

US Navy Medical Resources in support of NATO Operations

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- The views expressed are those of the speaker and do not represent official positions of the U.S. Government or Department of the Navy.
- I have no personal financial interest in any product to be discussed.
- Material to be presented is unclassified.



BLUF:

- Navy Medicine Overview
- Navy Medicine's Europe Laydown
- What Interests Us/Keeps Us Up at Night
- How to Collaborate

“Why Me?”

“Why Me?”

- Operational: Flight & Dive doc, Jumpmaster, Subs, Marines, NATO Medical Evaluator
- Clinical: Board Certified - Anesthesiology, Critical Care, Undersea & Hyperbaric Medicine
- Academic: Trauma Instructor, DMCC and Anesthesia Board Examiner, “Futurist”/Think Tank, Co-Editor of Essentials of Disaster Anesthesia, 1st ed., Associate Professor
- Leadership: Navy Anesthesiology Specialty Leader, Force Surgeon, prior Chief Medical Officer x3, Office of SECDEF

“Why Me?”

- *Most Important:*

Friend of Johan

Navy Medicine Overview

Navy Medicine Overview

ONE NAVY MEDICINE

ACTIVE DUTY + RESERVE + CIVILIAN

+ SUPPORTING 2 SERVICES +

UNITED STATES NAVY

Hospital Corpsmen: 19,080 AC / 2,270 RC
Medical Corps Officers: 3,050 AC / 330 RC
Nurse Corps Officers: 2,430 AC / 940 RC
Dental Corps Officers: 860 AC / 135 RC
Medical Service Corps Officers: 2,350 AC / 180 RC

UNITED STATES MARINE CORPS

Hospital Corpsmen: 5,320 AC / 860 RC
Medical Corps Officers: 440 AC / 120 RC
Nurse Corps Officers: 160 AC / 40 RC
Dental Corps Officers: 230 AC / 70 RC
Medical Service Corps Officers: 330 AC / 65 RC

* Total Force Estimates

BUOYED BY 2,700+ CIVILIANS

+ OPERATING ABOVE, ON, AND BELOW THE SURFACE +

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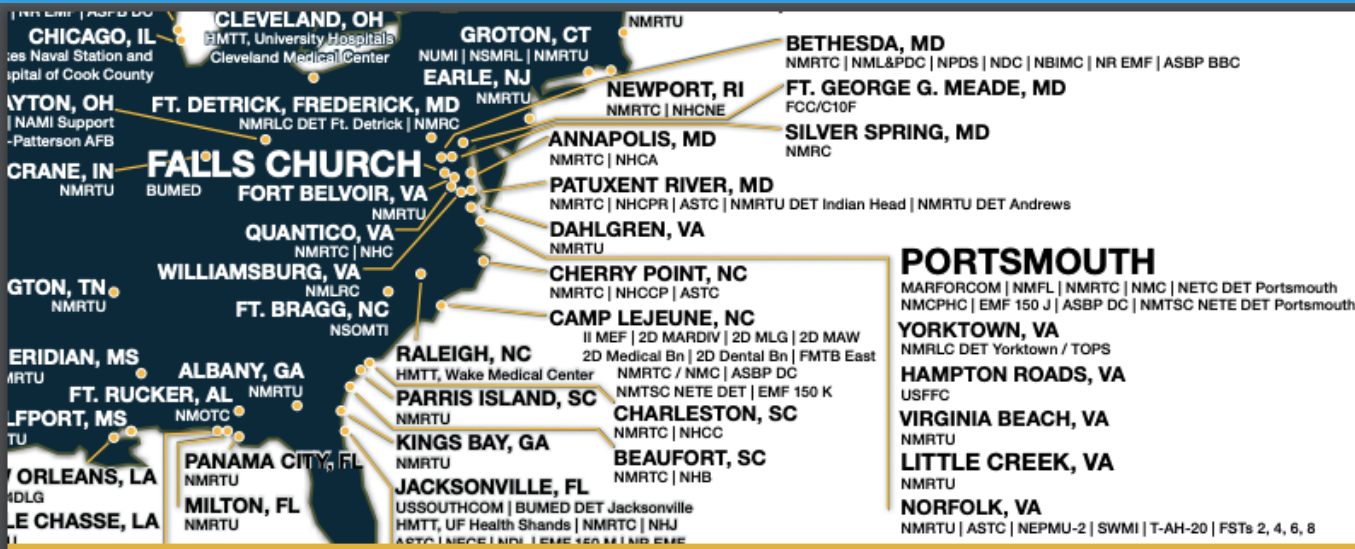
Navy Anesthesiology

- 180 Active Duty (OF-2 - OF-8)
 - 25+ in training
 - 15+ in senior roles
- 60+ in Reserves
- All: Commissioning, Medical Corps, Residency
- Increasingly:
 - Operational specialty (flight, dive, sub, Marine)
 - Fellowship (critical care, pain, cardiac, trauma)
 - War College
 - Overseas Tour

Other Entities

- Army Medicine - Landstuhl Regional Medical Center
- Air Force Medicine - RAF Lakenheath, et.al.
- Defense Health Agency (DHA) - hospital “owner”
- US Coast Guard, Dept of State, Homeland Security, Health & Human Services, Federal Emergency Management Agency, US Agency for International Development, Customs & Border Patrol, Centers for Disease Control and Prevention...
- Joint Commission (and JC International)
- Academia and Industry
- International Collaborative Bodies - UN, NATO, WHO...

Navy Medicine's Europe Laydown



Navy Medicine's Europe Laydown

NAVAL MEDICAL FORCES ATLANTIC (NMFL)

Mission:

Deliver operationally focused medical expertise and capabilities to meet Fleet, Marine and Joint Force requirements.

Vision:

To provide equipment, sustainment and maintenance of medical forces during combat operations and public health crises.

