Thur, Aug 14, 16:30-17:30, rm 447-448, 2025 Seattle WorldCon Panel MIL11 ***Post-Human Soldiers***: "Robotics and genetic engineering open the specter of enhanced soldiers with radically new capabilities and limits. Use of bionics, cybernetic augmentation, and neural interfaces are already spilling out of research labs. We'll speculate on their impact upon humans, robots, and aliens, today, and in the future."

Russell Ervin (mod), **Bob Hranek**, **Clayton Mann**, **D. Wes Rist**, **Catherine Asaro**

[My career began with 6 years of USAF Computer Programming plus 34 more years as an Aerospace Systems Engineer. Since I was a Defense Contractor for the Intelligence Community, I'm usually depicted as representing *the Dark Side* on panels. Hence my 'Protogen' name plate, which fans of ***The Expanse*** will understand. That being said, I do NOT speak for ANY of my employers! My role on this panel is to add my Military-Industrial perspective. I OVERprepare for all my panels, so if you'd like my file regarding Post-Human Soldiers, then just email me at BobHranek@gmail.com]

Background:

1. 2025/07-08 MIT Tech Rev, p15, in "The case for "spare" human bodies": "recent advances in biotechnology now provide a pathway to producing living human bodies without the neural components that would allow them to think … could ultimately allow us to create "bodyoids"—ethically sourced "spare" human bodies."
    a. This allows much more rapid human experimentation, and convenient spare parts to keep *bio-soldiers* going.
2. 2025/07 Science News, p14-15, Tim Freide deliberately took 202 toxic snakebites, & injections of snake venom, in order to build immunity to >12 venomous snakes, including cobras, coral snakes, black mambas, & rattlesnakes.
    a. 2 of Freide's antibodies + varespladib drug completely protected mice from 13 snake venoms & partial protection from 6 more. This could eventually provide soldiers with immunity to otherwise lethal toxins.
    b. Probably easier to administer "antibody cocktails" to likely-encountered toxins before a specific mission.
3. 2021/4/19, Russians want to refine/rebreed Scythian Warriors, from the DNA extracted from the originals' corpses.
    a. Even if such cloning were possible, there's no reason that these clones would have any advantages over people born today and even might be inferior, not having benefitted by the thousands of years of human evolution to diseases, etc. since the 3,000 old Scythian warriors were buried.
4. 2020/12/09, French want to make Super Soldiers of their own, "A report laid out conditions under which work on implants and other technologies designed to improve battlefield performance should be carried out in the future."
5. 2020/12/19, France, China developing biologically engineered Super Soldiers, "Just two weeks after it was announced China was developing biologically enhanced super soldiers, France has joined the fray in creating terminator troops."
    a. **Brain microchips**: France has been given the all-clear to develop microchips to enhance soldier brain power.
    b. **Bionic eye**s: Being developed in Hong Kong, this gives users infrared & night vision, but can the human mind fully process these new sensory inputs without sacrificing mental capacity in some other way?
    c. **Super hearing**: The US's Tactical Communication and Protective System are smart earbuds which boost soldiers' hearing to be near superhuman.
    d. **Health implant**: DARPA, the Pentagon's research arm, is developing cyborg implants to monitor combat efficiency.
    e. **Enhanced limbs**: Devcom report revealed plans to equip U.S. soldiers with enhanced limbs for increased strength, but a body can only be as strong as its skeleton & other organs will support.
    f. **Exoskeleton legs**: US Army has tested an exoskeleton which can be attached to soldier's legs and can increase their productivity by up to 27 times.
    g. **Synthetic blood**: Respirocyte is a theoretical Nanorobotic red blood cell that could help soldiers not get out of breath and stay underwater for hours.
    h. **Pain immunity**: DARPA's Persistence in Combat initiative would allow soldiers to have their pain suppressed for 30 days. There's always going to be the need to strike a balance here: turning someone into a "Viking Berserker" may mean they don't notice when they're bleeding to death, about to break a bone, etc.
6. 1990, Star Trek: The Next Generation, Season 3, Episode 11, The Hunted
    a. Showed soldiers genetically/chemically altered to serve as super soldiers, SEPARATE from their society.
7. 1987, Star Trek: The Next Generation, Episode 1, Encounter at Farpoint
    a. Showed a human soldier controlled with drugs and with fully integrated armor & weapons.

