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Introduction by Jon Sumida

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Contents

Introduction by Jon Sumida, University of Maryland, College Park	2
Review by Jeffrey A. Engel, Southern Methodist University	5
Review by Keith Neilson, Emeritus, Royal Military College of Canada	9
Review by Timothy S. Wolters, Iowa State University	12
Author's Response by Katherine C. Epstein	17

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Introduction by Jon Sumida, University of Maryland, College Park

In *Torpedo: Inventing the Military Industrial Complex in the United States and Great Britain*, Katherine Epstein deploys and integrates six different analytical approaches. First, she provides a detailed account of the development of torpedo engineering in the late nineteenth and early twentieth century, focusing on the guidance and propulsion sub-systems that were crucial to the emergence of the torpedo as a major challenge to artillery before the First World War. Second, Epstein elucidates the dynamics of the cooperation between government departments (navies) on the one hand, and private or government inventors and private corporations on the other, which were essential to the invention and production of these sub-systems. Third, she examines a highly problematical legal aspect of novel joint public/private research and development efforts—namely the issue of property rights. Fourth, Epstein structures the development history of torpedo sub-systems in a comparative framework that illuminates significant differences in technical policy and technical outcomes between Great Britain, the world’s leading naval power, and the United States, a then rising naval power. Fifth, she uses the ideas of William McNeill about the integration of government command and market imperatives in the late nineteenth and early twentieth century as a means of placing her findings within the broader historical context of the development of the military/industrial complex.¹ And sixth, Epstein delineates the connection between advances in torpedo capability and broader technical activity and concomitant tactical, operational, and strategic application, with due appreciation of the complexity and contingency of their interactions.

Epstein’s examination of multiple subjects is based upon complex, comprehensive, and rigorous research. The foundation of her scholarship is the study of documents. . In Epstein’s monograph, assiduous consideration of the documents is an essential part of creative analysis. Epstein possesses a rare talent for close observation of large amounts of fine-grained data in unpublished primary sources, which enables her to detect patterns of historical significance that would otherwise escape notice. That being said, Epstein’s intelligent reading of the secondary literature on American and British naval engineering, naval policy and administration, naval tactics and strategy, the history of technology, and national security law is also applied where appropriate to guide her interrogation of the primary sources and support her arguments.

All three reviewers admire Epstein’s integration of multiple lines of inquiry. Keith Neilson avers that Epstein “evaluates the literature—which is eclectic in the extreme, given that she deals with naval, business, political, and legal history—in a confident manner.” He concludes that “*Torpedo* should be read by all historians interested not just in naval history, but in the interaction between various historiographies that Epstein links together.” Timothy Wolters notes that “Epstein adeptly navigates the intersections of several historical-sub-disciplines, including military and naval history, business history, and the history of science and technology.” And Jeffrey Engel maintains that “Epstein combines

¹ William H. McNeill, *The Pursuit of Power: Technology, Armed Force, and Society since A.D. 1000* (Chicago: University of Chicago Press 1982).

naval history, business history, legal history, and the history of technology in a manner that is wholly digestible and more importantly wholly illuminating for scholars of each of those disparate fields.” He later adds “I can think of few if any equally impressive examples of a scholar not only crossing the boundaries of various complex fields, but weaving them together in such a revealing tapestry.” The three reviewers are also impressed by the very high quality of Epstein’s investigation of the documentary record. *Torpedo*, Wolters states, “draws from a deep base of archival sources.” “Epstein’s archival base,” Neilson declares, “both in Britain and the United States, is first-rate.” For Engel, Epstein’s book was “impressively researched,” and “represents a level of scholarship few will be able to equal or attain.”

The criticism of the three reviewers differs. Wolters had “one minor quibble and one major question.” In so far as the former is concerned, he believes that Epstein could and should have made much more of her invention of the category of ‘servant technology.’ With respect to the latter, Wolters identifies Epstein’s omission of the French experience as a major analytical gap while conceding that the subject was “beyond the scope of her study.” Like Wolters, Engel offers a minor and a major criticism. The former is that Epstein failed to consummate her narrative with a consideration of the torpedo’s operational record in the First World War. Engel then contests energetically Epstein’s argument about the development of the torpedo being an early manifestation of the full range of factors that drove what was to become known as the military industrial complex, on the grounds that the critical factor of “malicious intent” that so concerned post-Second World War opponents of the phenomenon was not yet evident. Neilson’s review does not offer explicit criticism, only stating “her work could have been made longer with good advantage.”

The general assessments of Epstein’s monograph by the three reviewers are exceptionally strong. Wolters writes that “*Torpedo* is an important monograph deserving of a wide readership.” Neilson is convinced that Epstein has produced “an excellent book” that “advances our knowledge of her topic at the same time as pointing the way for a fuller consideration of the disparate disciplines that pertain to it.” *Torpedo*, Engel argues, is “a book best described as brilliant.” He goes on to elaborate that “it is rare that one finds an author’s first book so full of insight, so artfully composed, and so illuminating.”

Participants:

Katherine C. Epstein received her Ph.D. in history from Ohio State University and is currently Assistant Professor of History at Rutgers University-Camden. Her current project is a history of national-security information in the United States from the Civil War to the Cold War.

Jon Sumida received his doctorate in history from the University of Chicago and is currently Professor of History at the University of Maryland, College Park. He is the author of *In Defence of Naval Supremacy: Finance, Technology and British Naval Policy, 1889-1914* (1989); *Inventing Grand Strategy and Teaching Command: The Classic Works of Alfred Thayer Mahan Reconsidered* (1997) and *Decoding Clausewitz: A New Approach to On War*

(2008), and editor of *The Pollen Papers: the Privately Circulated Printed Works of Arthur Hungerford Pollen 1901-1916* (1984). Sumida is working on a monograph on British naval tactics during the early twentieth-century and a collection of articles dealing with various subjects related to the Royal Navy.

Jeffrey A. Engel is founding director of Southern Methodist University's Center for Presidential History. Author or editor of eight books on American foreign policy, his works include *Cold War at 30,000 Feet: The Anglo-American Fight for Aviation Supremacy*, and (forthcoming) *When the World Seemed New: George H.W. Bush and the Surprisingly Peaceful End of the Cold War*.

