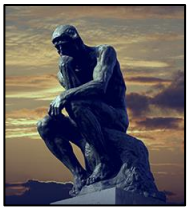

JHU/APL Rethinking Seminar Series
Rethinking Future Environments and Strategic Challenges

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JOHNS HOPKINS
APPLIED PHYSICS LABORATORY

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National Defense University

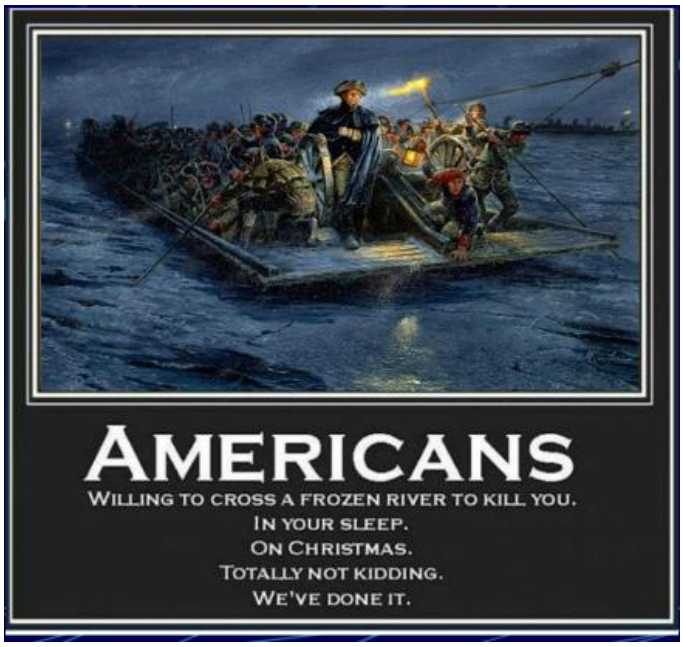
The 4th Industrial Revolution, De-Globalization, and its Effect on International Security

Notes:

1. Below are informal notes of the speaker's remarks as taken by a JHU/APL staff member.
2. The speaker used an extensive set of detailed slides (some of which included links to online videos) that are available in the Video Archives of www.jhuapl.edu/rethinking.
3. Links to the video, audio, and presentation files from other Seminars can also be found on the Video Archives, Past Series, and Speakers pages of the website. Videos from recent years may be found on the JHU/APL YouTube Playlist.

Introduction

In a disclaimer, Dr. Hammes noted that the views he was expressing were his own and not necessarily those of the Department of Defense or the National Defense University. Dr. Hammes then defined deglobalization as all the technologies that are coming together to change the globe economically that will lead to deglobalization. Subsequently, deglobalization will create a very different security situation for the US. He also noted that there has been some concern about of a weakening of the Americans willingness to fight. As a counterpoint, he offered this slide:



Analysts must look at a range of futures and much has been written about the globalized future. Dr. Hammes noted that he would discuss another of those futures—deglobalization.

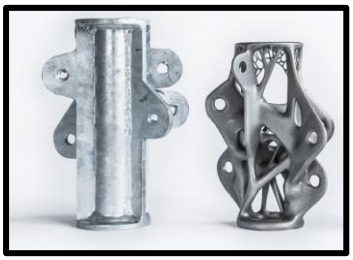
Indicators of Deglobalization

- Total international trade as percentage of GDP is decreasing
  - International trade is increasing but not as fast economic growth, which indicates that countries are producing more goods domestically
  - Picture is more severe when look at trade in goods and not both goods and services
  - Growth in international trade is largely regional
    - About half of US international trade is with Canada and Mexico
    - About 70% of Europe's international trade is within the core of Europe
    - Asia is becoming more and more of a trade center
- Growth in global shipping container throughput is projected to remain below GDP growth
  - Usually, growth in container throughput indicates increases in GDP
  - However, this GDP growth appears to be from domestic manufacturing or production of goods that are not being shipped in a container (some may go by air)
- Global financial flows that were almost 15% of GDP before the economic crash are now down to only 2% of GDP
  - Developing countries had the most dramatic drops
  - 2010 saw recovery for both the financial flows into developing countries and the GDP
  - Investment in developing economies fell off more recently
    - Over $400B left developing economies
    - Some of the change is from attempts to put money in safer economies or related to currency rate changes
    - Normally, in globalization you are looking for cheap labor rates requiring global investment but that isn't happening
- Deglobalization is not a new phenomenon – it's a historical cycle
  - You globalize when there is money to be made and deglobalize when profit goes away
  - Usually driven by political issues such as the tariff wars of the 1930s or security issues such as real wars
    - It took until 1977 to reach the 1914 level of globalization which was derailed by two world wars
    - Oil crises pushed globalization when containers made transportation cheaper and computers made tracking goods easy permitting the use of cheap labor globally
    - It was possible to make more money by manufacturing where labor was cheap, i.e., subassembly in SE Asia, higher order assembly in China, then shipped globally

Causes of Deglobalization

- Deglobalization today has totally different drivers: *technology, energy production, social,* and *political*
- Key new element in deglobalization is that the cost of labor advantage is disappearing
  - If the cost of labor overseas is no longer cheaper than domestic production, there is no reason to produce goods overseas given transportation and inventory costs
  - Other costs are also involved as are problems of response time to the market