Naval Medical Readiness & Training Commands (NMRTC) / Squadrons:

- NMRTC Annapolis, MD
- NMRTC Beaufort, SC
- NMRTC Bethesda, MD
 - Expeditionary Medical Facility (EMF) 150 Charlie
 - Expeditionary Medical Facility (EMF) Reserve
- NMRTC Camp Lejeune, NC
 - Expeditionary Medical Facility (EMF) 150 Kilo
- NMRTC Charleston, SC
- NMRTC Cherry Point, NC
- NMRTC Corpus Christi, TX
- NMRTC Fort Belvoir, VA
- NMRTC Great Lakes, IL
 - Expeditionary Resuscitative Surgical System (ERSS)
- NMRTC Guantanamo Bay, Cuba
- NMRTC Jacksonville, FL
 - Expeditionary Medical Facility (EMF) 150 Mike
- NMRTC Naples, Italy
- NMRTC New England (Newport, RI)
- NMRTC Patuxent River, MD
- NMRTC Pensacola, FL
- NMRTC Portsmouth, VA
 - Expeditionary Medical Facility (EMF) 150 Juliet
- NMRTC Quantico, VA
- NMRTC Rota, Spain
- NMRTC Sigonella, Italy

Naval Medical Logistics Command, Williamsburg, VA

Public Health & Preventive Medicine:

- Defense Centers for Public Health, Norfolk, VA
 - Navy Drug Screening Laboratories (NDSL), Jacksonville, FL / Great Lakes, IL
 - Naval Dosimetry Center, Bethesda, MD
 - Navy Bloodborne Infection Management Center (NBIMC), Bethesda, MD
 - Navy Entomology Center of Excellence (NECE), Jacksonville, FL
 - Navy Environmental & Preventive Medicine Unit (NEPMU):
 - NEPMU-2, Norfolk, VA
 - NEPMU-3, San Diego, CA
 - NEPMU-5, Pearl Harbor, HI
 - NEPMU-7, Rota, Spain

Navy Medicine's Europe Laydown

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Expanding Presence... (for example:)

- 3 billeted Anesthesiologists - Rota, Naples, Sigonella
 - 1 additional, going to NATO MARCOM, NW London
 - 1 (maybe, PEP applicant), Institute of Naval Medicine, Plymouth, UK
 - Expanding clinical/trauma relationships in UK, ESAIC, etc.
- 2 CAPTs - NATO Ctr of Excellence for Mil Med, Budapest
- NAVEUR, MARFOREUR/AF
- Participation on: NATO COMEDS, Trauma panel, STO HFM, STRIKFORNATO (Portugal), JFC Brunssum, JFC Naples, DHA (Army) officer at UK MoD,...

What Interests Us/ Keeps Us Up at Night

What Interests Us/ Keeps Us Up at Night



What We're "Used To"

- Preparation of the Battlespace
 - 4-5 mo buildup prior to H-Hour
- "(Fill-in-the-blank) Superiority"
 - Air - Freedom of movement, unmolested MEDEVACs
 - Space - easy to target enemy, hard to be targeted by enemy
 - Cyber - clear communications
 - 9-lines enable appropriate response
 - Access to Specialist Advice

What We're "Used To"

- Land-Based
 - "Sub-elite Athlete" Population
 - Body Armor, Armored Vehicles
 - Ground extraction
 - Predominantly Warm Climates
- Attacks on our forces typically "Targets of Opportunity"
 - Small Arms, IEDs
 - Limited Numbers of Casualties
 - "Green-on-Blue"
- Far-Forward Surgical Capability

10 trends for the future of warfare



Future War

- Waging war seems “easier” - *drones, standoff*
- Speed kills - *OODA loop, new technologies*
- Fear and uncertainty increase risk - *asymmetries*
- Deterrence and pre-emption - *cyber/UUV “2nd strike” prevention*
- The new arms race is harder to control - *“nuclear club” vs. strategic benefit redistribution, gas and bugs are cheap*

Future War

- A wider cast of players - *technology more affordable, widespread - encryption, surveillance, space, AI - more peer competitors*
- The grey zone - *hybrid warfare, non-state actors, ambiguity, proxies, plausible deniability*
- Pushing the moral boundaries - *destructive power “democratized,” uniformed military no longer have “monopoly” on force, dual-use tech*

Future War

- Expanding domains of conflict - *Arctic, submarine, cyber, space; lack of traditional borders make them difficult to manage within existing legal frameworks*
- What is physically possible becomes likely - *all developed technology eventually becomes weaponized, justified by security necessity*

Artificial Intelligence - 2016

- “Lethal autonomous weapons; greatest impact of AI on conflict may be socially mediated.”
- “Algorithmically-driven social media connections funnel individuals into trans-national but culturally enclosed echo-chambers, radicalising their world-view.”
- “Collapse of barriers between digital and physical, and between synthetic and organic, constitutes a Fourth Industrial Revolution.”

NOT What We're "Used To"

- No warning
 - Strategic surprise of the essence
- 5th Dimension/Hybrid Warfare - Disputes in ALL Regimes
 - Air - Effective A2AD, Hypersonic "carrier killer" missile
 - Space - easy to target enemy, hard to be targeted by enemy
 - Cyber - disinformation, compromise of records, public smears, fomenting of policy resistance
 - Land force parity
 - Capable surface force
 - Growing subsurface threat - subs and mines
 - Chemical, Biological, Radiological . . . (and COVID)
 - Asymmetry; "Little Green Men"

NOT What We're "Used To"

- Surface-Based Patients
 - May not be as physically fit as infantry
 - No body armor, enclosed space blasts, flooding
 - Sea-bed extraction
 - Large battlespace - *The Tyranny of Distance*
 - Hypothermia
 - Dangerous Marine Life
- Large surface vessels with tremendous numbers of potential victims
- Minimal Far-Forward Surgical Capability

= NO 98% CASE SURVIVAL RATE

AIR, INTEL & CYBER, LAND, SEA, SPACE, STRATEGY & POLICY

Generals Worry US May Lose In Start Of Next War: Is Multi-Domain The Answer?

