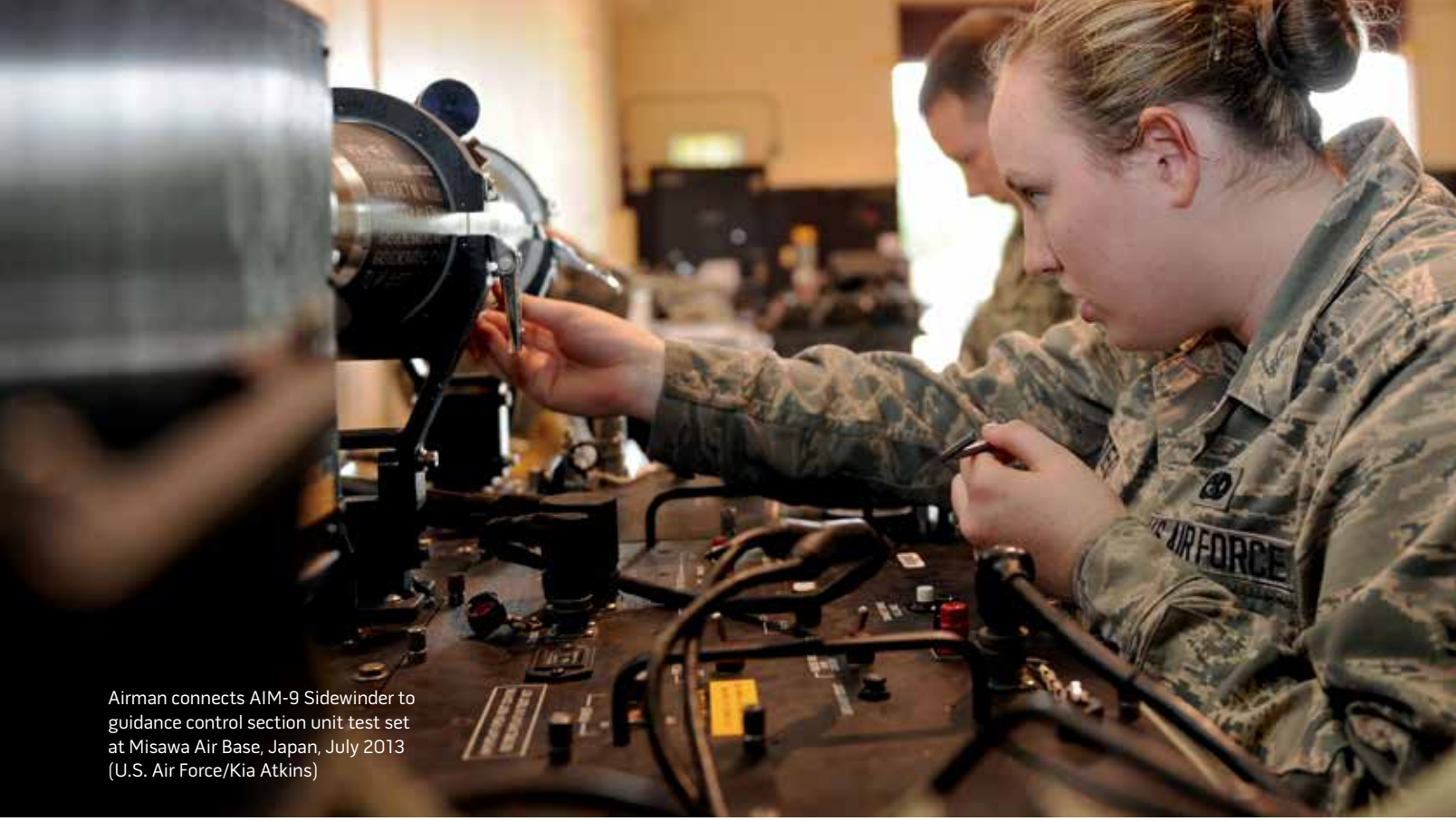

Airman connects AIM-9 Sidewinder to guidance control section unit test set at Misawa Air Base, Japan, July 2013 (U.S. Air Force/Kia Atkins)

Defense Entrepreneurship

How to Build Institutions for Innovation Inside the Military

By James Hasik

Fears of slipping dominance are driving an American push for military innovation. But while the accomplishments of American industry are enviable, not all innovation is grounded in technology or flows from the private sector. The U.S. Armed Forces have a considerable history with internally driven innovation, and today a new class of innovators is emerging within the Services. These public entrepreneurs watch for opportunities, make decisions under uncertainty, and then meld the factors of change in sticky (that is, locally commercialized) ways. Their entrepreneurship sometimes falters, as the controlling tendencies and vested interests of the bureaucratic apparatus resist. Defense entrepreneurs must overcome greater barriers than those faced by private entrepreneurs, but policymakers could speed their progress by building the right organizational models in staffing, structures, and incentives.

