

Toward a History-Based Doctrine for Wargaming

LT COL MATTHEW CAFFREY JR., USAFR

Editorial Abstract: While most human endeavors must deal with adversity or overcome opposition, warfare holds a unique place. When people decide to wage war against one another, they enter into a “zero-sum game” (for one side to win the other must lose) where the goals are quite literally as important as life and death. Given the stakes and uncertainties, it’s not surprising that those who contemplate war developed an early and abiding interest in gaming possible outcomes. In reviewing the evolution of wargaming, Lieutenant Colonel Caffrey shows that it too has been impacted by the familiar factors of fog, friction, and chance—often in ways the game designers or sponsors did not intend or could not envision.

SADLY, BOTH THE medical and military professions get to bury their mistakes. Because the cost of errors can be so high, student doctors are now using simulated patients to learn from their mistakes before treating real patients. For the same reason, the military has used wargames for centuries. Ever more powerful computers appear to promise increasingly more effective wargames. But will future wargames enlighten or mislead us?

Throughout history, wargaming has provided life-saving insights and dangerous mirages. If such mixed outcomes were random, there would be little use in studying the history of wargaming. However, history provides the raw material for anticipating cause and effect. By learning this history we will be able to devise ways to maximize the benefits of wargaming while minimizing its dangers. This history also provides insights into historic decisions and will suggest a connection between the spread of wargaming and of democracy. Finally, it’s an interesting story.

What’s in a Name?

First, what do we mean when we say “wargame”? The term *wargame* is simply a translation of the German *Kriegsspiel*. Unfor-



Report Documentation Page

*Form Approved
OMB No. 0704-0188*

Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

1. REPORT DATE 2000	2. REPORT TYPE	3. DATES COVERED 00-00-2000 to 00-00-2000			
4. TITLE AND SUBTITLE Toward a History-Based Doctrine for Wargaming		5a. CONTRACT NUMBER			
		5b. GRANT NUMBER			
		5c. PROGRAM ELEMENT NUMBER			
6. AUTHOR(S)		5d. PROJECT NUMBER			
		5e. TASK NUMBER			
		5f. WORK UNIT NUMBER			
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Air and Space Power Journal, 155 N. Twining Street, Maxwell AFB, AL, 36112-6026		8. PERFORMING ORGANIZATION REPORT NUMBER			
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)		10. SPONSOR/MONITOR'S ACRONYM(S)			
		11. SPONSOR/MONITOR'S REPORT NUMBER(S)			
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified	Same as Report (SAR)	24	

unately, many in the military are simply uncomfortable with the term *wargame*, perhaps feeling that war is too serious to be a “game.” This makes researching the history of wargaming challenging because wargames have been called by other names. These include “map maneuver,” “chart maneuver,” “field maneuver,” “exercise,” or increasingly, “modeling and simulation.”

Some use the terms *modeling*, *simulation*, and *wargaming* as if they were one term, but they are distinct elements of wargaming. Models are simply proportional representations of reality. A painting is not a model, but a blueprint is. Models vary in abstraction; a physical model of an aircraft, a blueprint of that aircraft, and a mathematical equation representing that aircraft’s characteristics are all models. Simulations are proportional representations of reality over time. For example, a small wing that is proportional to a full-sized wing is a model. Put that wing in a wind tunnel and measure the effect of various wind speeds and you have a simulation. As for wargames, while the earliest wargames were multisided abstract representations of combat, modern wargames require multiple sides that compete within a simulation of an armed conflict.¹

An exercise may or may not also be a wargame depending on whether or not it fits the above criteria. Typically, the deciding factor is the presence or absence of a thinking opponent. Hence, a Red Flag exercise with its aggressor force is a wargame, while a mobility exercise is not.

In the Beginning

Wargames emerged among the rulers of all early civilizations.² Cultures separated by thousands of miles and hundreds of years felt the same necessity to prepare their future rulers to outthink other rulers. Though games like “Go” and chess are abstract depictions of war, they did (and do) teach “downboard” thinking; that is, anticipating the consequences of one’s possible moves and the

opponent’s possible responses, an essential skill in the deadly game of war.

1664–1800: On the Brink

As the modern era dawned, there was an acceleration of changes that would impact and be impacted by wargaming. Maps grew more accurate³ and chess⁴ grew less abstract. In late 1781, John Clerk, a Scotsman, developed a method of using model ships to gain tactical insights.⁵ He used his ships to step through battles, analyzing the influence the geometry of the combatants had on their combat power. While a military simulation, Clerk’s work was not a wargame.

Yet, fundamental changes in society would soon produce fundamental changes in wargaming. In America, Benjamin Franklin had the audacity to say that all men should play chess, as it would help them learn how to look after their own defense. In Europe, Voltaire also encouraged the common people to play chess. The nobility was scandalized. If mere commoners played chess, where could it lead? Well, such thinking was typical of that which led to the French Revolution and to the rise of Napoléon Bonaparte.

Today we think of Napoléon as a great military genius,⁶ but other factors also played a part in his military success. One factor was that the French Revolution produced a meritocracy. Previously, only children of officers could become officers. Now, half of Napoléon’s marshals had once been common soldiers. Also, a democracy could field a far larger army than a similar-sized monarchy. Genius, meritocracy, and numbers—Prussia would invent modern wargaming while endeavoring, successfully, to overcome all these French advantages.

1811–24: The Birth of Modern Wargaming

Modern wargames were ushered in by a Prussian named Baron von Reisswitz,⁷ the Prussian war counselor at Breslau. In 1811, he invented an innovative wargame. First, he constructed a table model of actual terrain. He then used blocks to represent units. Each player would give orders to an umpire, who

was required to update the terrain table, resolve combat, and tell the players only what they would know at that point in an actual situation. To determine casualties, umpires first consulted complex tables that indicated likely attrition based on range, terrain, and other factors. The exact attrition was determined by a roll of the dice, which depicted the uncertainties of the battlefield!

Arguably, not since Johannes Gutenberg's invention of the movable-type printing press had one man made so many interlocking breakthroughs at the same time. Yet, many historians do not credit Reisswitz with initiating modern wargaming. Why not? Because for all its innovation, Prussia used Reisswitz's invention in the same old way—educating princes in war.

But times were changing. To counter Napoléon's advantage in numbers, the crowned heads of Europe turned to nationalism. Even after defeating Napoléon, dynastic rivalries encouraged—and the industrial revolution permitted—armies to continue to grow. Prussia soon found it had too many soldiers for only the sons of officers to command. Faced with this officer shortage, even conservative Prussia began allowing the sons of mere bankers, industrialists, and government officials to become officers.

One of these new officers was Reisswitz's son, Lt George H. R. J. von Reisswitz, who soon realized that he and his fellow "outsiders" simply did not know as much about war as those who had been taught it at their father's knee. He believed *his* father's game could help. In 1824 he adapted his father's game so it could be played on topographical maps. At a stroke, he made wargaming cheaper, more convenient (unlike a sand table, a map could be rolled up), and more flexible.

The younger Reisswitz soon demonstrated his innovation to the Prussian chief of staff, Gen Karl von Muffling. After initially being bored and skeptical, Muffling became increasingly excited. Finally, he exclaimed, "It's not a game at all, it's training for war. I shall recommend it enthusiastically to the whole

army." Actually, he soon ordered all garrisons to conduct wargames.

This was the beginning of the young lieutenant's problems. His fellow officers resented the time these cumbersome wargames required. Finding his isolation intolerable, he took his own life in 1827.

1825–71: Wargaming Comes of Age

Of course, not all officers hated wargaming. As early as 1828, Lt Helmuth von Moltke advocated the use of wargames.⁸ He even founded the Magdeburg (Wargaming) Club.⁹ In 1837, now as *General* von Moltke, he became chief of staff of the Prussian army and ordered an increased use of wargaming. Although he met initial resistance, Moltke understood what motivated his subordinates and he soon devised a strategy to increase the use of wargaming.

While Prussia had used nationalism to overcome France's advantage in recruiting, it found that adopting a meritocracy was more difficult. Prussia's solution was to pair commanders selected for their nobility with chiefs of staff selected by merit. Because the only chance even members of the petty nobility had of attaining high rank was selection for the staff corps, virtually all officers wanted to be selected. However, only graduates of the War College were eligible. Moltke now required that each application package include a letter from the applicant's commander, evaluating his performance as the senior umpire for a wargame. It worked.

When the successful applicants became War College students, Moltke saw to it that they did a great deal more wargaming. Wargaming appears to have always been part of the curriculum at the War College, but Moltke added several innovations collectively called the "staff ride."

Periodically, Moltke would take the entire student body of the War College to one of the actual invasion corridors into Prussia. Moltke would then describe the most likely first clash between invading and Prussian forces. He would then turn to the most junior student present and ask for his plan of battle. Next he

would ask the second most junior, then the third, and so on. Why? If the most senior spoke first, would any disagree?¹⁰

After arriving at a consensus battle plan, they then played a map-based wargame. Moltke would then name the senior ranking general (aside from himself)¹¹ to command the invading forces and the second-ranking general to command the Prussian forces. He continued thusly until they were split into two equal teams. Why? Moltke believed that if their plan could succeed against some of their smartest strategists, it would probably also succeed against any enemy strategist. Also, with two equal-sized teams, more officers could participate meaningfully. The next day, he would contact the local garrison (remember the staff ride was being conducted in an actual invasion corridor, so there would always be a garrison). He would direct the garrison commander to march a few hundred soldiers where the plan called for thousands to march. This was done to test the marching times and other details of the plan. When all this was done, the plan went on the shelf as the *actual* plan for an invasion along that corridor.

Now let us think about all this for a minute. Moltke started with an "off site" (to an environment conducive to candor and free thinking), had a team brainstorm to reach a consensus, tested the resulting plan against a world-class adversary, and finally tested the results with a field exercise. Essentially, he used many smart people and effective procedures to create a plan worthy of a genius, eliminating Napoléon's final advantage of genius. With all our technology, are we really this conceptually sophisticated today?

1872–1913: Wargaming Becomes Global

Oddly enough, Moltke and Prussia won a series of wars, usually against opponents with larger forces that were technologically equivalent. Not surprisingly, the rest of the world started copying Prussia's (now Germany's) wargaming methods.¹² While there were local variations, the pattern was strikingly similar. A

young officer would translate German manuals, often improving some aspect in the process. He would meet initial opposition, but in time the use of wargames became institutionalized.