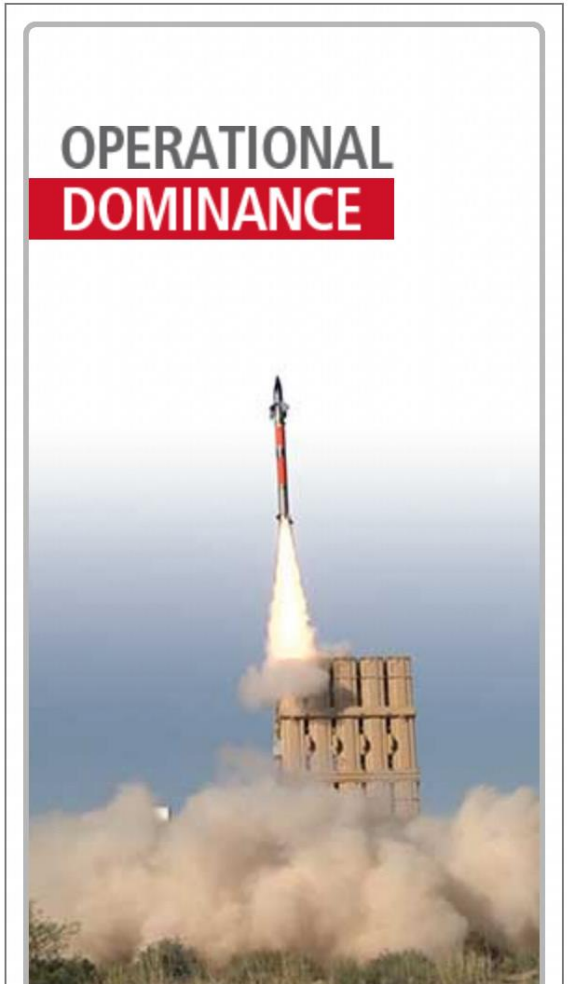
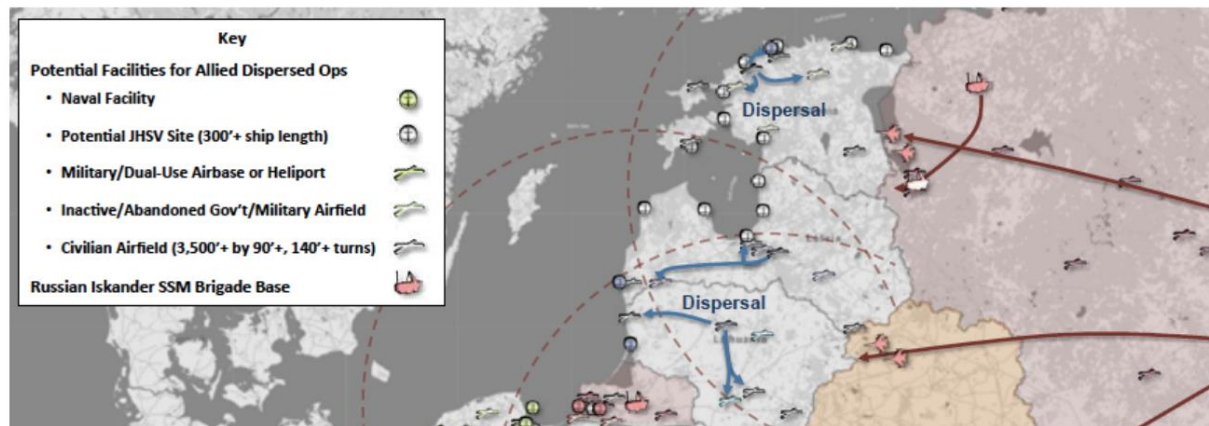
"There is a good chance... we'd lose the opening stages of this war," said one speaker. "Parts of the Pacific, parts of Europe are probably going to be overrun before we can gather ourselves."

By SYDNEY J. FREEDBERG JR.