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Understanding the Internal Innovation Imperative

Is the dominance of the U.S. military at risk? A host of democratized tools of destruction are spreading fear that hitherto regional actors and superempowered individuals will break the American monopoly on some of the grandest instruments of military force.[1] In response, then–U.S. Secretary of Defense Chuck Hagel in November 2014 launched a formal "Defense Innovation Initiative" aimed at reshaping research and development (R&D) with a "Third Offset Strategy," focused on robotics, miniaturization, and additive manufacturing.[2] In these fields in particular, officials and analysts have been exhorting industry to innovate, "save innovation," and practice "innovation warfare."[3]

But while the largest defense contractors would always like more government funding, they are only now increasing their heretofore scant spending on internal R&D.[4] Unless the defense industry creates "more compelling threats of potential lost business," these firms will be unlikely to boost their own investments.[5] At the same time, large-scale innovation may become more difficult as a result of the increasing accumulation of knowledge, such that each dollar spent on defense does not deliver as much technological advancement as in the past.[6] If this happens, the price of dominance will become prohibitive. The technological gap between the United States and its near-peer competitors will continue to narrow, exposing America's vulnerabilities.[7]

In other ways, however, the rate of recombinant technological change is outpacing the bureaucratic processes of defense planning and acquisition.[8] Firms that do not normally conduct business with defense ministries may be outpacing the record of innovation by traditional contractors in fields such as microsatellites, cyber defense, robotics, and networked communications.[9] These advances then cause their own problems, as offset strategies built on commercial technologies raise relatively fewer barriers to entry to those up-and-coming powers.[10] Where others can access common technologies, creating advantage requires melding people, products, and processes in novel but sticky ways.[11]

Highlighting Examples of Internal Success

Before overhauling the supply base, reaching for unobtainable advantages, and building a new innovation-industrial complex, however, the defense industry should consider leveraging internal resources. Some of the best new ideas have come from within the Armed Forces, and from the relative bottom of the hierarchy.[12] Examples abound, reaching back decades. Consider how the initial impetus for employing assault helicopters in combat came from a group of junior aviators in the Marine Corps in the late 1940s.[13] The still-vaunted Sidewinder heat-seeking missile began as a part-time project by a small team of government engineers at Naval Air Weapons Station China Lake in California.[14] More recently, the initial prototypes of the now ubiquitous Joint Direct Attack Munition (JDAM) were similarly developed at Eglin Air Force Base in Florida.[15]

Thus, as Deputy Secretary of Defense Robert Work notes, the first requirement of this new offset strategy is to foster more innovative people.[16] Fortunately, among the middle ranks, a group of innovators is again emerging, this time connected by social media and driven by a sense that change is necessary. They are tackling the middle-level problems resident in questions of organization, training, doctrine, and even weapons engineering.[17] "Following in the wake of military innovators and reformers past, like William Sims and John Boyd, they have begun to organize," forming associations like the now decade-old *Small Wars Journal*, the Center for International Maritime Security, and the Defense Entrepreneurs Forum.[18] Simply put, they are today's defense entrepreneurs.

