early in the twentieth century came the great disillusionment."

Source: H.G.Wells, *The War of Worlds*, Pearson's Magazine, April-December 1897



Trends, Shocks, and Discontinuities

- **Identify possible shocks and discontinuities**
 - **Trends:** Powerful forces that are setting the stage for large scale change (e.g. demographic changes)
 - **Shock:** Abrupt and major event that may or may not be precursor to a discontinuity
 - **Discontinuity:** Abrupt, major and permanent change of the global security environment – response to a shock or shocks

Defining a Revolution in Military Affairs (RMA)

“Revolution”= Radical and rapid break from the status quo

Note: “Rapid” in this case usually means several decades

Soviet concept of three 20th century “military technological revolutions” (MTR) expanded/refined by OSD’s Net Assessment as the “revolution in military affairs” (RMA)

A RMA (viewed as a “way of war”) contains a more complete set of change indicators than a MTR

- New military technology
- New modes of production
- New energy sources
- New modes of human mobilization
- New Doctrine/Concepts of Use
- New Organizations with advocates
- New training/education

A major conceptual question emerges: Is the concept of guerrilla/partisan warfare (“revolutionary warfare”) an RMA?

T.X. Hammes, et.al. of “Fourth Generation” (4G) warfare school of thought believe so

The First 19th Century Discontinuity aka RMA

**First dramatic period of change in
character of war during 19th Century**

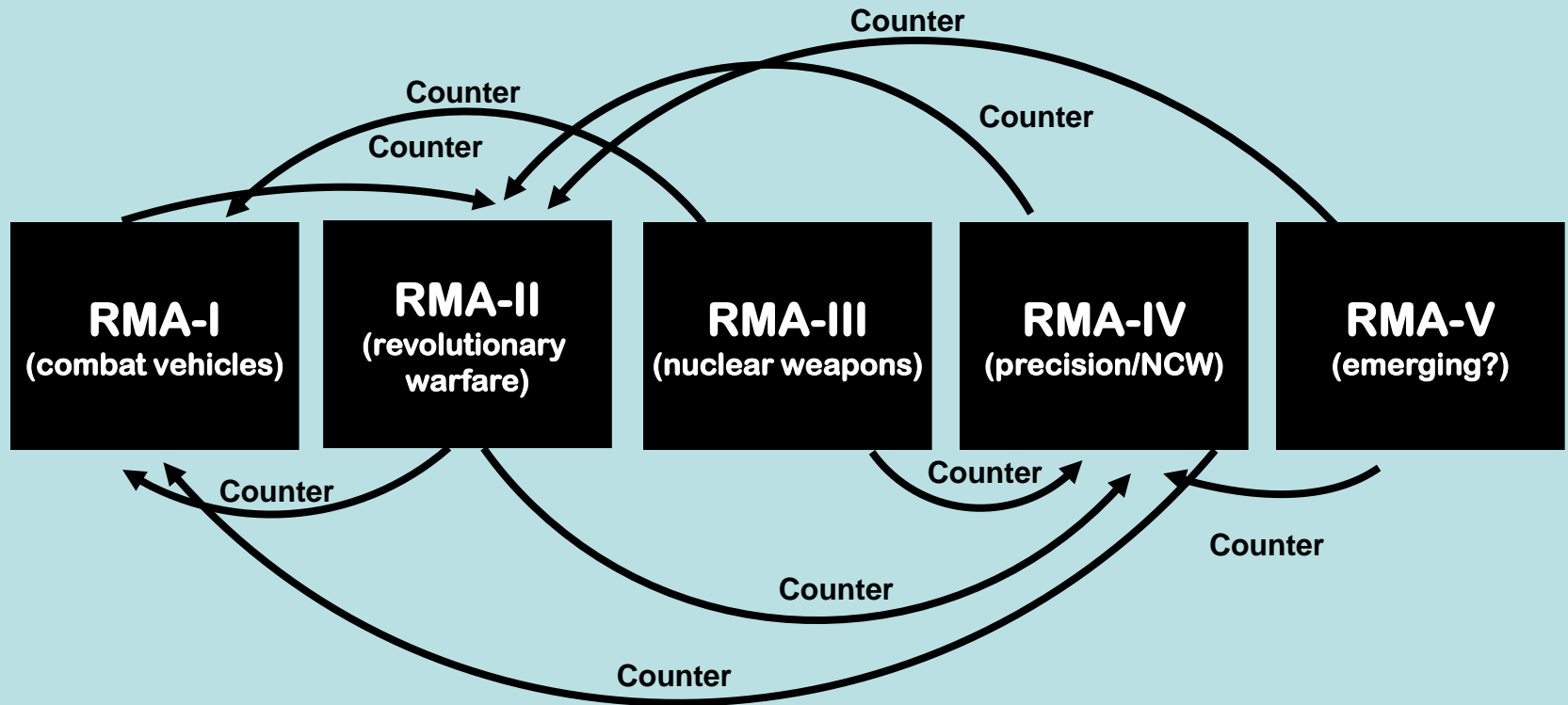
- **Phase One (1815-1870)**
 - Nationalism from Napoleonic era and mass conscription
 - First wave of industrialization and mass production
 - The emergence of the coal era
 - Steam engine and the railroad and steamship
 - Telegraph
 - Rifled Musket → repeating rifle → 1st generation machine gun (Gatling gun)
 - Iron → steel
 - Ironclad/steam powered warships
 - Print as the dominant means of mass media
- ***Crimean War, the American Civil War and the Franco-Prussian War***

The Four RMAs of the 20th Century

Four 20th-Century Revolutions in Military Affairs (all continuing)

RMA	Nominal Period of Change (all with older roots)	Characteristic Developments	Label for Resulting Strategy
I	1917–	Mechanization: self-propelled combat vehicles (air, sea, and land)	Industrial warfare
II	1930–	Insurgency; revolutionary, partisan, and guerilla warfare; terrorism, “Kulturkampf”	Insurgency
III	1945–	Nuclear weapons; long-range missile delivery	Mass-destruction weapons and long-range aircraft and missiles
IV	1980s–	Precision weapons; unmanned combat vehicles; persistent ISR; networked forces; computer-network operations (CNO)	Information technology

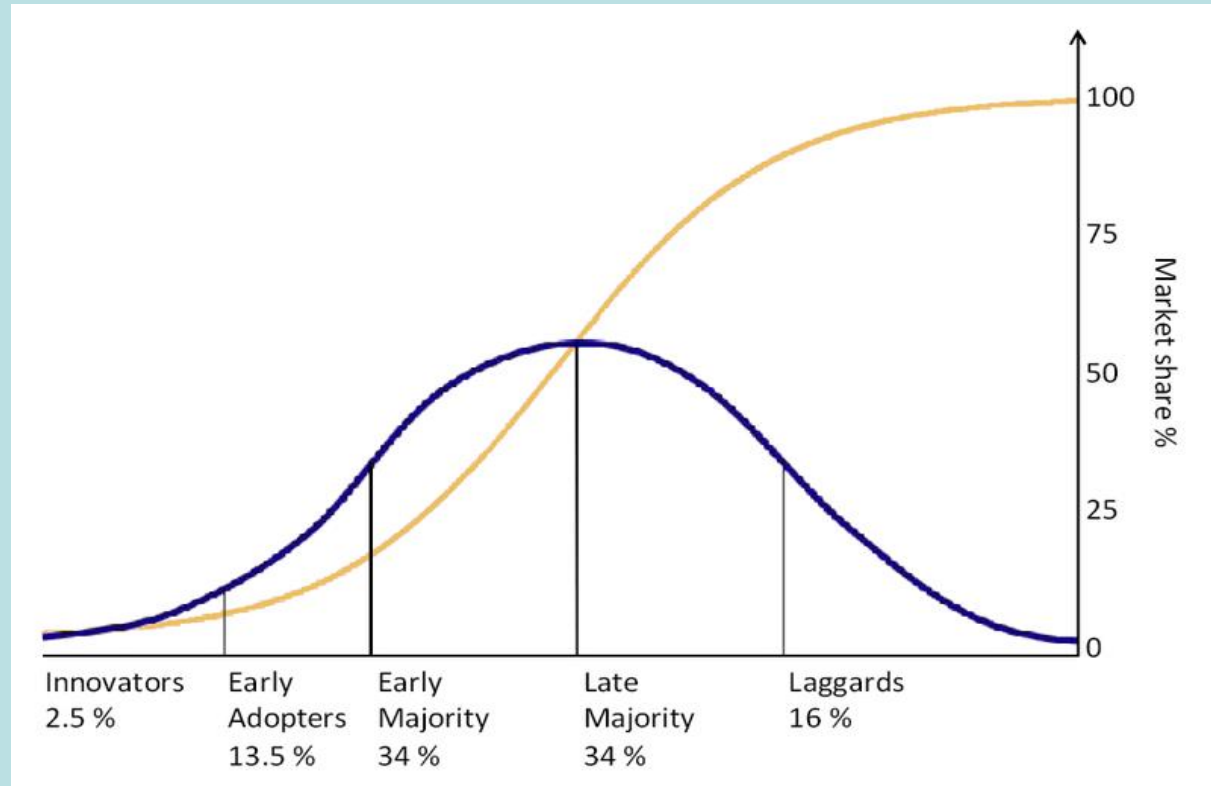
The RMA Measure-Countermeasure Interaction