Technological Drivers with The Most Immediate Effects



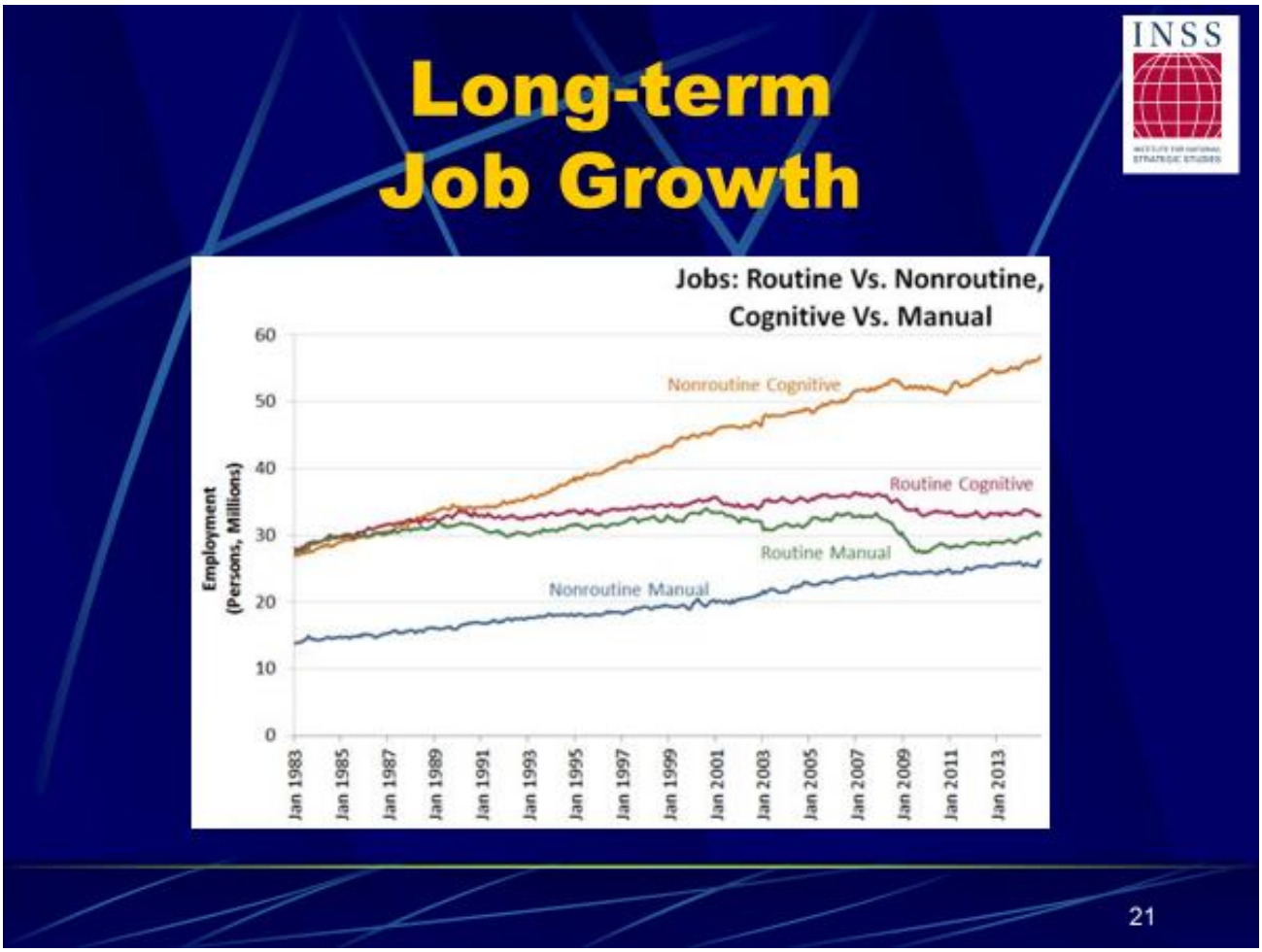
3-D Printing – making rapid progress from printing complex items using plastics to now producing those same items in metal

- The items in this picture are fasteners used in the walls of skyscrapers – thousands are needed in each building
- The 3-D printed one on the right is much stronger and 40% lighter and cheaper than the one on the left, i.e., a traditionally manufactured part
- Other examples of 3-D printed items include: metal replacements for human ribs and items that can be printed here in the US without relying on subassembly parts from SE Asia
- Automated 3-D factories require very few people and can increasingly produce a lot more product with a lot fewer people

Robots

- Industrial Robots are wide-spread but have significant limitations, i.e., they often require major safety considerations, and it is hard to make changes in the production line
  - Despite problems, they are already cheaper than Chinese labor today
  - Example: China built a new truck plant that makes 150% more trucks with greater reliability and without 90% of the workers
- Collaborative Robots (COBOTS) will make the real difference
  - They can be moved and retrained very easily – even multiple times a day
    - Programing may take only 20 minutes and doesn't need a specialist
  - Cost is reasonable especially since they work 3 shifts and never call in sick
  - COBOTS solved a problem for BMW where the workforce averages 47 years old and were having problems lifting large pieces that the robots now do for them
  - See an example at https://www.youtube.com/watch?v=IQ-h5KY703o where adding robots doubled production creating 50 new jobs in Denmark but eliminating many jobs elsewhere in the world
- Social Robots (SOBOTS)
  - Can do jobs such as teaching assistant, associate lawyers, radiologists, diagnosing oncologists, call center operators
  - Georgia Tech used Jill Watson, a version of IBM's Watson computer, as a teaching assistant for an online course
    - No one knew but praised her highly
    - "Best teaching assistant ever;" on-duty ready to answer 24/7
  - Another Watson version looks through every bankruptcy case filed in the country and sends relevant cases to senior partners in a law firm
  - Computers have been found to be better at radiology and oncology diagnoses
  - India has lost 70,000 IT jobs in call centers in the last year as the work is moved back to the US but it is being done by computers
  - Insurance clerks who gather data and fill out forms are being replaced by computers freeing humans for higher value work but eliminating some jobs
- SEWBOTS require bringing together high skills and complex operations
  - It was thought that clothing manufacturing would be one of the last areas that could be automated considering difficulties in handling, matching, cutting, etc.
  - Two companies have managed to fuse all the activities using different methods