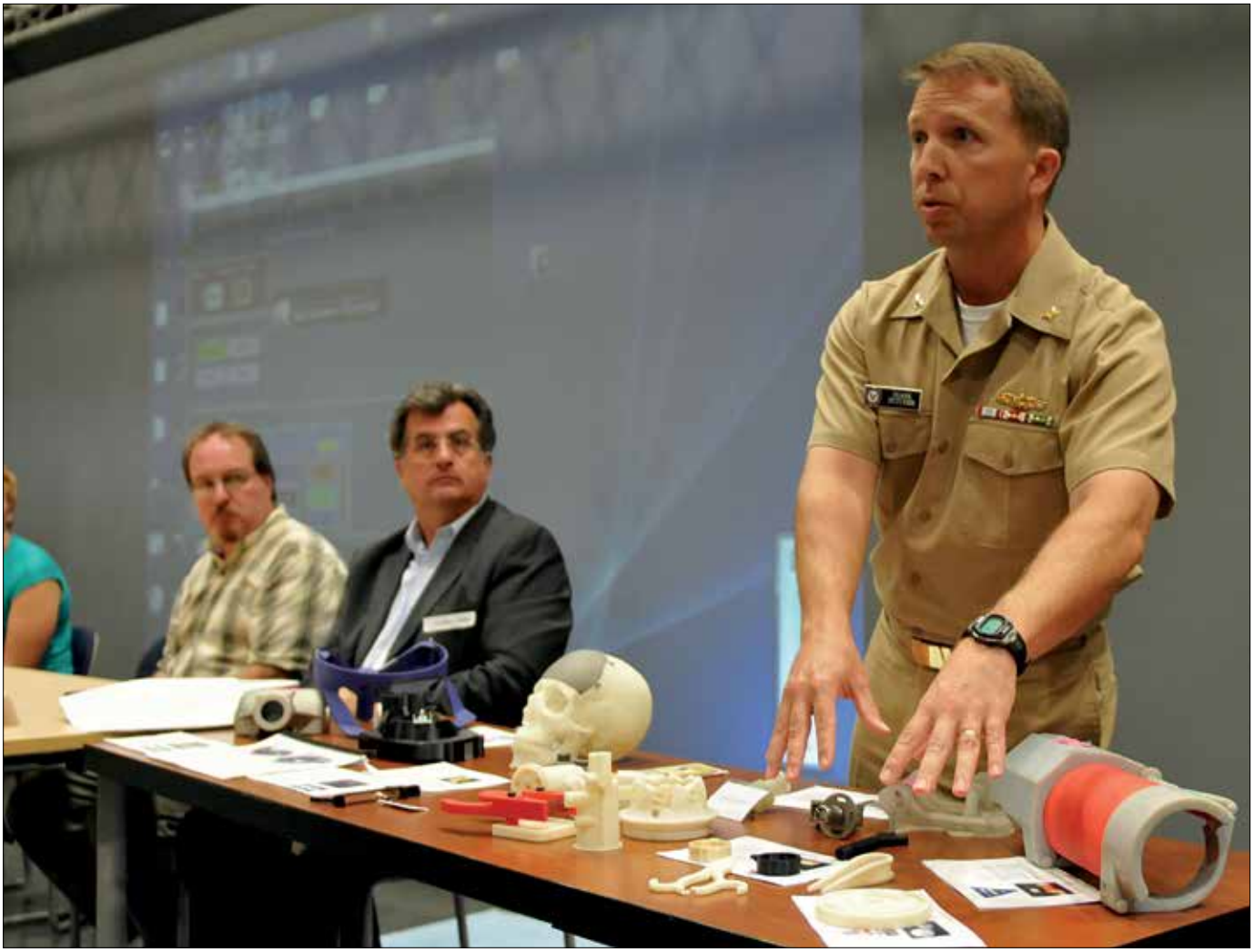
Perhaps most prominent is the Defense Entrepreneurs Forum. Now in its third year, the forum benefits from combining external sponsorship (primarily by the U.S. Naval Institute and University of Chicago) with a selected membership of substantially junior- and middle-ranking officers. Their work so far features some compelling ideas.[19] David Blair, an Air Force gunship and unmanned aerial vehicle (UAV) pilot fresh from a Ph.D. at Georgetown, wants to harness the big data of black boxes to continuously train better pilots. He calls the idea *Moneyjet*, but he also wants to keep the data from the micromanagement of higher headquarters.[20] Mark Jacobsen, an Air Force transport pilot now at Stanford University, is building cargo UAVs for humanitarian relief inside air defense umbrellas.[21] Matthew Hipple, a Navy helicopter pilot, is conceiving a force of networked decoy UAVs to "confuse, distract, and seduce" enemies.[22] Think of it as a combination of the Ghost Army of World War II and the helicopter decoy tactics of the Falklands War—or maybe even "smart chaff."[23]

Defining Defense Entrepreneurship

When creativity like this is unleashed, impressive forces can be raised. But just creating the demand for any program can be hard institutional work. In the classic telling, "manager and entrepreneur" U.S. Navy Rear Admiral Wayne Meyer, the legendary father of the Aegis air defense system, had a task as broad as the head of any startup business. Meyer had to "organize his staff, prepare designs for contractors, develop a working relationship with his sponsor in OPNAV [the headquarters staff], make sure Aegis ships met fleet needs, and keep Aegis afloat in Congress."[24] Meyer matched private industrial initiative to public service to bring about a revolution in air defense.

