Ensign observes Israeli INS *Lahav*, left, INS *Sufa*, center, and USNS *Leroy Grumman* from USS *Carney* during exercise Reliant Mermaid 2018, Mediterranean Sea, August 7, 2018 (U.S. Navy/Ryan U. Kledzik)

The Intellectual Edge
A Competitive Advantage for Future War and Strategic Competition

By Mick Ryan

In the early twenty-first century, the train of progress is again pulling out of the station—and this will probably be the last train ever to leave the station called Homo Sapiens. Those who miss this train will never get a second chance. In order to get a seat on it you need to understand twenty-first century technology, and in particular the powers of biotechnology and computer algorithms. . . . [T]hose left behind will face extinction.

—Yuval Noah Harari

Yuval Harari's warning about the future of human development in *Homo Deus* provides a clarion call for those who lead the intellectual development of future military leaders.[1] Harari and others such as Heidi and Alvin Toffler, Nick Bostrum, Andrew Krepinevich, T.X. Hammes, and Ian Morris have speculated about the potential future impacts of technology on humans and war.[2] While these visions of the future contain a wide array of predictions, they pose useful questions to inform future intellectual development within military institutions.

The world is potentially now at the start of a new industrial revolution. This revolution is underpinned by connectivity, biotechnology, and silicon-based

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technologies that include various forms of narrow artificial intelligence. Described as the "Fourth Industrial Revolution" by World Economic Forum founder Klaus Schwab, it is disrupting business, entertainment, communication, transportation, and national economies.[3] Like previous industrial revolutions, it is almost certain that this one will also change how society and its constituent communities develop and interact. Scientific advances, commercialization, and the diffusion of innovation are social processes that unfold as people develop and exchange ideas, values, interests, and social norms.[4]

The transformations that sweep through society will inevitably result in changes to how governments evaluate national security. As Kenneth Payne recently noted, "For encultured humans, technology, warfare, and society are dynamically linked."[5] This means that change will also cascade into how military organizations conduct military operations for the new era.

The impact of the new technologies of this revolution on military institutions has been explored by a range of authors, including Amir Husain, Williamson Murray, Paul Scharre, Sean McFate, and Hammes.[6] However, as McFate has recently written, "Warfare evolves before fighters do."[7] Therefore, if military institutions are to optimize the employment of these new technologies, investments in new military concepts and organizational approaches will have to be made. These evolved ideas and organizations must be underpinned by an evolved approach to the intellectual preparation of future military leaders.

The Military and Education: An Evolved Intellectual Edge

Over the next two decades, most Western militaries will be smaller than their adversaries, with a declining technological advantage. Compounding this challenge, they will fight in a new hyper-technical, transregional, and increasingly disaggregated physical-cyber operating environment. Increasingly dominated by more lethal weapons systems and the manifestations of a convergence of information and biotechnologies, the future conflict space will largely be a technologically level playing field. Recent publications, such as those by the Commission on the National Defense Strategy for the United States,[8] have described how the technological edge that has been the preserve of Western military institutions for several centuries has declined.[9]

As General Joseph Dunford described, the pace of strategic and technological change is increasing.[10] Where military forces do generate capability advantages, they are likely to be more short-lived than has been the case in previous eras.[11] Western military institutions must therefore evolve additional sources of advantage. Lacking an enduring technological edge, and often without recourse to the massed forces of previous eras,[12] the only other option is an intellectual edge.[13]

This intellectual edge manifests in two different, but interconnected ways. The first is individual professional mastery. The intellectual edge for an individual is the capacity for that person to creatively outthink and outplan potential adversaries. It is founded on the broadest array of training, education, and experience that can be provided by institutions, as well as a personal dedication to continuous self-learning over a long period of time. Increasingly, this intellectual edge for an individual will be underpinned by cognitive support through human–artificial intelligence teaming. Increasingly, synthetic biology and artificial intelligence must be used in concert with human intellectual power to general advantage. Frank Hoffman has described this as "System 3" thinking, where the nascent field in the collaborative application of biological and machine intelligence will increasingly be central to the development of the intellectual edge in military personnel.[14]

The second manifestation of the intellectual edge is institutional. While having the intellectual edge in leadership and planning is vitally important, so too is a collective, institution-wide intellectual edge. This will allow groups at different levels to effectively harness the disparate and diverse intellects of its individuals to solve complex institutional problems in the short, medium, and long term. This institutional intellectual edge must be applied to the challenges of force design, operational concepts, logistics, network security, the integration of kinetic and nonkinetic activities, as well as personnel development and talent management.