on May 14, 2018 at 7:43 PM

425 Comments

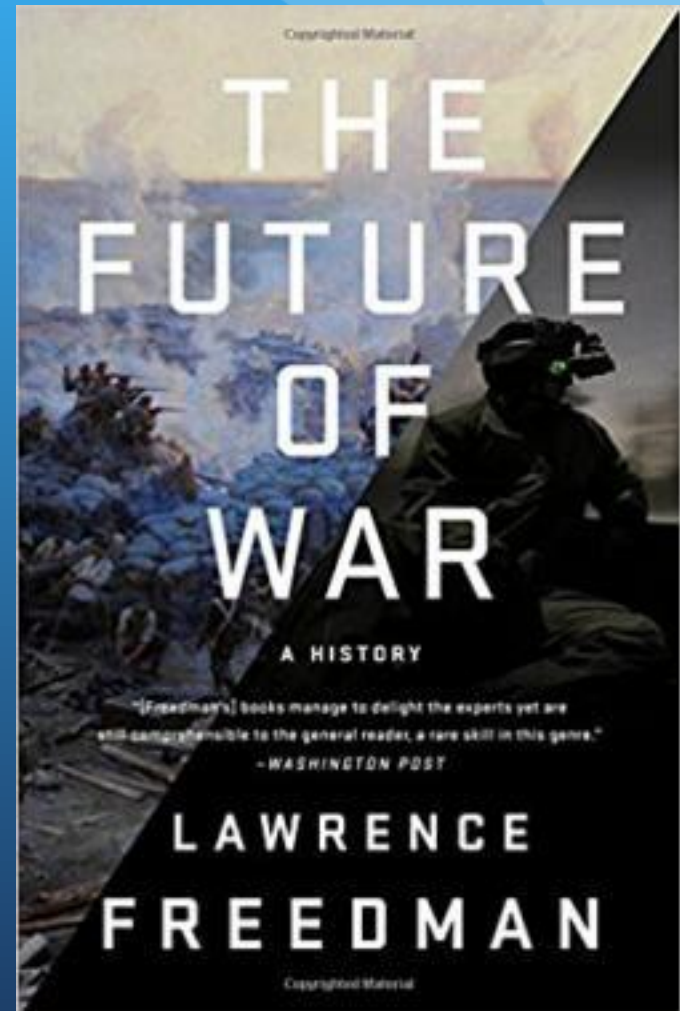
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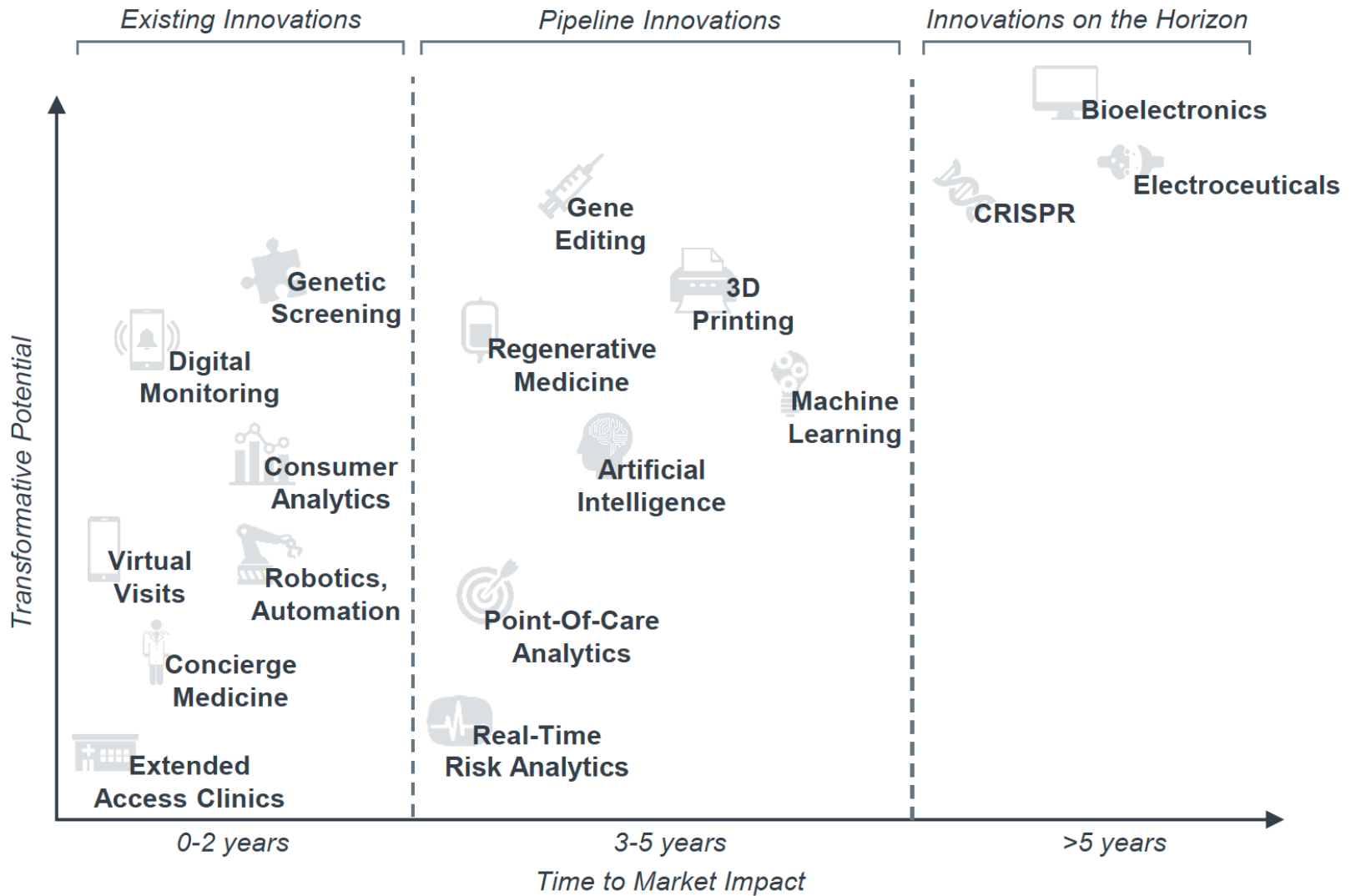


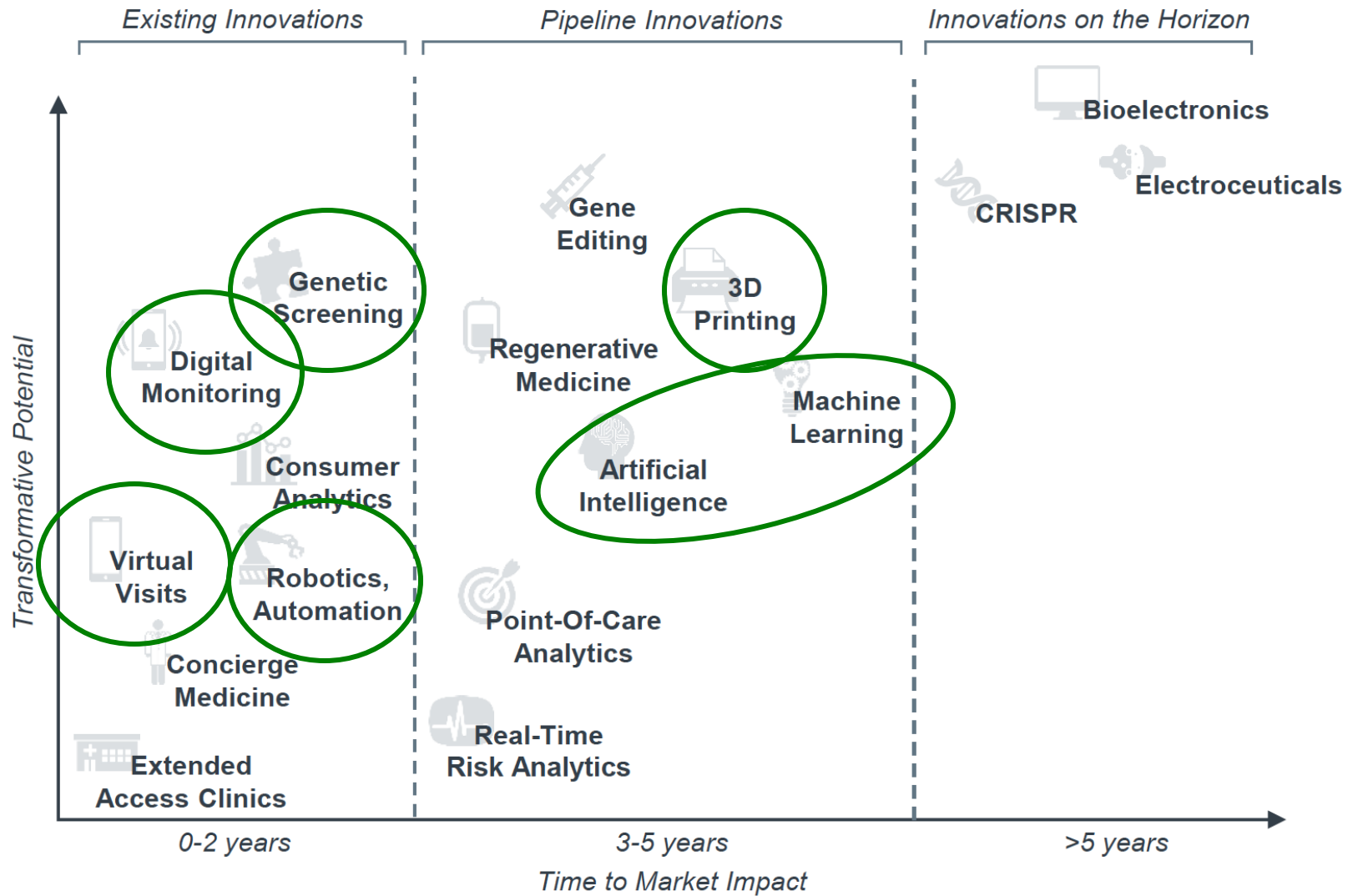
NOT What We're "Used To"