This idea of a *public* entrepreneur originates with the noted economist Joseph Schumpeter in the 1940s, but was brought to fuller understanding by Robert Dahl in the 1960s.[25] While precisely defining the nature of entrepreneurship can be challenging, describing what entrepreneurs *do* is easier.[26] For over a century, military innovation has been a collaborative enterprise and an emergent process among government, the military, and industry.[27] The entrepreneurs have been innovators in all three fields and have functioned as organizational agents of change. As Peter Klein and others have summarized, the management literature characterizes their functions in three ways.[28]

First, entrepreneurs *watch for opportunities*.[29] They will find "gaps between actual and potential outcomes or performance, and look for resources to close" them.[30] Incentives for action vary in source and intensity. On the battlefield, the military champion of change may view innovation as a matter of survival. In the laboratory or factory, contractors view opportunities as serving customers and earning profits. At headquarters, motivations may stem from a sense of obligation, the opportunity for advancement, or merely the prospect of retaining a job. The motivations may be duller than in commercial enterprises and languishing under the "trained incapacity"



Captain Frank Futcher explains display of 3D-printed objects during Navy Warfare Development Command–sponsored innovation workshop at Old Dominion University in Norfolk, Virginia (U.S. Navy/Jonathan E. Donnelly)

of bureaucracy.[31] Because these motivations exist, however, they can be leveraged in emergencies.

Second, entrepreneurs readily *make judgments under uncertainty* about where to invest money and effort.[32] In this formulation, uncertainty is not risk that can be modeled with probabilities, but is at best a known unknown. Uncertainty about reflexive bureaucratic hostility to discontinuous breakthroughs can deter those investments to an extent that simple risk does not. So entrepreneurs inform their judgment by probing and learning, preferably in ways that are inexpensive and, in retrospect, almost obvious.[33]

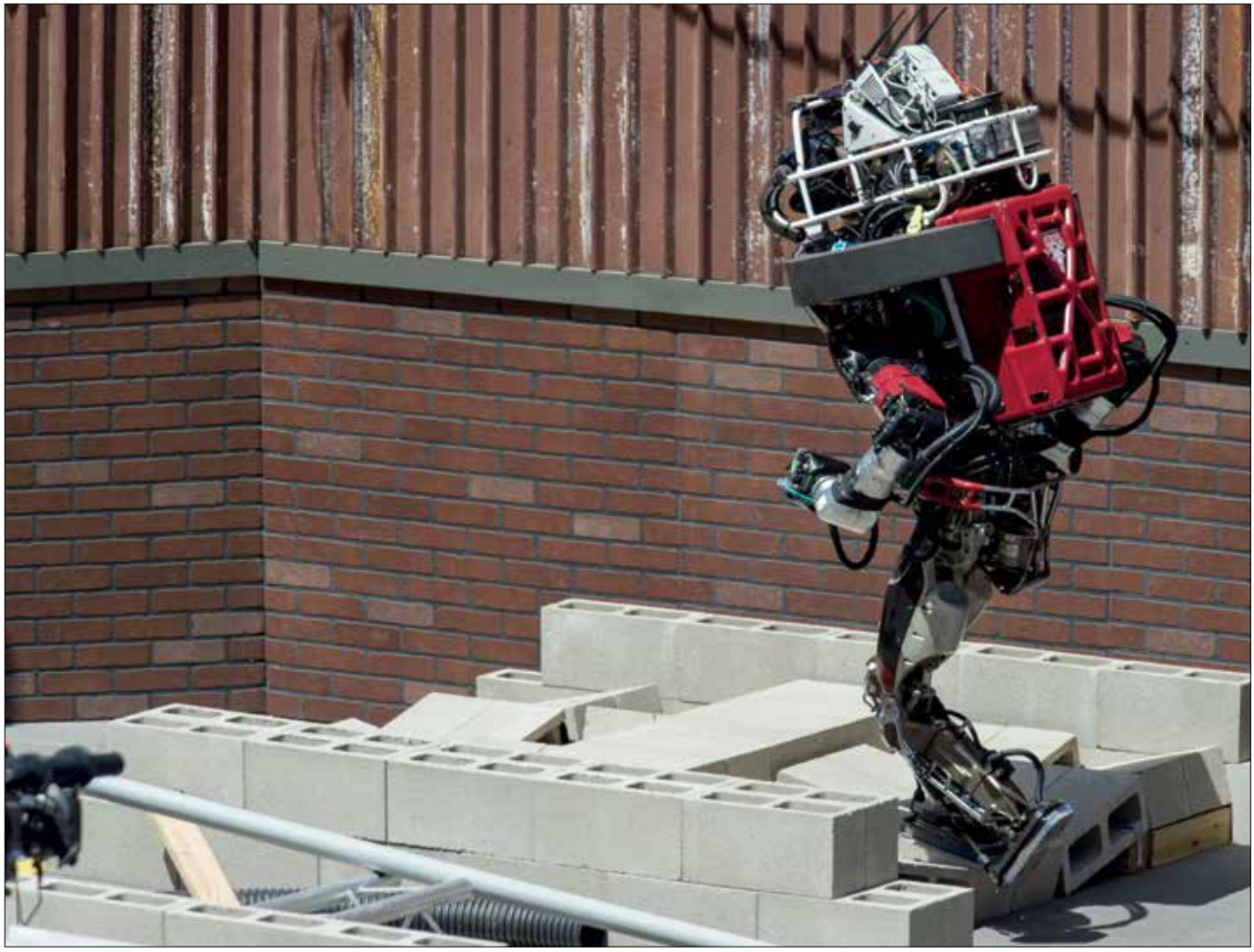
Third, entrepreneurs know how to *meld the factors of change in sticky ways.*[34] Engineers create new products and processes, but entrepreneurs bring about the change in people and teams as well. Indeed, the institutions themselves eventually become as outdated as the obsolete technology supporting them. At that point, both organizational and technological changes are required. One of the "spillovers of private actions to the public domain" is then the "establishment of [new] social norms and values," which drives better behavior by less enterprising elements of the bureaucracy.[35]