This intellectual edge must be constructed around the development of an ultra-professional intellectual military culture—from deployed forces to education and training institutions to strategic planning organizations. People in this system must be able to contextualize, plan, decide, act, and adapt faster and more successfully relative to adversaries.[15] The best within this evolved culture—the elite military thinkers—must be celebrated and nurtured in the same way as we currently celebrate and value elite athletes. Institutional incentives to encourage this elite thinking must be reinforced and, potentially, promotion pathways and talent management systems adapted.

Excellence in attaining military and broader national security outcomes in the 21st century will be achieved by those institutions that are able to develop their personnel in a way that supports them in the intellectual edge while applying this in a unified way to institutional problems. The ultimate expression of institutional intellectual edge will be the capacity to either win without fighting in a strategic competition or be able to apply its strengths to win any fight that it must engage in. To build this intellectual edge, military institutions will also need to appreciate two additional contextual elements that will influence the development of this evolved edge.

The first element is continuity in the wider security environment. Regardless of the disruption caused by various elements of the future environment, there are also likely to be some enduring characteristics. One is the likelihood that humans will still wage war on each other. Another is that the nature of work undertaken by humans, and the structures of military organizations, will continue to evolve as they have over millennia. It is important to understand this continuity because it provides the context that future military leaders must prepare for.

A second element is the overwhelming impact that the convergence of

information and biological technologies will have. For thousands of years, military leaders have applied their intellect and the tools of war to achieve their desired objectives. But regardless of the era, these military leaders have used machines and other tools as one part of their overall approach to win battles, campaigns, and wars. The world is now at the precipice of an era where humans and machines will work in an entirely symbiotic way. The rapidly evolving capabilities of artificial intelligence hold the promise of supporting better decisionmaking by military and political leaders. For the first time in history, humans and machines may be truly equal partners in many of the cognitive aspects of war and strategic competition. Evolving this new intellectual edge requires a range of institutional adaptations in the development of military personnel.

A Design for Future Intellectual Development

Building an evolved intellectual edge will demand a range of new and evolved approaches. But it is, at its heart, about people. Military personnel must be able to expand their skills and focus on the intellectual capacity to apply themselves to a wide array of activities that they may not have been prepared for. This requires a whole-of-enterprise approach to applying the right level of resourcing and focuses on training servicemembers who are ready for contemporary and future challenges, applying the military art and science within a broader national security establishment. The design for how this system operates within a larger military enterprise, however, must be driven by strategy. This strategy should draw its desired goals from the capability objectives of military organizations for the next two decades and will rely on a range of institutional, educational, and technological elements.

A Strategic Vision. The development of military personnel, through education, training, experience, talent management, and other mechanisms, provides the essential "software" of a military institution.[16] Therefore, an institutionally endorsed view of future military personnel—especially their leaders—is required.

This should form part of a more expansive view of future military capability and national security policy. In the U.S. context, the description of professional military education (PME) as "stagnant" in the recent National Defense Strategy provides a starting point and driving force for strategic reform.[17]

Strategic Engagement. Engagement among like-minded military institutions, different Services, and like-minded nations must continue to evolve and embrace an enhanced sharing of ideas. An array of concepts and designs in military education is being shared online, but this is not always replicated among institutions. Enhanced sharing of best-practice curricula, outstanding academic personnel, new learning approaches, and new military theories must be one of the cornerstones of the future approach to Western military alliances.

Strategic engagement must, however, extend beyond the sharing and exchange activities of like-minded institutions. Engagement with civilian universities is critical. In these civilian institutions reside centuries of learning across the humanities and sciences. Civilian universities represent a resource that can provide intellectual rigor to further hone skills for military personnel at the undergraduate and postgraduate levels. They could also provide viewpoints on national security that might differ from officially sanctioned policy, forcing military students to more carefully analyze the shibboleths of contemporary national security policy.