Keith Neilson is Professor Emeritus in the History Department of the Royal Military College of Canada. He received his undergraduate education and MA from the University of Alberta and his Ph.D. from the University of Cambridge where his supervisor was Norman Stone. Professor Neilson is an expert on Anglo-Russian/Soviet relations and on British strategic foreign policy in the period from 1850 to 1945. He is the author (or co-author) of five books and has edited eleven others. His most recent book (with T.G. Otte) is *The Permanent Under-Secretary for Foreign Affairs, 1854-1946* (London and New York: Routledge, 2009). At present, he is writing a book on British policy towards the neutrals, 1939-41.

Timothy S. Wolters is an Associate Professor of history at Iowa State University and the commanding officer of Navy Reserve Undersea Warfare Operations Detachment I, a unit that provides surge support to the United States' four theater antisubmarine warfare (ASW) commands. He holds a Ph.D. in the history of science and technology from MIT and is the author of *Information at Sea: Shipboard Command and Control in the U.S. Navy, from Mobile Bay to Okinawa* (Johns Hopkins University Press, 2013). His current research focuses on Samuel Eliot Morison and U.S. naval operations during World War II.

Review by Jeffrey A. Engel, Southern Methodist University

The military industrial complex, that conglomeration of vested financial, manufacturing, and political interests capable of guiding national policy for its own benefit and to ensure its own survival, did not begin during the Cold War. This is the central contention of Katherine Epstein's insightful study of British and American development of torpedo technology at the turn of the twentieth century. "It was, to be sure, smaller in scale than when President Eisenhower described it in 1961," she writes, "but many of its essential dynamics—and dangers—were in place: replacement of market by command, public-sector investment in private-sector technological development, the role of technocratic elites in the policy process, the beginnings of big-science, and government outreach to academia" (229).

"Before World War I," Epstein argues in her conclusion and consistently throughout the book, "the differences between peace and war were ultimately eroding" (229). Eisenhower warned of a permanent state of semi-war resulting from Cold War tensions, with the world forevermore primed for conflict and on a hair-trigger lest the other side seize an unassailable initiative, and with permanent structures of development, procurement, and deployment of military hardware around the world but the most visible manifestation of unceasing anxieties. Epstein tells us that to find the origins of what Eisenhower ultimately preached we must look less to the time of his presidency than to the era of his birth.

This is a contentious argument, which I will return to, but not before noting that this claim comes from a book best described as brilliant. Indeed, *Torpedo* poses a particular problem for the conscientious reviewer, because it is rare that one finds an author's first book so full of insights, so artfully composed, and so illuminating. Ultimately the book's qualities do not develop the point Epstein would like to drive home, that the military-industrial complex began in the 1800s—at least not in the full way she contends—but this should not diminish our overall appreciation of the work. The military-industrial complex no doubt has origins in the period she details, and perhaps even with torpedoes, as she describes. But the early twentieth-century military-industrial complex she portrays lacked the one thing that Eisenhower told his fellow Americans to fear most: a desire to forge dangerous national policies in order to ensure its own survival.

The story Epstein tells is one that will strike most historians as new and no-doubt fascinating. She details the evolution of the modern torpedo, exploring not only its initial effect on strategy but in even greater detail the engineering and manufacturing feats required to bring a wholly new industrial product to market. More than simply new, torpedoes of the era ranked among the most complex and impressive pieces of military hardware available to strategists of the day. "Several years before the outbreak of World War I," she writes, "torpedoes could travel at a speed of 45 knots (51 miles per hour) or run 10,000 yards." Impressive to be sure, but "to put those numbers in perspective, Glenn Curtiss, the great American engineer, won the premier airplane racing event of 1909 by flying 47 miles per hour for 12.4 miles—and, of course, he did not have to contend with water resistance" (5).

Water resistance was but one hurdle torpedo engineers had to clear in order to turn their blueprint drawings into effective machines of war, and it is in Epstein's detailed accounting of the fits and starts of British and American development and manufacturing that the book truly shines. Impressively researched and thoughtfully presented, the book's chief characteristic is its author's ability to track minute changes in engineering specifics across experimental and production models, while simultaneously explaining to readers why subtle and complex technological developments mattered not only for the machine's effectiveness but for its potential strategic effect. In other words, Epstein combines naval history, business history, legal history, and the history of technology in a manner that is wholly digestible, and more importantly, wholly illuminating, for scholars of each of those disparate fields. This is among her stated goals for the book, and I can think of few if any equally impressive examples of a scholar not only crossing the boundaries of various complex fields, but weaving them together in such a revealing tapestry. One simply cannot read this book without learning much about Epstein's subject, with no real competitor as a history of her topic.

So impressive is Epstein's mingling of fields that I fear she may have diluted her own effort to accomplish a second of her stated goals: to begin "new conversations" (17). It is no easy thing for legal scholars, diplomatic historians, and historians of technology to mingle (to cite but several of the fields this study engages). Each specialty requires a level of technical expertise so difficult to attain as to make it difficult for the majority of practitioners to find time to develop expertise in any other realm. Epstein hopes these groups might talk more, using her book as an example of how fields overlap, in turn producing a greater understanding of historical trends with contemporary resonance, including "defense contracting, advanced weaponry, national security, property rights, state power, and the blurring of war and peace" (17). While reading Epstein's detailed and eloquent work one cannot help, however, but come to the sad realization that few scholars have or will so effectively master overlapping fields as to make such multi-faceted conversations possible. *Torpedo* may well be a model for future scholarship, but it represents a level of scholarship few will be able to equal or attain. Epstein's is a laudatory goal, but the quality of her own work makes me pessimistic that many others might effectively follow in her footsteps.