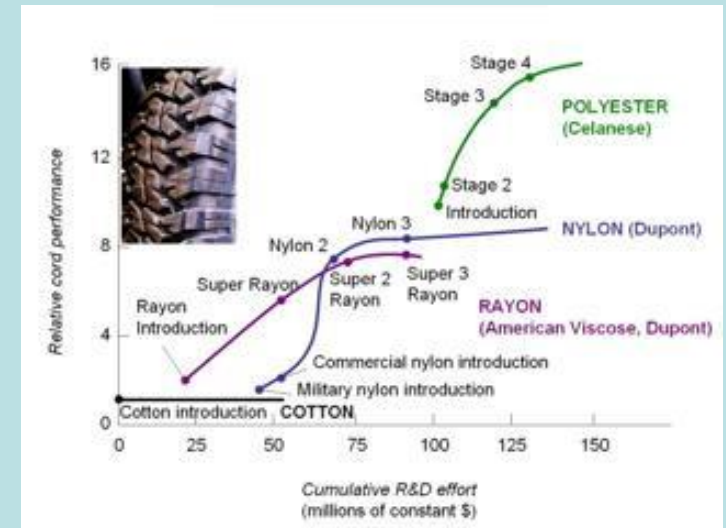
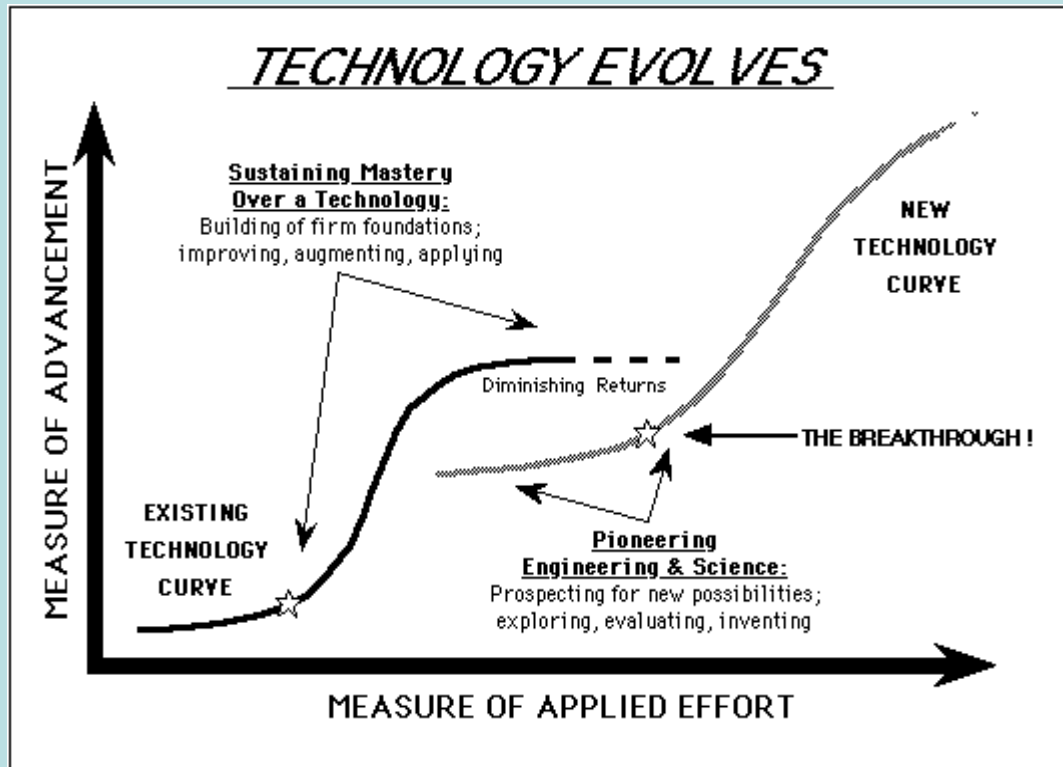
The different RMAs can be viewed as different domains or "ways of war." Not unlike the game of "rock, paper, and scissors" the various RMAs interact with each other in dynamic process of thesis and antithesis. Should RMA-V be defined by its ability to counter prior RMAs, specifically RMA-II, RMA-III, and RMA-IV? Is RMA-V simply a "hybrid" of all four prior RMAs?

On Innovation

- **Everett Rogers, Diffusion of Innovation, 1962**
 - Knowledge
 - Persuasion
 - Decision
 - Implementation
 - Confirmation
- **Mature Technologies**
 - RMA I Combat Vehicles
 - Chemical rocket motors
- **Emerging Technologies**
 - RMA IV Systems
 - Key role of Moore's Law

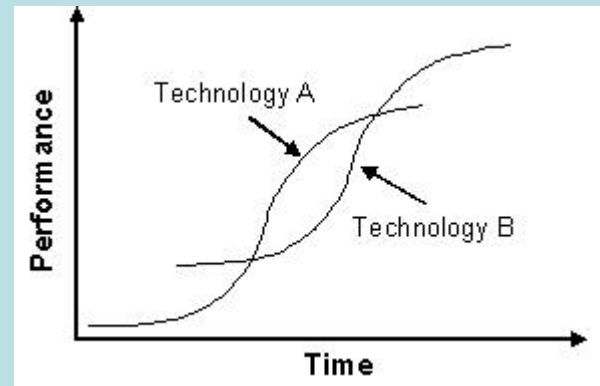
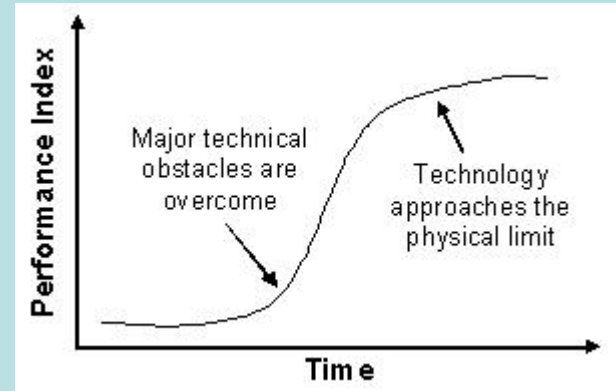


On “S” Curves



Overlapping Technological “S” Curves

- **Propulsion Developments:**
 - Steam
 - Electric
 - Diesel and Otto Cycles
 - Hybrids
 - Electric, Diesel, and Otto
 - Internal combustion aero engines
 - Jet engines
 - Low by-pass jet engines
 - High by-pass jet engines
 - Solid rocket motors
 - Liquid rocket motors
 - Electric-plasma rocket motors?
- **The Internals of Moore’s Law**



Falcon Heavy Flight Profile – Moving the “S” Curve

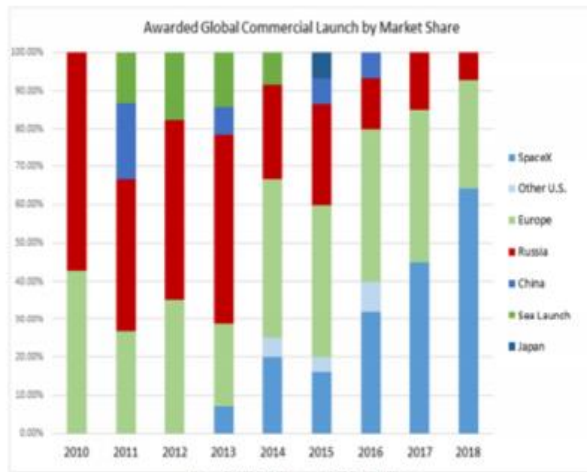
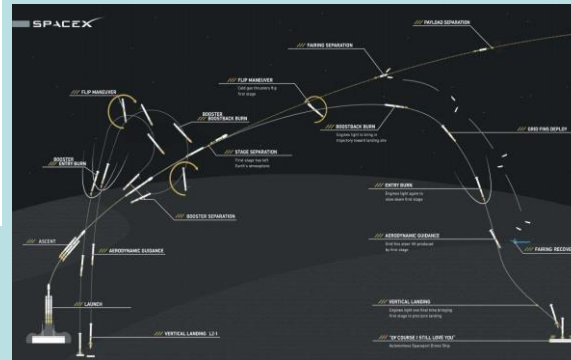
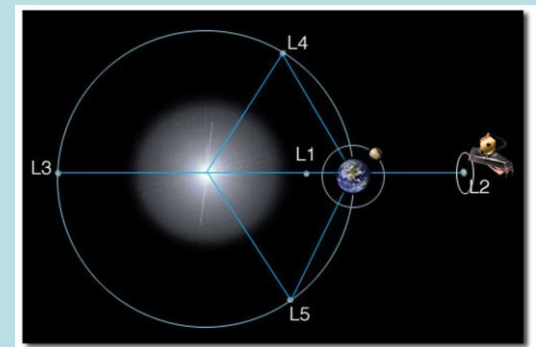
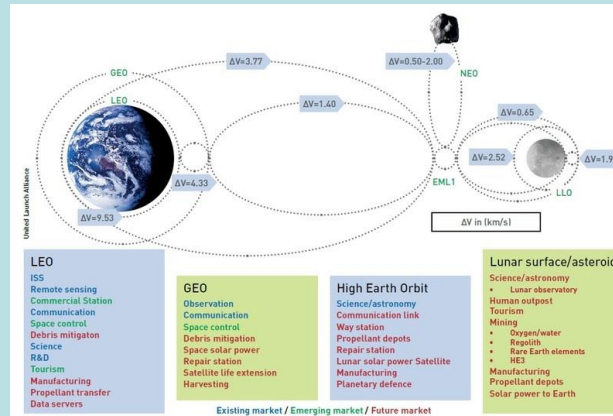
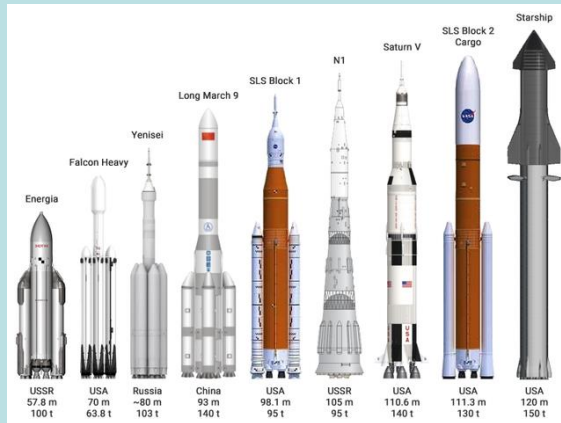


Figure 1: Global Commercial Market Share



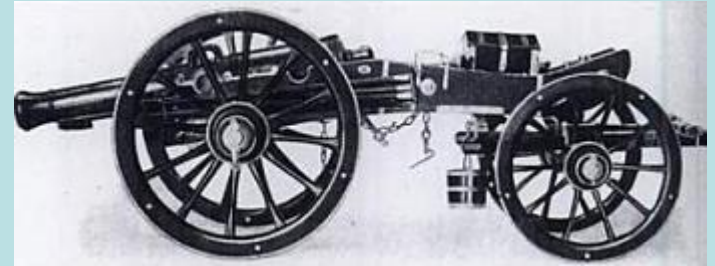
- Likely reduce heavy SLV launch costs (\$/kilo to orbit) by a factor of three to six
- Provides for dual manifest of two heavy SATCOMs to GEO for \$90 million