“Predictions of the future are never anything but projections of present automatic processes . . .

occurrences that are *likely to come to pass if men do not act and if nothing unexpected happens.*”







The Necessity of Partnership...

Tragedies of 2017 showed how military medical partners can help at home

Todd E. Rasmussen and Matthew J. Martin, Opinion contributors Published 6:00 a.m. ET Dec. 28, 2017 | Updated 8:50 a.m. ET Dec. 28, 2017

We can save lives, strengthen national security and keep military health personnel sharp by adding them to trauma teams that handle crises at home.

The Necessity of Partnership...

DoD, FDA partner to develop medical products for warfighters

CSIS

CENTER FOR STRATEGIC &
INTERNATIONAL STUDIES

✉ Connect

Evolving Partnership between DoD & Industry

Engaging in dialogue with DoD and industry partners as well as through focused research, DIIG explores this critical partnership and its effect on important defense topics.

<https://health.mil/News/Articles/2018/01/17/DoD-FDA-partner-to-develop-medical-products-for-warfighters>
<https://www.csis.org/programs/international-security-program/defense-industrial-initiatives-group/evolving->

Emerging Technology Effects the Entire System



Recruiting:

- Proactive Health Risk Identification
 - Better selection of force
 - Better assignment to special programs
- Predictive Analytics
 - Better use of EHR for prediction of post-exposure occurrences, etc.
- >85% of today's US Navy are Millennials . . .
 - Some investment required for buy-in
 - Clinician competence is assumed
 - Millennials care about convenience, societal impact

Navy Surgeon General on Technology

- “[Technology is a] driver of healthcare choice. In our Navy today, 98 percent of our sailors own smartphones . . . they're an integral part of their lives.”
- “The smartphone, not the doctor, is the primary source of medical information today.”
- “I've got to be in this environment or I'll lose influence and relevance over the health of the force.”

Training



Virtual Star

General Service/ Health Maintenance

Artificial Intelligence (AI)

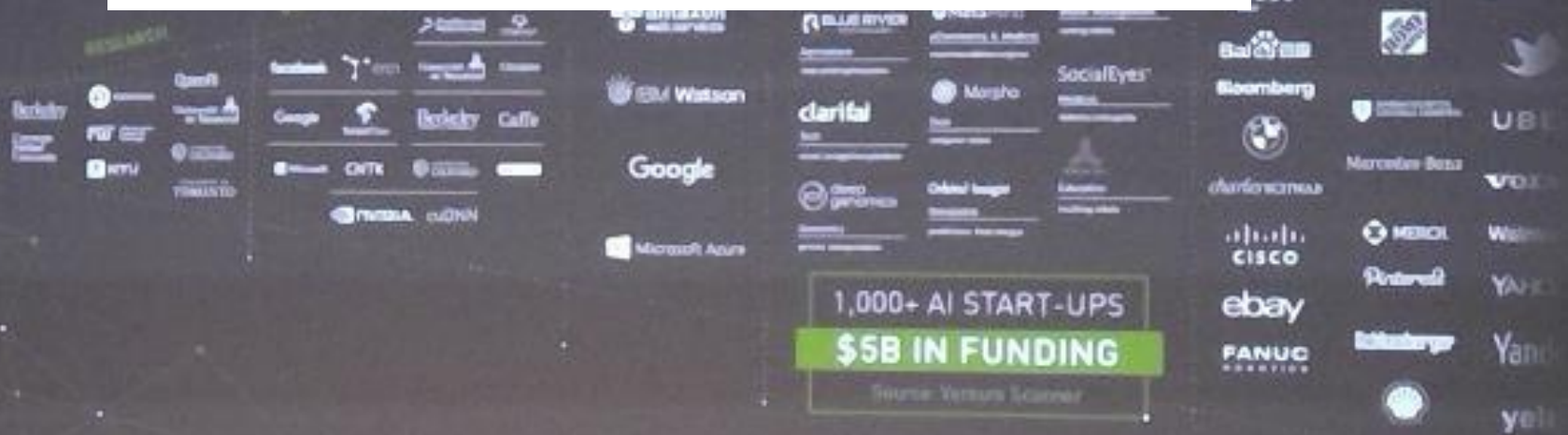
- Computer completes a task that would typically require human intelligence
- Machine Learning - computer finds patterns within certain parameters, and improves predictive and diagnostic capabilities
- Natural Language Processing - computer communicates with/within human language, and is able to extract meaning (and metadata) from text (including EMR)

AI's deep learning and robotic automation also bring closer the possibility of "singularity": the point at which machine thought supersedes human capability. It sounds like science fiction, but consensus suggests that, within a decade, smart might solve problems that humans struggle to conceptualize.