1776–1912: Coming to America

Like so much about America, our wargaming is partially home grown and partially acquired from other nations. Most observers credit Maj W. R. Livermore of the Corps of Engineers with bringing modern wargaming to America.¹³ In 1883, Livermore freely admitted he started by simply translating German rules. However, he then went on to compare their attrition tables to actual statistics from the American Civil War and Prussia's own wars in 1866 and 1870–71. He found that the German attrition tables usually predicted lower casualties than the historical record indicated, and he adjusted his tables accordingly.

Despite this historical foundation, when Major Livermore sought official acceptance of wargaming, he was blocked by Gen William T. Sherman, the US Army's chief of staff at that time. He disapproved Major Livermore's proposals, stating that wargames depict men as if they were blocks of wood rather than human beings who are seized by fear and sustained by leadership.¹⁴ His basic objection was that Major Livermore's wargame, like all up to that time, only depicted attrition as units fighting to the last man. Sherman knew better.

While one living legend blocked wargaming in the Army, another was advancing it in the Navy. William McCarty Little was one of those historical anomalies who shaped the world far more than rank or title would suggest. He had been medically retired for dubious cause in the middle of a promising naval career. Instead of being bitter, he went on to help found the Naval War College and to father naval wargaming in America. For years he did so as a volunteer, receiving no pay beyond his retirement stipend.¹⁵ In 1887, he wrote and delivered the first lecture on wargaming given to an audience of professionals in the United States. While he drew on his conversations with Major Livermore and

the writings of Capt Sir John Phillips Colomb of the Royal Navy,¹⁶ many of the insights were his own. Also in 1887, he and Major Livermore conducted the first joint Army–Navy wargaming field exercise. The Army high command promptly forbade any future joint exercises. In 1889, McCarty Little ran a wargame at the Naval War College, and wargames have been conducted there every year since then.

McCarty Little's selfless labors gradually paid off. As early as 1894 and 1896, wargames influenced the Navy's budget.¹⁷ In 1895, a wargame played a decisive role in convincing Congress to fund the Cape Cod Canal. In 1899, the Army established a war college, and McCarty Little did what he could to ensure that its curriculum included wargaming. It has done so from 1899 to the present day. Soon the Army began innovation, turning to transparent overlays instead of blocks so that a permanent record of each move could be made. Also, to standardize the input of moves to the umpire, they devised a format for an operations order.¹⁸ It was the father of the joint format still used today and of map overlays.¹⁹

While success was gradual, we can use a remarkable 1912 article in the US Naval Institute *Proceedings* to declare victory.²⁰ In this visionary article, McCarty Little describes concepts that are considered new today. He argued that wargaming had shaped and should continue to shape national policy; that it was the cure for peacetime "stove-pipe" mentality; and that it could not only produce better plans but could condition its practitioners to think and react quicker than their enemy, and hence gain an important advantage.²¹ The clarity, persuasiveness, and confidence of this remarkable article clearly indicated wargaming had come to America—and like earlier immigrants had truly become American.

1872–1905: German Wargaming, Innovation, and Decline

While wargaming was spreading throughout the world, it was not standing still in Germany. Unfortunately for that country, not all

of wargaming's movement was in a forward direction.

The combat experience that Prussia/Germany gained during their wars of unification had a powerful influence on their wargaming. Sherman could have told them one of the first things they had to learn: Units do not fight to the last man. In 1877, a Saxon captain named Naumann published rules to cover what today we would call "break points"; that is, the rules provided criteria for determining at what casualty level units would cease functioning.²²

The second innovation came to be called *Free Kriegsspiel*.²³ A series of books published between 1873 and 1876 argued persuasively for a radically different type of wargame. The concept was simple. Wargames have always been unpopular due to the cumbersome, time-consuming rules of adjudication. Therefore, combat-experienced officers were allowed to substitute their military judgment for many of these rules. This would result in games that were faster and thus more popular, hence played more often.

At first, *Free Kriegsspiel* seemed to work well. At its best, the professional judgment of experienced combat veterans could produce more accurate outcomes in less time. There were two problems, however. First, Germany's veterans of 1871 gradually aged, retired, and died. Their replacements could not adjudicate with the same authority. The second problem is today called "command influence." When one of the players outranked the umpire, that player tended to value his professional judgment over that of the umpire.

Nowhere was this problem more visible or more damaging than in the case of Kaiser Wilhelm II.²⁴ Thinking himself a great military genius, Kaiser Wilhelm never missed a staff ride. The rides still started on a hill overlooking a possible invasion corridor. Just when Moltke would have asked the most junior officer for his opinion, the kaiser would immediately announce the "perfect" battle plan. You can imagine the level of debate. Then, during the actual wargame, instead of having the teams split evenly, everyone wanted to be on the kaiser's team. The results

were predictable; the kaiser's side always won. It was Germany's loss.

1890s–1913: The Birth of Second-Generation Civilian Wargames

While many of the citizens of the Western democracies had played chess since the time of Franklin and Voltaire, they had missed out on the second generation of simulation wargames initiated by Reisswitz.²⁵ Perhaps not surprisingly, the “technology transfer” that led to the civilianization of wargaming started with a couple of reservists—one British, one German.



British gaming at war college, 1898

Spenser Wilkinson began his crusade while still attending college. In 1873, while on summer vacation in Germany, he was glancing through a pamphlet about the military balance and was shocked to learn that Britain's army was among Europe's smallest. Among his many initiatives, Wilkinson organized England's first wargaming club.²⁶ Presumably through Wilkinson's efforts, one member of Parliament in 1900 listed wargaming as a hobby.²⁷

The German reservist's contribution to civilian wargaming was more indirect. Civilians had to be motivated to study war before they could become interested in complex simulation wargames. Hans Delbrück provided that motivation. His family had advised Prussian kings on matters of war for generations. He wrote that “it was vital that the king understood war for it is on the outcomes of

war that the nation prospers or dies. Now Germany is evolving toward a democracy, the people are becoming the sovereign, and it is just as important that they understand war.” To help the people study war, he became the foremost military historian of his time.²⁸ A prolific and influential author, he founded the first chair of military history at a civilian university and edited the first defense affairs journal aimed at a civilian audience.²⁹ Interestingly, both the first modern naval and land wargames intended for a civilian audience were published in England.

The first publication detailed rules for naval battles that required very detailed ship profiles. Data on only four ships were included with the game, and customers were soon clamoring for more. A game supplement with the needed profiles for all British ships soon followed. Still, playing a wargame between British ships was a little like kissing one's sister. His next offering provided the needed data for the entire German navy. There was an uproar in the press—“The Germans are our friends”; “How dare he imply our navies may someday fight!” To avoid singling out any one nation, Fred Jane next published *Jane's All the World's Fighting Ships*. So the entire Jane group that has contributed so much to the reference sections of libraries and to the British balance of payments started with a wargame.

Finally, a ground combat simulation wargame was published for civilian use. The author's avowed purpose in designing the wargame was to help civilians better understand how terrible war was. He predicted that if the people of democracies truly understood how terrible war was they would make sure their governments would never again start one. While the author, H. G. Wells, made many correct predictions in his long career, this one was, at best, premature. His book of rules, called *Little Wars*, was published in 1913.

While both works were fairly popular, the number of civilians playing simulation wargames would remain modest for many decades. The fairly complex rules deterred some, but the main problem was the cost of



Naval simulation with game pieces at the Naval War College, Newport, Rhode Island

the metal soldiers or ships. Only the well-to-do could afford full sets of such miniatures around the turn of the last century. Still, this is not to say early civilian simulation wargames did not have an impact. One young British aristocrat enjoyed wargaming with miniatures well into his adult years—his name, Winston Churchill.

1905–18: Wargaming and the Great War

Arguably the most decisive wargames of all time were played in 1905. That was the only year Count Alfred von Schlieffen's plan for a wide-turning movement through neutral Belgium and Holland was wargamed before his retirement. Virtually all present were on the kaiser's (German) team, while two first lieutenants played on the side of the armies of France, Britain, Belgium, and Holland. The wargame concluded with the destruction of

the French army so quickly that the British did not have time to come to the aid of France.³⁰ The kaiser was pleased.

In the same year, at Wilkinson's urging, the British played a wargame examining the consequences of a new war between Germany and France. The British game also envisioned a German turning movement through Belgium. Like the German wargame, the British game also indicated that the Germans would destroy the French army before a British Expeditionary Force (BEF) could intervene. Wilkinson and his colleagues were not nearly so pleased with that outcome. This wargame led to a host of actions, in no small part due to Wilkinson's ensuring that the results of the wargame came up on the floor of Parliament. Repercussions ranged from reworking mobilization and cross-channel plans to informal staff talks with the French.³¹

Ironically, British wargaming was short-lived. Wargames dropped in popularity as it became evident that wargames of the period

could not address the psychological and political dimensions of the Boer War.³² Still, as the Germans lost the key first campaign of World War I because the BEF was in the wrong place at the right time, the impact of Britain's brief flirtation with wargaming on world history would be hard to exaggerate.

One wargame that did not shape history, but should have, took place in Saint Petersburg, Russia, in April 1914.³³ The same two generals who would command Russia's two most modern armies in the event of war directed the Russian side in the wargame. Both Russian armies advanced into East Prussia against little opposition. When the Russian armies entered an area of lakes that made cooperation between the armies difficult, the players for the German side placed a thin screening force in front of the Russian army to the north, then shifted the bulk of their forces to surround and destroy the Russian army in the south.³⁴

Just four months later, the same two Russian generals commanding the same two armies implemented what appears to be the exact same plan. Once again, both armies made good initial progress. Once again, they reached the area of lakes that made cooperation between the armies difficult. Now the real Germans placed a light screening force in front of Russia's northern army and shifted the bulk of their forces to surround and destroy Russia's southern army—near the town of Tannenberg. The lessons learned in the wargame had been completely ignored.

In Germany in the decade before the First World War, something of a wargaming renaissance was under way due to Helmuth von Moltke the Younger (the nephew of the great Moltke). This Moltke has received much abuse over the years for "ruining" Schlieffen's master plan. While the wisdom of decisions he made during execution can at best be called debatable, he clearly did much to improve planning methods before the war.³⁵

The younger Moltke started by going to the kaiser, a childhood friend (thanks to his famous uncle). He privately told the kaiser that the latter's strategizing during the staff

rides was closing off rigorous debate. The kaiser agreed to desist.