Further Shift in the “S” Curve



- Elon Musk’s SpaceX is on the verge of flying and producing the B-747 version of the chemical space launch vehicle (SLV)
- If successful, then human space flight will move forward rapidly to returning to the Moon, possibly exploiting the Asteroids and exploring Mars
- May be a big military rivalry between the United States leading the Artemis Accords allies and China
- Cislunar space and LaGrange Points will become terms of “geopolitics”

Napoleonic Revolution in Artillery



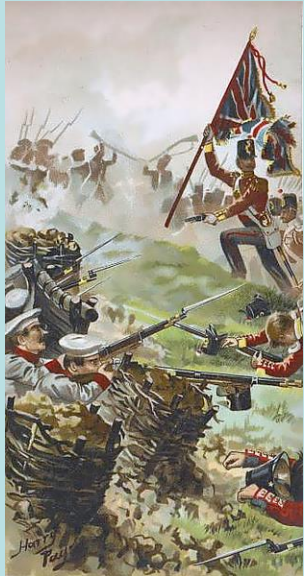
- **Jean Baptiste Vacquette de Gribeauval created the light/mobile artillery – conceptual and engineering revolution – developed between 1763 and 1767 – challenged superiority of infantry firepower and cavalry shock and maneuver**
- **Gave Napoleon firepower superiority during his European wars**
- **Artillery design and tactical concept became standardized and used up through the American Civil War**

Crimean War 1853-1856

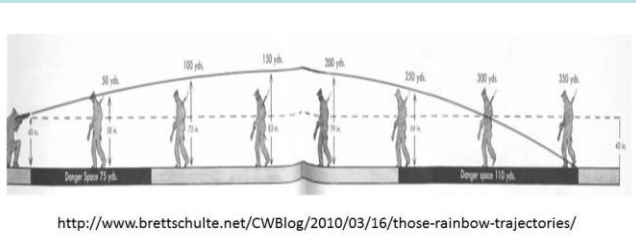
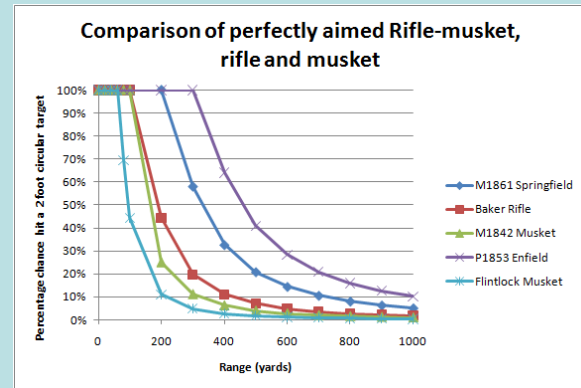


- Russian fleet annihilates Turkish fleet in the battle of Sinop, 30 November 1853
- Franco-British expeditionary force to seize Crimean region and key Russian port of Savastopol
- France and Britain had the rifled musket
- War ended in stalemate with France accepting limited peace outcome
- UK had the ambition to destroy the Russian Empire

Crimean War Innovations

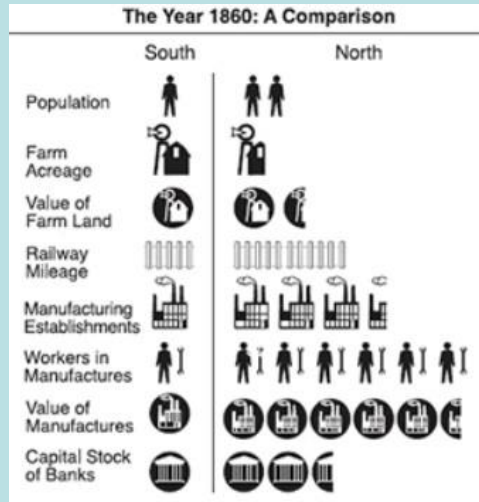


The Minnie Bullet



- The mass produced and/or converted rifled musket emerges with the Claude-Etienne Minie developing a self rifling bullet
- Increased lethality to 400 yards – firing at that range created a safe zone
- Often less well trained troops would only fire at the 150 yard range

U.S. Civil War



Economic Differences of the North and South

- Northern Economy – In the 1800's the U.S. started to industrialize.
- Most factories were built in the Northern states.
- Many Northern cities started to build infrastructure to support the factories.
- Infrastructure – buildings, roads, bridges, train tracks, telegraph lines, ect.



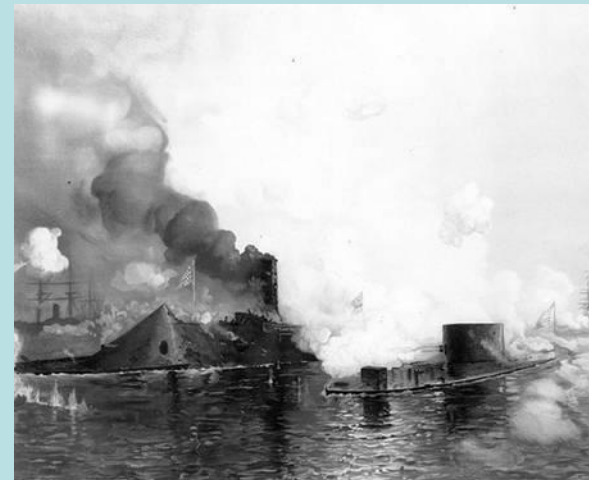
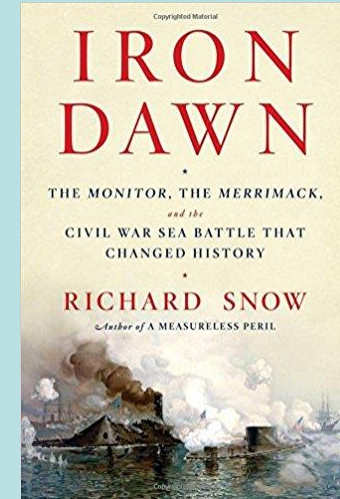
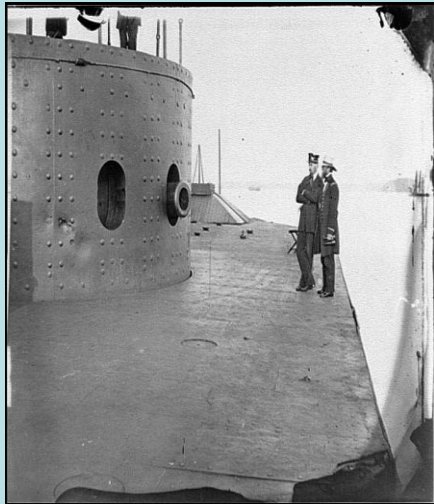
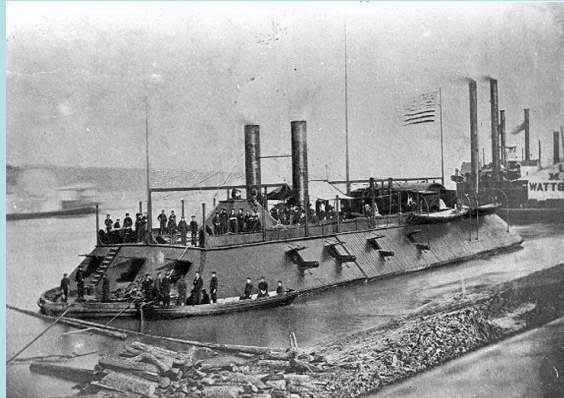
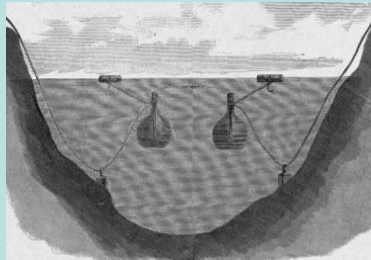
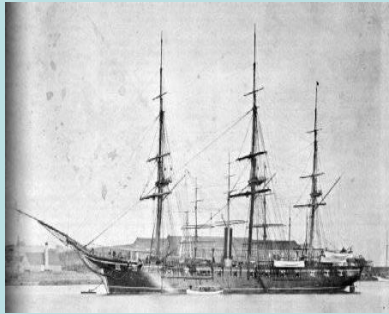
- 1860 census
 - 31,500,000
 - Confederate states
 - 9,100,000
 - 5,450,000 white
 - 3,500,000 slaves
 - 130,000 slaves
 - The North
 - 22,400,000
- North enjoyed 5-2 edge in manpower
- Industrial ratio was greater than 10-1 in favor of North
 - North produced 15 time more iron than South
 - North produced 97% of the firearms
 - North had 22,000 miles of railroads vice 9,000 in South
- North has 800,000 draft animals vice the 300,000 in the South