THE EX OF MOD

THE BIG BAND™

Big Data
GPU
Algorithms





streams

by DeepMindHealth

Identifying patients at risk

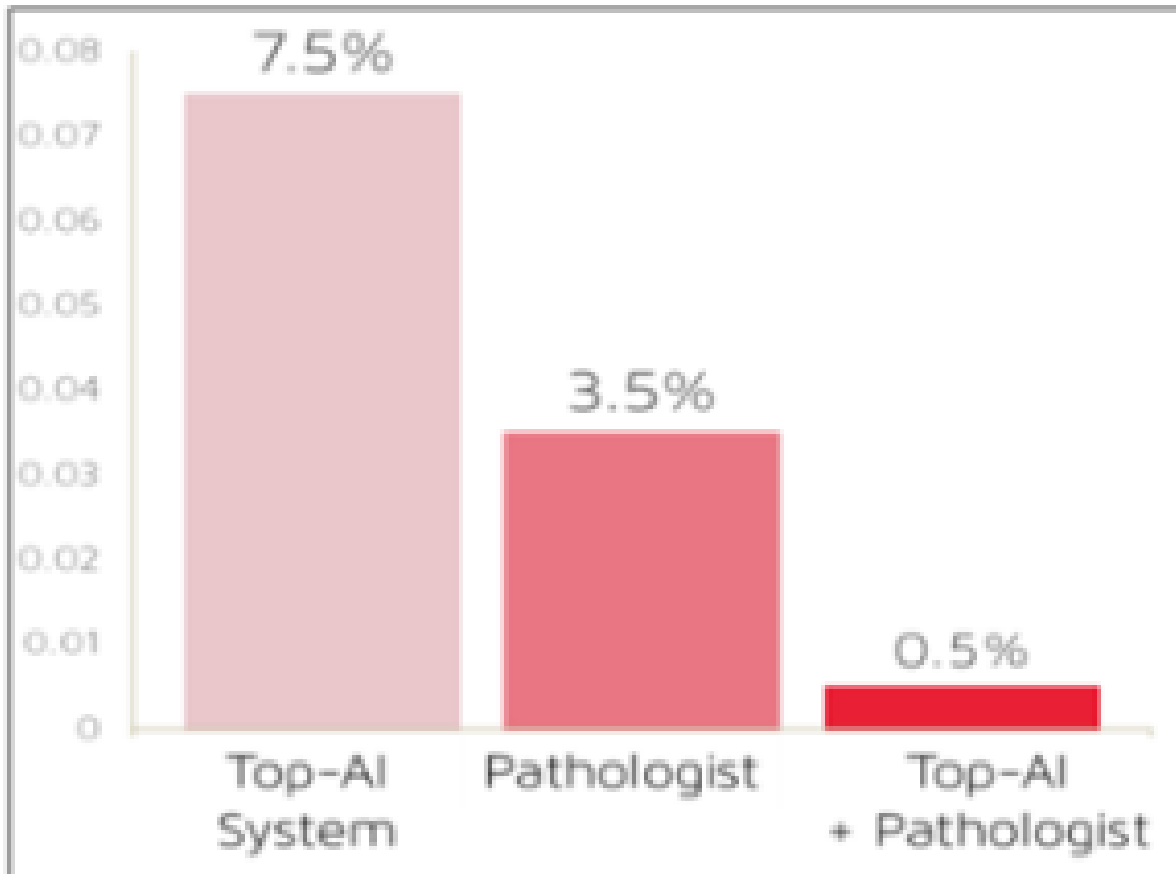
We have been collaborating with some of the UK's leading kidney experts at the Royal Free Hospital London, and product designers and engineers at digital product studio [uitero](#), to co-design and pilot a mobile app, called Streams, which presents timely information that helps nurses and doctors detect cases of acute kidney injury. AKI is a contributing factor in up to [20%](#) of emergency hospital admissions as well as [90,000](#) deaths in the UK every year. Yet NHS England estimates that around [25%](#) of cases are preventable.

Consultant Nephrologist and Associate Medical Director for patient safety at the Royal Free Hospital London, [Dr Chris Leding](#), who helped design the app and oversaw two initial pilots at the Royal Free, said:

"Using Streams meant I was able to review blood tests for patients at risk of AKI within seconds of them becoming available. I intervened earlier and was able to improve the care of over half the patients Streams identified in our pilot studies."

Chris, Sarah and Mary, from the Royal Free Hospital, helped us design and test Streams. Here's what they had to say about it:





AI significantly reduces pathologist error rate in the identification of metastatic breast cancer from sentinel lymph node biopsies.

AI Decision Support

- Rule-based query looking for clinical syndromes
- Raw data processed/evaluated
 - Physiologic values: abnormal, trends, rate of change
 - Multi-modal analysis - for example:
 - Increased heart rate, decreased BP suggests hypovolemia
 - Low SpO₂, high inspiratory pressures suggest lung injury
- Incorporate additional information from EHR
 - Lab results, radiology, problem list
- Clinicians routinely miss AEs - analysis software does not get tired or mesmerized by slowly changing data
 - 90% of anesthesia errors identified at personnel turnover

NATO Ready to Deploy Telemedicine Platform

A three-year project to create a telemedicine platform for international disasters and war zones has concluded. NATO says it's ready to send the suitcase-sized kit to wherever it's needed around the globe.



By **Eric Wicklund**

February 24, 2017 - NATO has finished testing a multinational telemedicine platform for emergency scenes or combat zones and is ready to deploy the suitcase-sized kits where needed around the world.



INTERNET

Treating patients caught in the world's war zones

From CNET Magazine: Telemedicine may not be new, but it's still one of the most powerful tools we have to help people hurt in the crossfire.