Explaining How Entrepreneurship Falters

The trouble is that the incentives for this internally driven change do not always align. Consider the tale of Major Robert Seifert, USAF (Ret.), an AC-130 gunship pilot whose experiences over Iraq led him to conclude that the aircraft could support both the battalions of the line and special operators. Two commanding officers tried to suppress his brief and higher headquarters attempted to classify it before *Joint Force Quarterly* published him.[36] Why does this happen?

Perhaps foremost, the bureaucratically minded dislike risk and detest uncertainty. As Max Weber put it, "bureaucratic administration means fundamentally the exercise of control on the basis of knowledge."[37] Without clear knowledge to point to, informal authority can wane. This limitation can induce *controlling tendencies* with which officials attempt to define and rationalize what they can.

Opportunity is not everyone's preference. Those with *vested interests* hold back reform through a lingering focus on existing technologies and comfortable



WARNER, a teaming of Worcester Polytechnic Institute and Carnegie Mellon University, navigates debris field during DARPA Robotics Challenge in Pomona, California, June 2015 (U.S. Navy/John F. Williams)

operating concepts.[38] Sometimes the process will be unconscious; the laggards will be trapped by their adherence to old paradigms. At other times, however, the rear guard actions will be quite deliberate. One of the more salient, if anonymous, quotes from the Vietnam experience features a senior officer who insisted, "I'll be damned if I permit the United States Army, its institutions, its doctrine, and its traditions to be destroyed just to win this lousy war."[39]

Finally, *public* entrepreneurs "are constrained by the need . . . to avoid excessive novelty."[40] Combining liberal democracy with a bureaucratic state apparatus naturally tends to restrain opportunities for bold leadership, simply to guard against "a dismantling of formal institutional checks and balances."[41] Appearing to move quickly stimulates the governmental *antibodies of change*, slowing the possible rate of innovation. Here again, where revolutionary change is required by abrupt changes in technology or the correlation of forces, failure to innovate is not an option.

Building Institutions for Innovation

Whether Seifert's idea was the best for supporting troops, it probably deserved a better airing. This is where the sponsors of entrepreneurs must undertake the fourth function—to *work to overcome the barriers to innovation*. As some private entrepreneurs entering the public realm have painfully realized, the challenges can be both impressive and confounding. The recent story of venture capitalist Jim Hake, who founded a 30-person private foundation to seek donations for military hearts-and-minds activities, did not start well—intervention by then–Secretary of Defense Leon Panetta was eventually required.[42] But public and private entrepreneurship remain interdependent, and effective defense entrepreneurship will require the co-evolution of an active public enterprise system with that of a more vigorous private defense industry.[43] The quality of the institutional arrangements supporting public entrepreneurship "is crucial for democratic capitalism" generally, and for the efficient supply of the Armed Forces specifically.[44]

Large organizations vary widely in their ability to innovate, and the Department of Defense should not be satisfied with its innovative capacity. So

what can Pentagon policymakers do? Encouraging entrepreneurship in defense is not just about funding the occasional technical breakthrough from small business or madly throwing money at possibilities.[45] Recent research at Bain & Company, a global management consulting firm, suggests that better innovative performance flows from an *organizational culture* that nurtures new products and processes.[46] When strategies "bubble up and accrete from below . . . the initiatives advanced by the operating levels of the organization are determined by the *staffing*, *structural*, and *incentive* decisions" made by top management.[47]