2.1. Economic and social differences between the North and the South.

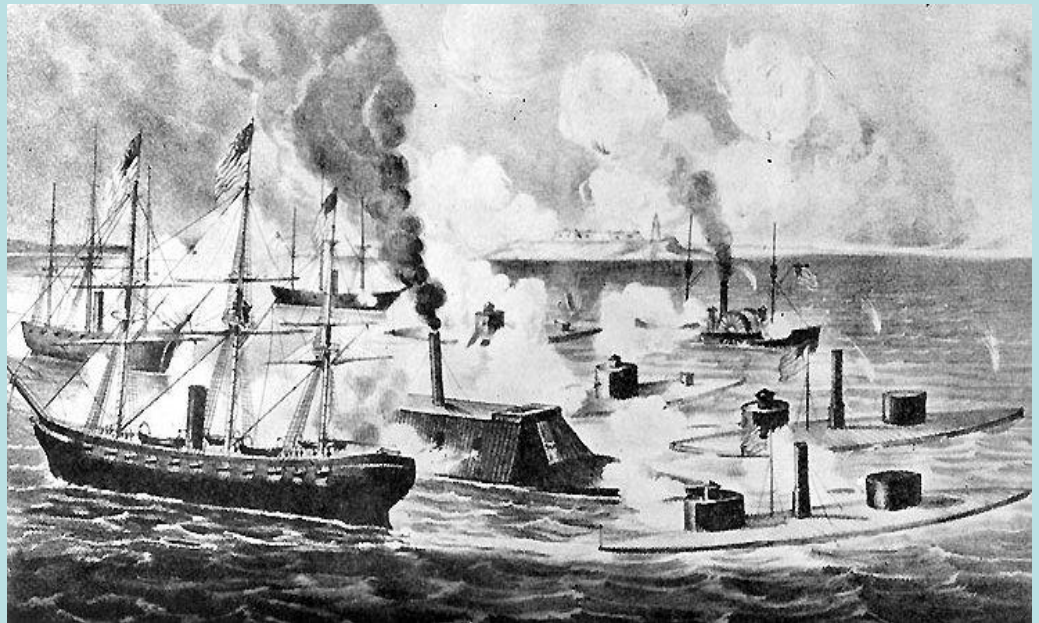
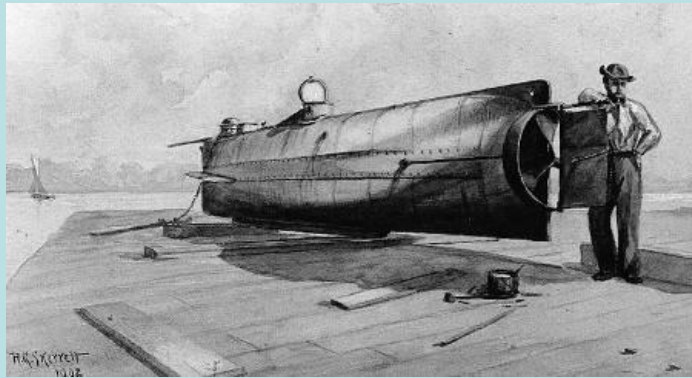
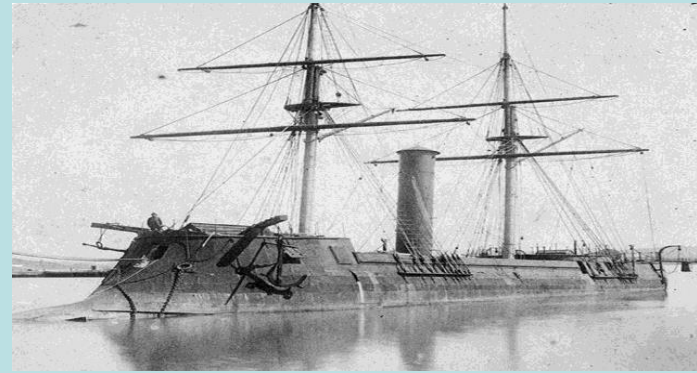
With the invention of the cotton gin in 1793, cotton became very profitable. This machine reduced the time it took to separate seeds from the cotton. However, at the same time the increase in the number of plantations willing to move from other crops to cotton meant the greater need for a large amount of cheap labor (slaves). Thus, the southern economy became a one crop economy, depending on cotton and therefore on slavery.



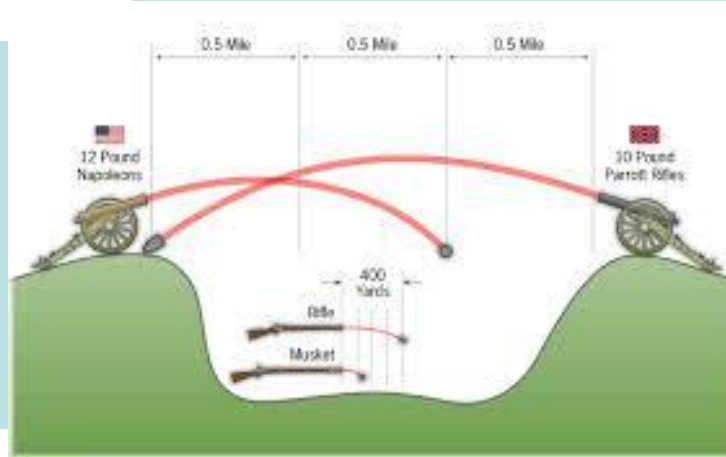
Transformation of Naval Warfare



Transformation of Naval Warfare (2)



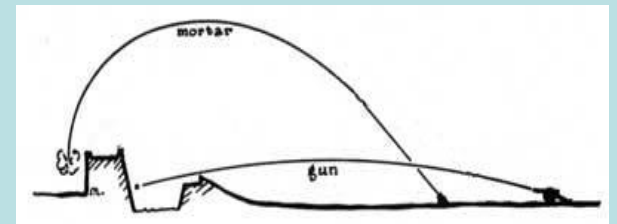
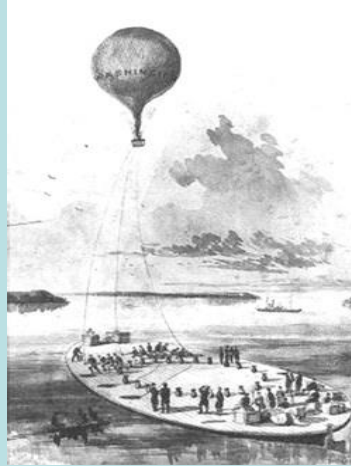
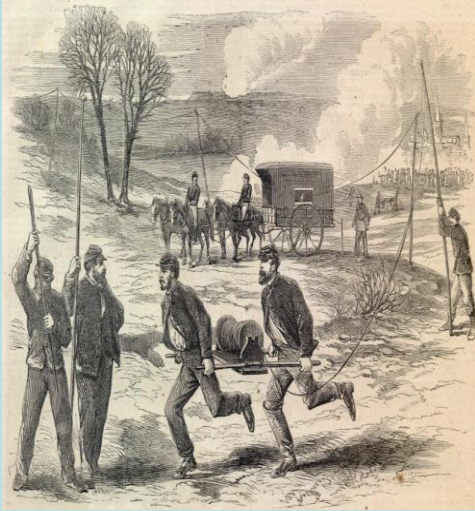
Transformation of Land Warfare



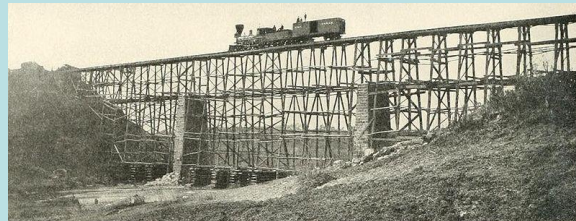
Transformation of Land Warfare (2)



Transformation of Land Warfare (3)

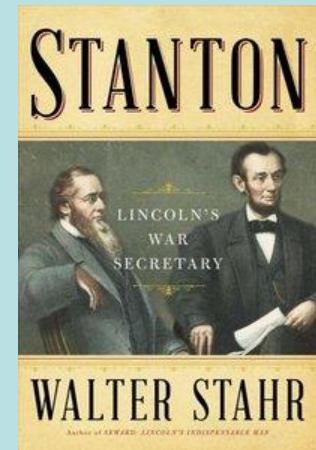
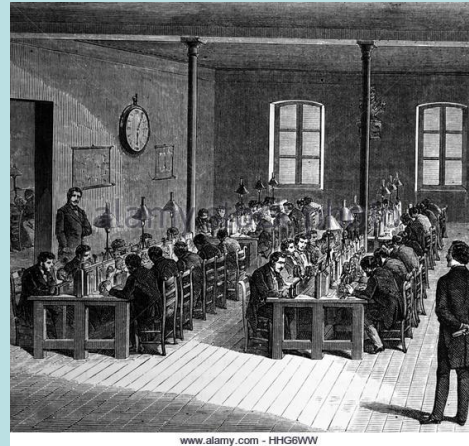
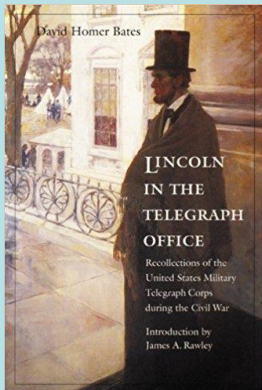
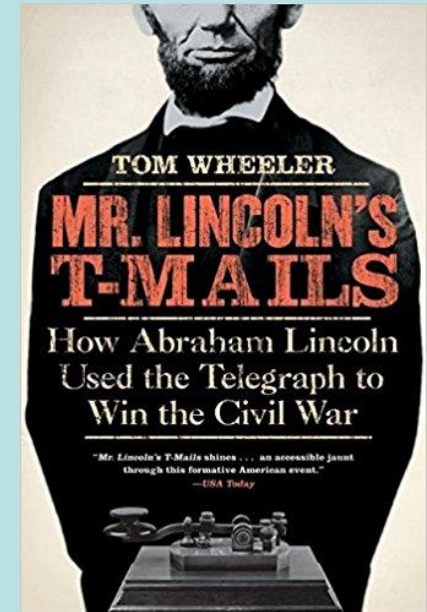


The Rail Road Revolution as Strategic and Operational Transportation System



- Union had clear superiority of density of rail system and industrial capacity
- Major raids launched by both sides to interdict their rail systems
- Destruction of Southern rail system part of Sherman's concept of total war
- Still need massive horse drawn logistics at the rail head to support troops

Lincoln's War Room – Telegraph Office



- Secretary of War Stanton's telegraph command center
- Lincoln's attempts to understand and control the war effort remotely

U.S. Civil War

“Lessons Learned and Unlearned”

- **Impact on the rifled musket**
 - Fighting in a more dispersed and protection positions
 - There is a revisionist view
- **Role of the telegraph and mass media**
- **Emergence of the explosive shell – siege mortars and field artillery**
- **The field fortifications redesigned – prove resilient**
- **Impact of the railroad**
 - Massing troops and supplies
- **Critical role of the Erie Canal and the major inland rivers**
- **Problem of maneuvering and supplying large forces in the field remain unchanged**
- **Union naval supremacy**
 - Maturation of the steam powered warship
 - The emergence of the armored warship
 - Union’s green water naval success
 - The threat of the commerce raider
 - The Alabama crisis
 - The Union threat against the British Empire
- **Brute Force**
 - Union’s mass production supremacy
- **Critical role of horse cavalry for reconnaissance**
 - War in the Western theaters of operations
- **Late emergence of the repeating rifle**
 - Gatling gun