To praise a book for too much competence is rare, and no matter how illuminating, no work is without flaw. Two in particular stand out in *Torpedo*, one a yearning for what this book does not fulfill, the other more fundamental to Epstein's project. In the former case, the book is done in by the time-frame of Epstein's study. The Great War looms large in the reader's mind as her tale of military and industrial competition and national scheming builds over the first years of the twentieth century, and the author is quick to point out the manifest ways the addition of torpedo technology forced policymakers and naval officers to reconsider their overall theories of battle and strategies of war. A relatively inexpensive weapon capable of sinking massively expensive capital ships from a distance beyond a battleship's effective range of fire has a way of focusing an admiral's mind. Yet her study concludes before we have opportunity to learn much about the torpedoes' effectiveness in battle during the war that readers know to be on the near horizon, even if that knowledge was unavailable to strategists of the time. It is no fair thing to criticize a book for failing to

include that which the author was never intending to cover, but an additional chapter explaining how the preceding 229 pages of industrial intrigue, engineering accomplishments, and naval strategizing played out not in tests but in actual combat—in the North Sea, the North Atlantic, and throughout the world—would have provided a satisfying conclusion to the otherwise complete study.

A second more overarching critique exists as well, arising from the author's overall goal of forcing scholars to push back the date at which they typically place the onset of the military industrial complex. There can be no doubt that Epstein's tale contains all the elements of the military industrial complex she details. These include the aforementioned "replacement of market by command, public-sector investment in private-sector technological development, the role of technocratic elites in the policy process, the beginnings of big-science, and government outreach to academia" (229). Each was a key element of the military-industrial complex as scholars have come to understand its Cold War evolution, the world Eisenhower perceived and feared. Yet Eisenhower's fear contained an additional element not present in Epstein's list, nor fully explored in her study: fear that weapons producers and their customers might ultimately find profit and purpose in continuing if not exacerbating international tensions in order to ensure their share of profits. One can find resonance of such fears well before Eisenhower's day, in the decades before World War II in particular when commentators from across the political spectrum found merit in the notion that 'merchants of death' helped spawn World War I, or at least contributed to American participation in the great conflagration. There was within Eisenhower's message a warning of similar nefarious scheming; that perhaps the Cold War might endure longer than need be, at greater risk, owing less to strategic realities than to the parochial and selfish needs of military planners and industrial giants eager to ensure their own survival at the risk of that of the nation. "In the councils of government," he intoned, "we must guard against the acquisition of unwarranted influence, whether sought or unsought, by the military industrial complex." To his mind it was not the fact of government, military, and industrial collusion that was to be feared, but instead "the potential for the disastrous rise of misplaced power" capable of endangering "our liberties or democratic processes."¹

There is little sinister in Epstein's tale, making her description of the military industrial complex during the first years of the twentieth century a tale of biology more than of theology. She describes the military industrial complex's growth, evolution, parameters, and foundation. She simultaneously reveals little of its purpose, however, which to Eisenhower's mind was ultimately less the sustenance of the American way of life than of the military-industrial complex's own perpetuation. Epstein's vision of the military industrial complex is full yet incomplete. It would take the full weight of the twentieth century to enlarge the garrison state to the point where it might fully dominate not only the execution but also the formation of policy. What she describes in her insightful, poignant, and truly exceptional book is indeed, as she terms it, the invention of the military industrial

¹ Eisenhower's text, and documents detailing the speech's evolution and production, can be found at: http://www.eisenhower.archives.gov/research/online_documents/farewell_address.html, accessed July 30, 2014.

complex. Its growth over the ensuing decades, however, saw the addition of something undiscovered in her study, yet something Eisenhower feared: the addition of malicious intent.

Review by Keith Neilson, Emeritus, Royal Military College of Canada

In 1982, William H. McNeill published his highly-influential book, *The Pursuit of Power: Technology, Armed Force, and Society since A.D. 1000*.¹ Among other insights, McNeill contended that the rising cost of technology had led to two things: less affluent states were unable to obtain or even to build the newest weaponry, and governments tended to form mutually beneficial relationships with arms producers in order to ensure that the latter developed the more advanced (and expensive) products. This latter effect McNeill termed ‘command technology’ and President Eisenhower famously categorized the resulting collaboration as the ‘military-industrial complex.’

Not surprisingly, McNeill’s most elegant example of both these phenomena was the relationship between the British Royal Navy and arms producers in the late nineteenth and early twentieth centuries. This was only logical, as naval technology was the most rapidly developing one of the period, the Royal Navy was the world’s premier navy, and the British government had the financial wherewithal (and the will) to provide the funds necessary for these related occurrences to take place. For McNeill, the focus of the naval military-industrial complex was the development of naval ships themselves, their means of propulsion and their guns. Building on McNeill’s insight, such scholars as Jon Sumida have examined the development of naval gun sights and the strategic consequences of the rising cost of naval advances.² Until Katherine Epstein’s work under review, the humble torpedo had escaped analysis.

Epstein sees her book as mapping “a busy but unexplored intersection of military history, diplomatic history, the history of science and technology, business history, legal history, and political history” (2). She rightly contends that the development of the torpedo – as with other complex military technologies – involves issues important to each of the historiographies she mentions, historiographies that rarely speak to each other as they pursue separate agendas. However, in reality, as both Eisenhower and McNeill would agree, they are each not entirely comprehensible without considering the other aspects of the topic.

Epstein’s choice of countries to consider with respect to the development of the torpedo is both interesting and informative. The two navies involved, the Royal Navy and the United States Navy, were both similar and yet profoundly different. The similarity lay in the fact that both were the product of democratic capitalist societies, where public opinion and pressure groups could exert influence on government decisions and well-established legal

¹ William H. McNeill, *The Pursuit of Power: Technology, Armed Force, and Society since A.D. 1000* (Chicago: University of Chicago Press, 1982).

² Jon Tetsuro Sumida, *In Defence of Naval Supremacy. Finance, Technology, and British Naval Policy 1889-1914* (Boston: Unwin Hyman, 1989), Nicholas Lambert, *Sir John Fisher’s Naval Revolution* (Columbia, SC: University of South Carolina Press, 1999), John Brooks, *Dreadnought Gunnery and the Battle of Jutland. The Question of Fire Control* (London and New York: Routledge, 2005)

systems could affect both the way in which industries functioned and provide recourse for those who felt that their patents had been infringed. The difference lay in the sheer size and complexity of the two maritime forces. The Royal Navy was not only the dominant global navy but also it technologically was the most advanced. In addition, the RN had its own, in-house, sophisticated providers of technology that provided competition for private firms, allowing the Admiralty to treat private firms in a fashion not available to the U.S. Navy, which lacked such accoutrements.