<https://mhealthintelligence.com/news/nato-ready-to-deploy-telemedicine-platform>
<https://www.cnet.com/news/healing-patients-caught-in-the-worlds-war-zones/>

Telemedicine a physician extender

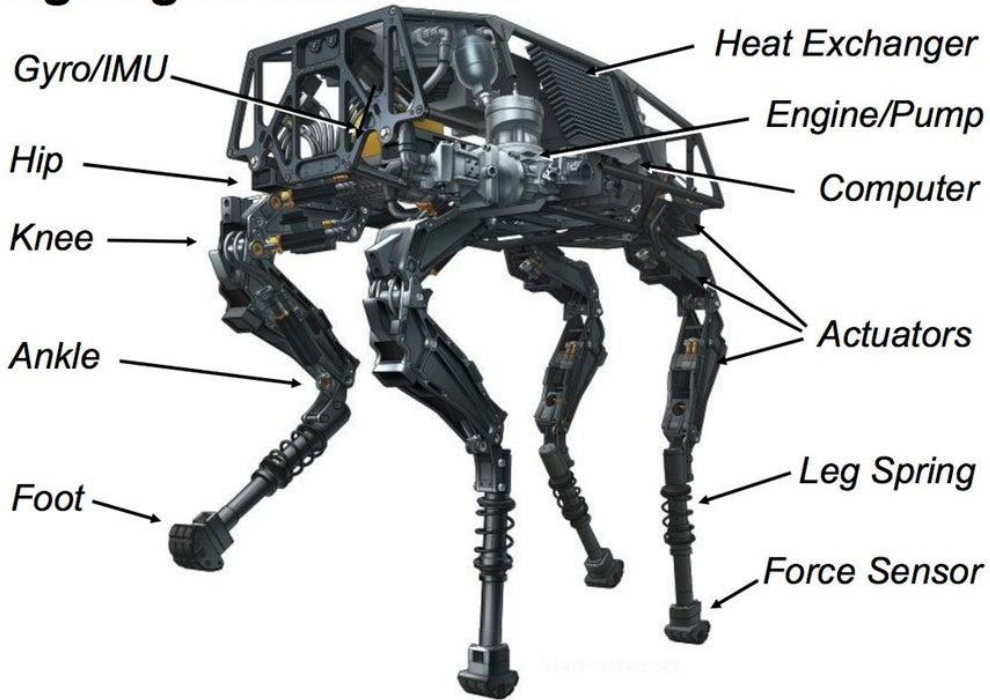
- All-source information ported to a cockpit
 - Field/shipboard examinations/procedures
 - Physiologic monitors, vents, infusion pumps
 - EHR - anesthesia record, labs, history
- Telemed docs collaborate with front line
 - Corpsmen/tech skills directed as needed
- Increased productivity

“Big Dog”



BigDog Architecture

Boston Dynamics





Maritime Medevac?

- Aerial?
- Surface vs. Subsurface?

Prolonged Casualty Care

- Manned vs. Autonomous?

UAVs for CASEVAC

- UAVs built for materiel transport used as lift of opportunity
 - Temperature, vibration, acceleration, safely secured patient, noise, communication (vs. sedation), monitoring, supplemental oxygen if >10K ft
- A dedicated UAV platform:
 - Provides time-critical response
 - Obviates risk to aircrew
 - No care . . . robot provider?
 - Remote piloting . . . autopilot?
 - Patient abandonment?



Treatment/ Rehabilitation

Medical Applications for 3D Printing: Current and Projected Uses

[C. Lee Ventola](#), MS

- Tissue and organ fabrication
- Customized prosthetics, implants, anatomical models
- Pharma research re: drug dosage forms, delivery, and discovery
- Customization/personalization of products, drugs, and equipment
- Cost-effective/increased productivity
- Democratization of design and manufacturing
- Enhanced collaboration