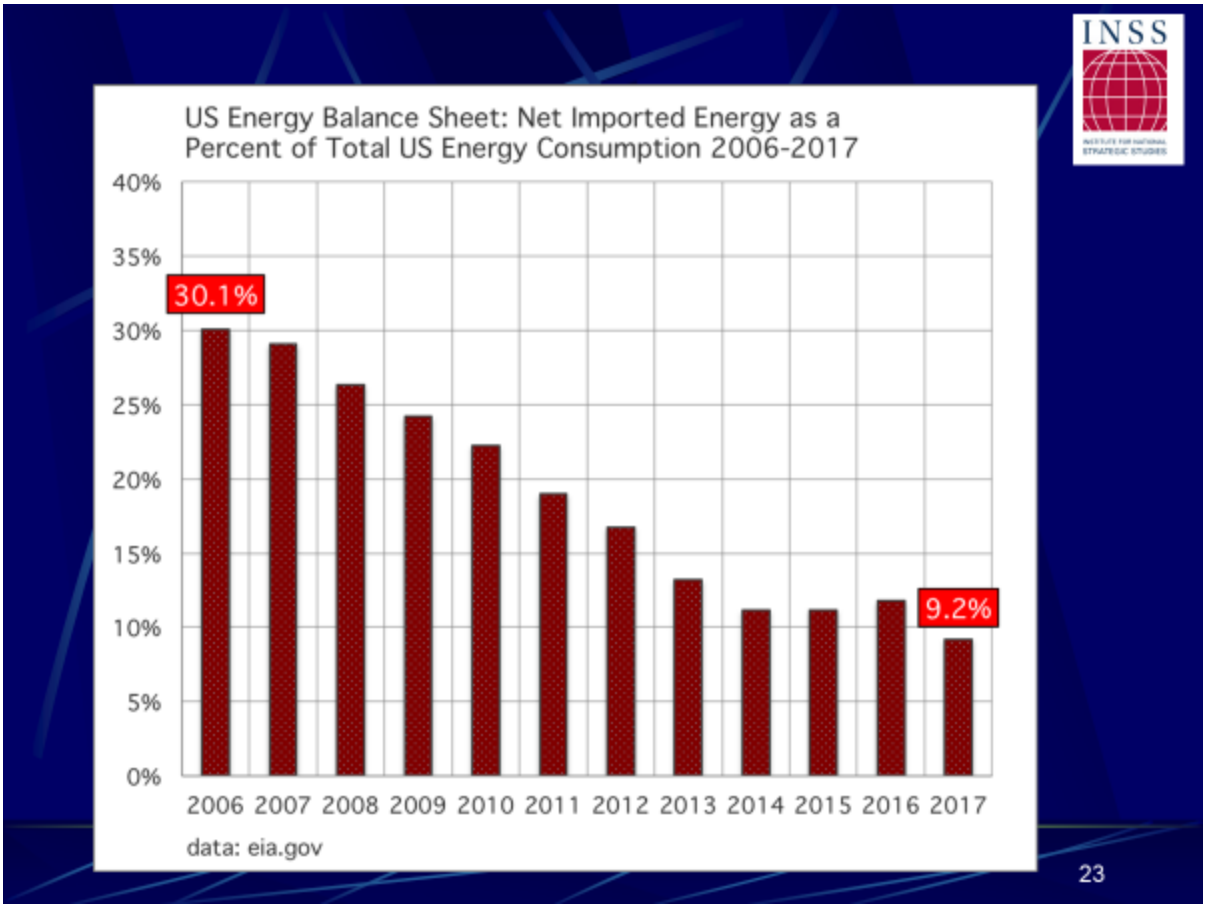
- Despite all the clothing makers going overseas, the US has maintained a cloth manufacturing industry because it was relatively easy to automate
- Now that automated cutting and sewing have been developed, production of clothing is returning to the US
- See https://www.youtube.com/watch?v=qXFUqCijkUs for an example of SEWBOT and its many phases of operation
  - This video was made by an organization that is concerned about the impact of automation on jobs in Asia
  - The problem: 67% of women's jobs in Vietnam are in clothing manufacturing (its over 70% in Bangladesh)
  - Such problems are not a new phenomenon



- Bottom line: As indicated in the chart above, once computers arrived, jobs in mostly routine tasks no longer grew at the same rate as jobs involving nonroutine tasks
  - If routine jobs had grown at the same rate as nonroutine manual, the US would have 30 million more jobs (50 million more if at the rate of nonroutine cognitive)
  - Routine tasks are the ones that have been automated up until now
  - Now as AI comes on line, we will see the nonroutine rates fall off, too, in areas such as sewing and work that can be done with printing machines