With these factors in mind, Epstein demonstrates that the two navies took diametrically opposed approaches to the new technologies – superheaters, gyroscopes, turbine and compressed-air engines and the like. As a relatively weak navy, and lacking in the technological infrastructure that the British had in abundance, the U.S. Navy attempted to make quantum leaps in technology, adopting radical solutions as a means of taking the lead in the technological arms race. It was handicapped in this effort by the lack of means (both material and personnel) to evaluate the offers put forward by inventors. And, because of the smaller size of the emerging military-industrial complex in the United States, greater subsidies from the American government were needed to stimulate private enterprise (where American firms were fledglings). The Royal Navy, on the other hand, could opt for incremental improvements and compare the same various innovations against both each other and the efforts of its own technological arms. The resources available to the Royal Navy also allowed it to wait until the contest between competing technologies had been resolved before committing itself without the penalty of falling behind, since, once the best technology had been determined, it was able to put it into service rapidly. Equally, the long-time collaboration between the Royal Navy and various large and well-equipped British firms and the Royal Navy's own capabilities meant that subsidies, although they occurred, were smaller and often optional. This latter allowed the Royal Navy to lower costs and achieve more with less financial investment.

The differing legal systems also affected development. The U.S. Navy, without its own technological base, often found itself entangled in arguments over whether it was infringing upon the patent rights of those who had put forward proposals for development, leading to complex lawsuits and payouts. The British had similar arguments, but the concept of 'secret' patents, which did not exist in American law, allowed the Royal Navy to avoid legal complications and to hide from the public scrutiny resulting from court cases the nature of innovations that had taken place.

Epstein follows the technological innovations with a clear eye. She makes comprehensible the difficulties involved with maintaining depth control, pitch and yaw, and fire control. She also follows the problems involved with command technology with respect to the law. Both the U.S. Navy and the Royal Navy had a tendency to seize upon ideas put forward by inventors and to claim as their own any variations that occurred after test models were provided for evaluation. She is equally clear in showing the differences between U.S. patent law and its British equivalent.

She is also quite aware of the impact that the development of the torpedo had (both potential and actual) on naval tactics. While much of naval history dealing with this era has

focused on the battleship and naval gunnery, Epstein makes evident the intellectual ferment that the torpedo caused. If torpedoes could become reliable, and if their range could be extended, and if the problems involved in hitting distant moving targets could be overcome, then both the composition of naval forces and their employment would be altered dramatically. Battleships would become expensive and vulnerable targets, instead of acting as the arbiters of fleet encounters. In this way, the debate around the value of the torpedo adumbrated the similar arguments in the post-1919 era between those who continued to trumpet the battleship and the advocates of air power who favoured the aircraft carrier.

This is an excellent book. Epstein's archival base, both in Britain and the United States, is first-rate. She is judicious in her judgments and evaluates the literature – which is eclectic in the extreme, given that she deals with naval, business, political, and legal history – in a confident manner. While the book is based on a Ph.D. thesis, it is clear that Epstein has taken the trouble to remove the evidence of the genre and has produced something that advances our knowledge of her topic at the same time as pointing the way for a fuller consideration of the disparate disciplines that pertain to it. If anything, her work could have been made longer with good advantage – a rare event in publishing. Despite its seemingly narrow subject matter, *Torpedo* should be read by all historians interested not just in naval history, but in the interaction between the various historiographies that Epstein links together.

On 26 March 2010, a sudden explosion rocked the South Korean warship *Cheonan*, breaking the vessel in two and causing the death of 46 sailors. Analysis by an international team of experts concluded the disaster resulted from an external underwater explosion generated by a torpedo manufactured in North Korea.¹ Although the North Korean government denied involvement, many experts in undersea warfare believe a North Korean midget submarine likely launched the fatal blow that sent *Cheonan* to the bottom of the Yellow Sea.

The *Cheonan* tragedy seems to confirm several popular conceptions about the torpedo; conceptions rooted both in public memory and much of the historical discourse on this notorious weapon of war. The first revolves around the connection between the torpedo and the submarine, a link cemented into public consciousness a century ago by the sinking of *Lusitania*. A second popular conception reinforced by the *Cheonan* incident is the idea that the torpedo is a weapon of the weak. Lacking the industrial infrastructure or trading partners to build and operate a modern navy, North Korea has invested heavily in mines and torpedoes, the archetypal weapons of asymmetric naval warfare.² Finally, discussions of the *Cheonan* disaster show that many observers are willing to place the torpedo inside a 'black box,' viewing the weapon as an artifact whose functions can be understood without an analysis of its internal workings.³

In *Torpedo*, a well-conceived and impressively researched monograph, Katherine Epstein blows a hole in these and other misconceptions surrounding the early development of the self-propelled torpedo.⁴ She begins her story in the late 1860s with torpedo pioneer

¹ Joint Civilian-Military Investigation Group, *Investigation Result of the Sinking of ROKS "Cheonan"*, 20 May 2010, http://news.bbc.co.uk/nol/shared/bsp/hi/pdfs/20_05_10jigreport.pdf (accessed 30 September 2014). Some aspects of this report have been criticized, for which see Mark E. Caprio, "Plausible Denial? Reviewing the Evidence of DPRK Culpability for the Cheonan Warship Incident," *Asia-Pacific Journal*, 26 July 2010, <http://www.japanfocus.org/-Mark-Caprio/3390> (accessed 30 September 2014).

² Scott C. Truver, "Taking Mines Seriously: Mine Warfare in China's Near Seas," *Naval War College Review* 65, no. 2 (Spring 2012), 30-66, and Herbert W. Richmond, "The Weapon of the Weak," *Journal of the Royal United Services Institution* 77, no. 507 (1932), 497-503.