Next, Moltke examined the wargames themselves. When he discovered that the effect of machine guns on the games was not being considered, he was told there was insufficient data to precisely predict their impact on attrition. Moltke saw to it that data acquired from the Russo-Japanese War could be used. He then asked why logistics were not being included. When told that wargames could not account for logistics, he pointed out that the Italian wargames had included logistics for decades.

Moltke then used his more objective and comprehensive wargame to test the Schlieffen plan. The game indicated that the two armies on the outside of the great wheel would run out of ammunition two days *before* the campaign ended. Moltke saw to it that Germany organized the first two motorized units of any army anywhere in the world—two ammunition supply battalions.

Of course, when war came, the plan did not work as well as the Germans hoped. Why not? Moltke's efforts to make the wargames more fully depict contemporary combat results did produce positive effects in that Germany was relatively less surprised by the nature of the early fighting. What got Germany into trouble was not what the Germans wargamed wrong but what they failed to wargame.

They did not simulate the diplomatic and political consequences of their actions. Spontaneous efforts by Belgian civilians to destroy their own railroads caught the Germans by surprise. There were no such contingencies in German wargames. Even more serious, they did not simulate the diplomatic consequences of invading Belgium. The invasion of that country brought the British Empire into the war,³⁶ the British were eventually influential in bringing in the United States, and the additional weight of US force ultimately defeated Germany. The Germans got most of the details right, but their wargames failed to adjudicate the most decisive consequences of their invasion of Belgium—the political consequences.

These consequences were also ignored when Germany conducted wargames prior to each of its 1918 “peace offensives.” Germany had a “window of opportunity” when its recent victory over Russia had freed up a great many forces, and few American forces were yet on the Continent. But if these offensives failed, Germany’s prospects were bleak. While they achieved spectacular advances by World War I standards, these offensives did not reach any truly strategic objectives and hence ultimately failed.

Delbrück, writing in his defense journal during the war, criticized the General Staff. He stated that the wargames had roughly predicted the indecisive outcomes that took place—yet the General Staff went ahead. He claimed that if representatives of the Foreign Ministry had been present at the wargames, they would have realized that the initial advances would have caused panic in Allied capitals. He claimed that if Germany had offered generous peace terms before the offensives had lost momentum (returning most of Belgium, for example), the offer might have been accepted. Now Delbrück feared Germany could not get such peace terms.³⁷ He was right.

1919–38: Interwar Wargaming: The Visionary and the Blind

Delbrück may have had a hand in bringing about the most sophisticated wargaming of the interwar or any other period. Delbrück testified before a government panel that poor grand strategy was the root cause of Germany’s defeat, and the General Staff’s purely military analysis of war plans was a cause of this poor grand strategy. Their wargames could only show the attrition effects of invading neutral Belgium or conducting unrestricted submarine warfare. They could not predict the political effects of these actions or the subsequent military consequences.

The German government soon established strategic-level wargames, not at the shadow general staff level but at the Ministry of Defense.³⁸ These wargames were truly compre-

hensive, with industrialists brought in to advise on the speed of industrial mobilization, attachés brought back from their assigned countries to play their countries’ militaries realistically, and diplomats integrating their actions with the militaries. Even journalists participated, commenting on likely world public opinion.

Limited to a skeletal military, Germany could still wargame with forces it did not yet possess. In addition, the Germans took an extremely pragmatic and detailed look at the history of the war. From this history they derived theories about what would and would not work in future wars. As the theories were rigorously compared to the historical facts, a new doctrine began to emerge. In turn, this doctrine was rigorously tested in wargames—all with forces that did not physically exist. The Germans called the concept they developed “mobile operations”; the rest of the world would soon call it *Blitzkrieg*.

Germany’s World War II preeminence in armor is all the more remarkable because at the end of World War I, the United Kingdom had the world’s most potent armored force. Britain also produced the interwar period’s most prominent armor theorists, J. F. C. Fuller and B. H. Liddell Hart. How did Britain fall so far behind? While many factors worked against the development of British armor, wargames that did not reflect the tank’s true value appear to have played a crucial role.³⁹

Although it did not reach the depths of British wargaming during the interwar period, US Army wargaming also reached a low point during that time. Little is written or known about it, and all that is known is bad.⁴⁰ Perhaps due to the malaise born of slow promotions and low budgets, most Army wargames stopped being wargames and instead became one-sided scripted exercises. The outcome was always the same regardless of brilliance or stupidity, diligence or laziness of the participants.

Some true wargaming did survive both at the Army’s staff and war colleges and in the field, though here there were problems. In

1934, six faculty members of the Air Corps Tactical School (ACTS), Maxwell Field, Alabama, including Maj Claire L. Chennault, were called to testify before a commission on the Army's use of airpower.⁴¹ They were originally told that they would have to pay their own way, as the Army had insufficient funds to pay for their travel. At the hearings, Chennault stated that during Army field maneuvers airpower had not been allowed to attack enemy forces before, during, or after amphibious landings but was only used in close support after trench lines had formed. The Army's response was that their learning objective was to practice trench warfare. If airpower were used too soon, the trench lines might not form.

Chennault argued that these wargames needed to include airpower precisely because airpower would prevent World War I trench systems from forming. If the Army did not learn how to fight the more mobile style of future war through wargaming, it would have to learn those lessons at a far higher cost on actual battlefields.

When Chennault returned from testifying, he was informed that his orders to attend the Army's Command and General Staff College (CGSC) were canceled.⁴² Not seeing a chance for advancement without attending CGSC, Chennault left the service.

This was *not* an isolated incident. The faculty of the Air Corps Tactical School participated in Army War College (AWC) annual wargames, starting in 1923, hoping to educate senior Army officers in the doctrinal use of airpower.⁴³ The results were uniformly disappointing. Despite the gradual inclusion of air officers in the planning process, AWC restricted air participation to activities in the combat zone and not against vulnerable enemy rear-area targets. The artificial nature of the depiction of airpower disgusted the ACTS participants and may have actually been negative training for the Army's future leaders.

Things were not perfect in the Army's air arm, either. At Maxwell Field, ACTS was evolving the doctrine and educating the airpower leaders for fighting World War II. On the sur-

face, their teaching methods appeared outstanding. Periodically, the students would apply what they learned by writing a plan to attack a real target. The faculty would then pick one of these plans and the entire student body would climb into aircraft and execute the plan. Not since Moltke's staff rides did planning receive such a fast real-world confirmation. There was just one problem: ACTS was simulating actual missions; they were not wargaming them. The bombers always got through to Selma, which was to be "bombed," as there was no enemy resistance. One can guess how this caused doctrine to evolve, or more likely not to evolve.⁴⁴

There was one bright spot. In 1929, a young captain named George Kenney recognized the need for airmen to understand how airpower fit into overall theater campaigns. On his own initiative, he developed an air/sea/land wargame that took maintenance, supply, and even airfield construction into account. Student feedback to his wargame was mixed. Immediately after execution, the wargame received a lot of criticism for being difficult to play. However, it was rated much higher in graduation surveys.⁴⁵

Unfortunately, the wargame was so complex and cumbersome that after Kenney's departure in 1932, no other faculty member was willing to take it over. How much impact could such a short-lived wargame have? Many historians believe General Kenney was the prime architect of Gen Douglas MacArthur's Southwest Pacific air, sea, and land campaign in that theater. How much impact, indeed?

Clearly, the wargaming success story of the interwar period is that of the US Navy. Both the fleet and the Marine Corps made impressive use of wargaming, with a positive impact that has seldom been equaled.

The Navy built upon the work of McCarty Little, continually refining his technique. Even before World War I, the bulk of their wargames began looking at a possible war with Japan. Initially, all wargames assumed that the American fleet would dash across the Pacific, fight and win a big climactic battle, and relieve the Philippines. However, as the

Naval War College refined its methods, the logistical constraints on such a rapid advance became obvious. Soon the wargames also made clear the need for forward bases in such a campaign. As understanding increased, the time needed for the advance grew from days to months to years.⁴⁶

Other elements were less clear. All through this period, US intelligence on the specific characteristics of Japanese weapons and of troop training levels was atrocious. Instead of arguing over what they did not know, the Navy turned this handicap into an advantage. How they did it shows their keen insight into education and human nature.

Naval War College students certainly wanted to win their big “capstone” wargame at the end of their school year.⁴⁷ As students have always done, they asked those who graduated before them for advice, or in the vernacular of the US military, “gouge.” Graduates were happy to provide advice: “Try to engage the Japanese at night, they are blind; watch out for their torpedoes though, they are killers; fortunately, though, their ships sink like rocks after the lightest of battering.” However, when they talked to someone who graduated in a different year, they learned “Avoid night engagements, the Japs are incredible; and their ships are so rugged they can really close in and slug it out; at least you don’t have to worry about their tinker toy torpedoes.” Slowly it dawned on the students—the faculty was giving the Japanese different strengths and weaknesses in each wargame!

What were the students to do? Unable to simply learn Japanese strengths and weaknesses before the game, they had to play the game in such a way that they could learn them through experience before any decisive engagements took place. Once they learned what those strengths and weaknesses were, they would then develop a strategy to put US strengths against Japanese weaknesses while protecting our weaknesses from Japanese strengths. They could then force the decisive engagements. In other words, they were “learning how to learn.”

This by itself was a breakthrough, but the Navy’s wargamers did more. Despite the Navy of this period being influenced by battleship admirals, the Navy’s aviation community was able to develop operational concepts and procedures that were ready to be implemented when, at Pearl Harbor, the Japanese took away our option for battleship tactics. How did they do it? The Navy was able to use wargames to cheaply, quickly, and educationally try out different ideas in aviation and even ship design. For example, the circular formation used during World War II by carrier task forces was first developed during an interwar wargame. Some of what was learned resulted in changes in ships already under construction.⁴⁸

The United States Marine Corps carried out arguably the most important wargaming work done during this period. The Naval War College’s wargames had shown the importance of forward bases in any war with Japan, yet World War I had seemed to show that amphibious assaults were problematic against modern weapons.

So the Marines had to solve an enduring problem, and they had to do so despite one of their traditional handicaps—a very sparse budget. Wargaming was the key.⁴⁹ Through both map wargames and live wargame exercises, they developed their doctrine of amphibious operations. They set out to make an offensive against Japan sustainable, yet what they really developed was the key to Allied success in all theaters. D day and victory in Europe would have been impossible without the work done by the USMC during the 1930s—with almost no budget and all too little recognition, then or now.⁵⁰

1933–41: The Storm Builds

It can be argued that the most potentially decisive wargames of World War II were never played. When Adolf Hitler came to power, he quickly put a stop to the strategic-level wargames. He would make the future strategic decisions for Germany. During the war, Germany fought smart at the operational

level, yet made poor decisions at the strategic level.