Changing Energy Flows

- Energy (in liquid or gas forms) moves easily around the world with natural gas having distinct trading regimes while oil is mostly in a global market
- The US hit peak energy demand a couple of years ago and is not growing even though the economy is growing because of newly introduced efficiencies
- Energy demand is still growing globally but not as fast as it was
- Energy production has improved significantly largely because of shale oil, which involves microwaving oil and water out of the rocks, bringing the cost down to $65/bbl
    - The US has 3.7 trillion bbls of shale oil
- Progress in producing renewables is also making great strides
- Bottom line: Energy imports to the US have continued to fall as indicated in the chart below
    - US production dropped when oil prices went down and some shale producers left the business
    - But, they came back when the prices went up
    - Producers could put another million barrels on line in about a year



    - The US is now importing only about 9% of its energy, most of which from N. America
- Changes in the cost of natural gas has made a huge difference to the US economy
    - When the prices were at the highest for the US, the chemical processing industry started to leave because most of it was based on natural gas

    - As the cost of natural gas dropped dramatically for the US, it created a massive advantage and chemical processing has begun to return
    - The situation could even improve when more pipelines and better storage methods are developed cutting down the amount of gas that is now lost to flaring
- Renewable energy growth has been very significant worldwide
    - Two years ago, 58% of all new energy installations in the world were for renewables, mostly solar and wind (68% in the US)
    - Now more efficiencies for wind are being developed, but there may be problems for the solar industry given the recently announced solar panel tariffs

Other Drivers

- Social drivers
    - Mass customization can now be accomplished using technology and AI giving companies reasons to move back to the US and providing new business opportunities
        - Adidas is building 20 new factories in the US to be near its markets for fast product turnarounds
        - Nike has buyers run on a treadmill while a system analyses their feet so that a 3-D printer can produces a specific shoe for each foot
        - One company is testing in-store production of machine-knitted sweaters delivered in 4 hours after a customer choses the style, yarn, etc.
        - Bottom line: More customers are demanding the fast fashion already found in Europe and beginning to come to the US
    - Environmental issues show up in the form of the *produce local, eat local* movements
- Political drivers
    - Protectionism has been growing – since 2008 there have been over 4,000 such measures worldwide with only 740 reversed
    - In reaction to US tariffs on solar panels, the Chinese are considering tariffs on sorghum and soybeans
    - Problem: Protectionist wars could be very bad for the US
- While the internet was supposed to unite the world, it has been fragmented as China has figured out a way to block its people off from the world wide web
    - China carved out its own internet with its *Golden Shield* and *Great Firewall*
    - China also collects vast amounts of data on its people to build individual social scores that determine who can go to a school, travel, etc.
        - People don't know their scores nor how to improve them
        - Result: People fear pushing against the government
        - Russia is adopting a similar system

Economic Impacts

- Long term trends have been really bad for manufacturing jobs in the US

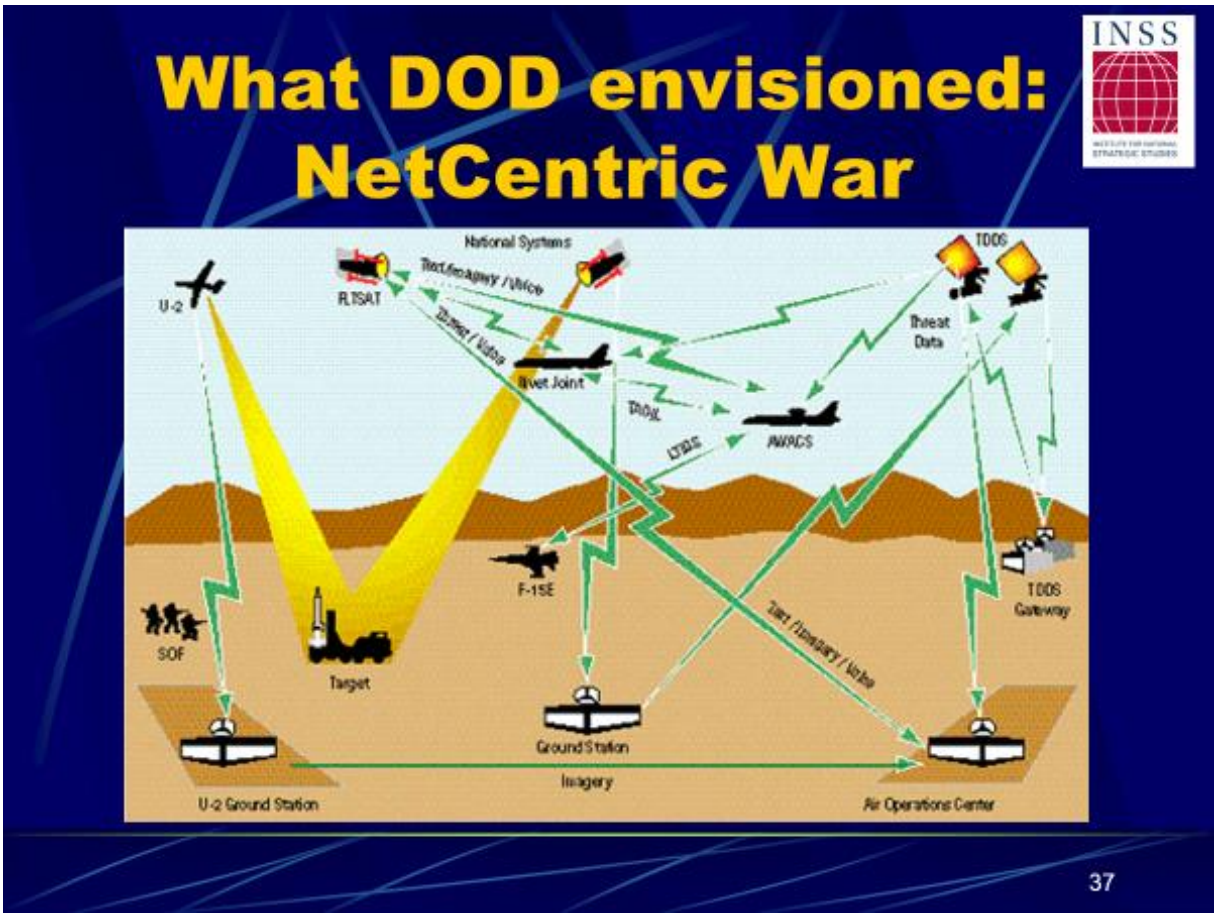
- Big drops in manufacturing jobs began when China joined the World Trade Organization (WTO) while output continued to climb
  - Of note, manufacturing jobs were beginning to increase again in 2010
  - Despite all the talk of the collapse of US manufacturing, it isn't given that 800,000 jobs were gained in the last 5 years plus:
    - US industry is still short 400,000 trained workers
    - 2015 and 2016 were record years for Foreign Direct Investment – over $400B was invested each year with 70% going into manufacturing
- Bottom line: US manufacturing is not in trouble: For the last 2 years 2% of the economy was foreign people investing in US manufacturing
  - Manufacturing is not as big a part of the economy as it used to be but it is recovering
  - Recent quarterly reports appear to show the same trends but there may be changes given changing US policies on taxes, etc.
  - US GDP from manufacturing is also steadily increasing
  - The US share of global manufacturing value added dropped as China's rose but the US share has begun to move back up starting in 2011