³ John Pomfret and Blaine Harden, "South Korea to officially blame North Korea for March torpedo attack on warship," *Washington Post*, 19 May 2010, <http://www.washingtonpost.com/wp-dyn/content/article/2010/05/18/AR2010051803094.html> (accessed 30 September 2014), Choe Sang-Hun, "South Korea Publicly Blames the North for Ship's Sinking," *New York Times*, 19 May 2010, <http://www.nytimes.com/2010/05/20/world/asia/20korea.html?pagewanted=all&r=0> (accessed 30 September 2014), and *Oxford English Dictionary*, s.v. "black box."

⁴ Only in the latter nineteenth century did military personnel begin to make a distinction between stationary torpedoes (which came to be known as mines) and self-propelled, or automobile, torpedoes. Timothy S. Wolters, "Electric Torpedoes in the Confederacy: Reconciling Conflicting Histories," *Journal of Military History* 72, no. 3 (July 2008), 755-783.

Robert Whitehead and follows events through the eve of the Great War. Concentrating on developments from 1894 to 1914, Epstein uses previously untapped archival sources to explore the history of the torpedo in both Great Britain and the United States.⁵ The reader learns that in these two nations the submarine had little to do with early torpedo development and gains a deep appreciation for the political, fiscal, technical, and legal complexities faced by policymakers. Epstein convincingly shows that most policies related to torpedoes were “an accretion of day-to-day problem solving, sometimes but not always with sensitivity to long-term consequences, and rarely committed to documents with titles revealing their significance” (215).

Epstein organizes *Torpedo* into three chapter pairs, bookended by an introduction and a conclusion. Each pair offers a comparative look at various aspects of American and British torpedo development. Chapters one and two explore the problems faced by leaders in both countries as they worked to turn the torpedo into an effective instrument of war. For the United States Navy these efforts revolved largely around the development of an indigenously manufactured torpedo, while for the British Royal Navy this meant working closely with the Whitehead Company. Both institutions struggled with the issue of horizontal guidance until Whitehead acquired the rights to the Obry gyroscope in 1896. The Obry gyroscope offered the potential for accurate torpedo runs out to 2,000 meters (22), but adoption of the device was far from straightforward in either nation. Epstein skillfully covers the internal debates and external negotiations that frustrated both navies as they sought to acquire a gyroscope that could dramatically improve torpedo performance.

Epstein’s third and fourth chapters examine events from 1903 to 1908. In a nutshell, she argues that the Royal Navy was more successful than the U.S. Navy in developing and acquiring torpedoes during these years. For Epstein, the U.S. Navy’s relative weakness in research and development meant that it had to pursue novel ideas in hopes of achieving a major technical breakthrough. The United States thus pursued an unproven turbine engine and had to deal with a supply crisis “so serious that vessels were forced to sail for foreign stations without torpedoes,” eventually forcing naval leaders to admit “the US bid for independence from the foreign Whitehead torpedo had failed” (85).

The book’s final chapter pair looks at the five years preceding the outbreak of the Great War. Once again Epstein is critical of the U.S. Navy, writing that its Bureau of Ordnance, “suffered the consequences of its earlier errors,” and then “repeated them” (133). For its part, the Royal Navy had developed torpedoes of “impressive speed and range,” but ones still bedeviled by “poor direction keeping and poor depth keeping” (184). By 1914, then, the torpedo was not the ship killer it eventually would become, but for nearly two decades it had been good enough to create major tactical and strategic problems. Epstein also gives considerable attention to several legal cases that demonstrate how the torpedo

⁵ Epstein draws from but is careful not to dwell upon details adequately covered elsewhere in the literature, especially Edwyn Gray, *The Devil’s Device: Robert Whitehead and the History of the Torpedo*, rev. ed. (Annapolis, Md.: Naval Institute Press, 1991).

represented a new type of invention, one where the distinctions between public and private, collaboration and competition, and employer and employee had all become highly blurred.

Epstein puts forward three key arguments in *Torpedo*, one centered on the relationship between automobile torpedoes and naval power, another that addresses technological change and the nature of innovation, and a third that examines shifting legal norms for intellectual property. All three relate to the book's framing concept, which is the notion that the origins of the military-industrial complex should be placed before the turn of the twentieth century rather than in the middle of it. Epstein borrows heavily from the historian William McNeill, who a generation ago posited that over the three decades running from 1884 to 1914 industrial weapons systems became so complex and expensive that even the biggest firms needed to mitigate their research and development risks. For Epstein, the torpedo was a weapon developed through extensive (and in many ways, unprecedented) public-private collaboration and therefore exemplifies what McNeill labeled "command technology."⁶

The first of Epstein's arguments is that torpedoes did not represent asymmetric anomalies to Mahanian notions of sea power, or as she puts the matter, "torpedoes were adjuncts to, not anomalies within, the capital-ship paradigm" (217).⁷ Epstein's ability to unpack the black box of torpedo development by analyzing technical Admiralty records shows that the Royal Navy embraced the new weapon even as its leaders camouflaged "their real views about the morality as well as the power of torpedoes," and lends much credence to her claim that many historians "have proven gullible" in accepting public pronouncements stigmatizing torpedoes as illegitimate weapons of the weak (218). The U.S. Navy also embraced the torpedo, although never as heartily as the Royal Navy. Partly for this reason, the British torpedo program was affected less by fluctuating defense budgets than was its American counterpart.

A second argument made by Epstein is that the early history of the self-propelled torpedo in Britain and the United States highlights the role of material resources in shaping both the course and pace of technological development. In comparing its torpedoes to those of the Royal Navy (and presumably to those of other navies as well), the U.S. Navy found itself somewhat lacking. To compensate for the Royal Navy's relative superiority in research and

⁶ William H. McNeill, *The Pursuit of Power: Technology, Armed Force, and Society since A.D. 1000* (Chicago: University of Chicago Press, 1982), 262-306. Epstein also gives proper due to Benjamin Franklin Cooling, *Gray Steel and Blue Water Navy: The Formative Years of America's Military-Industrial Complex, 1881-1917* (Hamden, Conn.: Archon Books, 1979), Thomas R. Heinrich, *Ships of the Seven Seas: Philadelphia Shipbuilding in the Age of Industrial Capitalism* (Baltimore: Johns Hopkins University Press, 1997), and Kurt Hackemer, *The U.S. Navy and the Origins of the Military-Industrial Complex, 1847-1883* (Annapolis, Md.: Naval Institute Press, 2001).