Staffing is perhaps the most challenging problem. In defining innovation as "the profitable application of creativity," Darrell Rigby, Kara Gruver, and James Allen of Bain & Company stress the importance of the differing skill sets for creation and commercialization. Citing examples such as Steve Jobs and Tim Cook at Apple, and Bill Bowman and Phil Knight at Nike, they note that great teams are built from both.[48] Military organizations, however, tend to breed more of the latter than the former. This approach must be revised, however, because melding that enduring change requires the inclusion of multiple kinds of people in the organization.

Command structures must become honest brokers for innovation. Senior leaders must choose the right pace of change and know when to kill off bad ideas.[49] Thinking *inside* the box sometimes leads to more usable ideas.[50] This must not be allowed to justify the protection of vested interests, but discipline is needed to foster what Scott D. Anthony, David Duncan, and Pontus Siren of the growth strategy firm Innosight call a *minimum viable innovation system*, defined as the "important intermediate option between *ad hoc* innovation and building an elaborate, large-scale innovation factory." This can be aimed to produce what serial entrepreneurs sometimes call the *minimum viable product*, that combination of proverbial "pipe-cleaners and cardboard" for working out the concept that forms the starting point for functional prototyping and early fielding.[51] Honestly vetting these ideas up the chain of command is not a natural process for most of the Armed Forces.

To make that happen, innovation needs incentives. Fostering entrepreneurship is not just about finding the smartest and most motivated entrepreneurs; it requires crafting the right rules of the game for those entrepreneurs to succeed. Leaders of the Armed Forces and the defense agencies, as well as those within the Office of the Secretary of Defense, ought to be asking themselves whether their organizations are rewarding, protecting, and *promoting* the 21st-century Williams Sims, Pete Quesadas, Hyman Rickovers, Brute Krulaks, Frank Aults, and John Boyds.[52] Review boards need to care more about pushing envelopes than peccadillos. As long as leadership is not actively pushing out the innovators, the cause is not lost, for not every potential *public* entrepreneur "is going to want to make a fortune by age 30 in a social media start-up." If personnel systems can offer opportunities for those with the creative itch to exit, make that fortune, and then serve again, the cause is not lost. The Department of Defense and the defense industry that supports it must compete with the better opportunities to build personal wealth that are offered in the public entrepreneurial space, but they often do provide more compelling technical and operational challenges than those found in writing messaging apps.[53] JFQ

Notes

[1] James Hasik and Mark Revor, *Democratized Destruction: Global Security in the Hacker Era* (Washington, DC: The Atlantic Council, September 2014).

[2] Chuck Hagel, "A New Era for the Defense Department," *Defense One*, November 18, 2014; Zachary Fryer-Biggs, "DOD Reshapes R&D, Betting on Future Technology," *Defense News*, April 20, 2014.

[3] See Marcus Wesigerber, "Hagel to Challenge Defense Industry to Innovate," *Defense News*, September 3, 2014; Aaron Mehta, "At AFA, USAF Secretary Calls for Innovation," *Defense News*, September 13, 2013; Sydney J. Freedberg, Jr., "How DOD Is Trying To Save Innovation," *Breaking Defense*, October 28, 2014; and Adam J. Harrison, "Innovation Warfare: Technology Domain Awareness and America's Military Edge," *War on the Rocks*, October 28, 2014; Doug Cameron and Julian E. Barnes, "Pentagon Presses Contractors to Innovate," *Wall Street Journal*, November 20, 2014.

[4] See, for example, Zachary Fryer-Biggs, "Northrop CEO: Low DOD R&D Spending Puts U.S. Tech Superiority at Risk," *Defense News*, September 16, 2013.

[5] Byron Callan of Capital Alpha Partners, quoted in Marcus Weisgerber, "Defense Firms Could Be Skeptical of Investing in Research," *Defense One*, November 26, 2014. That said, at least one top manager is concerned. See Paul McLeary, "CEO: Focus on Short-Term Dividends Could Blind Defense Industry to Long-Term Viability," *Defense News*, December 11, 2014.

[6] Benjamin F. Jones, "The Burden of Knowledge and the 'Death of the Renaissance Man': Is Innovation Getting Harder?" *Review of Economic Studies* 76, no. 1 (January 2009), 283–317.

[7] Jon Hamilton and Eric Williams, *USMC Strategic Initiatives Group Scouting Report*, October 24, 2014.