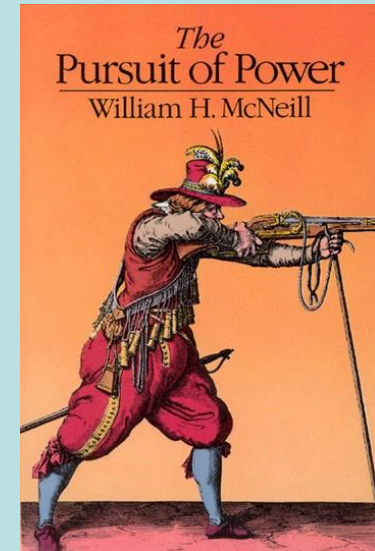
Second Discontinuity

1870→1914

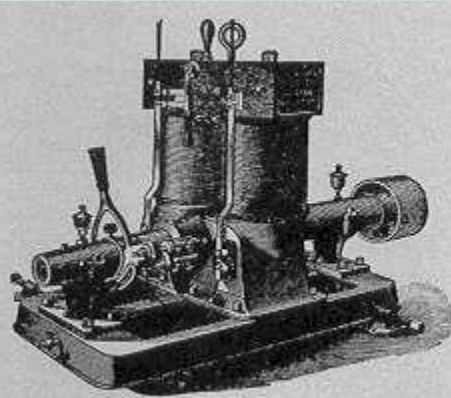
Second dramatic period of change in character of war during 19th Century

- **Phase Two (1870-1914)**

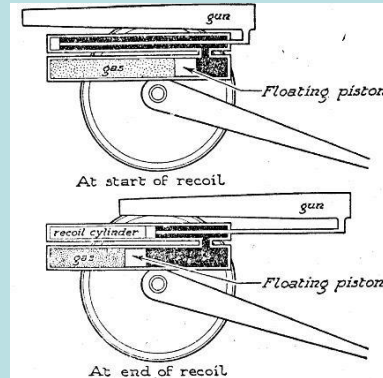
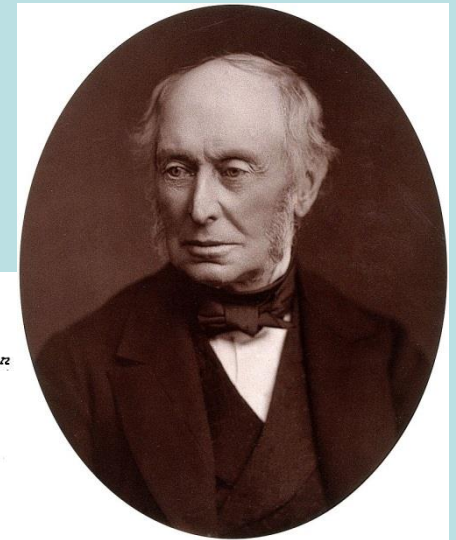
- Second generation of mass industrial production
- Worldwide railroad building boom
 - U.S. railroad bubble and the great depression of the 1870s
- Otto-cycle and Diesel-cycle internal combustion engines
- Transition from coal to oil
- Dynamo and the electric power grid
- First global digital internet – global telegraph
- Telephone
- Radio
- Breach loading naval rifles
- Quick firing light artillery (French 75)
- Maxim machine gun and bolt action multi-shot rifle
- Smokeless powder
- Barbed wire
- Naval optical fire control and continuous aimed fire out to the horizon
- Coal fire steam powered steel armored warships → British conversion to fuel oil
- Super large passenger ships and mass migration to U.S. and Latin America
 - 19th century's version of the B-747
- The submarine and the self-propelled torpedo



Key Late 19th Century Innovations

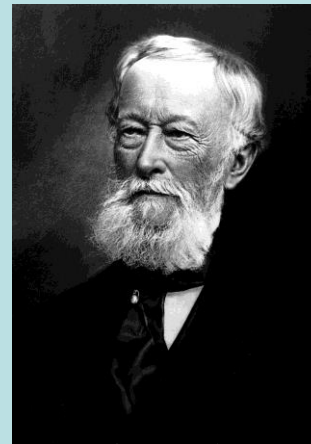
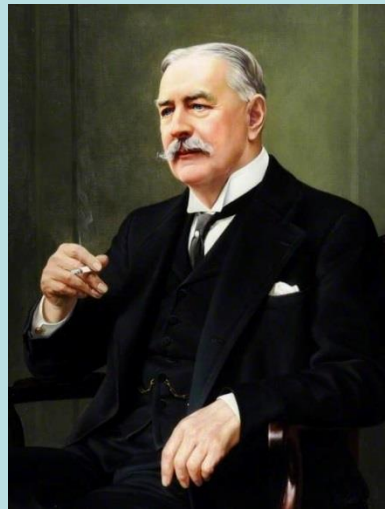
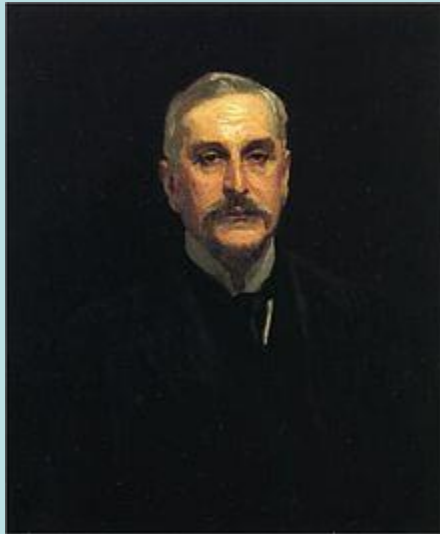


Important Arms Developers – Mid to Late 1800s



- Joseph Whitworth developed first rifled light artillery
- William George Armstrong and Joseph Whitworth join forces to dominate UK naval artillery development and production
- LTC Joseph Albert Deport – design of the French 75

The Private Arms Race in Europe

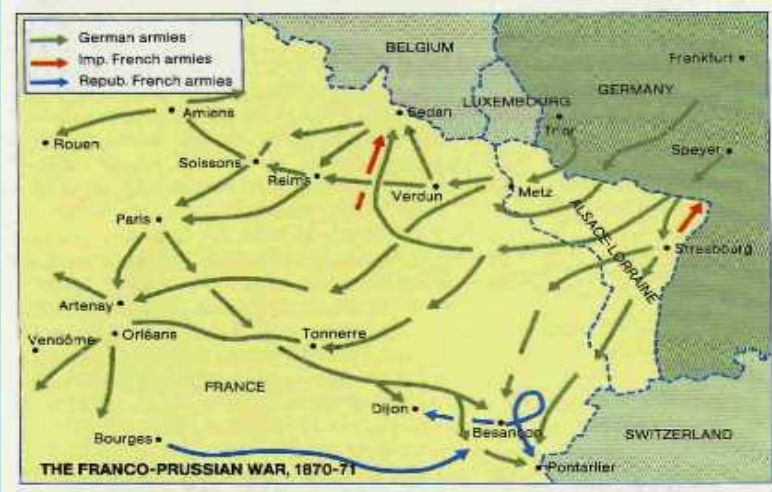


- Tom and Albert Vickers – key British armament industrialists
- Alfred Krupp – dominant German armament industrialist
- Need to innovate for foreign markets because of episodic government funding
- Naval arms race becomes nationalized before World War I

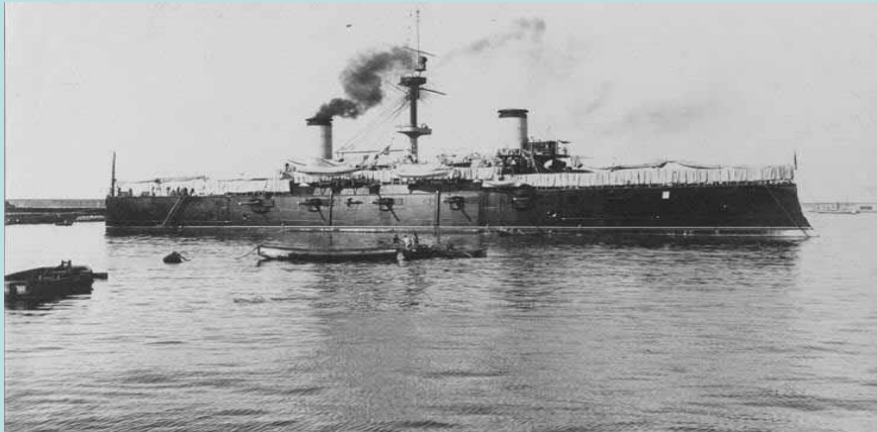
Franco-Prussian War

- Reinforced European view that U.S. Civil War was fought by “amateurs” – little lessons to be learned
- Rapid defeat of France argued for massive prewar mobilization capacity
- Although French and Germans suffer heavy loss at Sedan – the supremacy of the offensive still obtained
- The Gatling gun proves not decisive
- Siege of Paris hints of a future of protracted war but ignored

Franco-Prussian War



The Spanish American War of 1889



American-Philippine War 1899 – 1902

- Similar to the Boer rebellion, Philippine nationals attempted to overthrow the American occupation
- Lead to protracted insurgency and counter-insurgency
- Emilio Aguinaldo was political and military leader of this opposition
- It was a war of reprisal and counter reprisal
- U.S. introduced its version of concentration camps



The (Second) Anglo-Boer War 1899-1902

- **First Boer War (1880-1881)**
 - Creation of the Republic of Transvaal
 - 1886 massive quantities of gold found
 - Influx of *uitlanders* (foreigners)
- **Second Boer War (1899-1902)**
 - Phase one – Boers offensive against Natal and Cape Colony
 - Phase two – Successful British counter attack
 - Phase three – Boer guerrilla war and British COIN operations
 - First use of “concentration camps”