Would strategic wargames have influenced Hitler's decisions? Perhaps not. In 1938, Gen Ludwig Beck, then chief of the German General Staff, conducted a wargame of a German campaign against Czechoslovakia. While the wargame predicted a German victory, it also predicted that the fight would critically weaken Germany.⁵¹ Hitler ignored these findings, as he believed the Czechs would not fight.

Still, 1940 wargames conducted by the then obscure Lt Gen Erich von Manstein seemed to convince Hitler to order the bolder plan.⁵² The result was a French defeat far faster and more complete than would have otherwise been possible. Wargames could also discourage. For example, one game of an air campaign against Britain and a second on a cross-channel invasion both predicted difficulties. When the actual Battle of Britain proved indecisive, the predictions of the cross-channel invasion wargame were taken even more seriously.⁵³

Hence, a wargame predicting disaster in an attack on the Soviet Union may have had some effect. Such a wargame, Operation Otto, was conducted in three separate sessions.⁵⁴ At the end of the unprecedented third session, the wargame had been played only through to early November, yet no fourth session was scheduled. One reason was that the wargame predicted the destruction of 240 Soviet divisions, with only 60 remaining on a front line deep in the Soviet Union. Surely the Soviets could not recover.

Ironically, in the actual campaign on the actual "date" that Operation Otto ended, the Germans had advanced about as far as predicted by the wargame and had actually destroyed more Soviet divisions (248). However, instead of the Soviets being down to 60 divisions, they still had 220 divisions. How could the wargame be so wrong? The Soviets had mobilized entire new divisions upon the beginning of hostilities. To make matters worse, after the time period wargamed (early November), the Soviets acquired an old ally—

winter. German forces were woefully unprepared for winter fighting. Would a fourth session of Operation Otto have prompted preparation?

The Red Army also wargamed a German invasion.⁵⁵ Joseph Stalin's "displeasure" at the depth of the German advance in the wargame may help explain the premature counterattacks made in the actual invasion. Stalin conceded that one of the reasons the Red Army did so poorly was that the young general playing the German side of the wargame had played brilliantly. This general's name was Georgy Zhukov.

At the same time these wargames were being played, the US Army was increasing the rigor of its wargaming. One reason was the Army's new chief of staff, Gen George C. Marshall. Like Moltke, Marshall had liked wargames from the time he was a junior officer. Now, with the likelihood of war growing, he turned principally to the field exercise type of wargames.

Of these, the Louisiana maneuvers are best remembered.⁵⁶ While live play increased realism, especially in unit movement, combat used systems of adjudication very similar to map wargames. Because much equipment was new, the wargame could only be as accurate as the guesses about effectiveness.

There were some honest mistakes. The head of the tank-destroyer program provided the adjudication guide for the effectiveness of tank destroyers. Later events would show these guides overstated their lethality. But until then, these exercises "proved" their effectiveness. As a result, in early battles tank destroyers were used too aggressively—with tragic results.⁵⁷

Other flaws in adjudication were deliberate.⁵⁸ Efforts were made before play ever began to guarantee an outcome that would "prove" the ground officers' position on the employment of airpower. As a result, the ground officers' air concept prevailed.⁵⁹ Procedures were not changed until tragedies like the battle at Kasserine Pass demonstrated the need to do so.⁶⁰

The Japanese also used wargames. In August 1941, Japan's Total War Research Institute conducted a global political military wargame.⁶¹ Paying close attention to the politics within target, neutral, and friendly countries, this wargame (which did *not* include an attack on Pearl Harbor) predicted an Axis victory and may have encouraged Japanese entry into the war. After the decision for war, each service wargamed its planned operations. These wargames could predict relative attrition with greater precision, but they did *not* include political considerations.



Japanese model of Pearl Harbor, 1940. Note the battleship row placed next to Ford Island.

Some historians have maintained that Japan's wargaming of the attack on Pearl Harbor demonstrates how wargaming should be done.⁶² Japan originally planned to sail her carrier force from its normal base straight toward Pearl Harbor. During the wargame, the Japanese officers playing the American role used their limited sea surveillance assets to search for and find the Japanese force while it was still well out to sea. The Japanese side did "win" (i.e., they sank more ships than they lost), but it was a Pyrrhic victory that Japan could ill afford at the beginning of a long war against an industrially stronger nation. So the Japanese planners went back to their planning cell and came up with a new plan. This plan was wargamed with much better results. Japan's subsequent victory at Pearl Harbor seemed to validate their planning methods.

Yet, was Pearl Harbor a Japanese victory? Certainly it was a tactical victory by standards of attrition ratios. Shortly after his great "victory," Adm Isoroku Yamamoto said, "I fear all we have done is waken a sleeping giant and fill him with a terrible resolve."⁶³ The sense of purpose Pearl Harbor gave the American people far outweighed any temporary advantage it gave Japan. How could Japan have missed this? Japanese naval wargaming did not take political impact into account.

1942–46: World War and Eclipse

In contrast, the Japanese wargame prior to the Battle of Midway is usually cited as the best example of how *not* to wargame. During the game, the American side's airpower sank two Japanese carriers. Rear Adm Ukagi Matome, commander of their carrier force for the actual operation, unilaterally reversed the judgment of the umpires. With the carriers restored to the game, the Japanese side went on to capture Midway. Just weeks later, the Americans sank the same two carriers, plus two more. This time Admiral Ukagi could not reach into the "dead pile" and replace his ships.⁶⁴

Meanwhile, the US Navy was reaping a rich harvest from its years of wargaming. A few months into the war, Adm Chester Nimitz sent two lieutenant commanders back to the Naval War College to see if the college had ever determined Japanese strengths and weaknesses correctly. The officers found the records of two wargames with Japanese values close to their current intelligence. They returned with the doctrine and plans from those years.

The Marines also got to see how accurate their interwar wargames were. Frankly, their early landings like Tarawa did not unfold as the prewar wargames indicated. These inaccuracies had contributed to flawed doctrine and the development and purchase of not quite the right equipment.⁶⁵ But the wargames were close, and the Marines learned that in war it is easier to fix some-

thing that is close than to come up with a capability from scratch.

The Marines Corps refined its wargame techniques quickly. After a few assaults, it was getting results that were so close to actual casualty count and to the time required to secure islands that one marine called it "eerie." Yet, the wargame for the next landing was way off on both counts. They had adjudicated as before and had used the same methods to estimate Japanese strength. Why, then, was the game so wrong? It was due to a Japanese wargame.

The story of this Japanese wargame⁶⁶ answers a still bigger question: After the Japanese were hopelessly outnumbered in 1944 and 1945, why did they keep on fighting? When the Japanese ambassador to the United States and his staff returned to Japan, they were taken to a secret location outside Tokyo. There they played the US side in a rare Army/Navy wargame. In that wargame, Japan lost the war, prompting the Japanese to evolve a new strategy. The Japanese could not win the war, but they could kill Americans. They believed that if they could kill enough Americans, the United States would grow war weary and give Japan better terms—hence the doctrine of inflicting the maximum cost on the Americans in time and blood.

This new doctrine was what had gone wrong with the Marine wargame. The Marine Red Team had continued to follow Japan's previous doctrine. Later, Japan would produce a still larger variance from the War Plan Orange wargames using an innovation called *Kamikaze*.

The Soviets evolved a unique style of wargaming.⁶⁷ Closer to the elder Reisswitz's game than his son's, Soviet wargames typically centered on terrain models. Using each side's plan for the entire operation, the umpires would use incredibly detailed and cumbersome adjudication procedures to adjudicate all the way to its conclusion. Only then would the two teams be called back and walked through the operation step by step. Essentially, these were one-move wargames.

The Germans made heavy use of wargaming throughout the war.⁶⁸ The Germans' wargame of the "Middle" Battle of the Ardennes may have been their most unusual.⁶⁹ Early in the fall of 1944, the Fifth Panzer Army conducted a wargame of an American attack on their assigned sector—the Ardennes. While the wargame was going on, the Americans actually attacked. Instead of dismissing the game, Field Marshal Walter Model sent only the commanders of units in contact back to their commands. He then directed that actual American movements be fed into the game. The Germans then wargamed each of their orders before executing them. Finally, when it was time to commit the reserves, Model called their commander over to the wargame map, personally briefed him, and sent him on his way.

The defeat of the Axis powers ushered in an eclipse of wargaming. Obviously, the Axis ceased wargaming. Within the United States, the use of wargaming dropped almost as steeply. Only inside the Soviet Union did wargaming expand and become more rigorous. Few knew this at the time, and few would have cared. If the atomic bomb had made war obsolete, was not wargaming obsolete also?

The Late 1940s and 1950s: The Long Road Back

Our expectations of the future shape that future. The United States expected peace to be guaranteed by atomic weapons, while the Soviets expected continued conflict and doubted the effectiveness of atomic weapons. Because of those expectations, wargaming atrophied within the United States and grew in the Union of Soviet Socialist Republics (USSR). As with the space programs, the Soviets widened their lead in wargaming because the United States was standing still. Unlike space programs, Red wargaming was virtually unknown outside of the Soviet Union, so the lead in that field did *not* spur us to action.

Still, this bipolar wargaming world quickly began to change. The seeds of the eventual

recovery of wargaming in the West were planted even before its post-World War II eclipse. Techniques and technologies developed during the war years would eventually support its recovery.

A lasting legacy of the war was the mobilization of the scientific community for the war effort. The Manhattan Project is the most famous example, but the radar work at the Massachusetts Institute of Technology and countless other projects on both sides of the Atlantic contributed to Allied success throughout the war.

Those who came to be called the operations research (OR) community frequently had a rapid impact. They were first employed to help win the Battle of the Atlantic by seeking ways to use scarce Allied resources to the best effect. Due to some striking successes⁷⁰ by war's end, OR was being tasked to look into every type of military problem.

The war also spurred the development of computational devices for applications as diverse as code-breaking and artillery tables. The continuing requirement for computational machines during the beginning of the cold war provided the seed money for what would soon take off as the computer industry.