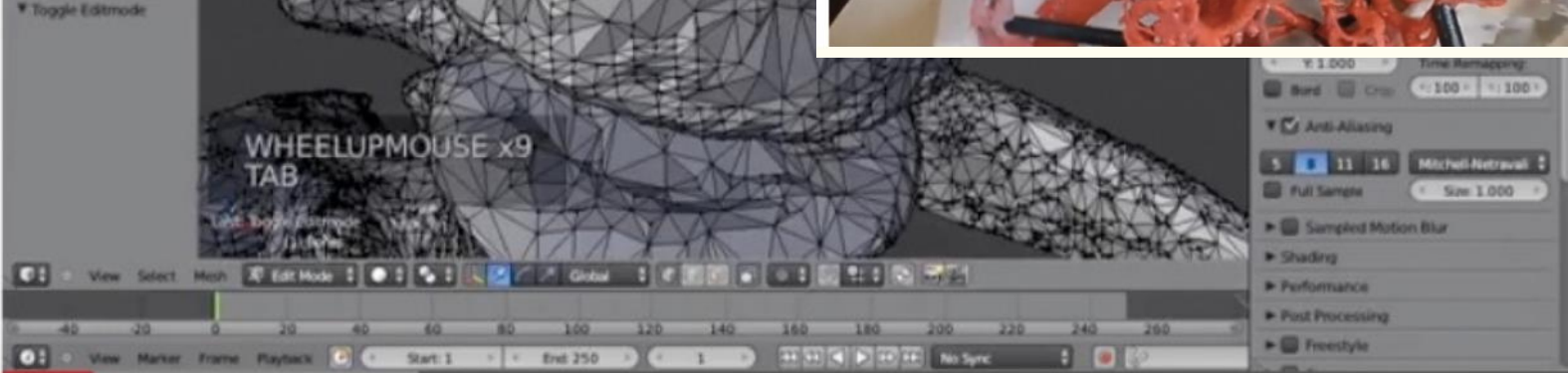
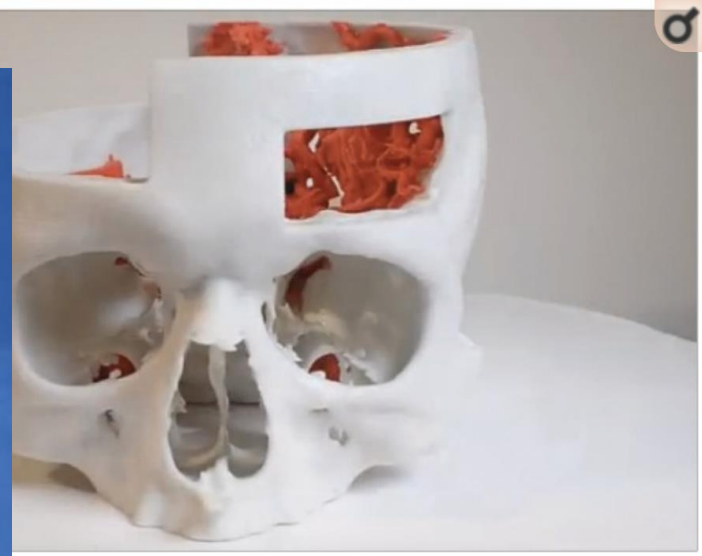
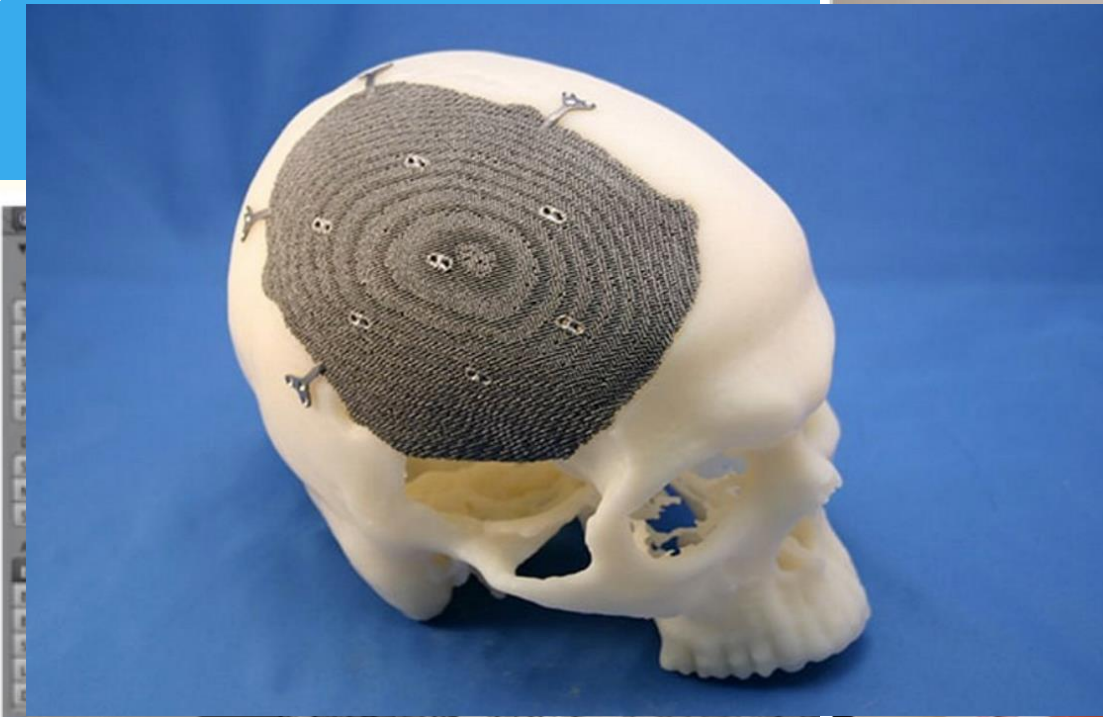


Figure 2 Radiographic images can be converted to 3D print files to create complex, customized anatomical and medical structures.¹²

Scaffolds + stem cells + growth factors = work better

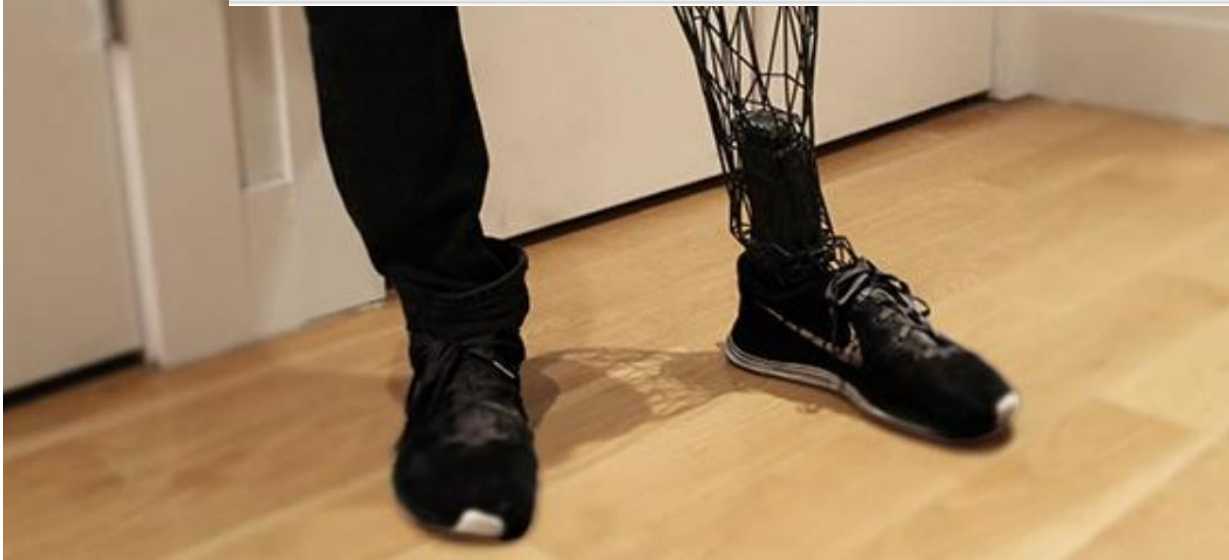


Artificial heart tissue
(Taylor, Minnesota, 2009)



Artificial kidney tissue

Scaffolds come from animal washed for cells



Limitations and Hurdles

- Technology development and cost
- Security - implications if compromised?
- Competition for Bandwidth with ongoing operations
- Safety/accuracy/defensibility of new technology
- Ethics - 2nd/3rd order effects

And the enemy gets a vote . . .



How to Collaborate

- Dept of State Channels, Security Cooperation Officers
- NATO Requests (including via Ctrs of Excellence)
- Navy Medicine: med.navy.mil (links to Specialties)
- Academic: Uniformed Services University (www.usuhs.edu); Naval Postgraduate School; US Naval Academy
- LinkedIn
- jkmd97@gmail.com

“Partner of Choice”

My colleagues and I look forward to working with you.

Thank You!