Second Anglo-Boer War

- **Some innovations and insights**
 - **Extensive use of bolt action repeating rifle**
 - **British army creates kaki uniform**
 - **Boer's fight war of attrition – a war not to be beaten – features of Maoist Revolutionary War (RMA-II)**
 - **Tactical use of the heliograph**
 - **Role of mass media and impact on UK domestic opinion**
 - **Viewed by British elite as a disaster**
 - **Role of counter propaganda – see Churchill's media career**
 - **UK creates the Union of South Africa as peace solution**
 - **Greatly accelerates modernization of British Army under Kitchener**
 - **Highlights strategic debate between those who wish to maintain the empire – focus on India vice those who feared the rise of Germany – Investment in naval arms competition and a larger conscription fed army for continental warfare?**

Practitioners of Pre – RMA-II



Rifle, Short, Magazine, Lee-Enfield, Mk. III (RSAF Enfield, 1908)

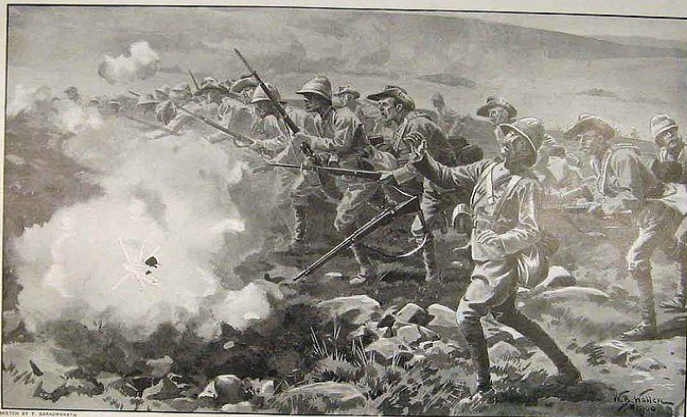
Photo: Cogansfield



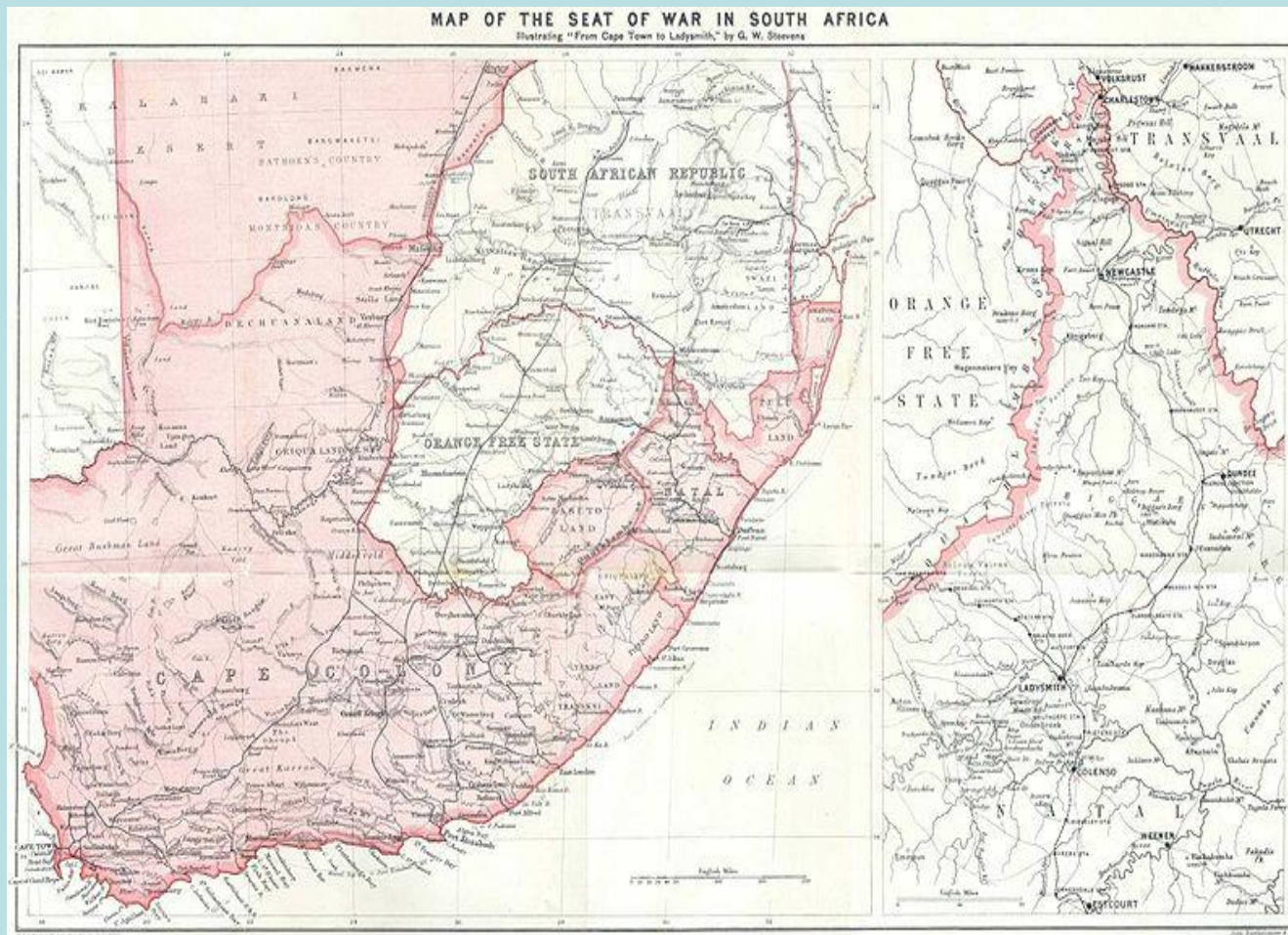
Britain Learns the Hard Wary



THE CHARGE OF THE C.I.V.'S AND THE COLDSTREAMS AT THE BATTLE OF DIAMOND HILL.



Theater Of Operation



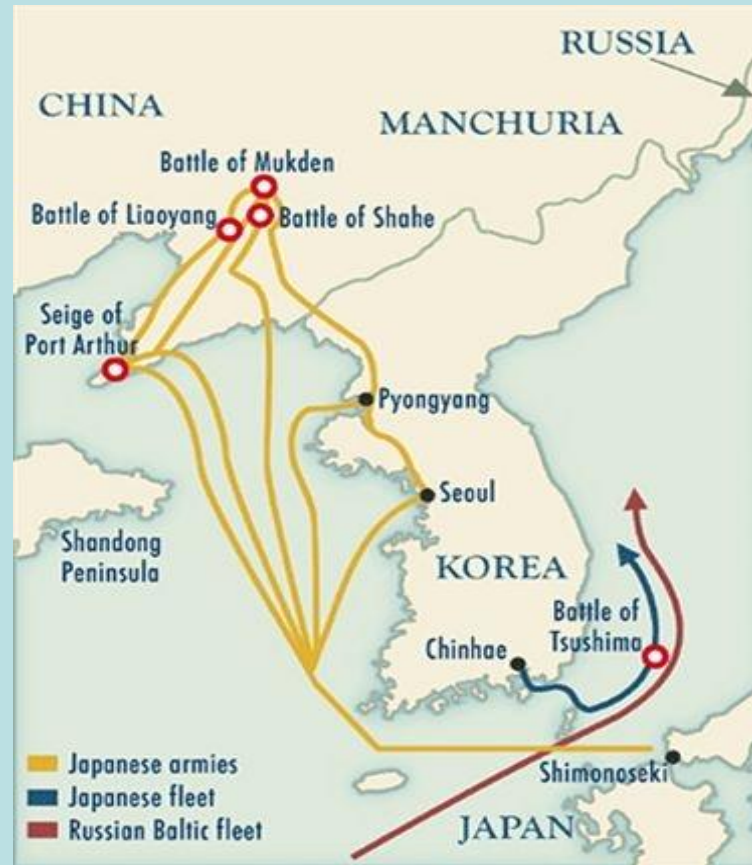
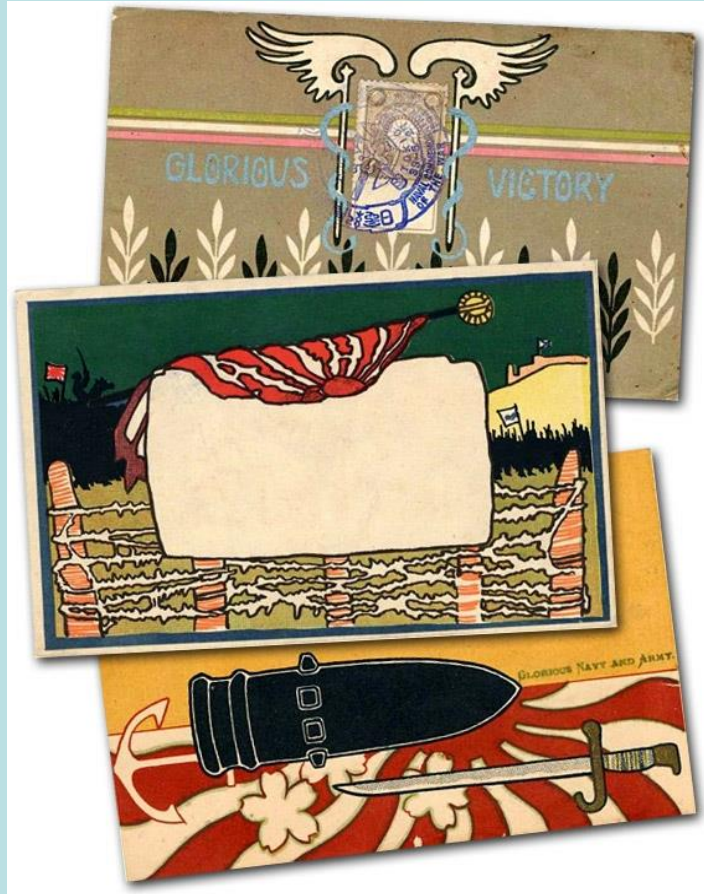
The Russo-Japanese War 1904-1905