As for the actual recovery of wargaming, the Navy again led the way. In 1947, the Naval War College increased its use of wargaming through the addition of a wargame-intensive logistics course⁷¹ and then in 1958 when the Naval War College's computerized Navy Electronic Warfare Simulator (NEWS) became operational.⁷² While later articles would admit this first computerized wargame never quite worked (aside from its big status screen), the mere fact that the wargame was computerized lent an air of modernity to what was supposed to be an antiquated procedure.

The US Air Force's initial use of wargaming came from the OR community.⁷³ After the war, the Air Force facilitated the creation of RAND Corporation as a way to retain access to OR specialists. In 1948, RAND began experimenting with "crisis" gaming. By 1954, it launched a number of innovative war-gaming projects. RAND began a computer model of

the cold war competition between the United States and the USSR. Input from the Air War College and the State Department prompted RAND to add political and economic factors. Though the depiction of these factors in a December 1954 wargame was viewed as crude, the potential value of including such factors was recognized. To increase flexibility, RAND later turned to a *Free Kriegsspiel* style of play and in so doing reinvented the German political/military wargame. Also in 1954, RAND attempted to game through an entire nuclear war. The next year, RAND used an air warfare model to accomplish a "net assessment" at the Air War College. Given the image of OR at the time, this gave an impression of modernity to Air Force wargaming.

Wargaming also recovered to some extent in the Army. Stung by its lack of preparedness in Korea, the Army began a continuing series of field maneuvers. Their cartoon adversaries, the "Aggressors," did *not* duplicate Soviet tactics, but it was a start. The Army did realize it might have to fight the Soviets, and it began to prepare for that possibility by starting the debriefing of German officers of the last army to do so. One of the things the Army learned from these German generals was the value that the Germans derived from wargaming.

In 1953, a young man named Charles Roberts started selling to civilians a map wargame he had designed called "Tactics." By 1958, he had sold two thousand copies and had come within \$30 of breaking even.⁷⁴ Encouraged, he founded the Avalon Hill Game Company to sell war, economic, and sports simulation games to the general public.⁷⁵

By the end of the decade, wargaming was clearly on the rebound. In 1958, the US Marine Corps established a "Landing Force Wargame" series at Quantico, Virginia. Even the *Harvard Business Review* published an article on adapting wargaming techniques to develop business strategy.⁷⁶ Talk about a comeback.

1960s: As Bad as It Gets

The 1960s got off to a promising start. While wargaming was also becoming more

international,⁷⁷ the main source for hope was the new secretary of defense, Robert McNamara. His strategy was to merge successful management techniques from General Motors with proven OR techniques.⁷⁸ His goal was effective defense at a cost the United States could sustain over the long haul. At its core, his concept for approving/continuing defense initiatives was elegantly simple: Accomplish a life cycle cost analysis to learn what a proposal would really cost and then use OR techniques to estimate military utility. The concept was sound, but problems would emerge during execution.

The 1960s also started well for naval wargaming, with Admiral Nimitz giving wargaming a ringing endorsement.⁷⁹ He said, "The war with Japan had been [enacted] in the game room here by so many people in so many different ways that nothing that happened during the war was a surprise—absolutely nothing except the Kamikaze. . . ." The Naval War College soon began offering a course in wargaming. Later the Navy conducted the first remote wargame, with the players aboard ship and the adjudication accomplished at the Naval War College.⁸⁰ By the middle of the decade, the Navy had upgraded its wargaming system to the Warfare Analysis and Research System (WARS).⁸¹ Even so, it believed naval warfare was increasing in scope and complexity faster than the capabilities of its wargames could be increased.

Major advances were also made in Air Force wargaming. Working with the Joint Staff and RAND, the Air Force started to wargame the Strategic Air Command's single integrated operational plan (SIOP) against a Red SIOP.⁸² The latter was prepared by intelligence officers who studied not only Soviet weapons but Soviet strategies and tactics as well. The Air Force also wargamed the defense of North America using a wargame called Big Stick. Big Stick was demonstrated at the Air Command and Staff College in 1961 and in 1964 became part of the school's core curriculum. Finally, in 1967, the Air Force introduced the world's first instrumented air weapons range. Established at Eglin AFB,

Florida, and used in weapon-effectiveness testing, the full impact of this innovation would become apparent in the next decade.

Army wargaming also became more effective during the 1960s. Wargaming was used by helicopter enthusiasts to develop the concept of an air-mobile division. It then used wargaming in 1962 to sell the concept to McNamara, who directed that the Army quickly follow through with the idea. When the Army deployed its first air-mobile division to Vietnam, it, like the Marines' before it, found that real combat was different from the wargames.⁸³ Also like the Marines', the Army's helped ensure that initial concepts were close enough for field adaptation.

Joint wargaming was becoming a reality. In 1961, a wargaming operation was established at the Joint Chiefs of Staff (JCS) level to provide an unbiased, joint arena to conduct McNamara's wargames.⁸⁴ The next year, predictions of a wargame cost study helped convince McNamara to support the creation of an air-mobile division, while relatively low-cost-effectiveness predictions influenced him to cancel the Skybolt air-to-surface missile system. This caused a storm of protests from Britain, which had spent significant funds on the program. The United States was blindsided by this criticism because McNamara's attrition-per-dollar calculations did not even consider the possible diplomatic repercussions of program cancellation.

Attempts were made during the 1960s to broaden wargaming beyond attrition. After the Bay of Pigs fiasco, President John F. Kennedy had complained that his military advisers did not understand the political implications of their recommendations. This encouraged the use of politico-military wargaming at the Pentagon and at professional military education (PME) schools. In 1964, the Advanced Research Projects Agency (ARPA) funded efforts to produce a wargame that would depict all the political, psychological, and economic ramifications of an insurgency.⁸⁵ This would have produced an entirely new generation of wargames capable of examining all wars in a much more compre-

hensive way. Regrettably, despite some interesting work in this area, the defense planning community continued to use attrition-based wargames.

In 1964, the JCS conducted a politico-military game called "Sigma I-64." This exercise depicted US strategy options for Vietnam. The exercise was repeated with an even higher level of participation. In his book *War Games*, Thomas Allen implies that these wargames predicted a US defeat.⁸⁶ However, review of the actual declassified reports on both exercises presents a different image.⁸⁷ First, the strategy executed in the wargame did not match what followed in the actual event. During Sigma II-64, the Blue side immediately executed attacks on an expanded version of the JCS's 94 Target Lists, and North Vietnam's ports were promptly mined. Second, each exercise depicted only the first several months of US involvement. Even if they had been able to adjudicate the political consequences of US casualties, the wargames did not cover sufficient time for those consequences to arise.

The most effective wargaming was done by the Communist North Vietnamese. Using Soviet wargaming methods, the North Vietnamese wargamed each of their operations. Familiarity with the plan produced by the Soviet method allowed the Communists to conduct fairly complicated attacks without radios, accomplishing coordination using wrist-watches and subordinates' memory of the plan.

The 1960s witnessed the steady growth of civilian wargaming.⁸⁸ While the decade started with one publisher and a few thousand annual sales, it ended with a half-dozen publishers with total sales of over 100,000 units per year. The sophistication of these wargames also increased due to the competition of the marketplace.

1970s: To Study War

Very little was published on wargaming in the early 1970s. Perhaps this reflected the anti-military attitude of the times. It appears that there was also something of a downturn in

the actual use of wargaming. If so, the decline was short-lived. As before, the Navy led the way, but this time they were soon overtaken—by the Air Force.

The war in Vietnam was not going well. Among all the other problems, our air-to-air kill ratio had dropped from spectacular in Korea to dismal (occasionally worse than one to one, seldom even two to one). A study called "Red Baron" concluded we were teaching our pilots how to fly, not how to fight. If a pilot survived his first eight missions, his "on-the-job training" would teach him to fight, and he would survive his tour.

The Navy acted first by establishing its Top Gun school in 1971.⁸⁹ The aggressor/instructor pilots flew small, nimble jets similar to those flown by the enemy. They also attempted to duplicate Soviet-style tactics. It worked. The Navy saw a significant improvement in its pilots' kill ratios over Vietnam.

The Air Force response took longer to kick off but was more comprehensive. In 1974, the Air Force established the Fighter Weapons School. The school would be similar to the Navy's Top Gun school but different in that air-to-ground tactics would also be taught. Then, in 1975, the Air Force initiated the Red Flag series of exercises to improve the fighting skills of all its combat pilots. Both the school and Red Flag used an electronic range like that at Eglin to allow more accurate adjudication and debriefing of engagements. Over time, the Air Force created an entire enemy "nation" in the Nevada desert complete with strategic targets guarded by simulated air defenses.⁹⁰ This also provided a realistic environment for trying out new equipment and tactics.

Also in 1975, the Navy established its Command Readiness Program, an ongoing series of wargames played by the actual surface combatants. At decade's end, the Navy launched a new batch of games, its GLOBAL Wargame series.⁹¹ A deliberate attempt to recapture the ability to gain valuable insights that Navy interwar games produced, GLOBAL also started with fast climactic naval battles. Like in earlier wargames, the rigors of

wargaming changed expectations of a war with the Soviets.⁹²

The 1970s were good to commercial wargaming.⁹³ An increasing number of publishers and growing sales encouraged innovations such as depicting the effects of morale, training levels, surprise, and many other supposedly “intangible” factors. Commercial wargaming was also starting to attract serious attention. In 1974, the US Army became the first service to buy a commercial-style wargame, the tactical ground combat simulation “Fire Fight.” In 1975, “Origins,” the first civilian wargaming convention, was held. Sales rose steadily during the decade, exceeding two million units in 1979.

Still, the trend with the most profound effect came from within the services. As the 1970s progressed, company-grade officers of the Vietnam era began to enter positions of greater authority. Many felt their fighting forces had been hamstrung by a failure of strategic vision and a lack of basic campaign planning. As individuals and as groups, many of them worked to ensure that the services would be better prepared intellectually the next time. In the Air Force, Lt Col Denny Drew pushed to put more “war” in the war colleges. In the Army, Lt Col Ray Macedonia pressed for more wargaming.

1980s: Promise and Performance

Things seemed to come together for wargaming in the 1980s. Each service, the North Atlantic Treaty Organization (NATO), and commercial wargaming made major progress.

The Army made the most important advances of the early 1980s. In 1980, the Army opened the National Training Center (NTC).⁹⁴ This “Red Flag for ground forces” employed an instrumented range, technology similar to laser tag, and a credible aggressor force to produce the most realistic ground-combat environment ever. More wargaming was also being done at home station, thanks to an innovation by III Corps.⁹⁵ It simply established a wargaming center at each maneu-

ver base. Wargaming skyrocketed when overworked commanders found the centers meant it took *less* of their time to set up a wargame than other types of training.