8. 1967, Original Star Trek: Space Seed
    a. Introduced "The Eugenics Wars" which lead to World War 3 by the inability to control genetically-enhanced humans that try to take control of the Earth.
    b. This is where the famous "Superior ability breeds superior ambition" quote comes from.
9. Use of drugs in the Military
    a. Fighter pilots have used amphetamines to stay alert for long flights since the Battle of Britain.
        i. 2019/06/25, https://allthatsinteresting.com/amphetamine-use-world-war-2
            1. "After the British discovered the Nazis' meth-like secret weapon in a downed German plane, they decided to develop their own performance-enhancement program."
        ii. 1992/04/11, https://apnews.com/article/d66b7f2fd8ee49f71aac1bb55d02ee7e
            1. "TACOMA, Wash. (AP) _ The Air Force has confirmed that some of its fighter pilots used amphetamines to stay awake during the Persian Gulf War, a newspaper reported."
        iii. 2003/01/12, https://www.nbcnews.com/id/wbna3071789
            1. "In conflict after conflict, whenever one of its most deadly enemies rears its head, the U.S. military employs a potent weapon: a little orange pill. The enemy is fatigue, a foe that claimed more deaths among military pilots in the past two decades than combat duty. The solution is selective use of amphetamines, an effective stimulant that has kept military aviators fierce-eyed and alert from the Battle of Britain to night strikes over Afghanistan. With air wings deploying again to the Persian Gulf, questions are surfacing about the safety of "go pills" in the cockpit."
        iv. 2006/01/05, https://abcnews.go.com/2020/story?id=123779&page=1
            1. "Dec. 20, 2002 -- Preliminary court-martial proceedings begin next month against two U.S. fighter pilots involved in a tragic incident over Afghanistan that cost four lives and exposed a little-known fact about the way America fights its long-distance air wars."
10. Use of mechanical enhancements in the Military
    a. Work continues by several nations to develop Exoskeleton technology to allow soldiers to endure combat situations for longer, carrying more, and providing greater damage protection.
    b. This comes nowhere near an "Iron Man" suit, at least nothing like that is foreseeable anytime soon.
11. Use of internal enhancements in the Military (DNA alteration, brain/machine interface chips, etc.)
    a. This technology remains in its infancy, and it remains to be proven if and how well any of these techniques can improve memory, skills, reaction time, strength, agility, endurance, etc.
    b. https://www.technologyreview.com/2021/10/27/1036821/brain-computer-interface-implant-mouse/
        i. **MIT Technology Review; Cambridge** Vol. 124, Iss. 6, (Nov/Dec 2021): 28-35
        ii. Dennis Degray is current fastest known brain-interface typist, at 18 words per minute. (p 30)
        iii. There is huge potential benefit for paralyzed people, amputees, and medical treatment overall.
        iv. This will definitely be used for recreational, social media, gaming, and "mixed reality". (p 33)
            1. Could even allow interaction with a virtual world every time you close your eyes. (p 34)
        v. The 1982 Firefox movie was just the start, "Before Musk and venture capitalists arrived onto the scene, DARPA [] was the world's largest funder of brain-interface research." (p 34)
        vi. Columbia's Rafael Yuste: "the military should be forbidden from employing brain implants."(p35)
            1. We don't live in such a benign world. Humans have repeatedly demonstrated that any technology that can be used for competitive advantage, even if slight, will be used.
12. More Dangerous Than Humans on a Battlefield
    a. The pace of military AI and drone development provides much greater effectiveness for the money.
        i. 2025/06, $300 Ukrainian drones destroying $100 million Russian bombers = the fiscal asymmetry.
        ii. Drones inflict around 70% of the casualties suffered by both militaries in Russia's war in Ukraine as of 2024. Watching a drone stalk & kill a soldier is like a terrifying Black Mirror episode in real life.
    b. Drones and other autonomous weapons can be deployed with no risk to your human forces.