- **Japan**
 - **Population: 46.5 million**
 - **New Model conscript army**
 - **Recent Conflicts**
 - **Civil War of 1877**
 - **Japan-China War of 1894/95**
 - **Boxer Rebellion of 1900**
- **Russia**
 - **Population 137 million**
 - **2/3 population was Slav and part of conscription pool**
 - **Recent Conflicts**
 - **Crimean War of 1854/56**
 - **Russo-Turkish War of 1877/78**

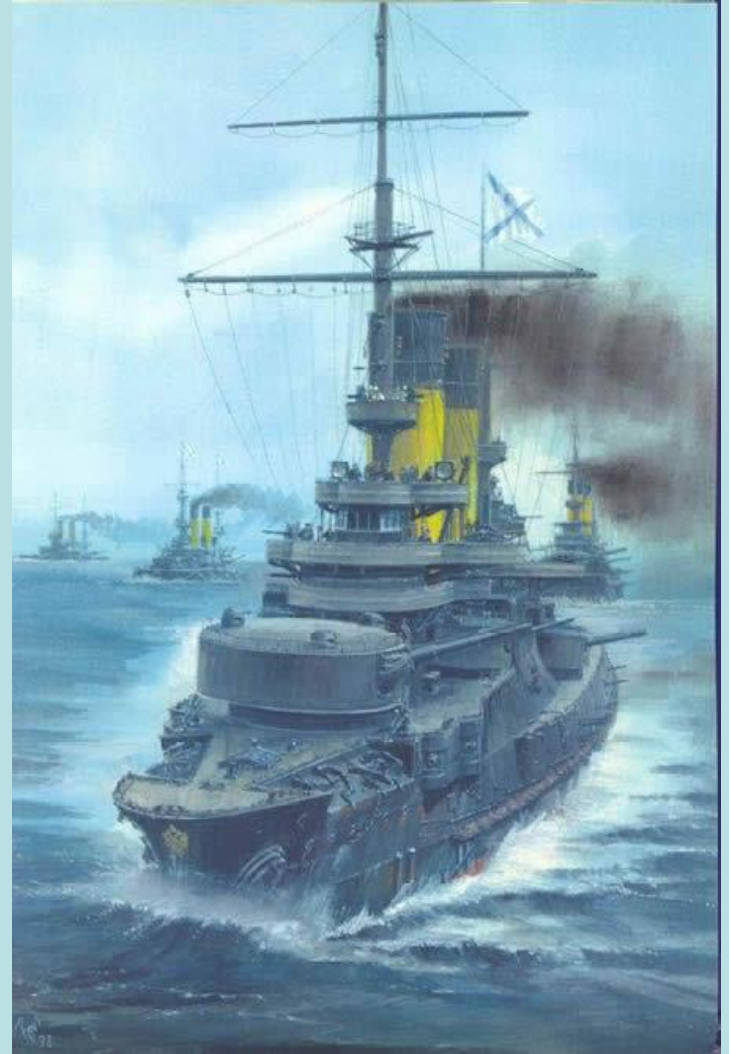
Russo-Japanese Theater of Operation



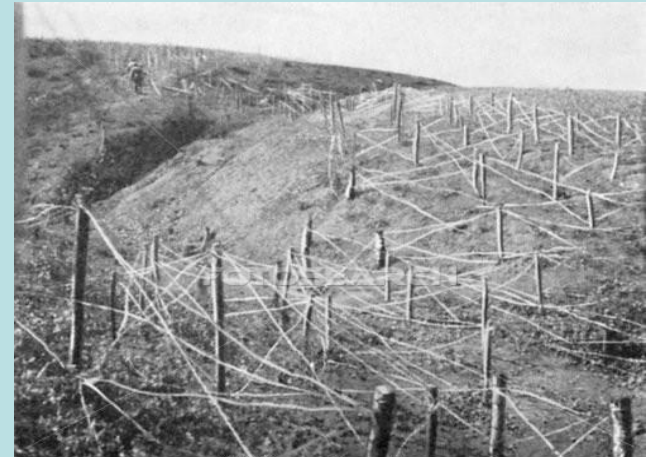
Land and Naval Operations



Preemptive Strike on Port Arthur



Siege of Port Arthur



1151240 www.fotosearch.com

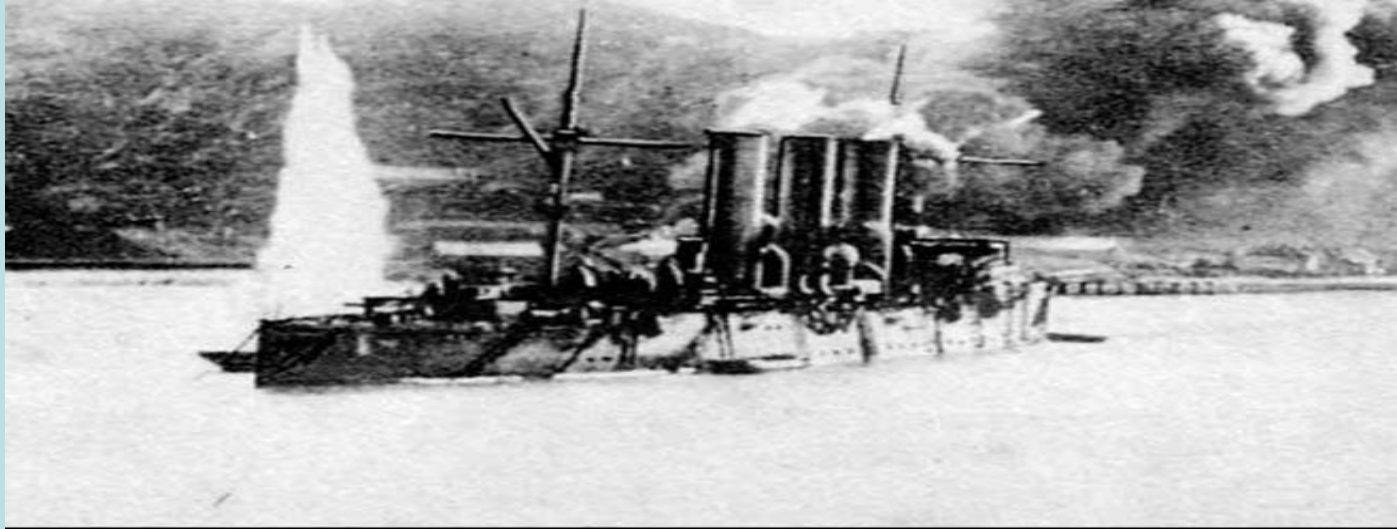


Battle of Tsushima

27 May 1904



Sea-Land Warfare Circa 1905

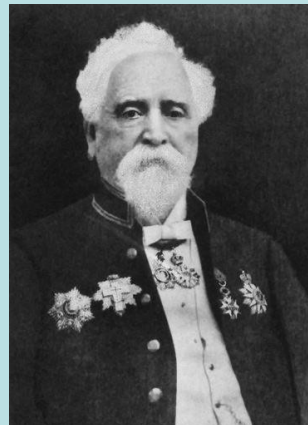
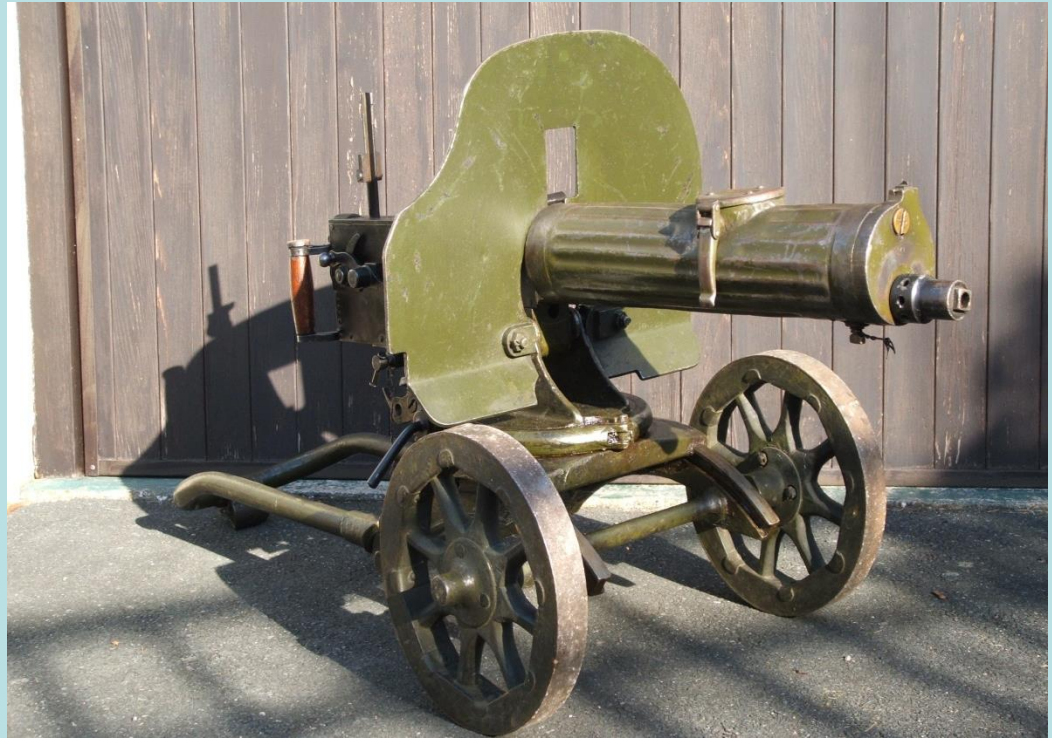


Major Innovations and Insights

- **Preemptive Warfare**
 - Surprise attack on Port Arthur
 - First use of motor torpedo boats
- **Extensive use of plunging fire artillery**
 - Key to Japanese success in breaking siege of Port Arthur
- **Extensive use of the destroyer and torpedo boat**
- **Night fighting with search lights**
- **Second major engagement with early 20th century armored warships**
 - Poor American gunnery during engagements with Spanish
 - Japanese superior gunnery during Tsushima
- **Mass casualties during infantry assaults**
 - Phenomenon of infantry going to fortified positions – seen during Crimean and U.S. Civil Wars
 - Use of the Maxim machine gun
 - Extensive use of barbwire by Russians
- **Relative ineffectiveness of horse cavalry**