Futures, Education, and Adaptation. The curriculum of military institutions must be informed by an institutional view about the future environments that its people will operate in. Military education must form closer and more substantial linkages with organizations—in the military and beyond—that undertake futures work. There should be a transparent and logical pathway from informed views of the future and type of intellectual development received by the future joint officer. To retain relevance and remain at the forefront of best practices, the PME system must also complement its future work with mechanisms for adaptation. The system requires formal mechanisms to identify the

need for change, make informed decisions about change, and enact those changes in a timely and efficient way.

Continuous Career-Long Learning. Future military institutions require a continuum with functional descriptions of what future military leaders must be capable of at various stages of their professional journeys. An institutional curriculum must underpin this. It should not, however, be an industrial-age production line. It should form a "backbone" around which individually tailored intellectual development might be constructed. Williamson Murray and Allen Millet, in their examination of interwar military innovation, found that military leaders were better able to lead and invest in innovative ideas and technologies when they had undertaken continuous learning throughout their careers.[18] Continuous learning has other important outcomes as well.

First, a more holistic approach to continuous learning should have the added benefit of assisting in talent and career management systems of military institutions. Second, it permits a series of "small bets" with more course corrections on the types of learning outcomes needed by military personnel. This contrasts with current approaches where reliance on a limited number of learning interventions many years apart means institutions make "larger bets" on preparing their people for future challenges.[19] A mixture of short and long residential learning opportunities, blended with formal online learning and curated hubs for self-learning, is the optimal approach for future continuous learning.

Guided Self-Development in a Global PME Ecosystem. Formal education in military institutions cannot hope to cover all the needs in the intellectual development of contemporary or future joint officers. Therefore, formal education must be supplemented through self-study.[20] This self-study might be most effective if it is complementary to formal educational experiences. The implication is that military organizations should provide curated resources that future joint officers might "pull down" from their institution—using Internet or other sources—to supplement

Marine rolls die during game of war-themed strategy board game Memoir '44 on Camp Schwab, Okinawa, Japan, December 10, 2019 (U.S. Marine Corps/Timothy Hernandez)

their professional development. These curated hubs of professional development material can complement informal resources, be widely available across alliance partners, and be changed quickly to adapt to changes in the strategic environment or in technological developments. They might therefore comprise a resource that has a shorter adaptation cycle than military schools and academies.

Skill, Re-Skill, Repeat. The future environment is one where the construction and destruction of occupations and industries will occur more quickly than in previous industrial revolutions. As Harari has recently predicted, "Just as in the 20th century governments established massive education systems for young people, in the 21st century they will need to establish massive re-education systems for adults."[21] Therefore, future military institutions will need to possess a system that is built around skilling and rapidly re-skilling their personnel as technology and strategic

circumstances change. Current military organizations may have to re-educate entire generations of military leaders in the next 5 to 10 years because of the profound impact of these new technologies and because of the historically unprecedented acceleration in technological change.[22]

Enhanced Technological Literacy. A range of advanced technologies, such as hypersonics, space-based capability, information technologies, and biotechnology, is starting to rapidly spread through military organizations. But if institutions are to effectively use these systems, they will need informed users. Military organizations will therefore need more than just deep technical experts in the development of algorithms and the design of artificial intelligence for military systems. As a recent United Kingdom government report describes, skilled workforces using new technologies should be a mix of those with a basic understanding, more informed users, and specialists

with advanced skills.[23] Over the coming years, at almost every rank level, military personnel will require basic literacy in a spectrum of new and disruptive technologies.[24] This must include knowledge of its application, how to provide a level of assurance and quality control, and how to optimally combine it with new concepts and human organizations at every level.[25]

Accessibility. Much of contemporary joint education and individual training is delivered in a residential setting. While this provides for good learning outcomes, it results in only a small percentage of military personnel gaining access to joint learning opportunities. Military institutions must break down geographic, technical, and cultural barriers to create a truly connected force where education is continuous and self-sustaining. The system to develop future military leaders should be accessible to military members and defense civilians, regardless of role, rank, or location. There is much that military