⁷ The most thorough analysis of Mahan's ideas about sea power remains Jon T. Sumida, *Inventing Grand Strategy and Teaching Command: The Classic Works of Alfred Thayer Mahan Reconsidered* (Washington and Baltimore: Woodrow Wilson Center Press and Johns Hopkins University Press, 1997).

development, the U.S. Navy sought a comparative advantage in its theoretical design work. Yet, because much of the basic science behind torpedo development was not fully understood, the existence of adequate resources to engage in systematic, trial-and-error experimentation was crucial. According to Epstein, the United States experienced major difficulties because torpedo technology evolved more through empirical processes than through science-based innovation. Efforts to develop torpedoes “through bold leaps in design” via “the drafting room rather than the testing range” were unlikely to succeed, so the Americans were “unable to look before they leapt” and “paid for their poverty with a troublesome turbine and corresponding delay in superheater development” (221).

Epstein’s third big argument is that command technology rendered obsolete the contract terms, patent procedures, accounting methods, and pricing assumptions of a procurement paradigm centered on the government’s purchase of finished military products from the private sector. A new model arose in which governments and commercial firms shared in the costs of research and development, but such collaboration raised fundamental questions about the nature of intellectual property as it related to new technology. In both Britain and the United States, the torpedo lay at the heart of such questions. Epstein looks at a series of legal cases that established the property rights to torpedo technologies jointly developed, ultimately concluding that “the governments won” (15). The comparative aspect of her work is especially valuable here, as Epstein shows how the British government used its authority to grant secret patents and the Official Secrets Act of 1889 to sidestep “the worst legal headaches of torpedo command technology” (226). Government victory took longer in the United States, which meant the Navy’s Bureau of Ordnance frequently found itself embroiled in legal battles that slowed torpedo development.

For all of *Torpedo’s* strengths, and there are many, this reviewer has one minor quibble and one major question. The quibble stems from Epstein’s decision to introduce a fascinating new concept, that of “servant technology” (15), and then bury her most thorough discussion of the idea in the middle of chapter three. For historians of technology, Epstein’s argument that torpedo development led to a new class of technology – one dedicated to generating the information needed to improve more sophisticated command technologies – will be intriguing, as will her suggestion that “the information generated by servant technology was a commodity unto itself. Indeed, it amounted to a distinctive type of property” (75).

The question is historiographical. Where are the French?⁸ Given the wide differences between the continental legal system of France and the common-law legal system shared by Great Britain and the United States, one would not necessarily expect to see the French in Epstein’s analysis of intellectual property rights. Yet her exploration of the role played

⁸ The marginalization of French industrial development in the historical literature has its origins in David S. Landes, “French Entrepreneurship and Industrial Growth in the Nineteenth Century,” *Journal of Economic History* 9, no. 1 (May 1949), 45-61. For a recent discussion of this phenomenon, see Jeff Horn, *The Path Not Taken: French Industrialization in the Age of Revolution, 1750-1830* (Cambridge, Mass.: MIT Press, 2006), 1-9.

by torpedoes in the evolution of naval tactics, a subject discussed in all six chapters, is an entirely different matter. For many military historians the topic of late-nineteenth century torpedoes will bring to mind the *jeune école*, an influential group of French naval thinkers who advocated distributing some of the capital ship's capabilities among smaller vessels.⁹ The automobile torpedo was an indispensable element of the *jeune école*'s theories from the 1880s onward, and the improved operational performance of submarines around the turn of the century allowed for some widely publicized submarine-launched torpedo firings during French naval exercises.¹⁰ The point here is not to criticize Epstein for failing to conduct research in the archival records of France's Ministry of the Marine, something seemingly beyond the scope of her study, but rather to point out that the absence of the French leaves a sizeable gap deserving of further investigation.¹¹

To be clear, *Torpedo* is an important monograph deserving of a wide readership. The book draws from a deep base of archival sources, and Epstein adeptly navigates the intersections of several historical sub-disciplines, including military and naval history, business history, legal history, and the history of science and technology. Technical details about torpedoes, their component parts, naval tactics, and government contracts abound, but the information presented is seldom superfluous and enables Epstein to provide a window into the past that sheds light on issues of the present.

⁹ Recent scholarly interest in the *jeune école* is explored in Erik J. Dahl, "Net-Centric before Its Time: The Jeune École and Its Lessons for Today," *Naval War College Review* 58, no. 4 (Autumn 2005), 109-35.

¹⁰ Arne Røskund, *Jeune École: The Strategy of the Weak* (Boston: Brill, 2007), and Theodore Ropp, *The Development of a Modern Navy: French Naval Policy, 1871-1904* (Annapolis, Md.: Naval Institute Press, 1987). These submarine-launched torpedo firings are also discussed in Arthur J. Marder, *The Anatomy of British Sea Power: A History of British Naval Policy in the Pre-Dreadnought Era, 1880-1905* (London: Frank Cass, 1940), 357-358, 360-362, and Nicholas Lambert, *Sir John Fisher's Naval Revolution* (Columbia: University of South Carolina Press, 1999), 42-43.

¹¹ In contrast to France, Epstein spells out her reasons for not examining torpedo development in Germany (16-17). One wishes she had put forward a similar explanation, however brief, for her decision not to discuss the *jeune école*.

Author's Response by Katherine C. Epstein

To start, I thank Tom Maddux for commissioning H-Diplo's first roundtable on torpedo history—hitherto a grievous if unnoticed lacuna in this fine series of publications. I am grateful to Jeffrey Engel, Keith Neilson, and Timothy Wolters for their thoughtful reviews, and to Jon Sumida for his introduction. It is deeply gratifying that my book passed muster with scholars from different backgrounds whose work I admire. Their careful readings make their comments and criticisms carry all the more weight.