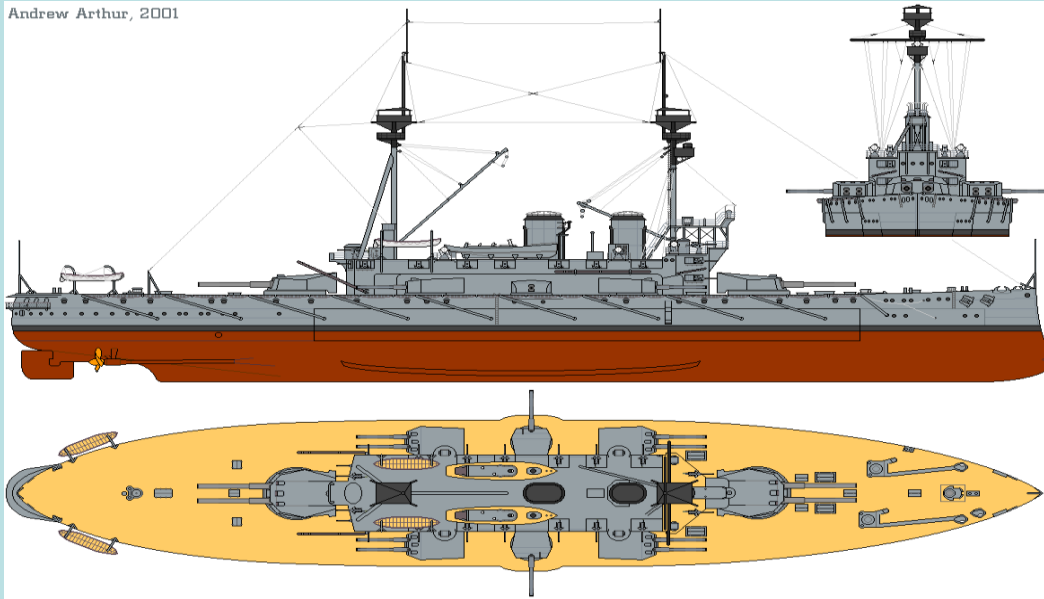
The Mass Killer – Its Uncertain Future Impact

Hilaire Belloc's poem, *The Modern Traveler*:
Blood thought he knew the native
mind;
He said you must be firm, but
kind.
A mutiny resulted.
I shall never forget the way
That Blood stood upon this awful
day
Preserved us all from death.
He stood upon a little mound
Cast his lethargic eyes around,
And said beneath his breath:
*'Whatever happens, we have got
The Maxim Gun, and they have
not'*



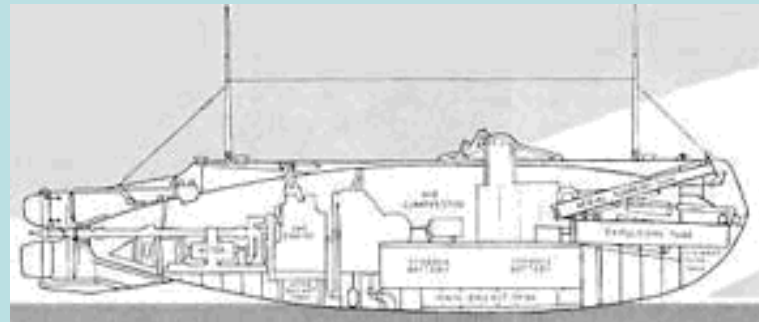
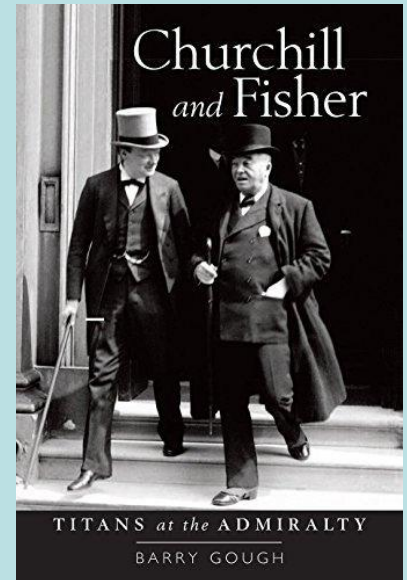
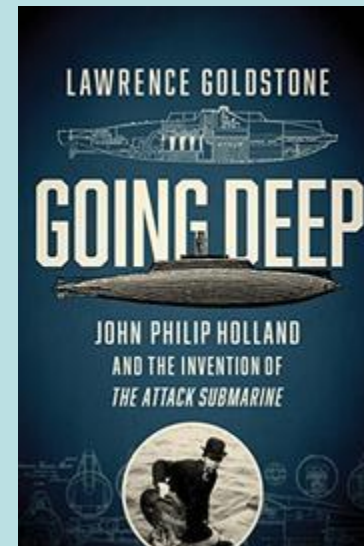
Pre-World War I Dreadnaught

Andrew Arthur, 2001

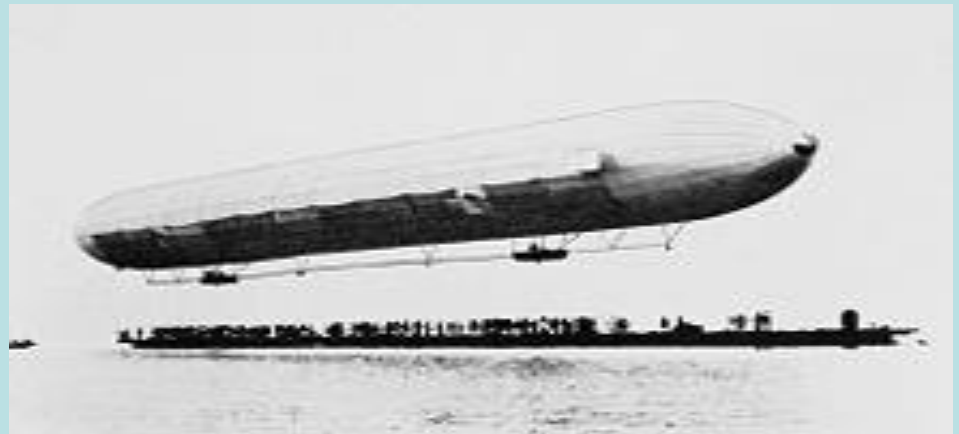
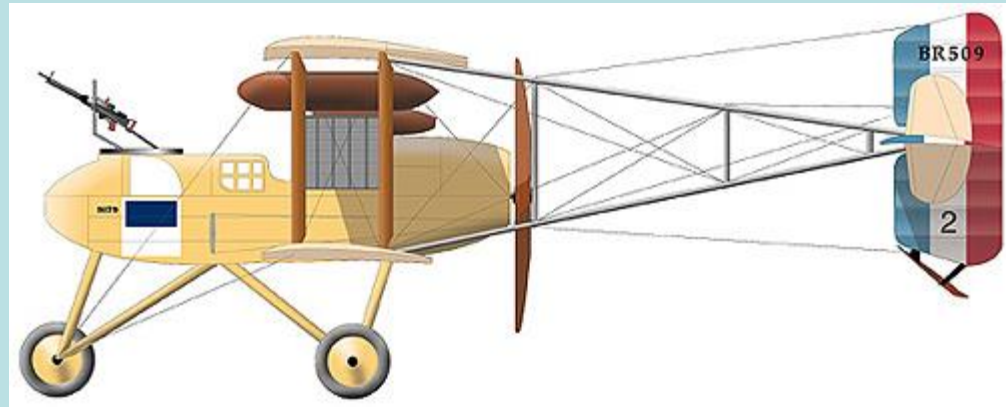
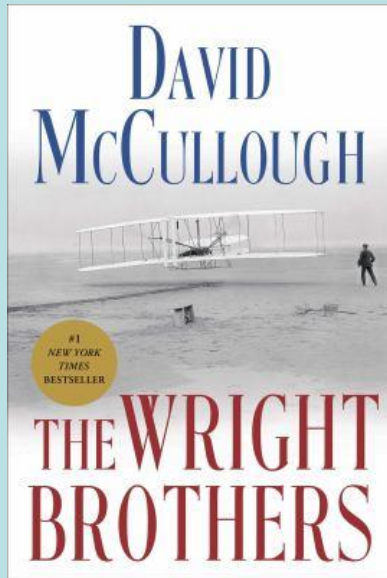


A New Form of Strategic Naval Warfare?

First Sea Lord Jackie Fisher Believed So



The Pre-World War I “Aeroplane” and Rigid Airship

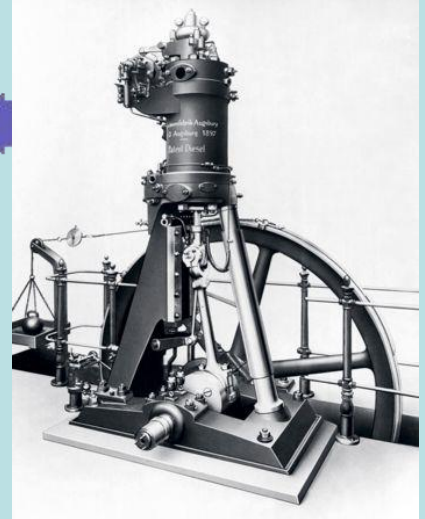
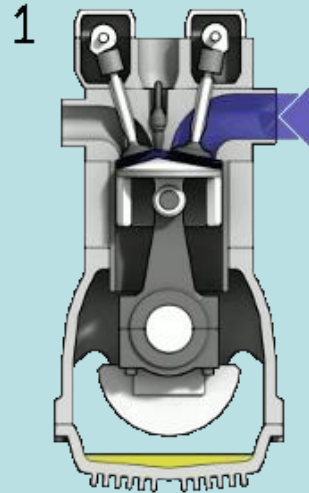


Fictional Land Dreadnought

H.G. Wells



The Otto and Diesel Cycle – Revolution in Ground Transportation



- **World War I greatly accelerated development and use of petroleum powered trucks and cars**

The Pre-War “Bipolar” World of Europe