In 1981, the Navy upgraded its WARS wargaming system to produce the Naval War Game System (NWGS).⁹⁶ Seven years later, they upgraded its system again as the Enhanced Naval War Game System (ENWGS). Each upgrade roughly doubled computing power. Yet, the scope of naval wargaming always seemed beyond its latest system. As in the 1950s, faculty filled the gaps with innovation, common sense, and long hours. The strain stemmed from increasing Naval War College and fleet use, and the GLOBAL exercises. As GLOBAL increased in sophistication, it became increasingly evident that a war with the Soviets would likely be protracted and that in a protracted war the Soviets were doomed.⁹⁷ As GLOBAL attracted more of Washington’s power hitters, that perception became widespread, coloring not only Navy strategy but national strategy as well. As GLOBAL increased the credibility of wargaming with Congress, the Navy turned to wargaming to support its budgets.⁹⁸ In 1988, the Marines began wargaming Program Objectives Memorandum (POM) initiatives as well.⁹⁹

In 1984, the Air Staff director of operations was given oversight of all Air Force wargaming.¹⁰⁰ In 1986, construction was completed on the Air Force’s first wargaming facility, located at Maxwell AFB, Alabama. Two years later, this \$21-million facility/computer system was declared fully operational¹⁰¹—despite continuing problems with adjudication software. As with the early generations of naval computer adjudication, hard-working individuals came up with workarounds.

The 1980s were also successful but transitional years for commercial wargames.¹⁰² Publishers of printed wargames saw their sales plummet. Peaking at 2.2 million units in 1980, sales dropped to less than a million at mid-decade and half a million by the decade’s end. Much of the decline was due to the rise of a new (for civilians) wargame medium.

Personal computers allowed the recreational software industry to take off, and with it, computer-based wargames for home use.

The 1980s also saw innovations in joint wargaming. In 1982, the National Defense University finally initiated a wargaming center,¹⁰³ and the Warrior Preparation Center became operational in Germany.¹⁰⁴ The latter was specifically designed to allow senior US leaders and NATO headquarters to try war plans without having to maneuver troops. Bills for exercising damage, environmental concerns, and concerns over Soviet capabilities to monitor live exercises all contributed to increasing support for the center. By the late 1980s, all area commanders in chief (CINC) were using wargames. A 1989 study concluded that US Central Command (USCENTCOM) was clearly ahead of the pack—a circumstance that turned out to be fortunate.

The 1980s also saw the first unclassified reports on how the Soviets wargame. This was due in part to greater openness. Articles that wanted to appear frank but revealed little began to appear in the Soviet open press. However, the real meat came from defectors from the Afghan army. Trained in Soviet wargaming methods, these officers were only too happy to provide details.¹⁰⁵

Another source was watching the Iraqis during the Iran-Iraq war. The Iraqis used Soviet wargaming methods during their successful offensives during the Iran-Iraq war.¹⁰⁶ However, Soviet wargaming could not adjudicate the strategic impacts of airpower. So, in 1986, Iraq contracted with the US defense contractors for a computer wargame.¹⁰⁷

1990–91: War on Sand Table and Sand

To a degree, the Gulf War was a fight between Soviet and US wargaming methods. The Iraqi invasion of Kuwait followed the pattern of Soviet wargamed operations—a fast start that petered out at the Saudi border.

Just prior to the Iraqi invasion of Kuwait, CENTCOM played another wargame called “Internal Look.” In this exercise, only a token

US force was sent “to show resolve.” Iraqi forces drove south, and the United States had trouble getting sufficient forces in-theater to slow the Iraqi advance.¹⁰⁸

On the morning of the Iraqi attack, Mark Herman, the designer of the commercial wargame “Gulf Strike” and employee of the defense contractor Booz Allen, was approached by the Joint Staff and asked to produce a wargame of the developing situation. He was on contract by lunch. By modifying his commercial wargame “Gulf Strike,” he was able to begin play of a now classified wargame by midafternoon!¹⁰⁹

During August, a joint planning cell led by Col John Warden and built in the Air Staff’s Checkmate office, produced the Instant Thunder theater air campaign plan. The plan was sent to the Air Force Wargaming Center. The resulting wargame produced no effect, as the software—being designed to model cold war attrition campaigns—did not adjudicate the impact of hitting strategic targets.¹¹⁰

As time for the coalition counterattack approached, an element of the US government pushed for CENTCOM to occupy western Iraq with the 101st Air Assault Division. It was believed that this would prevent mobile Scuds from getting close enough to launch against Israel. CENTCOM quietly wargamed such an operation and passed on the estimated casualty figures. The suggestion did not come up again.¹¹¹

Many others were wargaming the Gulf War. Although outcomes varied somewhat,¹¹² most official wargames indicated that coalition casualties would total about 30,000, of which six thousand would be American fatalities. Senator Sam Nunn (D-Ga.) decided to oppose the counteroffensive. It was his political judgment that the American people would not accept such high casualties.

As the time to attack grew closer, individual units started to wargame their own parts of the plan.¹¹³ At least one Army unit used a commercial wargame. A soldier wrote the publisher stating that a sandstorm had blown their game away and asking that a replacement wargame be sent quickly.¹¹⁴

The superb training received during live wargames like those conducted at Red Flag and the NTC contributed much to our success. Pilots based in Turkey referred to northern Iraq as "The Range," and a number of soldiers were taped saying, "The NTC [training] was much harder."

However, computer wargames misled commanders. After high casualties were adjudicated in these games, C-130 transport aircraft were configured for medical airlift, not to fly in the fuel that was actually needed. The wargames indicated that the Iraqis would fight to the last man, hence there was little preparation for prisoners of war (POW).¹¹⁵

As coalition forces moved forward, they uncovered evidence of Iraqi wargaming. From the terrain modeled, it was clear the Iraqis were rehearsing to repel an amphibious invasion.¹¹⁶

Though we achieved one of the most overwhelming military victories in history, we did not achieve a proportionately positive state of peace. Why not? It appears the United States never wargamed through to peace. The Marines had planned to conduct such a wargame, but military victory came too quickly. Even if it had been conducted, it is doubtful that our attrition models would have anticipated the revolts against Saddam Hussein.

The impact of wargaming on the Gulf War was enormous and mostly positive. Yet casualty predictions were over 20 times too high. These predictions had real political and military consequences. Did this produce yet another eclipse of wargaming? No.

1990s: The Return of Achilles

More money was spent on wargaming in the 1990s than all previous decades.¹¹⁷ Much of this increased investment is producing excellent value for the cost. Yet, the central problems that caused the bad predictions were pronounced impossible to fix or ignored.

A RAND paper, "The Base of Sand," captured the problem well. What was needed was a more comprehensive adjudication of armed conflicts. More computing power without a

more comprehensive understanding of war would simply produce the wrong answer faster and with more persuasive graphics.¹¹⁸

In 1990, the deputy secretary of defense created the Executive Council on Modeling and Simulation (EXCIMS) to take a comprehensive look at wargaming.¹¹⁹ They saw a maze of adjudication software, most looking at one regime, using different data, and producing different answers to the same questions. Ground and naval surface forces had clearly played an important role during the final days of the Desert Storm campaign, yet no wargame could fully depict such a joint operation.

As a first step to bring order to this chaos, a permanent DOD-level office was established. In 1991, the Defense Modeling and Simulation Office (DMSO) was established.¹²⁰ Next they established an information clearinghouse so that work was not duplicated out of ignorance. Established in 1993, in 1999 it became the Modeling and Simulation Information Analysis Center (MSIAC).¹²¹ As an interim measure, software was developed to allow existing service wargames to talk to each other. Finally, they funded programs to replace many one-service adjudication engines with a few joint ones. The Joint Warfare System (JWARS) was to replace most analytical models, while the Joint Simulation System (JSIMS), using modules developed by each service, was to replace all the models used to train CINC staffs.¹²²

Increased competition for limited defense dollars and the success of GLOBAL as an analytical and lobbying tool have led all the services to conduct GLOBAL-like wargames. Collectively called Title Ten wargames, the Air Force's "Global Engagement" and the Army's "Army after Next" are now held annually.¹²³

The 1990s were full of surprises for commercial wargaming.¹²⁴ Sales of printed wargames continued to decline, falling to two hundred thousand units a year. The industry then stabilized desktop publishing, allowing lower sales per title to still be profitable. In contrast, the recreational software industry has exploded (\$25 billion in worldwide sales

in 1997).¹²⁵ However, wargaming's share of those sales has fallen from 25 percent when personal computers (PC) began to about 10 percent today.¹²⁶ (Still, 10 percent of \$25 billion. . . .) Most surprisingly, wargaming with miniatures made a comeback, its proponents saying their painted figures are the ultimate "high-resolution graphics."¹²⁷ Commercial wargaming has also become global, with many US titles selling well overseas and several foreign titles selling well in the United States.

As the 1990s ended, there were some indications that defense wargaming may have reached the millennium early. In October 1999, a well-attended NATO conference on modeling, simulation, and wargaming demonstrated that wargaming had indeed become international again. Earlier in the year a major test of JSIMS by the US Atlantic Command demonstrated that this important \$150-million system was approaching operational usefulness.¹²⁸ Finally, as a fitting con-

clusion to a century of achievement, on 28 September 1999, the Naval War College dedicated its new \$19-million wargaming facility. Most appropriately, this latest attempt by the Navy to "push the envelope" is named for the selfless individual who started it all—McCarty Little Hall.¹²⁹

Yet, despite a decade of heavy investment and significant innovation, all is not well with defense wargaming. In the spring of 1999, defense wargaming received the acid test when America again sent its people into harm's way, this time in the skies over Kosovo. How well did wargaming do? Again, wargames failed to provide insights to the types of human effects and system impacts that were the main focus of NATO's air campaign.

How can these deficiencies be resolved? The history of wargaming provides proof of the importance and persistence of the problem and some clues to the solution. Describing a possible solution will require an article of its own. □

Notes

1. As for formal definitions, Webster defines *wargame* as a "simulated battle in military training maneuvers." While the *Official Dictionary of Military Terms* defines *wargame* as "a simulation by whatever means of a military operation involving two or more opposing forces, using rules, data, and procedures designed to depict an actual or assumed real-life situation."