- Economic impacts of deglobalization include
  - Greater global prosperity
    - Developed countries will have much greater wealth when you eliminate the cost of labor as it goes down to next to nothing
    - Problem: As in all industrial revolutions, capital is favored over labor
      - When industrialists buy 4 COBOTs to replace 9 people, they don't give the money they save to those who lost their jobs

        - How do we do income distribution since we are not good at it?
    - The US is in great shape since it is largely energy and food independent, with manufacturing and services returning
        - Currently, only 13% of the US economy is based on exports
    - Regional economies could do well
        - Regional supply chains plus market size will shape the emerging markets
        - North America could be a largely independent economy when you add the three countries together totaling over 500 million people in the region
            - It could be energy independent with some pipeline, etc. issues
            - It is already food independent
            - It could even be manufacturing independent
        - Europe and Asia are already trading regionally
    - Problem: Premature deindustrialization could occur for areas that were cheap labor destinations – now COBOTs are the cheap labor and they work everyday

4th Industrial Revolution Changes to the Character of War

- First rule of warfare: Leave mountain people alone (Tuscans, Afghans, Basque, West Virginians)
    - They are up there because they want to be there and left alone
- Warnings about predictions - come from looking at a 1992 slide predicting the future of warfare
    - Note that the only fighters on the battlefield are Special Operations (SOF) and no one talks to them
    - Did not turn out that way



- DoD predicted it would win wars without people, but recent history has shown that was wrong
- New predictions involve converging technologies that lead away from the few and explicit weapon systems we are building (powerful aircraft carriers, all-seeing F-35s, etc.)
- New weapons systems are predicted to be: *small, smart, many,* and *very lethal*
    - *Small*: Explosively Formed Projectiles (EFP) can be 3 oz. projectiles that could punch through a half inch of steel
        - If you add energetics (explosives), you get 10 times the power of TNT
        - Even more impact if use EFP on a 1,000lb T-LAM warhead
    - *Smart*: IEDs that hunt you use drones like those seen in in this YouTube video https://www.youtube.com/watch?feature=player_embedded&v=QRrSriR5b6s
    - *Many*: It is now possible to make vast numbers of drones cheaply using 3-D printing
        - An $800, 50-km-range drone, built in 28 hours, was made from a few 3-D printed parts and online-purchased batteries
            - $600 of the cost was the cell phone used to control it
            - It would be possible to put a small explosive on the drone and direct it into the nose of a vehicle destroying the engine
        - 3-D printing will become ubiquitous – UPS is getting into the business since it believes that the shipping business will eventually decline
            - 3-D printing plants will have thousands of printers which would permit printing hundreds of drones in a day
            - A dedicated factory could produce 100,000 cheap drones that could be converted into anti-vehicle weapons
        - Problem for ground fighters: How can I move with 10,000 drones over my brigade everyday that could kill my wheeled vehicles (but not armor yet)?
        - Drones can be mass launched: China has a 600-mi range Harpy autonomous system; the US can operate swarms of 100 drones that coordinate with each other
            - Many other countries also have drone systems that can reach hundreds and even thousands of miles; payloads are small but adequate in number
            - Some systems have stealth configurations; others can be cheap enough to be flown on lengthy one-way missions with significant payloads
            - Some can deliver ordnance for less than the operating costs of the F-35
            - Major advantage: Systems that are vertical take-off and recovery do not need airfields eliminating the threat of preemption
    - Cheap space can tell the drones where to go using inexpensive 3-D printed rockets to launch inexpensive, 3-D printed cubesats
        - Tiny cubesats already have enough camera resolution to provide a clear image of a car from space, while radar and thermal versions are being developed
        - Example: India launched 101 cubesats on a rocket last year; 88 were owned by one company that will sell you imagery of any point on the planet every 24 hours
            - If you are interested in what you see, they can shift to a slightly larger satellite to get half-meter resolution
        - Bottom line: The concept of hiding at sea or hiding an airfield are gone
    - Other systems can be hidden in plain sight: The Russian Sunburst system fits in a standard shipping container but can launch supersonic missiles up to 800 mi
        - China could easily put such systems on any number of their 200,000 fishing vessels and trucks that could handle such containers and they could become launchers