        i. Much less internal political issues from your population using machine forces vs human soldiers.
    c. Bird-sized reconnaissance drones are the ultimate Forward Observer for directing remote weapons.
    d. Only in science fiction do human reactions keep up with those of computers, not in our real world.
    e. The argument that ECM is the counter to all automation is no longer valid.
        i. Autonomous weapons can be designed to survive higher radiation levels than humanly possible.
    f. It's only a matter of time before AIs obtain the "combat experience" needed to outperform humans.
        i. They can currently be 'fooled' by techniques designed to confuse their programming.
        ii. A Borg-like adaptation to deception strategies is already provided by neural net AIs.
    g. The most significant long-term risk factor is keeping control of your autonomous weapons.
        i. You need some way of giving them new instructions that are secure AND quick.
        ii. You need to prevent unauthorized commands from being executed by them.
13. **AI: Centaurs Versus Minotaurs—Who Is in Charge?** 2023/06/28, my thanks to Chris Weuve for this reference.
    a. *Centaurs* = ½ human + ½ AI teams will evolve to AI replacing human warfighters in time-constrained ops.
        i. Scharre believes that teamed humans & AI will outperform humans & AIs working separately.
    b. *Minotaurs* = Sparrow proposes teams of humans under the control, supervision, or command of AI.
        i. Similar to people using Waze to drive to a destination. Waze tells us when to turn, avoid traffic, etc.
    c. *Centaur* implies that humans will be in charge at the top vs *Minotaur* implying AI making top level decisions.
    d. I think the *Minotaur* paradigm will hold until Robotics advances far enough to replace human soldiers.
        i. AIs are already very effective at using vast data sets to plan logistics, strategy, & tactical operations.
        ii. Cost-effective Implementation of those plans still requires the real-world adaptability of humans.
            1. An exception to this is Aerospace operations, where AIs already can outperform humans.
        iii. "Urban environments, forests, mud, snow, ice, & sand are extremely challenging for robots."
    e. Ethical issues include who takes responsibility for casualties? There's an argument that *Minotaur* fighting reduces fratricide. Need to prevent an AI from making a 1st-strike just because it decides it's optimal to do so.
    f. Strategic Centaurs: Harnessing Hybrid Intelligence for the Speed of AI-Enabled War, 2025/01/17.
        i. "In next 10 years, developing strategic centaurs will prove critical in out-maneuvering competitors."
    g. Neocentaur: A Model for Cognitive Evolution Across the Levels of War, 2025/05/09.
        i. Must prevent command staff becoming dependent on AI, unable to exercise their own judgement.
    h. Fighting Artificial Intelligence Battles Operational Concepts for Future AI-Enabled Wars, 117 pgs, Layton, 2021.
        i. The integration of AI, distributed sensors, & new tactics increases the effectiveness of small units.
        ii. Taken to its extreme, you end up with Starship Troopers (book) powered armor suits or (the much less likely) depiction of Iron Man suits from the movies.
        iii. The U.S., China, & Russia are leading the way to an AI-integrated battlefield.
        iv. "DARPA is now researching third-wave AI, that can adapt to the context encountered. This future third wave is envisaged as needing much less data to train properly, being able to converse in natural language and able to function with minimal supervision."
        v. 2 basic forms of autonomy: **at-rest**, like intelligence support systems, predictive maintenance tools, image recognition solutions, & operations planning support; & **in-motion**, like robots & AI weapons.
        vi. 3 modes of autonomy: **Human-IN-the-loop** (human decides to act); **Human-ON-the-loop** (human only acts to prevent action); & **Human-OUT-of-the-loop** (fully autonomous ops without any human).
        vii. The **OODA loop** is reactive; AI may break this loop by enabling "**sense-predict-agree-act**" instead.
        viii. War at sea is a battle of attrition, where the side that effectively strikes first gains a substantial lead.
        ix. All combat domains favor a proliferation of many low-cost sensors to provide a resilient network.
        x. There are many specific engagement scenarios discussed, but beyond the scope of this 1-hour panel.
        xi. "DARPA & the USN are now considering No Manning Required Ship (NOMARS) designs." Fully robotic.
        xii. "Fog of war" may be replaced by "fog of systems" if multiple AI systems interact in unforeseen ways.
        xiii. "AI's principal attraction for military forces will be its ability to quickly identify patterns and detect items hidden within very large data troves." I.E., Stealth Technology is about to become OBE.

14. 2025/07/14 AW&ST p12 & DARPA quantum apertures, one $1cm^3$ laser sensor can detect 10 MHz – 40 GHz signals.
    a. Combined with AI processing, this means the end of stealth for any platform emitting >1 milliwatt of energy.
    b. These sensors are so small they could be integrated for individual *soldiers* (human or otherwise) use.
15. PANEL DISCUSSION:
    a. What surprises you most about the prospect of Post-Human Soldiers?
    b. What do you believe people get wrong about Post-Human Soldiers, & how can that discussion be improved?
    c. What do you think the greatest danger is from the use of Post-Human Soldiers?
    d. How many years do you think it would take to achieve truly Post-Human Soldiers?
    e. What are the ethical considerations that we should be considering about the use of "post-human soldiers," alongside the military efficacy questions?