Students of Officer Candidate School class 01-20 are first to test new Conning Officer Virtual Environment cart system at Officer Training Command in Newport, Rhode Island, September 18, 2019 (U.S. Navy/Darwin Lam)

institutions can learn in this area from the civilian education sector, while also leveraging efforts such as the Advanced Distributed Learning Initiative.[26]

Innovation in Delivery and Learner Engagement. The pace of change in technology is also disrupting longstanding approaches to training and education. Technology has enabled a more "connected" approach to learning. This is resulting in a gap between older (or heritage[27]) institutional education models and the newer digitally enabled approaches. New learning approaches are now available for students who may have been excluded from existing models in the past.

Recent digital-age technologies will underpin this more advanced approach to learning. The bio-info technology revolution offers the military profession multiple pathways to enhancing the intellectual capacity of individuals and institutions. Artificial intelligence may significantly change the way militaries educate their personnel and underpin an expanded range of potential activities to support the education of military personnel.[28] Biotechnology, particularly neurotechnology, offers capabilities such as cognitive enhancement, implanted memory, and the use of expanded knowledge of the brain to inform better artificial intelligence algorithms.[29] The

impact of these technologies on learning and developing future military leaders might be an area of collaborative innovation among Western military institutions.

But not all evolutions of learning approaches need to be based on advanced technologies. Wargaming is an effective method of applied learning that has a long history in military institutions. The use of wargaming to allow future leaders to visualize the preparation for, and conduct of, military operations is a necessary component of preparing future joint officers. These wargames need not be sophisticated computer games. Simple desktop games are often effective at engaging students and providing additional outcomes such as collaboration and influence skills.[30] While the requirement to include integrated influence operations and space capabilities might be new, wargaming methodologies can be evolved to retain relevance for future learning needs.[31]

T.X. Hammes notes that "despite assertions to the contrary, war is not disappearing. If anything, it is increasing in frequency and duration. Armed conflict will remain central to relations among states and nonstate actors. It will remain a contest of human wills and thus the domain of uncertainty, compounded by human passions, friction, and fog.

Technology will not bring clarity or brevity."[32] The global security environment continues to evolve. Warfare is becoming more technologically complex while retaining its human essence. Military organizations must have the capacity to deal with future threats that the application of technology and mass will not solve. Only through thinking better and building the intellectual edge in servicemembers and institutions will they evolve an improved capacity for securing future national security objectives. While many of the skills required may change, and the human composition of these forces continues to evolve, the intellectual preparation of the military for the demands of future conflict is an enduring requirement.

Military organizations across the globe now find themselves with a range of new circumstances affecting how their operations are conceptualized and executed and how their people are recruited, trained, and educated. In developing an intellectual edge in their future leaders in these new circumstances, military forces must think and act anew.[33] **JFQ**

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Notes

[1] Yuval Noah Harari, *Homo Deus: A Brief History of Tomorrow* (New York: HarperCollins, 2017), 319.

[2] Alvin Toffler and Heidi Toffler, *War and Anti-War: Making Sense of Today's Global Chaos* (New York: Warner Books, 1995); Nick Bostrum, *Superintelligence: Paths, Dangers, Strategies* (Oxford: Oxford University Press, 2014); Andrew Krepinevich, *7 Deadly Scenarios: A Military Futurist Examines War in the Twenty-First Century* (New York: Bantam Books, 2010); and T.X. Hammes, "The Future of Conflict," in *Charting a Course: Strategic Choices for a New Administration*, ed. R.D. Hooker, Jr. (Washington, DC: NDU Press, 2016), available at <https://inss.ndu.edu/Portals/68/Documents/Books/charting-a-course/charting-a-course.pdf?ver=2016-12-08-154300-120>. Ian Morris explores the impact of technology and the potential "singularity" for its impact on humans and future strategy in *Why the West Rules—For Now: The Patterns of History and What They Reveal about the Future* (New York: Farrar, Straus, and Giroux, 2010), 592–596.

[3] Klaus Schwab, *The Fourth Industrial Revolution* (New York: Crown Business, 2016).