Future Weapons Systems

- Directed Energy: Lasers and Microwave
    - Land-based lasers have the advantage of being attached to power grids to support their massive power requirements and it is easier to conceal land-based systems
    - Weaknesses for lasers would be their problems with the presence of any smoke or haze in the target area or the possibility of reflective coatings on the target
    - Microwave problems in the past that required Faraday cages have less problems now that such cages can be 3-D printed around the equipment
- Looking at historical patterns related to the replacement of weapons systems gives some indication of future changes
    - Weapons system changes begin with an *assistant*, then a *partner*, then a *replacement*
    - Aircraft were originally *assistants* to battleships allowing them to look over the horizon and calling the shots for the ships
        - By the 1930s aircrafts were *partners* actually making the first strikes before the battleship could arrive
        - By the 1940s aircraft completely replaced the battleship
    - In general, we already have drones as partners but in some areas such as long-term surveillance drones have already replaced manned aircraft
        - DoD now uses cruise missiles for deep strike when the range is too far, or the threat environment is too high for manned aircraft
- We must look at these changing situations with honest, rigorous experimentation
    - If dishonest, then we will wind up in situations like the French methodical battles that worked well in exercises until the Germans showed up for a live fire game
        - Same sort of situation happened with US reliance on battleships instead of aircraft carriers at the start of WWII
    - For irregular warfare we must consider the converging elements of small, smart, and many, all of which favor the insurgents who also have the advantages of:
        - Less bureaucracy (meaning less lawyers) and less targeting issues – they can strike whatever they want to
        - Less infrastructure to protect and it was here that ISIS made a mistake – they provided a target for the US and allies to strike at when they took control of land
- The West must recognize that there is no more immunity for its comfortable bases since they now are so easy to hit given drones and other weapons available to irregular fighters
    - There are no more secure lines of communication
    - Insurgents can do things like blowing up an aircraft at a civilian airport to impede the US and allies tying to send their forces into a specific theater
        - Fighters can bring a small charge to use as a detonator since the explosives will already be there in the form of full gas tanks on the aircraft
        - They can threaten to do it again unless the US and allies are prohibited from using regional airports
        - By then civil airlines will stop flying in, thereby harming the local economy
        - Even important distant hub airports such as Frankfurt am Main
    - Meetings to get local hostiles talking could easily be threatened by drone attacks
    - Outside sponsors could be very powerful again since they could easily supply lots of off-the-shelf drones, no longer needing years of negotiating for planes and pilots
        - As in the Cold War, Russia could have others cause problems for the US

Changes to the Conventional Ground Domain

- Autonomous drones already exist and are cheaper than ATGMs for providing mass precision targeting
    - GPS is no longer needed with weapon systems returning to inertial guidance to get to the target area and then using visual guidance to do the rest
- Ground systems will evolve perhaps by flying drones into hostile areas and then allowing them to sit and wait for the target to come in range
- Mass reappears, now with precision targeting and these drones don't need to be smart
    - We could already swarm 10,000 dumb drones today – maybe 2,000 are so dumb that they run into each other and good air defenses could knock out another 5,000
        - Result: There still would be 3,000 drones left to hunt your vehicles and more could come back the next day
    - Dispersed 20-foot containers/pods can operate independently or as networks and it would be hard to preempt them since they look like normal containers
        - Standard shipping containers could also be used to hold huge amounts of explosives making 50,000 lb. IEDs when hit by the other side's attack
- Now may be the same as 1863 in the US Civil War when, because of the rifled musket and rifled cannon, nothing above the surface of the earth could survive a mass attack
    - That problem wasn't solved until WWI when the Germans developed storm trooper tactics
- Bottom line: We may be entering a period when defense is dominant in ground warfare

Changes to the Conventional Sea Domain

- Small drones can't sink ships but they can do mission kills
- If an aircraft is blown up on a carrier flight deck, it can take 96 hours to a month to repair
- Mission kills on an Aegis ship could be done with shotgun-like blasts to radars or the big boxes that contain missiles which won't take much to blow up
- Smart mines already exist and are becoming self-deploying at great distances such that the US should be practicing breaking out from ports as we did in the past