[8] Ibid.

[9] Secretary Chuck Hagel made a particular point of this in his speech. See also Paul McLeary, "DOD, Industry Huddle as Civil Firms Gain," *Defense News*, November 1, 2014.

[10] Loren Thompson, "Pre-Mortem: Hagel Innovation Initiative Is Too Little, and Way Too Late," *Forbes*, November 18, 2014; James Hasik and Alex Ward, "Third Offset Strategy, Second Adversary," *Defense Industrialist*, November 18, 2014; Sydney J. Freedberg, Jr., "Adversaries Will Copy 'Offset Strategy' Quickly: Bob Work," *Breaking Defense*, September 19, 2014.

[11] James Hasik and Byron Callan, *Disrupt or Be Disrupted: How Governments Can Develop Decisive Military Technologies* (Washington, DC: The Atlantic Council, May 2014).

[12] Adam Grissom, "The Future of Military Innovation Studies," *Journal of Strategic Studies* 29, no. 5 (October 2006), 905–934.

[13] B.J. Armstrong, "The Nuclear Option: Military Organizations, Leadership, and the Entrepreneurial Spirit," *War on the Rocks*, November 29, 2014; "The Answer to the Amphibious Prayer: Helicopters, the Marine Corps, and Defense Innovation," *War on the Rocks*, December 17, 2014.

[14] Ron Westrum, *Sidewinder: Creative Missile Development at China Lake* (Annapolis, MD: Naval Institute Press, 2013).

[15] James Hasik, *Arms and Innovation: Entrepreneurship and Alliances in the Twenty-First-Century Defense Industry* (Chicago: University of Chicago Press, 2008), chapter 4; Michael R. Rip and James Hasik, *The Precision Revolution: GPS and the Future of Warfighting* (Annapolis, MD: Naval Institute Press, 2002), 236.

[16] Remarks at the Defense One Summit, Washington DC, November 19, 2014.

[17] For the historical record of this phenom-

enon in the 1940s, see Paul Kennedy, *Engineers of Victory: The Problem Solvers Who Turned the Tide in the Second World War* (New York: Random House, 2013).

[18] B.J. Armstrong, "More Than an Offset: Defense Innovation from the Inside," *War on the Rocks*, November 26, 2014.

[19] For details on each proposal, see the *White Board: The Defense Entrepreneurs Forum*, available at <http://defenseentrepreneurs.org/whiteboard/>.

[20] The term is a clear allusion to Michael Lewis's *Moneyball: The Art of Winning an Unfair Game* (New York: Norton, 2003).

[21] For the autobiography, see Gail S. Halvorsen, *The Berlin Candy Bomber* (Bountiful, UT: Horizon Publishers, 2002).

[22] For more details, see Matthew Hipple, "Bring on the Countermeasures Drones," U.S. Naval Institute *Proceedings* 140, no. 2 (February 2014); and "Securing the Swarm: New Dogs, Old Tricks," *Small Wars Journal*, August 7, 2012.

[23] Megan Garger, "Ghost Army: The Inflatable Tanks That Fooled Hitler," *The Atlantic*, May 22, 2013. Additional comments were helpfully supplied by retired naval aviator Dan Moore and Atlantic Council Senior Fellow August Cole.

[24] Thomas C. Hone, Douglas V. Smith, and Roger C. Easton, Jr., "Aegis: Evolutionary or Revolutionary Technology?" in *The Politics of Naval Innovation*, ed. Bradd C. Hayes and Douglas V. Smith (Newport: U.S. Naval War College, 1994), 57.

[25] Adam D. Sheingate, "Political Entrepreneurship, Institutional Change, and American Economic Development," *Studies in American Political Development* 17, no. 2 (October 2003), 187, citing Joseph A. Schumpeter, *Capitalism, Socialism, and Democracy* (New York: Harper, 1942); and Robert Dahl, *Who Governs? Democracy and Power in an American City* (New Haven: Yale University Press, 1961).

[26] Peter Klein, "Confusing Definitions of Entrepreneurship," *Organization & Markets*, March 30, 2011.

[27] For the historical roots of this process, see Katherine C. Epstein, *Torpedo: Inventing the Military-Industrial Complex in the United States and Great Britain* (Cambridge: Harvard University Press, 2014).

[28] Peter G. Klein et al., "Toward a Theory of Public Entrepreneurship," *European Management Journal* 7 (2010), 2.

[29] Israel M. Kirzner, *Competition and Entrepreneurship* (Chicago: University of Chicago Press, 1973).