[4] Ibid., 91.

[5] Kenneth Payne, *Strategy, Evolution and War: From Apes to Artificial Intelligence* (Washington, DC: Georgetown University Press, 2018), 13.

[6] Amir Husain, *Hyperwar: Conflict and Competition in the AI Century* (Austin, TX: Spark Cognition Press, 2018); Williamson Murray, *America and the Future of War: The Past as Prologue* (Stanford, CA: Hoover Institution Press, 2017); Paul Scharre, *Army of None: Autonomous Weapons and the Future of War* (New York: Norton, 2018); Sean McFate, *The New Rules of War: Victory in the Age of Durable Disorder* (New York: William Morrow, 2019); and T.X. Hammes, "Cheap Technology Will Challenge U.S. Tactical Dominance," *Joint Force Quarterly* 81 (2nd Quarter 2016), 76–85.

[7] McFate, *The New Rules of War*, 250.

[8] *Providing for the Common Defense: The Assessment and Recommendations of the National Defense Strategy Commission* (Washington, DC: U.S. Institute of Peace, 2018), viii.

[9] This is brilliantly examined in Morris, *Why the West Rules—For Now*.

[10] "Gen. Dunford's Remarks at the National Defense University Graduation," Fort Lesley J. McNair, Washington, DC, 2016, available at <www.jcs.mil/Media/Speeches/Article/797847/gen-dunfords-remarks-at-the-national-defense-university-graduation/>.

[11] The term *transient advantage* is used in a 2103 article on competitive strategy. See Ruth Gunther McGrath, "Transient Advantage," *Harvard Business Review* (June 2013), available at <https://hbr.org/2013/06/transient-advantage>.

[12] Although, as Hammes has written, mass in the 21st century is potentially generated through the large-scale use of unmanned air, ground, and sea capabilities. See Hammes, "The Future of Conflict," 29.

[13] I have previously written on the rationale for an intellectual edge in *An Australian Intellectual Edge for Conflict and Competition in the 21st Century*, Centre of Gravity Series (Canberra: Australian National University, 2019), available at <http://sdsc.bellschool.anu.edu.au/experts-publications/publications/6825/australian-intellectual-edge-conflict-and-competition-21st>; and "The Value Proposition for Developing a Future Intellectual Edge," *The Forge*, November 28, 2018, available at <https://theforge.defence.gov.au/publications/value-proposition-developing-future-intellectual-edge>.

[14] Frank Hoffman, "Healthy Skepticism about the Future of Disruptive Technology and Modern War," *Foreign Policy Research Institute*, January 4, 2019, available at <www.fpri.org/article/2019/01/healthy-skepticism-about-the-future-of-disruptive-technology-and-modern-war/>.

[15] Similar logic was applied in development of the Australian army professional military education (PME) strategy in 2017. I am indebted to Lieutenant Colonel Tom McDermott in particular for his contributions.

[16] On the need for the "software" in a military institution, see Dima Adamsky, *The Culture of Military Innovation* (Stanford, CA: Stanford University Press, 2010), 142.

[17] *Summary of the 2018 National Defense Strategy of the United States of America: Sharpening the American Military's Competitive Edge* (Washington, DC: Department of Defense, 2018), 8.

[18] Williamson Murray and Allen R. Millet, eds., *Military Innovation in the Interwar Period* (New York: Cambridge University Press, 1996), 327.

[19] For example, 1 year at command and staff college and 1 year at a war college.

[20] For an example of this global ecosystem, the Grounded Curiosity Web site has a database of the interconnected online resources available for PME across key alliance partners, including the United States, Australia, and the United Kingdom. See <https://groundedcuriosity.com/guide-military-blogs-and-podcasts/>.

[21] Yuval Noah Harari, "Why Technology Favors Tyranny," *The Atlantic*, October 2018, available at <www.theatlantic.com/magazine/archive/2018/10/yuval-noah-harari-technology-tyranny/568330/>.

[22] The accelerating pace of technological development is a theme in multiple books and reports, including Max Boot, *War Made New: Technology, Warfare, and the Course of History, 1500 to Today* (New York: Gotham Books, 2006),16; *Global Strategic Trends: The Future Starts Today*, 6th ed. (London: Ministry of Defence, October 2018), 13, available at <https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/771309/Global_Strategic_Trends_-_The_Future_Starts_Today.pdf>.