Changes to the Conventional Air Domain

- The F-35 will eventually be a great aircraft but the enemy won't bother fighting the US in the air and doesn't have to
- It is easier to hit aircraft on the ground and all the systems that support them, i.e., other aircraft, logistic nodes, command and control nodes, etc.
- Recent study: If China suddenly attacks US bases in Japan, they would hit all ships in port and all headquarters, crater all the airbases, and kill 200 aircraft on the ground within the first few hours
- Cruise missiles could take over most air missions in the assist/partner/replacement trend
    - Drones are already in partner mode when they accompany F-35s and are under the aircraft's control
    - Key problem: US bases are no longer sanctuaries
    - Key question: Is the entire US manned aircraft fleet obsolete?
        - Kratos drones have a range of 1,500 mi (2-3 times that of F-35s) and cost $2m
        - The US could buy 65 Kratos for the price of one F-35 without counting the $45,000/hr operating costs, pilot and maintenance pipelines, air bases, etc.

    - Range is the real problem: Manned aircraft have ranges out to 800nm or less while cruise missiles and even cheap Chinese missiles and drones can reach nearly 2,000nm today
        - Range obsolescence has historically been a problem in warfare – armored knights could take apart bowmen if they could just get close enough
            - Battleships could out fight carriers if they could get in range
            - Even B-21 airfields in Missouri would be vulnerable to Sunburst cruise missiles shot from a merchant ship in the Gulf of Mexico
    - Bottom line question: Are we spending billions of dollars on obsolete weapons systems?
- Tradeoff costs:
    - F-35s cost $100M (or maybe $125-140M), plus $45K per operating hour
    - Carriers cost $20B with their air wings but not counting their battle groups
    - Loitering TLAMs did cost $1.1M but with new Additive Manufacturing could lower the cost to about $600K
    - Cost equivalents:
        - 1 F-35 costs about the same as 160 TLAMs or 50 QX222 drones
        - DoD can buy 1 more TLAM for each month that a squadron doesn't fly an F-35 (just counting operating costs)
        - In a similar situation, DoD can buy 3 more QX222 drones for each squadron month that F-35s aren't flown
        - Instead of buying one aircraft carrier DoD could buy
            - 33,000 TLAMs or 10,000 QX222 drones or
            - 6 Virginia Class submarines plus17,000 TLAMs
    - Carriers are obsolete since they can't get in range of the target
        - Still useful in low intensity conflicts if fighting Afghan tribes or Iraqi militiamen

Changes to the Conventional Space and Cyber Domains

- Everyone already has space assets
- Surveillance will be ubiquitous – There is no more hiding at sea or hiding airports
- Everyone will have space communications and potentially space attack capabilities
    - Cubesats are already being developed to maneuver enough to repair other cubesats
    - If you can maneuver cubesats close enough to do repairs, you can make them do less beneficial operations to others' satellites
- Cyber Domain
    - We must recognize that all cyber originates in the real world and it is possible to strike these exposed nodes (servers, networks, etc.)
    - It is also possible to strike underwater cables and their key nodes inland
    - EMP cruise missiles could be used
    - Quantum computing could have an impact but that is currently unclear since it is still some time away
    - Electromagnetic spectrum warfare is not a domain for the US because it falls under cyber and unless it has its own presence in DoD's budget it won't get much funding
        - It is a specific domain for Russia and China and both are very good at it
        - The US is not even in the game

Strategic Implications of Deglobalization

- Decreased American interest in international affairs can already be seen
    - Previously, when there was trouble in the Middle East, US oil prices would go up and so would gas prices, but that is no longer the case
    - Similar situations will occur with manufacturing
- The cost of intervention will increase since the US will need to figure out how to defend itself from the time its forces leave the homeland on the way to any hostilities
- The concepts of mass and mobilization will return
    - The US has been moving to fewer and fewer platforms
        - Peak global production for the F-35, which is projected to occur in 2022, will only be 17 per month for 7 air forces, 2 navies, and 1 marine corps
        - This won't be combat replacement numbers
    - If you are going to need mass, then you must plan for mobilization
        - The civilian factory may be able to print 10,000 or 100,000 drones but they won't be handling the explosives
- We need to recognize that wars will be long, i.e., short wars are a fantasy
    - Looking at 200 years of history, we can see that wars between developed, relatively healthy states have lasted between years and decades
    - Short wars have only happened when a healthy state fights a collapsing empire – Japan against Russia and China; Germany against Austria and France; the US against Spain

Operational Implications of Deglobalization

- Does tactical defense become dominant?
    - The US considers itself a power projection force but that will become more difficult
    - It will be easier to deny a domain than to use it
- Dominance in any domain will be much more difficult
- Cross domain attacks will be easier: It will be easier to launch long-range cheap drones at a cyber system when it comes out of the ground in the homeland

Implications for Great Power Competition

- The good news is that the coming changes favor the defense and geography favors the defense for the US
    - China has to break out of the First Island Chain and Russia has to come out of Russia
    - Defense in both places can be dominant and relatively cheap
- The US can sustain its alliances by talking to smaller powers, discussing this fundamentally defensive approach, and developing lower cost weapons that the allies will also buy
    - Problem: If the US buys F-35s, then the allies think they should buy F-35s
    - Pilots think pilots should exist even though drones can do everything pilots can do

Big Questions

- Does *small, smart, many* dominate the few and exquisite?
    - If so, are we buying wrong stuff?
    - Pouring in lots of money won't do any good if you are buying battleships in 1940
- Will land power come to dominate all domains?
    - If we have cruise missiles and ballistic missiles that allow us to stand off 2,000 miles, do we really need to worry about the adversary's navy or air force?