[30] Klein et al., 3

[31] Robert K. Merton, *Social Theory and Social Structure* (New York: Simon & Schuster, 1968), 251–252, citing Kenneth Burke, *Permanence and Change* (New York: New Republic, 1935), 50 ff. The phrase appears to have originated with Thorstein Veblen. See Erin Wais, "Trained Incapacity: Thorstein Veblen and Kenneth Burke," *K.B. Journal* 2, no. 1 (Fall 2005).

[32] Frank Knight, *Risk, Uncertainty, and Profit* (Boston: Houghton Mifflin, 1921).

[33] Gary S. Lynn, Joseph G. Morone, and Albert S. Paulson, "Marketing and Discontinuous Innovation: The Probe and Learn Process," *California Management Review* 38, no. 3 (Spring 1996), 8–37.

[34] Joseph A. Schumpeter, *The Theory of Economic Development: An Inquiry into Profits, Capital, Credit, Interest, and the Business Cycle* (Cambridge: Harvard University Press, 1934).

[35] Klein et al., 4.

[36] Robert J. Seifert, "A Pilot Speaks: The USAF Is Harder on Internal Ideas Than It Is on Evil Insurgents," *Foreign Policy*, December 4, 2014. For the backstory, see Seifert, "Iraq and the AC-130: Gunships Unleashed," *Joint Force Quarterly* 45 (2nd Quarter 2007), 78–83.

[37] Max Weber, *The Theory of Social and Economic Organization*, trans. A.M. Henderson and Talcott Parsons (New York: Free Press, 1947), 339.

[38] J.P. Eggers and Sarah Kaplan, "Cognition and Renewal: Comparing CEO and Organizational Effects on Incumbent Adaptation to Technical Change," *Organizational Science* 20, no. 2 (March–April 2009), 461–477.

[39] Brian Michael Jenkins, *The Unchangeable War*, RM-6278-1-ARPA (Santa Monica, CA: RAND, 1972), 3.

[40] Klein et al., 7.

[41] Jan Schnellenbach, "Public Entrepreneurship and the Economics of Reform," *Journal of Institutional Economics* 3, no. 2 (August 2007), 183.

[42] Daniel Henninger, "How a Venture Capitalist Went to War," *Wall Street Journal*, November 28, 2014.

[43] Klein et al., citing Elinor Ostrom, *Governing the Commons: The Evolution of Institutional Forms of Collective Action* (Cambridge: Cambridge University Press, 1990); and Elinor Ostrom, *Unlocking Public Entrepreneurship and Public Economies* (Helsinki: United Nations e-government Development Index, 2005).

[44] Klein et al., citing Douglas C. North, *Institutions, Institutional Change, and Economic Performance* (Cambridge: Cambridge University Press, 1990); and Sheingate.

[45] Steven Davidoff Solomon, "Throwing Money at Start-Ups in Frenzy to Find the Next Uber," *New York Times Dealbook*, December 16, 2014.

[46] Eric Almquist et al., "Cracking the Code of Innovation," *Forbes*, August 2013.

[47] Sydney Finkelstein, Donald C. Hambrick, and Alberta A. Cannella, Jr., *Strategic Leadership: Theory and Research on Executives, Top Management Teams, and Boards* (Oxford: Oxford University Press, 2009), 6, citing Joseph L. Bauer, *Managing the Resource Allocation Process* (Oxford: Harvard Business School Press, 1970); Robert A. Burgelman, "A Process Model of Internal Corporate Venturing in the Diversified Major Firm," *Administrative Science Quarterly* 28, no. 3 (September 1983), 223–244. Emphasis added.

[48] Darrell K. Rigby, Kara Gruver, and James Allen, "Innovation in Turbulent Times," *Harvard Business Review*, June 2009.

[49] Adam Bluestein, "Debunking the Myth of Innovation," *Inc.*, September 2013.

[50] Drew Boyd and Jacob Goldenberg, *Inside the Box: A Proven System of Creativity for Breakthrough Results* (New York: Simon & Schuster, 2013). For a summary by the authors, see "Think Inside the Box," *Wall Street Journal*, June 14, 2013.

[51] Scott A. Anthony, David S. Duncan, and Pontus M.A. Siren, "Build an Innovation Engine in 90 Days," *Harvard Business Review*, December 2014, 62; comments by Dan Moore at the 2014 Defense Entrepreneurs Forum.

[52] Dan Moore, personal communication with author, November 1, 2014.

[53] Byron Callan, "DII Should Help Reshape Defense Industry and Relative Position of Contractors," Capital Alpha Partners, December 3, 2014.