2. There are several works on very early strategy games. Perhaps the best brief account is Alfred H. Hausrath, *Venture Simulation in War, Business, and Politics* (New York: McGraw-Hill Book Company, 1971), 3–5.

3. For a general study in the rise of quantification in the West, see Alfred W. Crosby's *The Measure of Reality: Quantification and Western Society, 1240–1600* (Cambridge, U.K.: Cambridge University Press, 1997).

4. John P. Young, *History and Bibliography of War Gaming* (Washington, D.C.: Department of the Army, 1957), 2–6.

5. Peter P. Perla, *The Art of Wargaming: A Guide for Professionals and Hobbyists* (Annapolis, Md.: Naval Institute Press, 1990), 19–21.

6. Indeed, Napoléon *may* have invented the first operational war simulation. He would "walk through" his campaigns in advance, using colored pins on maps to help him visualize where his units and those of his enemies would be and when.

7. Hausrath, 5–8.

8. Stephen B. Patrick, *Wargame Design* (New York: Simulations Publications, Inc., 1977), 4.

9. Young, 9.

10. Besides, the younger officers might come up with something innovative.

11. He was always the senior umpire.

12. The following list of countries and when they began wargaming was derived from several sources, principally Young, 11–13:

1866 - Austro-Hungarian
1872/1883 - England
1873 - Italy
1874/1889 - France
1820/1875/1905 - Russia
Secondary diffusion - Japan, Turkey, Latin America

13. However, some believe that Lt C. A. L. Totten was first. While advocates of both make good cases, Livermore is generally considered first because he was the first to publish. See Young, 16, for more detail.

14. The noted author David Isby E-mailed me an equally clear though not so succinct Sherman quote: "I know there exist many good men, who honestly believe that one may, by the aid of modern science, sit in comfort and ease in his office chair, and with little blocks of wood to represent men or even with algebraic symbols, master the great game of war. I think this is an insidious and most dangerous mistake. . . . You must understand men, without which your past knowledge were vain."

15. Anthony S. Nicolosi, "The Spirit of McCarty Little," US Naval Institute *Proceedings* 110 (September 1984): 77.

16. Capt John Phillips Colomb, RN, appears to have designed the world's first true naval wargame. See Francis J. McHugh, "Eighty Years of War Gaming," *Navy War College Review* 21 (March 1969): 88–90.

17. Following is one indication of that influence: In 1897, Theodore Roosevelt wrote the Naval War College to ensure his

visit would coincide with one of their big strategic games. Perla, 66.

18. William McCarty Little, "The Strategic Naval War Game or Chart Maneuver," US Naval Institute *Proceedings* 38 (December 1912): 1223.

19. Young, 18.

20. Little, 1213-33.

21. The similarity of some of the concepts in this article and those espoused by Col John Boyd, USAF, over six decades later are striking. My suspicion is they both came to the same truth by different routes. For a tight description of Boyd's concepts, see David S. Fadok, *John Boyd and John Warden: Air Power's Quest for Strategic Paralysis* (Maxwell AFB, Ala.: Air University Press, 1995), 13-20.

22. In the late 1980s, this author was told by a senior Air Force wargaming official that it was impossible to depict break points in contemporary Air Force wargames. For more information on how Germany was doing the "impossible" 110 years earlier, see the 1968 book by Andrew Wilson, *The Bomb and the Computer* (New York: Delacorte Press, 1968), 12.

23. Perla, 31-34

24. Lt Roger Harrison (promoted to lieutenant colonel in 1983), *The Influence of War Gaming on the Schlieffen Plan* (Washington, D.C.: Georgetown University Graduate School, 1967).

25. During the early and mid-1800s, a number of war chess games were published in the United States, but these had more in common with earlier versions of war chess than with modern wargaming. See George Gush with Andrew Finch, *A Guide to Wargaming* (New York: Hippocrene Books, 1980), 24.

26. The Oxford Kriegsspiel Club was founded in 1873. See *ibid.*, 24.

27. Mentioned in E-mail from James F. Dunnigan, "dean" of contemporary commercial wargames designers.

28. He is considered by many to be the father of modern military history.

29. For more information on Hans Delbrück, see Gordon A. Craig's chapter on him in Peter Paret's *Makers of Modern Strategy* (Princeton, N.J.: Princeton University Press, 1986).

30. Harrison.

31. For more detail, see Wilson, 28-32.

32. M. R. J. Hope Thompson, "The Military War Game," *Journal of the Royal United Service Institution* 11 (February 1962): 50.

33. The French thought they knew Germany's broad plan in the event of war—an immediate offensive against them hoping to defeat France before Russia could fully mobilize. To defeat this strategy, France urged its Russian ally to focus all its mobilization efforts on its two most modern armies. As their mobilization was complete, these two armies would invade East Prussia. This would help Russia since the Germans would be unready for such an early offensive. Even more importantly, it might have helped to keep France in the war by causing the Germans to divert forces from their campaign against France. Russia agreed to the French strategy and developed it into a detailed plan. The wargame would test this new plan.

34. For more detail, see Wilson, 33.

35. Harrison.

36. Barbara W. Tuchman, *The Guns of August* (New York: Macmillan Publishing Company, 1962), 90-91.

37. Paret, 349-50

38. After World War II, General Manstein claimed these exercises were initiated at his suggestion. See Francis J. McHugh, *Fundamentals of War Gaming* (Newport, R.I.: Naval War College, 1966).

39. B. H. Liddell Hart, *The Liddell Hart Memoirs* (New York: G. P. Putnam's Sons, 1965), 252-54.

40. All I have found on Army wargaming during the interwar period are two brief references in articles on naval wargaming.

41. Maj H. Dwight Griffin et al., *Air Corps Tactical School: The Untold Story* (Maxwell AFB, Ala.: Air Command and Staff College, 1995), 7.

42. Claire Lee Chennault, *Way of a Fighter: The Memoirs of Claire Lee Chennault* (New York: G. P. Putnam's Sons, 1949), 18-19.

43. Robert T. Finney, *History of the Air Corps Tactical School, 1920-1940* (Washington, D.C.: Center for Air Force History, 1992), 22-23.

44. Various lectures at Air University have gone into greater depth than any published source I have found, but the bare bones of this method is laid out in Griffin et al., 5.

45. During work on my master's thesis on the history of wargaming, I did not find any information on wargaming at the Air Corps Tactical School. The above is based on conversations I had in the early 1990s with Maj (now Col) Peter Faber while we were both at the School of Advanced Airpower Studies. His PhD dissertation is on the Air Corps Tactical School.

46. Michael Vlahos, "Wargaming, the Enforcer of Strategic Realism: 1919-1942," *Navy War College Review* 39 (March 1986): 7-22.

47. While in this case the ship was an early aircraft carrier, wargames could also have a more systematic effect on design. For example, the design of the *Brooklyn*-class light cruisers was validated through wargaming. See John Prados, *Pentagon Games: War Games and the American Military* (New York: Perennial Library, c.1987), 4.

48. While the Marines wargamed at least as early as 1924 (Victor H. Krulak, *First to Fight: An Inside View of the U.S. Marine Corps* [Annapolis, Md.: Naval Institute Press, 1984], 89), work on developing an amphibious doctrine shifted into high gear in 1933 when the commandant of Marine Corps schools discontinued all classes so faculty and students could work on defining what was needed for the capability. John H. Cushman, "Maneuver from the Sea," US Naval Institute *Proceedings* 119 (April 1993): 47.

49. Cushman, 47.

50. Many sources allude to this incident. The earliest I've found is in Wilson, 21.

51. T. N. Dupuy, *A Genius for War* (McLean, Va.: The Dupuy Institute, 1984), 266.

52. For the Operation Sea Lion wargame, see Wilson, 38; and Hausrath, 27. For the Luftwaffe's wargame, see James S. Corum's *The Luftwaffe: Creating the Operational Air War, 1918-1940* (Lawrence, Kans.: University of Kansas Press, 1997), 356; also see Edward L. Homze, *Arming the Luftwaffe: The Reich Air Ministry and the German Aircraft Industry, 1919-39* (Lincoln, Nebr.: University of Nebraska Press, 1972), 243.

53. Again, there are several accounts. While somewhat verbose, the most authoritative account comes from the US Army program to learn from the German army's experiences during World War II by producing a number of papers by the German generals themselves. See Rudolf M. Hofmann, *German Army War Games* (Carlisle Barracks, Pa.: US Army War College, 1983), 38-44.

54. Earl F. Ziemke and Magna E. Bauer, *Moscow to Stalingrad: Decision in the East* (Washington, D.C.: Center of Military History, US Army, 1987), 16-18.

55. Christopher R. Gabel, *The U.S. Army GHQ Maneuvers of 1941* (Washington, D.C.: Center of Military History, US Army, 1991).

56. Martin Blumenson's chapter on Kasserine in *America's First Battles, 1776-1965*, eds. Charles E. Heller and William A. Stofft (Lawrence, Kans.: University of Kansas Press, 1986), 226-65, provides a good, concise if somewhat Army-centric view of the battle. The lessons the battle taught about tank destroyers are summarized on page 263.

57. Comments on the depiction of airpower during the Louisiana maneuvers is based on research done by then-Maj

Mark Clodfelter while he was on the faculty of the School of Advanced Airpower Studies.

58. Warren A. Trest, *Air Force Roles and Missions: A History* (Washington, D.C.: Air Force History and Museums Program, 1998), 77.

59. In fairness, the air battle over Kasserine also demonstrated the need for sufficient air base construction engineers to allow forward fields to keep up with advancing ground forces.

60. Perla, 45.

61. Prados, 1-2.

62. While this quote is often attributed to Admiral Yamamoto, nowhere is it presented more powerfully than when it is shown on screen at the conclusion of the feature movie *Tora, Tora, Tora*.

63. This morality play is arguably the most often-told incident from the history of wargaming. While the above is true, it makes the argument against the admiral more "open and shut" than was actually the case. Most authors fail to mention that the American aircraft that sank the carriers during the wargame were B-17s. In the actual battle, B-17s proved completely ineffective (during the battle, B-17s did not hit a single enemy ship), so, in a narrow sense, Ukagi was right. Still, Admiral Ukagi failed to address the issue that the loss of his carriers in the wargame should have brought up: What if the Americans get in the first hit? Would we [the Japanese] have enough strength to win anyway?

64. For the best brief account of Tarawa and its lessons, see Ronald H. Spector, *The Eagle against the Sun: The American War with Japan* (New York: Vintage Books, 1985), 259-66.