    - Bottom line: DoD needs some vigorous wargames
- Will the Fourth Industrial Revolution lead to deglobalization and, if it does, will the US move to regionalism and give up on the world and just stay home?

QUESTION & ANSWER SESSION

Re: Artificial Intelligence (AI) for Cueing

- AI is not yet advanced enough to take over more elaborate thinking processes; so far our capabilities are limited to task-specific AI
    - We can already tell a drone to go out to a general location, look for a specific type of aircraft with specific characteristics, and when found, attack it
- General AI is not ready yet to carry out human-level thinking processes
- It is possible in closed societies to use Big Data with data-mining techniques on cell phone records and other sources that can help identify what is happening and to cue analysts
    - Data sources could also be movement of goods or long-term imagery studies
    - AI is not really that useful to control societies at this time

Re: The Nature of War

- Wars always involve confusion, passion, chance, and reason
- In the future, people will still be involved in making war unless the machines will decide everything and the humans are just slaves
    - People will still decide when and where to fight
    - Chance will be involved: Who is in the White House and does the president believe that the bloody nose attack is the best idea for handling a potential adversary?
    - There will always be different human opinions about what are good ideas versus bad ideas
- We must always expect uncertainty since one side won't always know what the other side was thinking – especially when the other side is a very alien culture such as N. Korea or China

Re: Return of Industry and Jobs to the US

- The 4th Industrial Revolution will allow some developing countries to skip industrialization
    - Some regions in Africa are already depending on local power grids and batteries so that they can skip national power grids
    - Use of cell phones has permitted skipping national telephone landline systems for some states
    - In badly managed countries where corrupt officials own the power companies, equipment for the regional companies is often destroyed whenever it is installed
- Premature deindustrialization and that could cause a good deal of unrest
    - The US is in a fairly good situation because the US, Canada, and Mexico can have pretty good tradeoffs and wealth – if we don't mess it up
    - Big problems would occur if a collapse occurred in the Middle East or Africa sending huge waves of migrants to Europe
        - This issue has already caused a split in threat perceptions in Europe and NATO
        - The northern and eastern countries see Russia as the biggest threat
        - The southern and western countries see migrants as the biggest threat
        - Result: Two different sets of defense and security concerns in one alliance

- Historic studies can provide some hints of how the earlier Industrial Revolutions affected populations using data from records kept on British cities
    - 1790-1820: In the first Industrial Revolution one can see steady improvement in the human condition from major improvements in life-expectancy and health
    - About 1820: The 2nd Industrial Revolution starts and human condition (life-expectancy and health) begin to dip
        - People then had to move to cities and work at various mills
        - Conditions were horrendous causing health situations which lead to high death rates and those conditions remained until about the 1860-1870s
    - Between 1870 and1890: Life-expectancy doubled in the cities as working and living conditions improved for inhabitants
- Key question now: How long and how deep will the dip be for the 4th Industrial Revolution?
    - How well will we do wealth distribution?
        - Problem: We usually do not do that well in the US
        - China has similar problems with large disparities between the rich and the poor
    - Coming up with a government system that can handle this problem will be a real challenge

Re: Demographics and Wealth

- An aging population might not be a bad thing in the long run where more wealth will be distributed among a smaller number of people
- The US and China will probably be better off than countries with young populations that are still growing
    - The US is still growing somewhat but China is aging faster than any other country except Japan
- One major factor in demographics is the empowering of women by providing them control over reproduction through birth control options
    - After the introduction of such an option, we always see a tremendous decline in the birthrate, i.e., a positive concept for most populations
    - This would be a more positive impact than cheap robots
- If Third World countries can get past their population bulges, then things should improve
- Cultural differences:
    - In the Middle East and elsewhere, one person in a family of 10 or 12 may work and support the rest
    - In the US family members may think, “I’m working and you aren’t – too bad for you”
- Bottom line: Demographics will depend a lot on the social structure and` how it is operating

Re: The Future of Deterrence

- We must always keep the will to fight – See the first slide on what Washington’s troops were willing to do crossing the Delaware
- Deterrence is always a matter of denial and punishment
    - If you have denied the adversary you have deterred them as long as they know it
    - So, there also must be an information campaign involved in deterrence
- Example: The Baltics could never raise enough armored divisions to stop a Russian invasion
    - They could have a yearly exercise with 5,000 cheap drones launching from normal 20-ft containers to attack target vehicles placed near the border

        - They could also set off a couple of 50,000lb IEDs set in containers
        - Such exercises must be well publicized
    - Rather than trying to teach civilians to fight infantrymen in monthly drills, teach them what they already know how to do in their own neighborhoods
        - They know where the containers are and are connected to lots of cheap cameras in trees that will alert them when the Russian convoys approach
        - They will detonate the container IEDs when the Russians get in range
    - Their jobs will be to blow up the container IEDs from a distance, just as the Afghans have done with road IEDs
        - As the Iraqis learned, there is no percentage in getting in a firefight with the US Army
        - However, blowing up US soldiers using IEDs seemed to work well
- Bottom line: New weapons systems give them denial (Russians might not be able to cross into the Baltics) and they would be punished for even trying, but there also must be an information campaign so that the danger to the adversary is clear