All three reviewers note my indebtedness to William McNeill's work, which for me provided the bridge from torpedoes to diplomatic history. With my research underway and my thesis as yet unclear, I took a break from slogging through some exceptionally tedious contract negotiations between the U.S. Navy and its principal torpedo supplier to read McNeill's *The Pursuit of Power*. McNeill's thesis about "command technology"—that is, technology commanded by the government from the private sector rather than initiated by the private sector—suddenly made the contract negotiations much more exciting.¹ I realized that they concerned an example of command technology, and that the parties were arguing over the implications of command technology for intellectual property rights. Similar arguments, I then saw, were occurring on the British side. The project thus evolved from one about torpedoes to one about the public-private relationships necessary to wage modern industrial war. From a foreign-relations standpoint, of particular interest to me were the tensions between arms manufacturers and governments regarding the flow of scientific and technological information across national borders.

As all three reviewers further note, I chose to frame my analysis of those tensions around the concept of the 'military-industrial complex' (MIC). I argue that the MIC emerged in the late nineteenth century, not in the mid-twentieth century, as most have contended. Keith Neilson and Timothy Wolters accept my arguments about the MIC, but Jeffrey Engel, who has produced very fine work on the World War II and Cold War MIC, raises a stimulating challenge that I would like to address.² He argues that my definition of the military-industrial complex differs from President Dwight Eisenhower's in an important respect: the absence or presence of malicious intent ("nefarious scheming") in its component parts. Before proceeding further, I think it is important to distinguish between Eisenhower's fears and the actual operation of the military-industrial complex in the mid-twentieth century: Eisenhower could have feared that the MIC had, to borrow Engel's words, "a desire to forge dangerous national policies in order to ensure its own survival" without the MIC actually having had that desire.

¹ William McNeill, *The Pursuit of Power: Technology, Armed Force, and Society since A.D. 1000* (Chicago: University of Chicago Press, 1982), 278–79.

² See Jeffrey Engel, *Cold War at 30,000 Feet: The Anglo-American Fight for Aviation Supremacy* (Cambridge, MA: Harvard University Press, 2007), and idem, "Not Yet a Garrison State: Reconsidering Eisenhower's Military-Industrial Complex," *Enterprise and Society* 12, no. 1 (March 2011): 175–99.

As for the first issue, of what Eisenhower thought, it seems to me that his warning can plausibly be read both ways, as including an element of malicious intent or as not including one. On the one hand, his dwelling on the ways in which the existence of the Cold War served the interests of the MIC suggests that he feared malicious intent. On the other hand, he allowed that the “acquisition of unwarranted influence” by the MIC might be “sought *or unsought*” (emphasis added). Complicating matters further is that Eisenhower warned not only of the corruption of policy (“in the councils of government”) by profit-oriented businesses, but also of the corruption of the market (“our toil, resources, and livelihood”) by the security-oriented military.³ The proper balance between security and liberty could be thrown off from both directions, not from just one. These ambiguities make it difficult to say for certain how he weighted agency and structure in his diagnosis of the MIC.

As for the second issue, of how the MIC operated regardless of what Eisenhower thought, a definition of the MIC which relies heavily on malicious intent strikes me as problematic. It is reminiscent of what E. H. Carr called the “Bad King John” approach to history, in which bad actors, like merchants of death, are responsible for bad things like wars.⁴ That said, we need not default to the opposite end of the methodological spectrum and adopt what Carr termed the “vast impersonal forces” approach to history.⁵ People exist within structures which leave them some element of agency but also make some choices easier than others. While widening the circle of responsibility does not preclude holding some people more responsible than others, it does make any moral reckoning more complete. The military-industrial complex did not happen because a few individuals wanted it to happen, but because extensive networks of inter-dependent interests—who can ignore their responsibility by blaming a small group of bad actors—enabled it to happen.⁶ To me, any satisfactory definition of the MIC should focus principally on those inter-dependencies.

Such a focus is all the more appropriate given that the MIC faced substantial challenges from within, a point made in my book and even more forcefully in Mark Wilson’s forthcoming history of U.S. political economy during World War II.⁷ It is one thing to see the MIC as a smooth-operating machine, such that all the criticisms of it came from outside of a mutually

³ Eisenhower’s speech can be viewed at <http://millercenter.org/president/eisenhower/speeches/speech-3361>.

⁴ E. H. Carr, *What Is History?* (New York: Vintage Books, 1961), 55–57. The moral inverse of the “Bad King John” approach was the “Good Queen Bess” approach.

⁵ *Ibid.*, 54. Carr was quoting Isaiah Berlin.

⁶ The potentially wide implication of interests and responsibilities is a point to which Engel himself drew attention in an essay on the MIC: Engel, “Not Yet a Garrison State,” 182–84.

⁷ Mark Wilson, *Destructive Creation: American Business and the Winning of World War II* (Philadelphia: University of Pennsylvania Press, forthcoming 2016). Wilson also explores this theme in “Making ‘Goop’ out of Lemons: The Permanente Metals Corporation, Magnesium Incendiary Bombs, and the Struggle for Profits during World War II,” *Enterprise and Society* 12, no. 1 (March 2011): 10–45.

beneficial cabal. It is another to realize that along with those mutual benefits came a potentially unbridgeable gulf between the security interests of the military and the property interests of industry, to which defense contractors vigorously drew notice. Broadly speaking, militaries want secrecy while contractors want a relatively free flow of information. As Peter Galison observes, “[i]ndustry chafes under the restriction of classification,” because “declassification makes it easier and cheaper for industry to produce—and, needless to say, opens the vast civilian and, within the constraints of export controls, the huge foreign military market.”⁸ Given the co-existence of state command and capitalism, clashes between the public and private sectors are not random occurrences but structural certainties. An explanation that causally privileges the badness of certain actors is all the more problematic when the bad actors are divided against themselves. Surely we must then look past motive to forces beyond the meaningful control of any small group of individuals. In my book, I propose that these forces were industrialization, globalization, and geopolitical tension.