[23] Laurie Points and Ed Potton, *Artificial Intelligence and Automation in the UK*, Briefing Paper No. 8152 (London: House of Commons Library, December 21, 2017), 9, available at <https://researchbriefings.parliament.uk/ResearchBriefing/Summary/CBP-8152>.

[24] This must include knowledge of its application, how to provide a level of assurance and quality control, and how to optimally combine it with new concepts and human organizations at every level. See Mick Ryan, "Intellectual Preparation for Future War: How Artificial Intelligence Will Change Professional Military Education," *War on the Rocks*, July 3, 2018, available at <https://warontherocks.com/2018/07/intellectual-preparation-for-future-war-how-artificial-intelligence-will-change-professional-military-education/>.

[25] Approaches to achieving this are explored in Mick Ryan, *Human-Machine Teaming for Future Ground Forces* (Washington, DC: Center for Strategic and Budgetary Assessments, 2018), available at <https://csbaonline.org/uploads/documents/Human_Machine_Teaming_Final-Format.pdf>.

[26] See Advanced Distributed Learning Initiative Web site, available at <https://adlnet.gov/>.

[27] Cathy Downes, "Rapidly Evolving, Digitally-Enabled Learning Environments: Implications for Institutional Leaders, Educators and Students," in *Innovative Learning: A Key to National Security*, ed. Ralph Doughty, Lin Wells II, and Theodore C. Hailes (Fort Leavenworth, KS: Army University Press, 2015), 101.

[28] This is explored in Ryan, "Intellectual Preparation for Future War"; Michael Horowitz and Casey Mahoney, "Artificial Intelligence and the Military: Technology Is Only Half the Battle," *War on the Rocks*, December 25, 2018, available at <https://warontherocks.com/2018/12/artificial-intelligence-and-the-military-technology-is-only-half-the-battle/>.

[29] A range of issues concerned with biotechnology, including human augmentation, are explored in Robert E. Armstrong et al., eds., *Bio-Inspired Innovation and National Security* (Washington, DC: NDU Press, 2010), available at <https://ndupress.ndu.edu/Portals/68/Documents/Books/CTBSP-Exports/Bio-Inspired-Innovation.pdf?ver=2017-06-16-111126-690>.

[30] The Australian Defence College has found that simple desktop games have been highly effective, particularly in large-scale, whole-of-nation problems requiring joint as well as coalition and interagency collaborative planning.

[31] The issue of wargaming in military education is explored in multiple articles and publications. These include Elizabeth Bartels, "Getting the Most Out of Your Wargame: Practical Advice for Decision Makers," *War on the Rocks*, January 26, 2016, available at <https://warontherocks.com/2016/01/getting-the-most-out-of-your-wargame-practical-Advice-for-decision-makers/>; Elizabeth Bartels, "Building a Pipeline of Wargaming Talent: A Two Track Solution," *War on the Rocks*, November 14, 2018, available at <https://warontherocks.com/2018/11/building-a-pipeline-of-wargaming-talent-a-two-track-solution/>; Shawn Burns et al., *War Gamers Handbook* (Newport, RI: U.S. Naval War College, 2015), available at <https://apps.dtic.mil/dtic/tr/fulltext/u2/1001766.pdf>; Benjamin Jensen, "Welcome to Fight Club: Wargaming the Future," *War on the Rocks*, January 4, 2019, available at <https://warontherocks.com/2019/01/welcome-to-fight-club-wargaming-the-future/>.

[32] Hammes, "The Future of Conflict," 17.

[33] Eliot A. Cohen, The *Big Stick: The Limits of Soft Power and the Necessity of Military Force* (New York: Basic Books, 2017), 226; Mick Ryan, "Mastering the Profession of Arms, Part III: Competencies Today and into the Future," *War on the Rocks*, March 23, 2017, available at <https://warontherocks.com/2017/03/mastering-the-profession-of-arms-part-iii-competencies-today-and-into-the-future/>.