65. Dr. Ronald H. Spector went into detail on this incident during a master's degree course he gave for the University of Alabama at the Air University. Several published sources touch on it, such as Hausrath, 32.

66. The most detailed description of Soviet wargaming I have found was based on the debriefing of two Afghan army colonels. See John Sloan et al., *Soviet Style Wargames* (Washington, D.C.: Science Applications, Inc., June 1986).

67. Early in 1944, the Germans conducted a wargame on an Allied invasion of France that focused on German logistical preparations. The exercise prompted and clarified logistical improvements that increased the effectiveness of German resistance when the invasion came. See *World War II German Military Studies: A Collection of 213 Special Reports on the Second World War Prepared by Former Officers of the Wehrmacht for the United States Army*, vol. 12 (Washington, D.C.: Historical Division, US Army Europe, 1979), 50. Later, German reconnaissance spotted some of the preparations across the Channel from Normandy. The Germans concluded that the Allies were preparing a feint, a secondary invasion intended to trick them into thinking Normandy was the main attack. Still, they conducted a wargame of an Allied landing at Normandy and concluded that an Allied lodgment was probable! If the feint proved successful, the Americans might decide to make the feint their main effort. For this and other reasons, the Germans therefore ordered reinforcements into Normandy. The regiment that made Omaha Beach so bloody was one of those reinforcements. Ironically, while one German wargame made D day far more costly, another actually helped the Allied cause. When the invasion took place, many key commanders were away from their headquarters, on their way to a second wargame. This wargame would test how well they could meet an invasion of Normandy when all the planned reinforcements were in place. While many sources about D day mention German anticipation of a feint invasion in Normandy and the final wargame (the most well known being Cornelius Ryan's *The Longest Day, June 6, 1944* [New York: Simon and Schuster, 1959], 80-81, and the movie of the same name), I have been unable to find a source for the Germans' first Normandy wargame and would appreciate any leads.

68. Hausrath, 27.

69. Wilson, 45-62.

70. Perla, 77.

71. *Ibid.*, 78.

72. The best work on specific early RAND/Air Force wargaming initiatives is Ghamari-Tabrizi's soon to be published "Simulating the Unthinkable: Gaming Nuclear War in the 1950s and 1960s." For a more general history of the RAND-Air Force relationship, see RAND's commemorative booklet "50th Anniversary, Project Air Force, 1946-1996."

73. The staff of *Strategy and Tactics* magazine, *Wargame Design* (New York: Simulations Publications, 1977), 11.

74. Martin Campion and Steven Patrick, "The History of Wargaming," *Strategy and Tactics* (1972), 12.

75. G. R. Andlinger, "Looking Around: What Can Business Games Do?" *Harvard Business Review* 36, no. 4 (July-August 1958): 147-52.

76. See Hausrath, 143-44, for a quick overview of UK and Canadian wargaming at that time. There were also some open-source hints at Soviet wargaming. See Ivan Boikov, "At The General Staff Academy," *Soviet Military Review*, June 1967, 12-13.

77. Ghamari-Tabrizi's paper builds a convincing picture of the level of credibility OR enjoyed at the time.

78. E. B. Potter, *Nimitz* (Annapolis, Md.: Naval Institute Press, 1976), 136.

79. Perla, 83.

80. *Ibid.*, 85.

81. Actually, the term used was *Red Integrated Strategic Operation Plan* (RISOP).

82. Hausrath, 47.

83. Thomas B. Allen, *War Games* (New York: McGraw-Hill, 1987), 28.

84. *Ibid.*, 188.

85. *Ibid.*, 193-227.

86. See the discussion of Sigma I-64, II-64, and the Sigma game series in Allen, 193-208.

87. Campion and Patrick, 17.

88. Briefing, "History of Modeling and Simulation," Staff Officers Course, Defense Modeling and Simulation Office, Washington, D.C. The course is held roughly a dozen times a year, typically half the time at Orlando, Florida, a quarter of the time in the D.C. area, and the remainder around the United States.

89. Amazingly, no formal history of Red Flag has yet been written, but Michael Skinner's *Red Flag: Air Combat for the '80s* (Novato, Calif.: Presidio Press, 1984) provides a great snapshot of what it was like going through Red Flag in the mid-1980s.

90. Bud Hay and Bob Gile's *Global War Game. The First Five Years* (Newport, R.I.: Naval War College, 1993) does a great job of describing the origins and early growth of the series.

91. Henry Bartlett and Paul Holman, "GLOBAL War Games and the Real World," US Naval Institute *Proceedings* 117 (February 1992): 25.

92. See Stephen B. Patrick, "The History of Wargaming Update," *Strategy & Tactics* (1975), 11; and Seth Owen, "The History of Wargaming 1975-1990," *Strategy & Tactics* (1990), 7.

93. Anne W. Chapman, *The Origins and Development of the National Training Center, 1976-1984* (Fort Monroe, Va.: US Army Training and Doctrine Command, 1992).

94. Col John D. Borgman and Maj Richard L. Hooverson, "The Rebirth of Wargaming," *Armor*, September-October 1981, 44.

95. Perla, 85.

96. Hay and Gile, 52.

97. Col Raymond A. Hord, "The Marine Corps Wargaming and Assessment Center," *Marine Corps Gazette* 73, no. 12 (December 1989): 38-40.

98. *Ibid.*

99. David B. Lee, "War Gaming: Thinking for the Future," *Airpower Journal* 4, no. 2 (Summer 1990): 44.

100. Nick Lackeos, "Military Presence Reinforces Area Economy," *Montgomery Advertiser*, 12 May 1989, 5H.

101. Owen, 51–56. Comments also based on E-mailed comments from James F. Dunnigan and Gene Billingsley, president of GMT Games (a leading printed wargame publisher and computer wargame developer).

102. Cited in the briefing, "History of Modeling and Simulation," during the Defense Modeling and Simulation Office's Modeling & Simulation Staff Officers Course.

103. Lee, 44.

104. Sloan et al.

105. During a briefing on the later stages of the Iran/Iraq war, a NATO officer who served as an air attaché in Baghdad during that war described the physical setup of an Iraqi wargaming facility. The facility perfectly matched the setup of a Soviet one.

106. Allen, 4.

107. Richard M. Swain, *Lucky War: Third Army in Desert Storm* (Fort Leavenworth, Kans.: US Army Command and General Staff College Press, 1994), 7–8.

108. James F. Dunnigan and Raymond M. Macedonia, *Getting It Right: American Military Reform after Vietnam to the Persian Gulf and Beyond* (New York: William Morrow and Company, 1993), 67.

109. Richard T. Reynolds touches on this incident in his *Heart of the Storm* (Maxwell AFB, Ala.: Air University Press, 1995), 48. The above is primarily based on my conversations with Colonel Reynolds.

110. Based on briefing by Col Gary Ware (General Schwarzkopf's chief of modeling, simulation, and wargaming during the war, and previously director of the Air Force Wargaming Center), given to the College of Aerospace Doctrine, Research and Education (CADRE) shortly after the war.

111. While one source (Claudio Cioffi-Revilla, "On the Likely Magnitude, Extent, and Duration of an Iraq-UN War," *Journal of Conflict Resolution* 35, no. 3 [September 1991]: 387–411) predicted casualties in the "100,000 to low millions" range, and a few analysts like Col Trevor Dupuy, USA Retired, and James Dunnigan would later brag about being "only" an order of magnitude off, most estimates fell in the range given in the test. This is confirmed by Mark Herman, "Crisis in the Gulf: Planning for the Worst," *Jane's Defense Weekly* 15, no. 3 (19 January 1991): 83; and an E-mail from Mark Herman, 11 February 2000.

112. The *Army Times* ran a series of division and independent maneuver regiment after-action reports. About half the articles described some sort of unit wargaming. The most memorable anecdote involved a battalion commander expressing a preference for death over war-gaming it one more time.

113. Mentioned by Frank Chadwick, the publisher who received the letter, during a talk at Origins 91, an international strategy gaming conference.

114. Commercial wargame designers/military analysts such as Jim Dunnigan and Charles Kamps predicted far fewer coalition casualties than the "official" estimates—mainly because they were used for "factoring in" the intangibles that old-time government hands always said couldn't be calculated.

115. A picture of the Iraqi terrain model is in the center section of Norman Friedman's *Desert Victory: The War for Kuwait* (Annapolis, Md.: Naval Institute Press, 1991).

116. It is difficult to show a trend line for spending on wargaming. Estimates for the same year will vary based on what is considered a wargame. Apparently using a working definition of any multisided simulation of armed conflict, John Prados in 1987 estimated a billion dollars was being spent annually through the defense establishment on wargames and wargaming. During an early 1990s conference, I could not get the director of the Joint Staff's J-8 section to even guess at a level of annual spending, but he said my guess of two billion dollars was probably not far off. Recently, an officer at the Air Force Doctrine Center estimated annual spending of over three billion dollars, given the above definition.

117. Paul K. Davis and Donald Blumenthal, *The Base of Sand Problem: A White Paper on the State of Military Combat Modeling* (Santa Monica, Calif.: RAND, 1991).

118. History of Modeling and Simulation, M&S Staff Officers Course.

119. *The Historical Background on the MSIAC*, 18 June 1999.

120. *Ibid.*

121. Rick Adams, "An M & S Primer," *Defense News Marketing Supplement*, 1996, 9–10.

122. William B. Scott, "'Title-10' Games Shape Policies," *Aviation Week & Space Technology*, 2 November 1998, 61–62.

123. Perhaps most surprising of all, there has been some movement toward cooperation between the military and commercial wargaming communities. See J. R. Wilson, "Shall We Play a Game?" *Military Training Technology*, (1999), 20–25.

124. Comments are also based on E-mailed comments from James F. Dunnigan and Gene Billingsley.

125. Press release from the Software Developers Association during the 1998 Computer Game Developers Conference, Santa Clara, California, 1998.

126. Estimate by Evan Brooks, originator of an on-line index of computer wargames and former wargames editor for *Computer Gaming World*.

127. Based on comments made by Wilbur E. Gray, secretary of the Historical Miniatures Gaming Society—East, to Connections, the Air University-sponsored international, interdisciplinary conference on conflict simulation, 1998.

128. Paul Holtzhausen, "On Target," *Military Training Technology* (1999), 17.

129. Jerry O'Brien, "Navy Dedicates Premier War-Gaming Center," *Providence Journal-Bulletin*, 28 September 1999.