I also note that these forces characterized the period before World War I as surely as they did the Cold War, and that they helped to forge new, permanent relationships between the military and industry. Thus Eisenhower was incorrect to state that “the United States had no armaments industry” before World War II. Yet, I suggest, his error served an ideological purpose: his chronology advanced a self-serving narrative of American exceptionalism, in which the United States compromised its unique liberalism and became more ‘European’ only in the mid-twentieth century, not earlier. In many respects, I think my argument parallels the Wisconsin School’s ideological critique and its identification of the late nineteenth century as a transformative moment in the relationship between the United States’ domestic political economy and its foreign relations. Given my belief that all the other basic elements of the mid-twentieth century MIC were in place by the early twentieth century, I do not see why “a desire to forge dangerous national policies in order to ensure its own survival” would have been any more present in one era’s MIC than in the other.

Besides my argument about the MIC, all three reviewers also point to my effort to speak to multiple fields of historical inquiry. Although my principal training was in military history, as I went along I realized that my sources involved diplomatic history, the history of science and technology, legal history, policy history, and business history. I patched together some knowledge of those fields as best I could in a sort of rearguard *bricolage* action, my goal being not mastery of them (which seemed hubristic given their rich literatures) but sufficient familiarity to ask the questions of my sources that experts in them regard as matter-of-course. On the one hand, this approach has its pitfalls, one of which Wolters identifies: the under-development of my idea of “servant technology,” with which a historian of science and technology might have been able to do more. I was coming at the issue with William McNeill’s thesis about “command technology” and the legal historian Morton

⁸ Peter Galison, “Removing Knowledge,” *Critical Inquiry* 31, no. 1 (Autumn 2004): 243.

Horwitz's interpretation of the dephysicalization of property in mind.⁹ On the other hand, working at the intersection of multiple fields can also reveal connections that more exclusive grounding in a particular field might occlude. For instance, by delving into the naval weeds I think I was able to extract a few potentially productive lines of inquiry for diplomatic historians, who too often black-box navies. I am glad that the reviewers seem to feel that the advantages of my efforts to integrate several fields outweigh the disadvantages, as do I.

Engel's pessimism that others will be unable to match *Torpedo's* blend of several fields of historical inquiry is flattering but misplaced. His *Cold War at 30,000 Feet*, though it examines a different technology (aircraft) several decades after the period covered by my study, helped me to think through the intersection of the history of science and technology, legal history, military history, and diplomatic history.¹⁰ To his work I would add Jon Sumida's *In Defence of Naval Supremacy*, noted by Neilson, as well as Jonathan Winkler's *Nexus* and David Zimmerman's *Top Secret Exchange* as models of this genre.¹¹ That said, I would agree that the genre is small, and that transnational flows of science and technology, the non-state actors known as arms dealers, and high-level diplomatic arguments over weapons exports have not received the attention from diplomatic historians that they deserve.

I understand Engel's wish that *Torpedo* covered World War I, although I fear I would not have published my book until the war's 150th anniversary, if then. I actually spent a few months researching and writing a chapter that would have dealt with the war, but it was a mess. The existing naval historiography of the war left me with more questions than answers and unable to produce a confident overview. The archival sources, which were difficult enough to manage for the pre-war period, simply explode with the outbreak of war and would have required years of additional research to master. More fundamentally, I concluded that the war was not a necessary part of my study. It could have been one of the literary critic Hayden White's tropes that when historians know a war is coming, they think narratively in terms of a three-act play—causes, course, and consequences. This narrative pull is teleological, however, because people living before a war do not know it is coming and thus do not think in terms of living through its origins. Not ending the book with the war was in that sense a deliberate choice to leave the narrative as contingent as it would have been to decision-makers before 1914.

Timothy Wolters' query about the absence of the French is a nice change of pace, since I usually get asked about the missing Germans. He is quite right about the significance of the *jeune école* in the history of naval theory about torpedoes—and I am pleased that he regards

⁹ McNeill, *The Pursuit of Power*, 278–79; Morton J. Horwitz, *The Transformation of American Law, 1870–1960: The Crisis of Legal Orthodoxy* (New York: Oxford University Press, 1992), 146–48.

¹⁰ Engel, *Cold War at 30,000 Feet*.

¹¹ Jon Sumida, *In Defence of Naval Supremacy: Finance, Technology, and British Naval Policy, 1889–1914* (Boston: Unwin Hyman, 1989); Jonathan Winkler, *Nexus: Strategic Communications and American Security in World War I* (Cambridge, MA: 2009); David Zimmerman, *Top Secret Exchange: The Tizard Mission and the Scientific War* (Montreal: McGill-Queen's University Press, 1996).

the subject as one for other scholars to address. I chose Britain and the United States because they represented the leading and an aspiring naval power, respectively, and I limited myself to them because I wanted to be able to sustain a certain level of archival intensity and historiographical familiarity for both.

Keith Neilson is certainly the first person to wish that my book were longer, and I have every confidence that he will be the last. His overview of my book, from my perspective, is elegant and accurate. As he notes, one of my arguments is that Britain had a much stronger naval-industrial base than did the United States, and I would add that this argument is indebted to his own work, which has been among the pioneering critiques of the British strategic decline thesis.¹² Given Britain's naval-industrial hegemony, William McNeill's identification of the origins of the military-industrial complex in 1880s Britain, described by Neilson, should come as no surprise.¹³ It should serve as a reminder to U.S. diplomatic historians that the United States before World War I, notwithstanding its industrial rise relative to Britain, did not seriously dent the pillars of the globalized world economy dominated by Britain—naval power, ocean-going merchant shipping, global communications, and financial services. It is also evidence that the military-industrial complex was an international phenomenon, not one that was unique to the United States, a fact which should direct attention to international forces like industrialization, globalization, and geopolitical tensions in explaining its emergence.

I thank the contributors to this roundtable again for their work.

¹² See Keith Neilson, "'Greatly Exaggerated': The Myth of the Decline of Great Britain before 1914," *International History Review* 13, no. 4 (November 1991): 695–725, and idem, *Britain and the Last Tsar: British Policy and Russia, 1894–1917* (Oxford: Clarendon Press, 1996).

¹³ McNeill, *The Pursuit of Power*, 269–85.